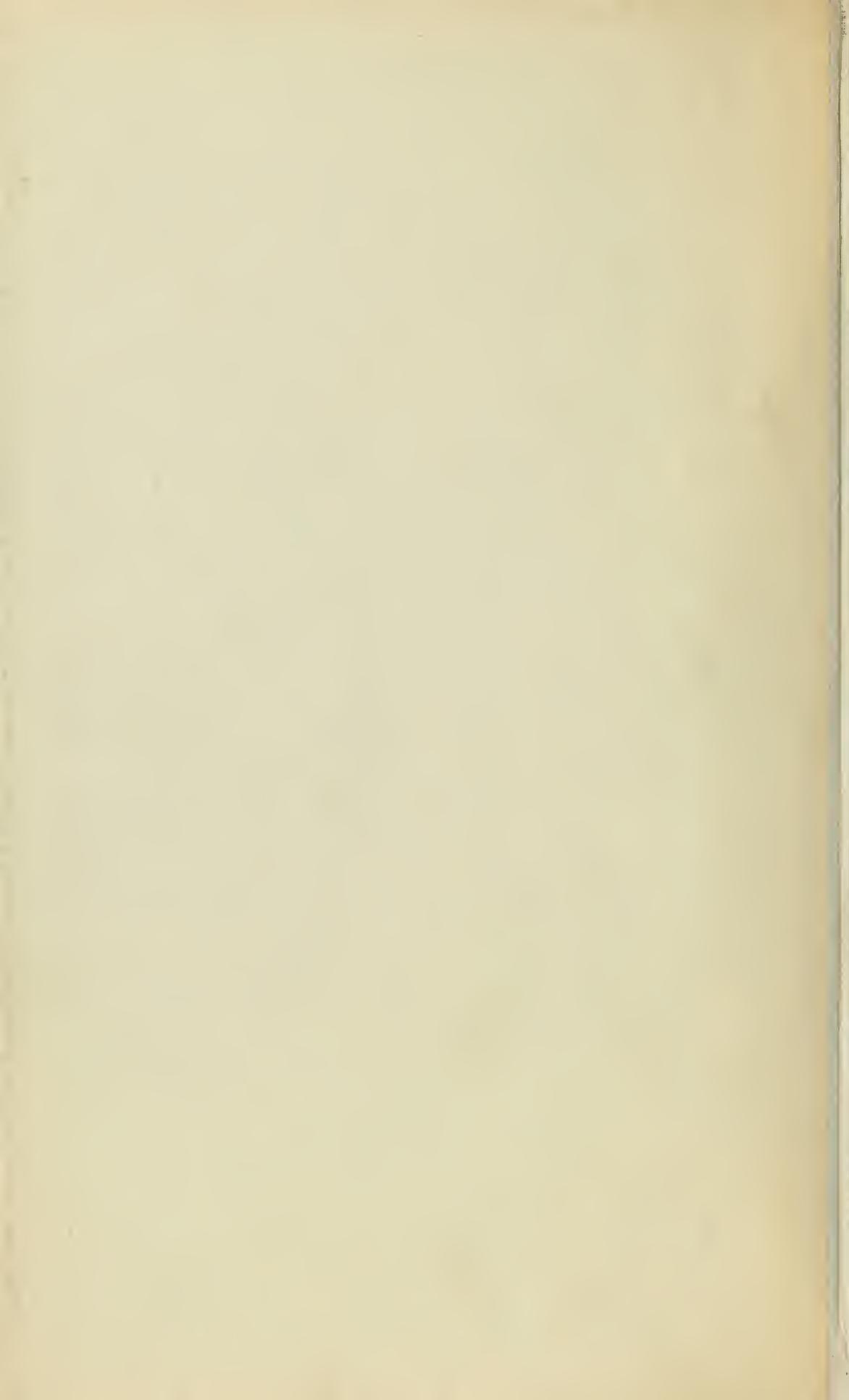


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# THE ELECTRICAL REVIEW.

Vol. LXXII.

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No. 1,892.

## ELECTRICAL REVIEW.

1912—1913.

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WHEN these lines appear in print, the majority of our readers will be too busily engaged about their business to study a detailed review of the electrical doings of a past year. Everybody specialises nowadays, and therefore every reader knows what has been happening in his own particular line. Nevertheless, it is as well for us all to take a comprehensive view of the whole of the departments of the science and industry occasionally, and the passing of one year and the opening of another provide a fitting opportunity for brief general retrospection or review. To meet this need, and this alone, do we touch the subject here.

Notwithstanding the depressing influences of the recent Christmas weather, we approach the subject in a satisfied mood whether we look backward over the achievements in 1912 or venture forward into 1913. Our satisfaction is modified somewhat by the recollection that 1912, like the year that preceded it, was a period when the relations of employers and employed were seriously disturbed. The increasing cost of living coupled with the prevalence of excellent trade and the continuance in office of a Government credited with a willingness to grant legislation in a hurry at the bidding of organised labour, brought clamour from many sides for a larger share of the profits, and without here entering into the merits of such questions, we must remember them here as factors which during the year brought grave disquiet and handicap to those representing the control of Industry. Electrical engineering firms remember only too well how the strikes among the colliery workers, the transport workers, and the "not-in-the-Police-Court-sense" railway men, have harassed them in their productive and distributive operations, and all of us will profoundly hope that in view of the large concessions granted, or the lessons severely learned, industry will be allowed to settle down peacefully for awhile to handling a record volume of business. While it is right that the interests of the worker should be studied in our schemes of social legislation, nothing is so serious a disturbing factor in industrial affairs as sweeping legislative reforms passed without mature deliberation. If we appear to dwell too fully upon this point, it is because nobody can either faithfully record the past, or intelligently anticipate the future, without recognising how important an influence labour disaffection must ever have.

Passing now from larger matters and those which have a general bearing upon all sections of electrical and engineering activity, we may turn with the greatest possible satisfaction to the position of individual electrical departments. It does not matter which way we turn—with the solitary exception of the tramway field—there are evidences of a splendid improvement having taken place during the past year, and as we start out upon 1913, not only is there no falling-off in the rate of progress, but there is in prospect more business, in both the larger and smaller classes of manu-

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## THE UNIVERSAL ELECTRICAL DIRECTORY

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factures, than ever before. One's thoughts naturally turn to the gratifying progress in electric heating and cooking, as the result of the cultivation of the domestic and trade consumer: to the large requirements of electrical supply authorities for new plant, and in some cases entire new stations; to the great headway that is being made in the wireless telegraph sphere; to the progress of railless electric traction and the petrol-electric 'bus; to the new telephone situation following the transfer, which is giving, and must continue to give, rise to very big requirements for apparatus and equipments both for new exchanges and for the users' premises (automatic working is the outstanding development of the year); to the extraordinary advance that was made in the electric power department, both independently of, and as a result of, the miners' strike, when hundreds of industrial works turned to public supplies of electricity for the first time; and finally, and quite as encouraging, if not more so than all the rest, the long-delayed movement in the railway electrification department which has come at last, as witness the great triple event of the closing months of 1912—the decisions to proceed with the equipment of 150 route miles of electric railway at Melbourne, of 79 track miles on the L. & N.W. Railway, and of 73 track miles on the L. & S.W. Railway. All of these will be worked on the direct-current system. The Central London tube extension to Liverpool Street was completed in 1912, and the East London is at last in the electrical contractors' hands, while the L.B. & S.C. Railway has brought the single-phase system into operation on some additional lines.

Now that we have got so far in the railway department, there is every reason to believe that even in this long prayed-for circle, widespread revival and conversion will speedily spread. Closer working arrangements have been entered into by many of the metropolitan tube, motor-'bus and tramway companies, which, it seems, must make for increased efficiency and convenience.

The triumphant progress of the steam turbine, which is now being built of no less than 30,000 kw. capacity, and the increasing use of the Diesel engine, which is being rapidly developed for ship propulsion, and will therefore soon be available in large sizes for central-station work, call for notice, and we should not omit mention of the start which has been made in the adoption of electric transmission on board ship.

Each of these items would make an excellent text for an article devoted solely to its own development and prospects, but we think the mere recital given above serves sufficiently to indicate broadly how general is the electrical advance that is now proceeding.

That the reorganisation of the Institution of Electrical Engineers, with the establishment of standing committees to deal with industry and research, will strengthen the position of the Institution and promote the best interests of all engaged in electrical work we all hope and believe, and we look forward confidently to a continuance of that prosperity with which the New Year has commenced.

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## THE AMERICAN UNDERWRITERS AND CANADIAN TRADE.

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WE publish elsewhere in this issue an exhaustive report to the Board of Trade, prepared by Mr. C. Hamilton Wickes, on the American Underwriters' Laboratories (Inc.), its constitution and the scope of its operations, and their effect upon the importation of British manufactures into the Dominion of Canada. As we have already indicated, this is one of the first pieces of work to result from Mr. Hamilton Wickes's appointment as H.M. Trade Commissioner in the Dominion, and we

commend it, together with the conclusions and recommendations which it contains, to the serious study of all who are interested in the promotion and extension of British electrical trade across the Atlantic; more especially do we ask our manufacturers to weigh the whole matter as one concerning which it is their duty to have a conviction, and to express an opinion. Indeed, let all of us determine that, the matter having been carried thus far by one of His Majesty's representatives, whatever lies in human power to give the question a full hearing and a fair discussion shall be done; and if the definite proposal that is advanced commends itself as the best method of dealing with the situation that has arisen, let us all strive to ensure that something very tangible shall emerge.

Every student of the Canadian electrical trade position has something to say about the Underwriters' organisation and its adverse influence from the British electrical manufacturer's point of view; but perhaps, if we get to understand better, as this report may enable us to do, the reasons which gave birth to this undertaking, and the work that it has done in the way of fire prevention, and the absence of British electrotechnical co-operation and guidance in connection with its procedure, we may be able to clear away prejudices, the removal of which may prepare the way for the introduction of influences which will tell in favour of British manufacturers in the future.

At this juncture it is not our intention to pronounce any very definite view respecting the details of the new scheme, though we do not hesitate to say that in principle the proposal appears to contain very reasonable advice. The right thing for us to do at this moment is to invite opinions from those who are actively engaged in manufacturing and exporting. The Trade Commissioner has done his part, we have done ours in giving the matter such complete publicity, and it now remains for our firms—their principals, managers, and other experienced representatives—to express themselves and to get to work on this side considering the wisdom of the proposal, and devising means for carrying it into effect.

Briefly stated, what is recommended is that British electrical engineers should take a leaf out of the American book and equip their own laboratories in the United Kingdom, on the same lines as the American. The more the suggested British laboratory works in conjunction with the Chicago authority, obtaining the right to use its labels, the more likely is it that British manufacturers will gain the advantage not only in meeting the wants of Canada, but in even opening up to themselves the United States electrical market, for the use of the labels mentioned would carry equal commendation to all inspectors throughout North America. The necessity for co-operation must be emphasised. Independent British action in such a case would be fatal. It would seem that nothing short of a laboratory in England, which will be *practically an offshoot of the Underwriters' Laboratories (Inc.), of Chicago*, will meet the case. It must be run on similar lines, utilising the experience gained at Chicago, employing equally competent, but British, consulting and technical engineers. It is suggested that the article approved by label or tab should be accepted by both the British and the Chicago laboratories, the same careful system of experiments and tests being followed by the consideration of reports before they are issued, and

the adoption of the same, or a similar, system of labelling, tabs and inspection.

The foregoing is in barest outline the idea now advanced, but there are many reasons why the entire report should be read before anyone attempts to criticise it, for there are various details which, if ignored, would leave one with an incomplete idea of the position. One word more—let it be remembered that the Chicago organisation will welcome any such movement as is suggested in the hope of minimising fire risks, and is in no sense to be regarded as having hostile interests. British apparatus possessing outstanding fire preventive qualities will be welcomed on their merits if they bear the stamp or label of authority, and knowing the high quality of the material that our electrical manufacturers are in the habit of producing in the interests of public safety, we feel that it should stand a good chance of passing the test and report stages satisfactorily.

#### The Berlin Railway Conversion Scheme.

THE Government scheme for the conversion to electric traction of the Berlin City, circle and suburban railways, has recently been engaging the attention of a Commission of the Prussian Diet. The project was brought forward in the last session of the Diet, but was postponed in consequence of the doubts expressed in various quarters, and also because proof was desired that the same results could not be attained by the use of more powerful steam locomotives and at a smaller expenditure than £6,300,000, the sum contemplated under the electrical scheme. In the meantime a fresh memorandum has been prepared and submitted for the consideration of the Commission. It appears that the steam interests have presented a scheme for a six-axle tender locomotive weighing about 100 tons, and working with superheated steam. The document states that a comparison of this type with the proposed electrical system shows that the former cannot compete with the latter either from a working or an economical point of view. If guarantees could be obtained for the certain carrying-out of the services it would only be possible to operate 32 steam trains per hour in either direction on the City railway, with a seating capacity for 19,500 passengers, whereas electrical working will permit of 40 trains per hour with accommodation for 24,400 persons. The introduction of heavier locomotives would involve an outlay of £4,450,000, as compared with £6,300,000 in the case of electricity, but the annual expenses, including interest and depreciation on the new capital, would be £295,000 less in the case of electrical working. The deficiency on operating the railways in 1910 was £18,000 and it was £23,000 in 1911, whilst in 1916 the deficit, without providing for depreciation and interest on capital, would amount to £117,000 with electricity, and as much as £498,000 with steam locomotion. It is therefore considered that the latter can no longer be taken into consideration. An increase in the passenger fares is foreshadowed on the ground that at least the deficiency in working must be avoided and 4 per cent. interest obtained on the new capital expenditure. A further point of interest relates to the supply of power for the operation of the railways. As will be remembered, a private group of manufacturers have offered to furnish the necessary energy for a period of 30 years—by the erection of central stations, at least one of which would utilise lignite as fuel. The offer ranges from 3·3 pence to 3·8 pence (·387d. to ·446d.) per kw.-hour delivered on the railway side of the station, and according to the quantity required.

It appears that the State railway authorities have the option of purchasing the whole of the generating plant and transmission lines during the term of the agreement, on certain conditions which have been formulated. This is a new proposal, the object of which is presumably to disarm the opposition which has been aroused by the possibility of the creation of a monopoly in the supply to the railways. No obligations have, however, been assumed by the State railway authorities in the matter, and it is, therefore, possible to enter into negotiations with other undertakings for the supply of energy, as occasion may arise. The proceedings before the Commission of the Prussian Diet elicited the statement that trials have already been made of new types of steam locomotives, but that electrical working is more economical, and that the possibility exists of an extension of the latter method on other railways, apart from those in Berlin.

#### Train Lighting and Burning.

IN our issue of September 27th we drew attention once more to the dangers of lighting railway trains with gas, referring particularly to the accident at Ditton Junction, whereby 15 persons lost their lives, and several were burnt. We had no hesitation, in view of the evidence then available, in ascribing the burning of the wrecked coaches to the use of gas, and the report of Lieut.-Col. Sir H. A. Yorke to the Board of Trade, of which we give extracts on another page, fully confirms our conclusion. The Inspector recalls that Major Pringle, reporting on the Hawes Junction accident in 1911, expressed the view that electric lighting should be adopted in place of gas, and he supports this recommendation, stating that "so far as safety is concerned, there can hardly exist in anyone's mind a doubt that electricity is the better." He thinks that the railway companies would be wise to recognise this fact, and to adopt electricity on all their main-line trains before they are compelled to do so by the pressure of public opinion.

We gather from the report that, after the previous accident, the Board of Trade made representations to the railway companies to the same effect, and we welcome this praiseworthy action. Our contemporary, the *Gas World*, objects that the Board of Trade, in doing so, has gone ahead of public opinion, but surely this is a matter for congratulation rather than reproach—it is a pity the phenomenon is so rare! Our contemporary makes a mysterious reference to "the more than doubtful record of the proposed substitute, electricity," which, we must confess, has left us dumbfounded.

We challenge the *Gas World* to cite a single instance, in any part of the world, where the electric lighting equipment of a railway train has even been *accused* of causing a fire after a collision. It should know better than to remark that "the contemplation of an express train rushing through the night for two hours without a stop with a short-circuit at work is not consoling." If fire were to break out—from any cause—on a train in motion, common sense would stop the train and let the passengers get out. But who ever heard of a short-circuit on a train enduring for even two minutes?

Major Pringle's report referred to the Hawes Junction disaster as the first occasion on which it could be "proved beyond question" that the fire was caused by burning gas; but on previous occasions Board of Trade inspectors had pointed out the dangers of gas, and we have before us a list of no fewer than 13 instances since the year 1887 in which railway accidents abroad were followed by fires ascribed to the presence of gas. We are glad to know that the number of British coaches lighted with electricity is increasing yearly, but may not the process of reform be hastened by the teachings of foreign experience, as well as by our insular holocausts?

## INCREASING STEAM PLANT EFFICIENCIES.

BY EDWARD INGHAM, A.M.I.M.E.

CONSIDERING the high working efficiencies of the boilers, and the low steam consumptions of the engines and turbines at electric lighting and power stations which are obtained at the present time, it would appear that the scope for further improvement is somewhat limited. With regard to the engines and turbines, this is, perhaps, to a large extent the case; but as regards the boilers, there are various ways in which it seems possible to increase the present efficiencies, and in this article it is proposed to point out how such improvements may be effected.

The proper combustion of the fuel is, of course, a point of the first importance; but so much has been written bearing on this question, that little need be said about it here. There can be no question that excessive losses may, and do, occur as a result of imperfect combustion, the admission of excessive quantities of air to the furnaces, &c. Indeed, in a great many instances the working efficiency might easily be improved by 5 or even 10 per cent. by properly regulating the air supply. As illustrating what can be done in certain cases by careful attention to the boiler plant, it might be mentioned that at the Loughborough Electricity Works the generating costs per unit were reduced by no less than 44 per cent. merely by using a more suitable class of fuel, reducing air leakage and generally obtaining more perfect combustion of the fuel.

Where many boilers are concerned, as is the case at all large central stations, it is certainly advisable to install a CO<sub>2</sub> recorder in the boiler room, as such an instrument provides the fireman with a means of ascertaining whether or not he is getting the best results, and he can then regulate the air supply, &c., accordingly. After all, the fireman is a most important factor in the attainment of high boiler efficiencies, particularly where hand-firing is practised, and for this reason it will, generally speaking, pay to adopt a bonus system for the fireman, as a pecuniary incentive will certainly go a long way towards reducing the coal bill. The large influence the fireman has on the working results is well illustrated by tests which have been carried out from time to time. In one instance four good stokers were made to fire a large Lancashire boiler, one after the other, the conditions being maintained as far as possible the same, and it was found that there was a difference in economy of as much as 23 per cent. between the best and the worst fireman. In another test, carried out by Messrs. Davy Bros., of Sheffield, five men were made to fire the same boiler, and whereas the best man evaporated 9 lb. of water per lb. of coal, the worst only succeeded in evaporating 7.4 lb., representing a difference of 22 per cent.

Considerable savings may often be made by carrying out calorific tests of the various fuels available, combined with practical trials extended over a few days' supply to the station. This enables the engineer to choose the fuel which costs least per unit, and by so doing the annual coal bill may often be reduced very considerably. Coals having high calorific values, and free from dirt, are not always the cheapest to use.

Mechanical stoking, whilst it may not show much advantage over hand stoking in the case of a small station, will certainly do so where large stations are concerned, as by its adoption the firing is more even and regular, and the combustion, therefore, more efficient, whilst the losses arising from the admission of large quantities of cold excess air through the fire-doors and through holes in the bed of fuel are avoided.

The cost of labour is also greatly reduced, especially when the machine stokers are used in conjunction with coal elevating and conveying plant.

Good draught is another important factor, as without such perfect combustion is impossible. Mechanical draught, either forced or induced, possesses a great advantage over natural draught, inasmuch as it enables the fires to be worked thicker, which tends towards economy, whilst the air required for combustion is brought into more intimate contact with the fuel, and more coal per sq. ft. of fire-grate can be burned than would otherwise be possible.

At electric generating stations in particular, mechanical draught is of great advantage, because at such places the load frequently changes quickly and to a large extent, owing to fogs, dark clouds, &c. With mechanical draught the intensity of the draught can be regulated according to requirements.

One way in which it seems possible to increase steam boiler efficiencies is by heating the air required for the combustion of the fuel before admitting it to the furnaces, the heat in the products of combustion being utilised for this purpose. It has indeed been found possible to effect an economy of 15 per cent. in this way by suitably arranging the boiler house and flues, and there is, no doubt, considerable scope for improvement in this direction.

It has been frequently suggested that the furnace of a steam boiler should be separated from the boiler itself, and the fuel burned in a producer. There is every reason to believe that the adoption of this suggestion would result in much higher efficiencies. A producer is certainly better adapted for the proper combustion of coal than a fire-grate, as it would permit of better regulation of the gas and air supply with less draught, whilst losses from radiation could be much reduced. In a paper read before the International Association for the Prevention of Smoke, some years ago, by Prof. C. H. Benjamin, it was pointed out that "when we compare the comparatively sluggish and badly-regulated coal fire of the power plant with the perfect combustion and intense heat of the open-hearth steel furnace, we are justified in predicting an improvement in the former."

It was further stated that "when the coal fire is removed from its inconvenient and uneconomical position under the boiler, and the combustion is perfected in a brick-lined reverberatory furnace operated under forced blast with air heated by regenerators, the heat efficiency and the evaporative capacity of steam boilers will be enormously increased. The secret of good combustion in boiler work, as in metallurgy, is complete combustion of the coal in a separate receptacle and the maintaining of the gases at a very high temperature before coming in contact with any cooling surface whatsoever."

The fundamental reason why gas and air can be burned more economically than coal and air is that both the former are gases. Air cannot be intimately co-mingled with solid pieces of coal, but air and gas can be brought into intimate contact with one another in the correct proportions at the proper time and place for the chemical combinations known as "combustion" to take place. This means that there is little or no useless residual "free" air to be wastefully heated up. By gasifying the coal in a separate brick furnace close to the boiler, and then burning it with all the sensible heat of its production by the introduction of heated air in such a way as to thoroughly intermingle the two, an enormous gain is obtained. The combinations of combustion can also be completed prior to the gases coming into contact with the water-cooled boiler plates, which is another reason why great gain results. Further, the whole of the boiler flue surfaces are usefully employed in absorbing heat instead of acting more as cooling surfaces as in the ordinary ashpit.

An external furnace has recently been designed on these lines by Mr. E. C. Mills, of Manchester, and in tests made on a Cornish boiler, with and without this furnace, by Mr. J. B. C. Kershaw, F.I.C., of Liverpool, the following results were obtained:—

	Ordinary furnace.	Mills' furnace.
Lb. of water evaporated per lb. of coal from and at 212° F. ... ..	6.99	11.2
CO <sub>2</sub> in flue gases ... ..	7.32	14.6
Thermal efficiency... ..	51.85 %	77.1
Temperature of chimney gases ... ..	518° F.	372° F.

It should be mentioned that no economiser was used in connection with the boiler tested, the efficiency of which with the ordinary furnace is low. The increase in efficiency which resulted from the adoption of the external furnace is, however, very considerable, even when the great scope for improvement in this particular case is taken into account. The writer understands that further tests on larger and more efficient boilers are about to be made with the object of further proving the merits of the external furnace, and in a subsequent article he hopes to give the results of these tests, together with a description and an illustration of the furnace.

Some reference should be made to the adoption of liquid fuel for steam generation purposes. With such fuel it is much easier to regulate the quantity of air required for combustion, and losses due to the admission of much excess air may be thus reduced to a minimum. It is stated that 10 or 15 per cent. increase in efficiency is possible by the employment of liquid fuel instead of coal, but it is doubtful if such is the case. The writer holds the opinion that, as far as economy is concerned, liquid fuel, owing to its high cost, is not likely to take the place of coal, but it may certainly be used to great advantage in certain cases. Thus, at an electric generating station, where sudden demands for steam may be made at any moment, it will be obvious that, if the fires could be made to respond quickly to any such demand, great benefit would result. This, of course, is not possible with solid fuel, but by means of suitable burners oil fuel could be blown on to the fires, and the necessary sudden accession of the fires thus obtained just when desired.

The heat generated in the boiler furnaces has to pass through the plates before it can be usefully employed for evaporating the water into steam. It is obvious that the transmission of heat from the hot furnace gases to the water in the boiler should be as free from resistance as possible, and hence it is absolutely necessary that the plates should be kept clean both on the water side and the fire side. It is quite impossible to obtain high efficiencies if the plates be allowed to get coated over with scale on the water side and soot and dirt on the fire side. According to Mr. Stromeyer, of the Manchester Steam Users' Association, a layer of average scale  $\frac{1}{4}$  in. thick offers as much resistance to the passage of heat as a plate of steel 10 in. thick, whilst grease is ten times worse than scale. Hence the importance of keeping the plates clean. The figures quoted by different writers to show the losses due to scale should be taken with the proverbial "grain of salt," because so much depends upon the nature of the scale. Excessive thicknesses of some forms of scale have less effect in impeding heat transmission than thin layers of other scales.

Recent experiments and researches have shown that even with thoroughly clean plates, steam boiler efficiencies are not nearly so high as they might be. This is apparently due to the fact that under working conditions a stationary non-conducting film of gas clings to the fire side of the plates, whilst a similar film of water attaches itself to the water side of the plates. These films seriously impede the free transmission of heat from the hot gases to the water and so materially reduce the efficiency of working. It has been demonstrated repeatedly that if the hot gases and the water be moved rapidly over the plates, the rate of heat transmission is enormously increased, this being in all probability due to the fact that by so doing the non-conducting films referred to are removed from the plates.

The question of moving the hot gases and the water over the plates at high speeds is therefore one to which designers of steam boilers might in the future give serious consideration, as there is no doubt a large field open for improvement in this direction.

In his book on the "Steam Engine and other Heat Engines," Prof. Perry states that "Whether a tube be made of copper or iron or brass is of no consequence, except as to convenience and oxidation by the flame. The real resistance to the passage of heat is not due to the bad conductivity of the metal; it is due to the fact that the particles of hot gases will not come up fast enough to the surface to get cooled, and the particles of water will not come up fast enough on the other side to get heated."

Again: "We want the surfaces of the metal wall to be scrubbed, the one with hot gases and the other with circulating water, and the student who pays most attention to simple experiments on convection is most likely to invent the best boiler. Probably the best boiler will be one in which a flame or hot gas tube surrounds or is surrounded by a water tube, the gas and water flowing fast in opposite directions."

Efficient circulation and agitation of the water in steam boilers are very important factors in the attainment of high efficiencies. The rate at which heat is transmitted from the hot furnace gases to the water in a boiler depends upon the rate at which the water can carry the heat away from the heating surface, and hence the more efficient the circulation,

the more efficient will be the heat transmission. In ordinary boilers, such as the vertical and the Lancashire, the circulation is defective, whereas in a well-designed water-tube boiler it is systematic and thorough. Experience appears to show that water-tube boilers are slightly more efficient than Lancashire boilers, this being due, no doubt, very largely to the better circulation which obtains in the former. When it is remembered that a Lancashire boiler, notwithstanding its defective circulation, will give an efficiency of nearly 80 per cent., it will be obvious that this type of boiler might be made extremely efficient if some method of improving the circulation could be satisfactorily applied. Special circulating devices have been patented, suitable for such boilers, by means of which, it is claimed, the working efficiencies may be increased by from 5 to 10 per cent.

Agitation of the water in boilers, as might be expected from what has been said with regard to circulation, is another way in which greater efficiency could be obtained. Thus, it is a well-known fact that water placed in a pan over a jet can be made to boil much more quickly by constantly stirring the water than when the water is allowed to remain still. A locomotive boiler, when used on the railroad, will evaporate a far greater quantity of water in a given time than it will when used as a stationary boiler, this being, no doubt, due to the shaking and agitation the water receives during transit. If it were possible to rock our boilers mechanically, we might reasonably expect to obtain better results.

The setting of steam boilers is not always carried out to the best advantage, in consequence of which much avoidable loss often occurs. Those parts of the setting which rest in contact with the boiler plates should be reduced in width to the absolute minimum, so that as little heating surface as possible will be covered up. The best setting is that in which all the parts in contact with the plates are made of a rounded form, as in the "Poulton" system. With such a form, practically no useful heating surface is lost. In a Lancashire boiler, with the ordinary form of setting, as much as 80 sq. ft. of heating surface is lost in some instances. It may be mentioned that there is no necessity to make the seatings 3 or 4 in. in width, as is usually done. A width of  $1\frac{1}{2}$  in. is quite sufficient to support the heaviest Lancashire boiler when full of water.

In building the side walls of the setting it is always advisable to provide an air cavity in the walls, with the object of preventing loss of heat by radiation through the setting. Air is a very good insulator, and the provision of a stagnant air cavity round the setting effectually prevents loss. The makers of the "Poulton" setting, in addition to building a cavity in the side walls, also provide one underneath the boiler, the importance of doing so being well illustrated by the following example:—"At a large electric light and power station where a range of 10 boilers is installed, it was found that the temperature of the clay underneath the concrete foundations, 10 ft. below the bottom of the boilers, was as high as 280° F. These particular boilers were worked night and day by means of forced draught. A huge mass of material was thus maintained at this high temperature day and night, by a direct waste of useful heat"—which, of course, was constantly flowing into the subsoil and being dispersed.

A certain amount of loss by radiation is unavoidable, but by providing air cavities in the way pointed out, covering the boilers and steam pipes with good non-conducting composition, &c., the losses may be reduced to very small dimensions. As a further preventive against radiation, the brick walls may be carried up to the top of the boilers and then roofed over so as to form a hot-air chamber, in addition to the non-conducting covering.

Much loss frequently occurs through allowing the non-conducting covering to become defective. Many types of covering are perishable, and it is therefore advisable to examine the material periodically to see that it is in good condition.

Generally speaking, the quantity of heat lost by radiation from a hot boiler averages about 10 per cent. of the total heat of combustion. This figure might easily, in a great many instances, be reduced to 7 or 5 per cent., so it is obvious that this question of radiation is one of considerable importance.

It is not generally realised to what extent loss may occur through constant fluctuations of the water level in steam

boilers. By maintaining a constant water level and feeding regularly, a more uniform steam pressure, drier steam, and an improved circulation may be obtained, all of which tend to effect economy in working. Hence, great care should be exercised on the part of those in charge of steam plant to prevent fluctuations of water level and to feed regularly.

This is not a difficult matter when the load is a steady one, as at a cotton mill, but at power stations such conditions do not prevail, and hence the adoption of an efficient automatic feed-water regulator will prove to be of great advantage at these places. From comparative tests which have been made on boilers with and without automatic feed regulators, it appears that an economy of 5 to 10 per cent. may be effected by means of the regulators, the best results being obtained where the load fluctuates a good deal.

In conclusion, some reference should, of course, be made to the importance of utilising some of the waste heat from steam boilers. A large proportion of the heat generated by the combustion of the fuel in the furnace is not used in evaporating water into steam in the boiler, and passes away towards the chimney stack, and it is, therefore, necessary to employ suitable means of utilising some of this heat. Fuel economisers, superheaters, &c., are employed for this purpose, and by their adoption the fuel consumption may be reduced by anything up to 15 per cent., depending on conditions. These accessories are so well known and familiar to station engineers that little need be said about them, except that the remarks already made regarding clean plates, both on the water side and the fire side, high rates of flow of gases and water, &c., apply equally to economisers as they do to steam boilers.

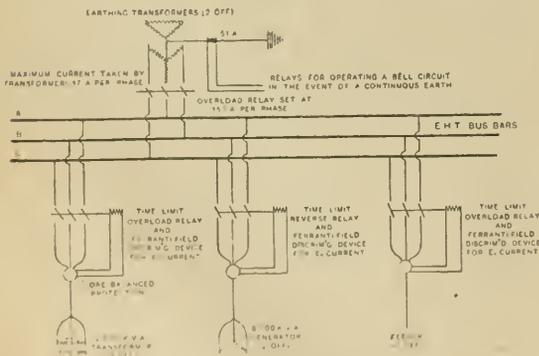
## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

### Earthing the Neutral.

Mr. Peck's paper upon "Earthed and Unearthed Neutrals on Alternating-Current Systems" has raised an interesting discussion. The majority of the speakers agreed upon the question of earthing, but none of them appear to give reasons why the current should be limited or unlimited. The question of earthing had to be settled here some 18 months ago owing to the adoption of a three-phase supply, and I think the following information will be interesting to your readers.

The two and three-phase systems are interconnected by



Scott-connected transformers, and the first point I had to decide was to provide an earth when the transformers were supplying three-phase current. The capacity of the transformers is 1,000 K.V.A. each, and at light loads they supply three-phase current to several feeders.

It was undesirable to earth the three-phase system through the neutral connections of the transformers, the chief reason being that should an earth develop on any of the

feeders, the overload relays on the transformers would operate and thus cut off all the supply, including the earth connections, without indicating the faulty feeder. Up to the present, earthing through a resistance on A.C. systems only follows a similar arrangement with a D.C. three-wire system at 500 volts.

The use of limiting devices now generally employed on E.N.T. three-phase systems causes an abnormal rise in pressure in the neighbourhood of the fault. On the other hand, to allow 500 amperes to stray between the fault and the neutral point of the system is not beneficial either to gas, water and telephone companies' property, or to the distribution system. It was, therefore, necessary to adopt some other method of overcoming these difficulties.

I give below the advantages of the arrangement that has been in use in Sheffield during the past 18 months. The diagram of connections is shown herewith, which, I think, is self-explanatory:—

1. The personal element of switching a working generator or transformer to earth is obviated.
2. No expensive automatic selecting device is required.
3. The earth current is limited to 51 amperes, which is sufficient to trip the Ferranti-Field discriminating device.
4. The earthing device was built by the British Electric Transformer Co., and is in the form of a transformer arranged with primary star-connected and secondary delta-connected. Having the secondary delta-connected ensures that the neutral point on the primary is always at earth potential, as proved by experiment.
5. The earthing transformers are arranged to operate the trip coils of the respective switches in parallel with the overload and reverse relays.

6. The units per hour taken by the earthing transformer are 1,250 watts. The capital cost was approximately £150.

S. E. Fedden, *Manager.*

Electric Supply Department, Sheffield,

December 21st, 1912.

[This arrangement was referred to in our article on the Sheffield undertaking, on September 6th last.—Eds. E.R.]

### Electric Cranes.

I was rather interested in an article appearing in a recent issue dealing with electric cranes, and would be glad if the author would further enlighten me on this important subject. The controlling gear of the D.C. crane consists of a double-pole distribution board, controllers that can be wired for either single or double pole, and eight trolley wires between the girders.

Why is the crane wired single pole?

I understand that the overwinding arrangement is a knife switch erected on the crab, and at the proper time this switch opens and breaks the main circuit.

If I am correct in this assumption, I should hardly call it modern practice; most cranes have a circuit-breaker connected in the hoisting-motor circuit, and, erected in the control cabin; this is held in position by means of a coil which, when short-circuited, trips and opens the breaker. A small switch, which takes the form of a push-button, is erected on the crab, and employed to do this.

This means more trolley wires, I know, but I think it is worth the extra expense as opening the main circuit on the crab has some objectionable features.

Regarding the crane wired for alternating current, I should obviate the use of a common main by putting up another trolley wire.

The practice of having a main common to two or more motors is one not to be commended, because faults may arise in the wiring which would greatly increase the danger of the hoisting motor brake operating when cross travelling or long travelling.

My remarks regarding the hoisting limit switch on the D.C. crane hold good for the A.C. one, and finally, I think there are more efficient controllers on the market for controlling three-phase asynchronous motors than those shown in the diagram; in any case the wiring at the controllers is obviously wrong, because we have a short circuit between two phases of the supply on all controllers.

J. L.

Glasgow, December 26th, 1912.

### The Case of the Sub-Man.

I and other members of the E.T.U. have been interested readers of the correspondence which has appeared in the columns of the REVIEW during the past weeks, from sub-station and shiftmen, about their woe-begone condition.

The whole correspondence bristles with contradictions; they first of all assume that they occupy a unique position, being a sort of aristocracy of the electrical industry, upon whom shines the reflected glory of the chief engineers (I see the Burgh of Paisley requires the services of one of these embryo Faradays at £1 5s. per week), and in the next sentence they say that milkmen, yardmen and others can, and do, accomplish their work.

They are all agreed that Trade Union principles are not applicable to their grade, and the unanimity with which they refrain from telling us why is certainly convincing.

The objective apparently is, *vide* "Motor-Generator," to form an association, to be called "The Electrical Shift Engineers' Association," the object being the furthering of the living wage cause (rate not stated), and to be recognised as a body of men of education and training; the association not to be run on Trade Union principles. The I.E.E. is to be approached for "recognition," and the trick is done. "O the brave music of a distant drum."

The more one reads this correspondence; the more apparent does it become that, however well-intentioned the writers may be, they lack a true appreciation of the factors which govern the wages and working conditions of any industry, and the sooner they get rid of the shibboleth "profession," and the snobbishness attaching thereto, the better it will be for themselves.

The "chief" is merely a deputy for the employer, and, from the nature of his position, has to show a return on the undertaking, and the price of labour, especially unorganised, is more easily squeezed than the price of Osram lamps.

If "Motor-Generator" and his colleagues are really serious in their contention that "to strike one blow for this great cause" is to form an "Association" to obtain "recognition" from the I.E.E., they had first better visit a local menagerie, obtain access to the lion's den just before feeding time, say a few prayers, and await the result.

The interests of the station attendant and the wireman are identical; both sections are necessary for the efficient working of the industry, they are interdependent, their economic circumstances are due to the same primary causes, and a multiplicity of organisations will not find the solution. The Electrical Trades Union is an accomplished fact, has a considerable body of central station men in its ranks, has improved conditions for large numbers of electrical workers in the various grades, and will welcome recruits on the principle of "each for all and all for each."

J. Potter,

*District Secretary, Electrical Trades Union.*

London, N.W., December 28th, 1912.

### High-Tension D.C. in Mines.

I am much interested in Mr. Sydney Walker's article entitled "A Plea for the use of High-Tension Constant Continuous Currents in Mines." Under the heading "Questions of Economy," he states that with a three-phase system at a working pressure of 3,000 volts in a mine having five miles of cable the combined losses are in the neighbourhood of 500,000 Board of Trade units per annum. I have no doubt Mr. Walker has gone very carefully into these figures, and do not in any way wish to criticise them, although they appear somewhat high. What I should like to know is—

1. What percentage loss this is of the total Board of Trade units consumed?

2. What Mr. Walker estimates the loss would be in a high-tension continuous-current system having a proportionate length of cables with, as I understand from his article, full-load current circulating throughout the whole system continuously?

Unless some such information is to hand, it is difficult to form any idea of the merits of the two systems from an economic point of view.

Civil Engineer.

The title of Mr. S. F. Walker's article in your issue dated December 27th, 1912, as above, disarms any criticism on the point that he writes as an advocate and not as an impartial judge. Nevertheless, as an engineer who has devoted some few years to electrical work in mines, the writer would like to put forward a few points which appear to discount somewhat the advantages claimed on behalf of the above system, taking these *seriatim*:—

*Two Cables versus Three.*—Since three-core cables must (and should) always be used underground on the three-phase system, the great advantages of and greater simplicity in making connection to the concentric cables advocated for the U.T. C.C.C. system are not very apparent. In neither case must any attempt ever be made to joint the cables when alive. The majority of jointers prefer jointing three-core cables, and these have the additional advantage that the cores need not be jointed in order to take off a branch circuit.

*Pressure Variation between the two cores at Different Points.*—The writer grants that should this difference of pressure in any particular district (say, at the coal face) be so small that a shock would be harmless, some advantage might be claimed, but this hardly appears probable, as any difference of pressure above, say, 100 volts, should be regarded as dangerous from a "shock" point of view. The spark danger would exist at any pressure. A distinct disadvantage would appear to be, that although the cable on the C.C.C. system would normally carry the constant current at a certain difference of pressure between the cores, it would be neither advisable nor practical to grade the various cables to withstand this pressure only, as the pressure might vary to such a large extent when alterations or additions to the motors were made. In fact, it seems to the writer that the whole of the cables should be built to withstand the maximum pressure likely to be generated, otherwise continual change of cables would be necessary, and great liability to serious accidents incurred through the breakdown of cables under higher voltages than they were built for. A similar problem will have to be faced if the total load at any time exceeded that contemplated when laying down the plant. This compares disadvantageously with the three-phase system, where the sectional area of the cables can be increased by simply putting others in parallel at any part of the system required.

*Liability to "Short."*—Surely, Mr. Walker is not serious in his statement that, because there are three cores as against two, liability to "short" is increased sixfold?

Cables made by any of the leading firms in this country are not likely to "short" (barring misuse) unless mechanically damaged, say, by a fall of roof, in which case there is little, if any, advantage in a two-core over a three-core cable.

Again, if a "short" occur in a C.C.C. system all apparatus beyond the "short" is put out of action, as Mr. Walker states; but, on the other hand, a similar occurrence on a three-phase system will not necessarily put the whole service out of gear, as Mr. Walker suggests. Part of the system only will be cut off in this case also, owing to the operation of a trip coil or fuse controlling the section containing the fault. Yet again, in the C.C.C. system, surely local heating can take place at a "short," since this will carry the whole current? The contact is not likely to be so good that heating never takes place.

*Armouring.*—The difficulty of repairing armouring is not so great as Mr. Walker imagines. The best way (apart from putting in a new length of cable) is undoubtedly to use a joint box. It must be remembered that on a large system there will be a number of these boxes, say, 100 yd. apart with a very heavy cable, and 400 or 500 yd. apart with a light one. One extra joint box where the cable has been damaged, is not a very serious matter. It may be of interest to state here that joint boxes which *efficiently* bond the armouring can be obtained from cable firms who have made a special study of mining work. Serious damage to the armouring is not a frequent occurrence where the cables have been installed in the right way, and are properly looked after.

*Danger from Shock.*—Cases of shock, similar to those mentioned by Mr. Walker, are not inherent in, or peculiar to, the three-phase or any other system, but are usually caused by the lack of knowledge or carelessness on the part of those who are responsible for the installation or the working of the system. The writer cordially endorses the opinion that

a great deal of the trouble in the past has been due to the fact that many of the designers of electrical appliances for use in mines had very little practical knowledge of mining conditions. This, however, was to some extent the fault of the mining people themselves, sufficient discrimination not always having been employed by them in placing their contracts, the question of first cost frequently determining their choice.

*Economy.*—It is rather disappointing to find under this heading that no attempt has been made to compare the two systems. The author does not say how he arrives at the high figure given for hysteresis and magnetising losses.

As against this, too, must be taken into consideration the fact that the  $c^2R$  losses in the c.c.c. system will be proportionately greater when only a few motors are in use, more particularly when they happen to be at the far end of the line.

Again, while on the subject of economy, the first cost of the cables in the c.c.c. system would appear to be rather high, since their sectional area must be the same throughout, and, in the writer's opinion, to grade the dielectric strength would be likely to lead to trouble in the future when alterations or additions were made.

Other disadvantages suggest themselves, but for the present purpose space and time have limits.

As the subject of electrical work in mines must be of great interest to a large number of your readers, further articles on the subject would probably be welcomed.

L. C. Trevor-Roper.

Sheffield, December 30th, 1912.

Having had some experience of mining electrical appliances, I read with some interest the contribution by Mr. Walker in your current issue which naturally attracted my attention, especially as some of the statements appear so wide of what my experience points to, that I think, for the sake of the many more or less connected with mining work who read your paper, they should not be allowed to go unchallenged.

This is my excuse for writing on the subject, and airing some views which are my own, and which I shall think correct till some one proves them otherwise.

On one matter I agree with Mr. Walker, viz., the unreliability of armoured cables carrying several conductors of greatly varying potential and phase.

A remedy, however, for this, suggested long ago, which would, I believe, have been tried but for the bugbear of a little experimental initial cost, is as follows:—

Adopting an alternating system, either single-phase or polyphase, with transformers, run separate well-insulated and braided conductors in iron tubing—not of just the ordinary house-wiring strength, but more resembling the pipes used for carrying steam or compressed air, but, of course, smaller, so as to give equal, or even greater, tensile strength, with, of course, only a fraction of the cost of the steam or air pipes. The joints to be safe ones, both electrically and mechanically, by using either faced flanges, screwed couplings, or some other reliable arrangement. Junction-boxes and transformer-boxes of equally strong mechanical construction to be similarly joined to the tubes, and the whole casing to be well "earthed" on the surface, and at as many places on the way in the mine as reliable "earth" can be found.

The two advantages claimed for this arrangement are:—(1) Being entirely enclosed, high-tension currents (up to 5,000 volts or more) could safely be employed; (2) the cables being separate, could easily be tested for "earthing" or breakage from the surface, and the fault easily rectified. The cables from the transformers to motors, if only carrying current at 100 volts or thereabout, could be given the flexibility required for coal cutters, &c., without danger or much risk of the insulation giving way.

This system, too, would get over most of the variable potential difficulties to which Mr. Walker refers.

With direct current (or continuous, whichever term you prefer; I prefer the former, being shorter, and generally understood to mean the same) we have not yet any system or practical means of reducing to low pressure that can be enclosed efficiently without the difficulties inherent to

running machinery enclosed, or at the same very small loss as obtains in a transformer. On this point, iron losses in transformers of reasonable size and decent construction rarely exceed 2 per cent. of the energy transmitted, and an instance came before me where one of 500 watts capacity, 200 to 50 volts, 50 cycles, tested by a Leeds Corporation inspector, showed only 2 watts iron loss.

Then, coming to the working of a direct-current motor with a by-pass, which is used to cut it out by short-circuiting, if not working, this must be either automatic or under hand control—I presume the latter; this requires, it seems to me, very reliable and conscientious use for one machine not to interfere with others on the same mains, and the beautiful conception of the voltage and consequent shock risk lowering as one gets further in the mine, can only hold good whilst all is in apple-pie order. Past experience does not warrant the assumption, however, that series apparatus can be relied on to keep in good order.

On the other, both transformers and alternating motors are amongst the electrical items of which the maintenance is easiest and least expensive, and seem to give the lasting solution which will, I believe, when those who have the choice of the electrical plant are sufficiently educated, be more and more used.

Apologising for the length of this, which, however, but briefly explains what could be further demonstrated—

A. W. Bennett.

Leeds, December 30th, 1912.

## NOTES FROM INDIA.

[FROM OUR SPECIAL CORRESPONDENT.]

*Calcutta.*—An effort is being made to bring together the members of the I.E.E.; invitations have been sent out to the various members, associate members, &c., to foregather at Peliti's restaurant at dinner with a view to having a preliminary talk as to the best way to arrange for frequent meetings and discussion. This is a step in the right direction, because, even though members of the Institution may be rivals in business, there is no reason why they should not meet outside business hours, on neutral ground, and have friendly discussions on technical points of interest to all. The last meeting of Calcutta members was held in 1903, with the late Father Lafont, C.I.E., in the chair, when an interesting paper on "Electrical Instruments for India" was read by Prof. Bruhl, of Sibpur Engineering College.

*Lahore Electric Supply Co.*—The official opening of the new electrical power house of this company took place recently, and there is every prospect of a good load coming on soon. Mr. Jensen, the chief engineer, is responsible for the design and working of the installation, and in him the directors have been fortunate in finding a capable and enterprising young engineer who will leave nothing undone to ensure the success of the undertaking.

*Simla.*—While the Imperial Government is down in Delhi for the cold-weather months until March, 1913, a good deal of installation work is certain to be carried out in Government buildings and private bungalows in Simla. Even at present a couple of local small wiring contractors are reaping a good harvest before the bigger firms of Calcutta and Bombay send representatives up there. The municipality have prepared very rigid rules for wiring work, and are open to register the name of any reputable firm who bind themselves to adhere to these rules when carrying out work. This is a wise precaution, as many of the Simla buildings are wooden ones, where a fire caused by an arc or a short would lead to disaster.

*Ranpur.*—Messrs. Siemens Bros. have been successful in obtaining the contract for the city lighting; the machinery will consist of Ruston crude-oil engines and Siemens dynamos, with accumulators. About 14 miles of streets are to be electrically lighted.

PROCEEDINGS OF INSTITUTIONS.

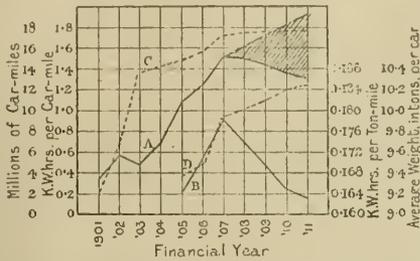
Tramway Feeding Networks.

By J. G. CUNLIFFE, M.Sc.Tech., and R. G. CUNLIFFE, M.Sc.Tech.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Manchester, December 3rd, 1912.)

The object of the paper is to present a suggestive treatment of the modifications which, as a result of continued development, are rapidly becoming necessary in the design of the feeding networks of many large street railway undertakings, and in the legislative limitations imposed thereon.

Larger and more powerful cars are continually being adopted, and are run at closer intervals. Traffic stops increase in frequency, necessitating a quicker acceleration in order to maintain the schedule speed, and the rate of consumption of energy per car is greatly increased. The net result of this increased rate of consumption and of the reduced headway is to cause a still greater



Curve A, kw.-hours per car-mile; Curve B, kw.-hours per ton-mile; Curve C, car-mile run; Curve D, average weight per car.

FIG. 1.—OPERATING STATISTICS FOR MANCHESTER.

increase in the intensity of electrical loading as expressed in kilowatts per mile. These effects are illustrated by the curves on fig. 1. At Manchester, owing to the small extent of the "city area," the rate of electrical loading at the centre is some 1,500 kw. per mile of route, and the rate of energy consumption of a car is some 38 per cent. greater at the city end than at the suburban end of a route. Special references are made to Chicago, owing to its very heavy loading.

Several of the sub-stations are designed for an ultimate capacity of 18,000 kw., whilst sub-stations of 12,000-kw. capacity are not uncommon. These large stations are interconnected by heavy cables, which generally serve also as feeders.

It is obvious that, under these circumstances, in view of the strict limitation of the line pressure, the governing factor in the feeder designs must, at some stage in the development, change from overheating to pressure drop, and that boosting must ultimately be resorted to. As the intensity of loading increases, special

The conductivity of the trolley wires is a matter of importance with the feeding system illustrated in fig. 2, a, and at Manchester their section is increased, on renewal, according to the distance between feeders and to the intensity of loading, this being a temporary provision until such time as installation of additional feeders is justified by the increased intensity of loading, the rate of consumption of energy being reduced by this and similar means as shown by the shaded area in fig. 1.

Several feeders are often operated in parallel for the purpose of preventing too frequent opening of the circuit breakers controlling very heavily loaded sections; and, even with very short sections, it is observed that, owing to the relatively high conductivity of the feeders as compared with that of the trolley wires, the feeders do not share the load equally, the centre of gravity of the load moving over a range of quite half the length of the section. As the whole of the copper must be fully utilised, this has led to the use of heavy feeders with several short sub-feeders radiating to the adjacent feed points. This method is becoming very common, more especially for the feeding of complicated networks. It is equivalent to the installation of equalising cables between the feeders.

Little relief can be afforded long feeders by over-compounding, as the permissible pressure rise at the bus-bar is limited by the pressure rise which may be allowed at the feed points of the shorter feeders, and this should not exceed 10 per cent. If a pressure drop materially in excess of 10 per cent. is, for economical design, required in the long feeders, therefore, it becomes necessary to employ separate positive boosters.

It is unsafe to operate a group of separate feeders from a common booster owing to the risk of abnormal pressure rise at the feed point of a temporarily lightly loaded section, and although, by parallel operation of the feeders, this risk may be avoided, the practice leads to unequal distribution of the load amongst the feeders, the shorter ones being overloaded. For satisfactory operation, therefore, a separate booster ought to be installed in each long and heavily loaded feeder, and with the heavy loading under consideration this would often be practicable. In order, however, to avoid the installation of a large number of boosters of varying capacity the authors suggest that advantage be taken of the method already described of employing main feeders, each having several short sub-feeders. The arrangement is illustrated in fig. 3, and the pressure drop in the main feeder alone would be compensated by the booster, so that the sub-feeder bus-bar would be maintained at a constant potential, the design of the sub-feeders being governed by considerations of overheating alone, and their load fluctuations not materially affecting the pressures at the feed points.

Automatic circuit-breakers with tell-tale indicators at the generating station, whence they could, if desirable, be operated by

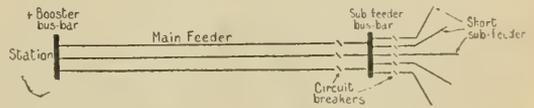
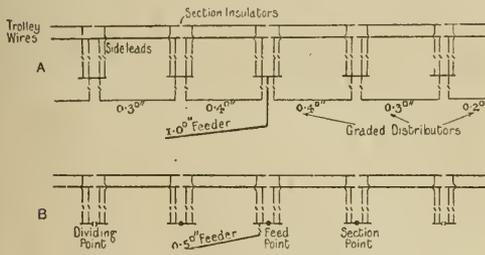


FIG. 3.—SYSTEM OF FEEDING BY SUB-FEEDERS, WITH MAIN FEEDER ONLY COMPENSATED FOR PRESSURE DROP.



A, British Standard with side leads and distributors (Birmingham); B, British Standard with side leads and simple feeders, (Manchester).

FIG. 2.—METHODS OF POSITIVE FEEDING.

means become necessary in order to maintain the rail drop at a sufficiently low value, and negative boosters must ultimately be adopted.

With light loading and few supply stations the system of feeding illustrated in fig. 2, A, is generally employed, and consists of feeders supported by distributors, which may or may not be graded in size according to the nature of the load variation and to the special duties which they may be required to fulfil. With a large number of supply stations, as at Manchester and Liverpool, the simple feeder system shown in fig. 2, B, is employed, since, even with the short lengths of feeding section available, with economical distribution through the trolley wires alone the feed points are nearer to the stations than to each other. As the intensity of electrical loading increases, the length of feeding section rapidly diminishes, and with very heavy loading, owing to the reluctance of engineers to employ feeders much larger than 1 sq. in. in cross-section, the simple feeder system of feeding is universally adopted, although, in many cases, with modifications, as at Chicago, where the feeder is continued throughout the whole length of the section and tapped on to the trolley wires at intervals of from three to six spans, the conductivity of the trolley wires being ignored in the design.

remote control, might be installed as shown in order to confine the area affected by a feeder breakdown, and would immediately localise the fault.

The general method of negative feeding is by means of separate feeders, as illustrated by fig. 4. It is impossible mechanically to divide the rails into definite feeding sections as is done in the case of the "line," and all negative feeders from any station must be operated in parallel, the difficulties encountered arising from the resulting lack of exact control of the load distribution in the rails. The conditions are exactly the reverse of those applying to the parallel operation of positive feeders, the conductivity of the four rails of a double track being equal to that of some 4 sq. in. of copper, and hence greatly superior to that of any individual negative feeder. It follows, therefore, that with light loading the amounts of current returning by the respective feeders, if of the same size, will be almost inversely proportional to their lengths, and in order to compel the longer feeders to do their duty they are in some cases made heavier than the shorter ones. In other cases resistance is inserted in the shorter feeders.

However carefully the negative feed points may be selected, the distribution of the return current amongst the feeders is, with very heavy loading, to a great extent governed by the nature of the load distribution, and there cannot be, without excessive outlay in copper, more than one point in the track on each side of the supply station at which there is no current flow, i.e., the rails on each side of the station cannot be divided into more than two feeding sections in which the directions of current flow are mutually opposed, the direction near the station being outwards from it. It is merely a question of the balance of potential following Kirchhoff's laws. The balance point between the two sections can, for fixed loading conditions, be moved farther from the station by increasing the resistance of the shorter negative feeders or by reducing that of the longer ones, and vice versa, but the extent to which, with heavy loading, this can be done, is limited by the pressure loss in the feeders, since the latter alternative is too expensive in copper. For a given length of track with increasing loading the maximum permissible rail drop is ultimately attained when copper must be provided to carry any additional current, and as this copper is operated at a very low current density, its use is very uneconomical.

At Chicago, the 129-lb. rails are reinforced by bare copper cable, in increasing section from 500,000 cm. (0.3927 sq. in.) on the outskirts of the sub-station area to 10,000,000 cm. (7.854 sq. in.) in the neighbourhood of the station, and even with this great outlay there is much electrolytic trouble. The direction of flow is uninterrupted, and if the bonds were cut and the cables separated, the longer ones would bring back more current.

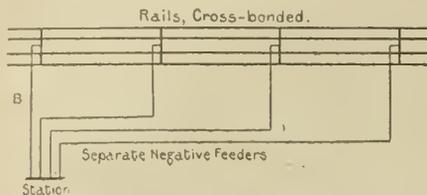


FIG. 1.—METHOD OF NEGATIVE FEEDING ON BRITISH STREET RAILWAYS.

By the use of negative boosters the track may be divided into definite feeding sections almost as perfectly as is the line, and the flow of current in the rails may be controlled in a manner which is almost ideal; but in the few cases in which negative boosters are in use, this has not been done. No definite principle has been adopted, the boosters serving merely as a means of compelling long negative feeders to do their duty without excessive outlay in copper, the principles underlying the application being the same as in positive boosting.

Thus, Glasgow has a negative booster mounted on the shaft of each rotary converter at the sub-stations, and provision is made, as at Sheffield, for switching any booster on to any one of the long negative feeders, or on to a group of long negatives. At Glasgow and Sheffield the negative boosters are excited from positive feeders, but at Leeds there is a large negative booster, capable of being switched on to a group of long negative feeders, excited from a shorter negative feeder, whilst several smaller boosters, used on occasions of heavy traffic, are excited from positive feeders. A negative booster has been in use for some time at Birmingham in order to maintain the feed point on a route served by a long negative feeder at the same potential as that on another route fed by a shorter negative from the same station, whilst the authors know of no case of the use of negative boosters in America, and of only two cases on the Continent.

(To be continued.)

### The Turbo-Converter.

THE paper on this subject, by MR. F. CREEDY, of which an abstract was given in our issue of November 8th, 1912, p. 765, was read before the meeting of the SCOTTISH SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS, at Edinburgh, on December 10th.

PROF. BAILEY (Edinburgh) said he took it that with the contrivance they required plant of, say, 1,000 kW. to turn out 500 kW. of power. That was a serious matter, and could only be allowed if they could not work the commutating machine at all. He could not see where this elaborate arrangement could be more satisfactory than simple mechanical gearing. It cost a great deal more and must be distinctly less efficient. Mechanical gearing would run up to 95 per cent. efficiency in large sizes at least, and this machine could not manage that; 92 or 93 per cent. would be the greatest that the induction generator would reach. He gathered that any suitable ratio could be used, and it might have particular applications in certain cases, although he did not see its application for ordinary central station work, where they wanted to run a D.C. machine at a lower speed than the turbine speed. He commended the introduction of the squirrel-cage motor and the application of the spinner idea.

MR. J. A. ROBERTSON asked Mr. Creedy for the combined efficiency of the set. He would not agree with the author in describing the direct-current turbo-generator as a mechanical monstrosity. A great change has taken place in the design of these machines, and he had seen a 1,000-kw. D.C. machine with carbon brushes, which had been running for about two years without the brushes having to be renewed. If they could get a D.C. turbo-generator to work satisfactorily, it would be preferable to this complicated design. Looking at the matter from the commercial point of view, he pointed out that they very rarely in present practice required D.C. in the central station. Modern practice was tending towards large generating units, and the transmission of energy in large quantities, which meant high-pressure transmission, and they were all agreed that the only practicable method of doing this at all was the three-phase A.C. system. He had found in recent years that remarkable efficiency could be obtained in generating with A.C. and utilising the rotary or motor-converter in sub-stations. As for the three-wire system, he thought the figures given by Mr. Creedy were better than anything that had been got from the usual arrangement of tapping a neutral point in a transformer, and carrying it through to the middle wire of the D.C. system, and quite lately he had adopted the expedient of putting in automatic reversible boosters on the end of the rotary shaft: as one side or the other was out of balance, they found this gave good compensation for the drop in voltage.

MR. F. A. NEWINGTON (Edinburgh) thought the arrangement would be more reliable for large sizes than mechanical gearing. He did not see how they could get a reliable machine with cut gearing to

run at 3,000 or 4,000 revolutions per minute, while he would not agree with Mr. Robertson that there was no use for D.C. plant in large power houses, it seemed that they would be driven into the adoption of A.C. simply because of commutator troubles. It was not the system, but the plant that was at fault.

MR. BUNTING (Edinburgh) asked if the actual machine had been constructed of any particular size.

MR. WILFRID L. SPENCE (Edinburgh) said he saw the greatest difficulties with the proposed bearings, and an almost insuperable difficulty in keeping them oiled. They got a reduction of the overhang in one of the diagrams submitted, but they also got the ends of the bearings right into the centre of the electrical windings. The spinner ideas were, commercially speaking, almost impossible. He could get mechanical gearing to work well at high speeds, and this was simply due to perfection of cutting and lubrication.

MR. SAM MAVOR (Glasgow) said it might interest Mr. Creedy and others to know that his firm (Messrs. Mavor & Coulson) were in communication at present with one of the most experienced builders of large marine turbines on the Clyde, with special reference to mechanical defects involved in the spinner motor, especially in large sizes, and those engineers had said most emphatically that they saw no insuperable difficulty in the mechanical design of the spinner motor in large sizes. They considered that they had overcome difficulties much greater.

THE CHAIRMAN said he had seen a good deal of trouble with commutators at high speeds.

IN the course of his reply, MR. CREEDY pointed out that the device was got up on purpose to avoid a machine of 1,000-kw. capacity to give a 500-kw. result. This was the result they got if they used an A.C. generator to drive a rotary converter. The arrangement he had described bore the same relation to that as the motor-converter bore to the motor-generator. The capacity of the set was the sum of the capacity of the elements, not twice that. As to the three-wire system, Mr. Robertson had answered the question about the compounding of it, for which there was no way except by a booster. He considered the percentage of drop quite reasonable. He agreed with Mr. Robertson that the thing to do was to abolish D.C., but failing that, he thought there was some use for that apparatus. He had not got any definite figures to offer on efficiency. He was glad to hear Mr. Mavor's statement that large marine turbine builders saw no insuperable difficulty in the spinner idea. In this respect he thought mechanical engineers less conservative than their electrical brethren, who sometimes failed to admit the utility of a design which mechanical engineers were familiar with. The apparatus described was free from the possibility of gear stripping in the case of sudden short-circuits, and while the gearing might be less expensive than the induction generator, they saved on the converter, which was cheaper than the generator.

### Modern Methods of Electric Wiring.

ON December 11th MR. FRANK BROADBENT, M.I.E.E., read a paper on this subject before the ASSOCIATION OF ENGINEERS-IN-CHARGE. Referring to the earlier methods, the author pointed out that in 1874 a Canadian patent of Woodward described both the tree system and the distribution system of wiring, on which all modern developments were based. For interior wiring, he said, the distribution system was now practically universal in this country; in rare cases a pair of conductors were run to each individual light, and in motor installations this system was undoubtedly the best, as it facilitated testing and caused the least possible derangement in the event of the motor being overloaded or faulty. In large installations subdivision was necessary, carrying the distribution system a stage further; from the main switchboard feeders were run to main distribution boxes, and from these in turn sub-distribution boxes were fed, followed by smaller sub-boxes, if necessary, before the branches were run to the various groups of lights. In planning an installation, it was often the best plan to work back from the lighting points to the main switchboard, rather than *vice versa*. The Institution Wiring Rules, which were now generally recognised as the minimum standard to which good electrical installation work should conform, prescribed a limit of 600 watts for a branch circuit and fuse, but even this small value, with modern lamps, represented more than one might care to control by one fuse. In public buildings it might be necessary to run two circuits where one would suffice from the point of view of current-carrying capacity, in order to prevent the possibility of plunging a room in darkness through the failure of one fuse. The principal circuits might, with advantage, be limited to 5,000 watts, fixing the number of ways in the sub-distribution boxes at 10 or 12. The main distribution boxes should not control more than about six circuits each. The largest installation thus consisted of a number of small installations linked up to a central distribution point. The same principles applied to motor installations, treating each motor like a group of lights.

JOINTS in wiring were to be avoided, looping being preferable, within limits; but the latter was frequently carried to excess, causing unnecessary expense, complication and risk, as the wires were not really looped in actual practice, but were cut and held together in the terminals, and the mechanical connections thus made were not always above reproach.

WHILE the Institution rules allowed small wires to be run at current densities up to thousands of amperes per square inch, on the basis of temperature rise alone, it was not possible to use such high densities unless the length of conductor was very short, as the voltage drop would be excessive. For lighting circuits a drop of 2 or 3 per cent. might be allowed, but for power circuits the current density was the only limit. Not more than half the drop

should take place between the main switchboard and the distribution boxes.

Regarding the quality of conductors employed, owing to the fact that the smaller cables of a given grade had a higher insulation resistance than the larger ones, it was possible, when a specification called for a given minimum insulation resistance, as in the Phoenix Rules, to use cables of different grades of insulation on a job without any of them falling below the proscribed minimum. On the other hand, the Institution Rule No. 41 made it clear that for all work up to 250 volts the cables must be of at least the 600-megohm grade, in which the smallest cables had an insulation resistance of 1,250 megohms per mile. The grades referred to were those of the Cable-Makers' Association, and the "Association" label was a hall-mark as to quality. The "non-Association" quality was listed as a 600-megohm class, and nothing above 600 appeared to be guaranteed in any size. The only simple test of rubber insulation was the stretching test, and the only safe practice to use well-known British manufactures.

For feeders and main circuits, paper or fibre-insulated lead-sheathed cables might be used with advantage.

For low pressures and in dry situations, wood casing had done very good service, and even in damp places it had been extensively and successfully used when treated inside and out with waterproof paint or varnish. The chief objection to it was its combustible nature. For moist places, good lead-covered cable, properly installed, was hard to beat, but it must be properly supported throughout its length. It must never be used in tanneries or breweries, or underground near the roots of trees, unless specially protected. It could be run along dry brickwork with comparative safety, but not along a damp wall or in contact with moist lime. The creeping of the lead sheathing must be guarded against by continuous support, and in the case of vertical runs, lugs should be soldered to the sheath. Lead-covered cables must not be laid in contact with iron.

For factory wiring and public buildings, screwed barrel was very largely used, and, when well done, made a sound engineering job. Slip socket conduit was not recommended. The choice of system for use in moisture-laden atmospheres was a difficult question; pipes tended to become water-logged, with disastrous consequences. For such cases open work on insulators was preferable, the vertical runs to switch positions being in conduit sealed with compound at the top and open at the bottom. Electrically speaking, there was no such thing as a watertight piping system.

Using screwed piping installations in "fireproof" buildings, the author had never had any trouble due to condensation in the pipes, owing to the fact that he insisted on a clear space being left between the pipes and the walls or ceilings. The piping must be metallically continuous and earthed, and the joints must not be made with red or white lead, but the screw threads should be painted with aluminium paint and put together whilst wet. The earth connection was often quite inadequately performed. After filing a clean place on the conduit, it should be painted with aluminium paint, and a substantial earthing grip should be attached to the prepared place. The same method should be applied to the waterpipe which formed the earth. Serrated earth grips made a very good contact.

All switch boxes, motors and other metal must be earthed, but manufacturers, with few exceptions, never fully appreciated the fact.

Thus we have small ironclad switches and fuses with two smooth inlets and outlets for the cables, instead of one tapped boss top and bottom to receive a screwed pipe. When only one hole is provided, it is in rare cases that sufficient room is provided to permit of leading the cables into the terminals without dangerous cramping. In some designs, even by the most reputable firms, the iron cases are split across the cable inlets, which are provided with porcelain insulators to pass the cables through. This involves stopping off the pipes on each side of such boxes, bushing the ends, attaching earthing clips to them, and connecting these to the boxes by wires in any convenient way, which is generally by twisting them under the heads of the fixing screws. It is a tinker's job when all is done. Again, motor makers turn out motors intended for 400-volt circuits without terminal boxes. In some cases they adopt the hateful American practice of leaving tailpieces sticking out with brass sweating sockets on the ends. How in this world they expect a wireman to connect his cables up to these, and at the same time maintain metallic continuity between the pipework and the motor case, in accordance with Home Office requirements, is known only to themselves. I am afraid I speak rather feelingly on these points, as I have seen so much of it, and cannot help sympathising with the wiremen and erectors, who get thoroughly disheartened when, after taking special pains to maintain metallic continuity throughout the piping system, they find that the fittings supplied have been designed in entire disregard of all regulations, and that they have to make a patchwork job at the finish.

"One is tempted to go on to criticise those fittings, and they are legion, which are so designed as to make it impossible to wire them without stripping the conductors of their protective coverings; to comment on those distribution switch and fuse-boxes which need to be entirely dismantled in order to erect them; to point out the absurdity of placing terminal screws in such positions that it is impossible to apply a screwdriver to them, and so on."

Wood distribution boxes were preferable for domestic purposes; the continuity of the piping could be preserved by fixing iron plates top and bottom to receive the pipes, and bonding them together. The common practice of connecting fuses directly to the bus-bars in the boxes prevented them from being made dead without making the box dead, when replacing a fuse. When knife switches were used with the current passing through the hinges, the live ends of the cables must be connected to the clip contacts and not to the hinges, otherwise the blades were alive when the switches were off.

For dry interiors the Stannos and Henley systems of wiring were finding wide application, as they made a much neater job than steel conduit for surface work. The St. Helens Cab-tire sheathing was also useful for specially bad situations.

## THE PHYSICAL SOCIETY EXHIBITION.

(Continued from Vol. 71, page 1034.)

Robt. W. Paul.

A large number of instruments were exhibited by Mr. Robt. W. Paul, most of which were of quite recent design.

We illustrate (fig. 3) a sensitive microammeter, indicating one-fifth of a microampere and arranged with suitable internal resistances and shunts for measuring pressures from '02 to 600 volts and insulations up to 3,000 megohms. The shunt switch is fitted with a clutch which prevents the instrument from being closed unless



FIG. 3.—PAUL UNIPIVOT TESTING SET.

the switch is left in the least sensitive position, and connection may be made directly to the galvanometer by means of detachable plugs. This test set has advantages in respect of simplicity and compactness of design.

A still simpler form of testing set was shown (fig. 4) no larger than a lineman's detector; it consists of a Unipivot with two scales, one of which is graduated in megohms. This galvano-



FIG. 4.—UNIPIVOT DETECTOR.

meter is a separate unit, and can be detached for other tests when required. When it is in position in the set, any insulation resistance connected to the terminals I, E, is read off directly on the scale.

Another exhibit was the Unipivot series of D.C. millivoltmeters adapted for the measurement of high-frequency and alternating current by the addition of a heater, which is crossed at its centre by a small thermo-junction; the alternating current being passed

through the heater, the thermo-junction indicates the value of the high-frequency current or pressure direct on a square-law scale. The device is enclosed in an exhausted bulb which, by means of suitable resistances put up in the same case, can be standardised, and in that form is called a thermal converter. These thermal converters may be fitted with interchangeable multipliers, so that current or pressure up to any value may be read by a system already well known in connection with the D.C. instruments.

Dynamometer Unipivots have now been developed as single or multirange ammeters, voltmeters or wattmeters, in a form convenient for portable precision instruments for alternating current of frequencies up to 400 per second.

An improved dynamometer was shown, which was recently invented by Mr. J. T. Irwin, and contains an astatic moving coil, whereby errors due to extraneous fields, even of considerable

about .002 mm. diameter, and the instrument can be used with a reading microscope, or by projecting curves on a travelling photographic plate for recording wireless telegraph signals and for physiological work.

The Irwin Optiphone was shown recording speech waves, and among other telephone measuring apparatus was a cross-talk meter and an artificial telephone cable. The latter, which we illustrate (fig. 6), was designed by Mr. B. S. Cohen. Each section can be separately removed, it being shielded from the remainder by aluminium plates. Each section is thrown into action by operating a four-pole switch, thus obviating the necessity for the manipulation of a number of switches or plugs, and rendering speedy adjustment possible.

#### H. Tinsley & Co.

THE principal features of this firm's exhibit were the various instruments devised by Dr. C. V. Drysdale for alternating-current work. The A.C. potentiometer which has been evolved by their co-operation, for frequencies between 25 and 500 cycles per second, was

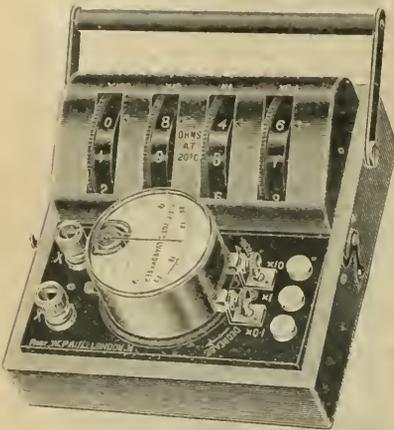


FIG. 5.—PORTABLE BRIDGE.

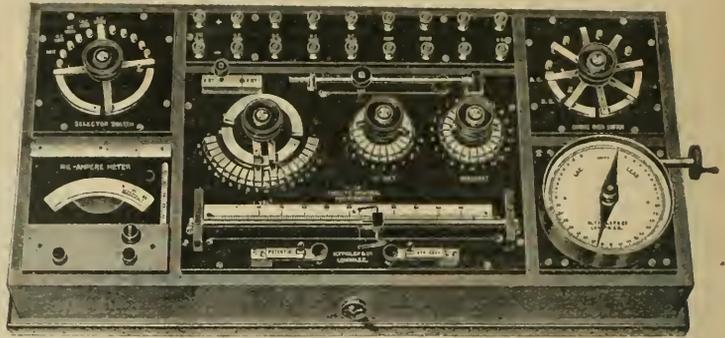


FIG. 7.—DRYSDALE A.C. POTENTIOMETER.

intensity, are eliminated. This dynamometer is made as an ammeter, voltmeter or wattmeter in a convenient portable form, and also as a reflecting instrument of high sensitivity. It can be set up as a standard for calibrating A.C. apparatus.

Among numerous improvements in resistance measuring apparatus may be mentioned an extremely compact and portable self-contained Wheatstone bridge (fig. 5), weighing a little over 2 lb., and containing four decade sets of coils, together with multiplying ratios, which are put into action by depressing one of three keys. These keys are arranged so that the small battery, which is enclosed in the set, shall not be unnecessarily exhausted. On pressing the key lightly a resistance is put in the battery circuit, and thus the sensitivity of the bridge is reduced. When the balance is nearly obtained the key is pressed harder, and the resistance is then short-circuited, so that the full sensitivity is obtained. The battery can be easily renewed, as it is of a kind kept by most dealers in electrical

shown (fig. 7). As the result of five years' work, the readings of this instrument, in its most improved form, are accurate within 0.1 per cent., and the phase angles within 0.1 of a degree; the phase-shifting transformer now gives a pure sine wave at all angles, in spite of the presence of iron, the harmonics being almost entirely eliminated. This instrument fills the gap in alternating-current work corresponding to the indispensable potentiometer in D.C. work, and we understand that it is being adopted by large electricity works for the measurement of alternating currents up to thousands of amperes, in the same way as the D.C. potentiometer.

A high-frequency A.C. potentiometer for telephonic research was also shown, having a range up to 2,000 cycles per second, and, in conjunction with this, an artificial telephone line, 100 miles long, was exhibited. One of the most interesting features of the exhibit was a diagram plotted from readings obtained with this instrument over a 50-mile telephone cable; the attenuation of this line at 1,000 cycles per second was enormous, but the readings were obtained on the potentiometer with ease and certainty; the effect of the inductance of the receiving instrument in compensating for the capacity of the line at the receiving end was clearly demonstrated. The phase displacement in this instance amounted to as much as 360°, as regards the voltage, and the current twist was 376°.

Other exhibits included Dr. Drysdale's stroboscopic slip indicator, the principle of which has been fully described by the author in our pages, and which is the only instrument of its kind that gives by direct reading the percentage slip to within  $\frac{1}{100}$ th per cent.; standard wattmeters with astatic coils and fields with an accuracy well within 0.1 per cent.; and the Drysdale phase-shifting transformer for meter-testing, a new pattern which is guaranteed to give an absolutely pure sine wave at all phase angles as well as a constant voltage, the phase angle being also guaranteed correct to a fraction of a degree. Many other instruments were contained in this very interesting exhibit.

#### Harry W. Cox & Co., Ltd.

This firm showed a collection of X-ray apparatus, interrupters, fluorescent screens, &c.

#### The Edison Storage Battery Co.

Edison accumulators, complete and in parts, were shown by this company.

#### Elliot Bros.

The latest patterns of the Century testing sets, P.P. dynamometer instruments, and instruments of various types for portable and switchboard use, were shown.

#### A. Gallenkamp & Co., Ltd.

Furnaces for temperatures up to 1,100° C., of the resistance type, with silica heating surfaces, were the electrical features of this exhibit.

(To be continued.)

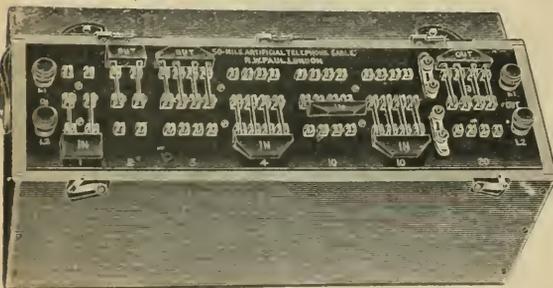


FIG. 6.—ARTIFICIAL TELEPHONE CABLE.

novelties. As in the case of the insulation meter, the galvanometer can be detached and put into a leather case for pocket use.

A number of new types of electrostatic voltmeters and pyrometers were shown, as well as some new instruments of the Harris ohmmeter class, the working parts of which are similar to those of the Omega described in our issue of October 18th last. Of these ohmmeters, one was exhibited having separate ranges and reading from 1 microhm upwards.

Mr. Campbell's apparatus for high-frequency measurement of inductance and capacity was shown in action, the latter measurement being made by the Carey Foster method, which gives direct readings from 1 micro-microfarad up to 10 microfarads.

Important improvements have been made in the string galvanometer, which has now been reduced to its simplest and most accessible form, the design being based on that of Dr. H. S. Sonttar; in this instrument the string consists of a glass tube

## LEGAL.

OSHAM LAMP CO. v. D. SMITH &amp; CO.

IN the Chancery Court on Friday, December 20th, before Mr. Justice Warrington, Mr. Colefax, K.C., on behalf of the Osham Lamp Co., applied for an injunction to restrain Messrs. David Smith and Co., Red Lion Court, Fleet Street, E.C., from dealing in certain electric lamps which were an infringement of two of their patents, namely, No. 23,899 of 1904, and No. 18,622 of 1906.

Counsel stated that defendants had traded in certain electric lamps which they said were made in Dresden, but which the plaintiffs alleged were an infringement of their two patents in the treatment of the filaments. In November the defendants were approached, and 150 lamps which were described as "Goblin" lamps, were purchased, and some of these were handed over to Dr. Oberlander, who analysed them. Others were sent to Sir James Dewar, and an analysis of the filaments convinced both gentlemen that these had been made of tungsten with a compound of binding material, and that the carbon had been removed by the process which was an infringement of the plaintiffs' patents. His Lordship would remember that the whole matter was dealt with in a previous action. So far as the evidence of the defendant was concerned, it amounted to this, that this Dresden company from whom he obtained his lamps had simply informed him that the lamps had been made in a way that was not an infringement of the plaintiffs' patent, and the only other evidence was that of Mr. Bevan, who had stated that in his belief there was another process by which they could extract carbon from the filaments by the use of hydrogen. Counsel read affidavits of the results of the examination of the lamps by Dr. Oberlander and Sir James Dewar, and asked, having regard to these, that an injunction should be granted.

MR. TERRELL, K.C., for the defendants, stated that after the trial of the action to which Mr. Colefax had referred, everyone was particularly anxious that there should be no infringement of these patents, and the defendants had obtained specifications of them and forwarded them to Dresden asking if there would be any infringement of the English patents in connection with the Goblin lamp. In reply he had been assured that they did not infringe these patents in any way. At the trial of the previous action the question raised was whether the carbon was removed physically or chemically, and, of course, after the judgment in that instance, everybody had taken care what method was used. Why should it be presumed that in the present instance moisture had been used? Supposing there were three ways of dealing with filaments; one by using nitrogen, one by using moist hydrogen, and a third by which the carbon could be removed physically by electric current at a high temperature. If his learned friend said that the first two came within his patents, he still had to prove that it had not been done in the third way. That carbon could be taken out of the filament by this means there could be no doubt.

HIS LORDSHIP said he thought, on the whole, he ought to grant an interlocutory injunction. There had been no evidence at all from the manufacturers of the Goblin lamp as to their process. All he had was a general statement that they did not infringe the patent. A specification of the second patent was sent to the German manufacturers, but it was not said in their answer that they treated their filaments by chemical process purely, and they did treat them with hydrogen. It was just possible that they might treat them with hydrogen in such a way as to expel the carbon physically and not chemically, but that was all, and he thought he ought, on the evidence of Sir James Dewar and Dr. Oberlander, to treat that as being so doubtful that it would be better that he granted an injunction for infringement rather than let the defendants go on selling the lamps, which might possibly be a serious matter for the plaintiffs.

His LORDSHIP granted the injunction accordingly.

## DUNDEE TRAMWAY CLAIM.

A PECULIAR point arising out of the working of the Dundee-Monifeth Tramway has been decided by Sheriff Neish. A farmer sued the Dundee, Broughty Ferry and District Tramway Co. for £60 in respect of loss and damage sustained by him through one of the defenders' cars coming in violent contact with a cart and two horses belonging to him. For the company it was contended that the motorman and conductor of the car were at the time of the accident acting as servants of the Dundee Corporation, and the Sheriff finds in fact and in law that they were, and dismisses the action, with expenses to the defenders. His Lordship thinks pursuer's remedy was to sue both the company and the Corporation, and let them fight out the question of liability. He feared, however, the pursuer was now too late to sue the Corporation.

**The Numbering of Tramway Routes.**—In reference to a decision by the London County Council, on July 30th last, that the routes on the tramways should be numbered, the routes to be indicated by means of numbers fixed to the cars, the Highways Committee recently reported that since that date an improved type of plate, manufactured by VENNER'S SIGNS, LTD., had been brought to their notice. To fit all the cars with this type of plate and the necessary reflector, lamp, &c., would cost about £1,570 more than in the case of the plates originally contemplated. The Committee recommended, and it was agreed, that the plate manufactured by Venner's Signs, Ltd., should be adopted.

## BUSINESS NOTES.

**Calendars and Diaries.**—THE ARMORDUCT MANUFACTURING CO., LTD., of Farringdon Avenue, London, E.C., have sent us a set of refills for their perpetual desk calendar circulated a few years ago. We shall find these refills useful in 1913. The Armorduct Co. has also sent us one of its desk blotting pads which might have been more serviceable if the top pocket border had been just a little quieter. Each sheet of blotting contains a calendar for the year.

THE DIAMOND COAL CUTTER CO., of Wakefield, have prepared a wall calendar with monthly slips for 1913. The design includes a picture of one of their coal-cutting equipments.

From MESSRS. VENNER & Co., of 6, Old Queen Street, Westminster, London, S.W., whose new year souvenirs are always useful, and last well, we have received a handy little key-ring, accompanied by an appropriate folder written in characteristic Venner style. If any of the firm's usual recipients have been inadvertently overlooked, they are asked to notify the fact, and so long as the stock lasts they will prevent disappointment.

MESSRS. ALFRED HERBERT, LTD., of Coventry, have again issued a most serviceable monthly sheet calendar for the New Year, each sheet bearing an art illustration of one of their machine tools, and boldly-printed dates.

THE D.P. BATTERY CO., LTD., have again drawn upon the beauties of the country in which their works are situated for a picture wherewith to adorn their 1913 calendar. A charming view in colour of Water-cum-Jolly on the River Wye, which provides the company's water power, so takes one's interest that the set of small monthly slips is almost lost sight of.

THE HART ACCUMULATOR CO., LTD., of Marshgate Lane, Stratford, London, have once more prepared as a New Year souvenir for their friends a handy desk blotting pad.

From the GENERAL ELECTRIC CO., LTD., of Queen Victoria Street, London, we have received another of their serviceable desk reminder stands, with a set of turn-over engagement slips for the year 1913.

From MESSRS. PIRELLI, LTD., we have received an ingenious hanging or desk perpetual type calendar. Daily and monthly changes are effected by turning a couple of brass knobs, the name of month and date figures being clearly brought out within the circle of a Pirelli tire which stands out quite realistically against a green and blue watery background, with waterfalls and a sky of golden glory beyond.

The insulating varnish department of Mr. CHAS. H. BLUME (White Building, Sheffield) will be remembered during 1913 by all who receive their excellent wall calendar, for above the monthly date slips there is a charming reproduction of the well-known picture by Millais in which two boys—Sir Walter Raleigh and another—are under the early spell of tales of the sea and what lies beyond it. Together with the calendar Mr. Blume has also sent us a handy size memoranda and pocket engagement book (one line per day) for the year. A number of useful tables and an "Ocean" insurance coupon are contained therein.

THE SUN ELECTRICAL CO., LTD., of 118 and 120, Charing Cross Road, W.C., have sent to their friends a pocket propelling pencil and case of refills for obvious purposes during 1913. If perchance any pencils have gone astray, a line dropped to the company will at once bring another to take its place.

A calendar of serviceable size and interesting design has been received from the WESTERN ELECTRIC CO., LTD., of Norfolk House, London, W.C. It is suitable either for hanging or for desk use, and has monthly tear-off slips with clear figuring.

MESSRS. THERMIT, LTD., of 27, Martin's Lane, London, W.C., have issued one of their useful pocket note-books with 1913 and 1914 calendars, also a number of pages of descriptive and other matter relating to the Thermit system.

MR. H. A. WESTMCCOTT, electrical contractor, of 280, Geswell Road, London, E.C., has circulated a wall calendar with monthly slips.

A wall calendar in which both the perpetual and the monthly tear-off slip arrangements are employed has been prepared by POPE'S ELECTRIC LAMP CO., and they will send a copy to anybody who may perchance have been overlooked, on receipt of application. "Elasta" wire lamps are, of course, well in evidence in the design.

Friends of MESSRS. FALK, STADELMANN & Co., LTD., 83-87, Farringdon Road, London, E.C., have received an "Efesca" scribbling pad, which, we imagine, will be a very serviceable desk companion for some time to come. Calendars for 1913 and 1914 appear inside the cover, and the pad is of the renewable class. Any of our readers can have one on application to the firm.

MESSRS. NEALE & WILKINSON, LTD., shipping and forwarding agents, 32, St. Mary Axe, London, E.C., have issued a wall card for 1913, showing conveniently a calendar for the entire year, in addition to which there is a block of daily date slips, with bold red figuring. Copies will be sent on application.

THE DUSSEK BITUMEN CO., of Canal Bank, Deptford, London, S.E., have made an excellent improvement in their pocket-book and diary for 1913. This time, instead of the accustomed cover, we have a letter and card case with refill diary (Letts), also an accident insurance coupon.

**Concert.**—On Saturday next, January 11th, at 7.30 p.m., the St. James' Electric Athletic Club will hold its 12th annual smoking concert at the Pillar Hall, Victoria Station Restaurant.

**Book Notices.**—*The Practical Electrician's Pocket-Book and Diary for 1913.* Edited by H. T. Crewe, M.I.Mech.E. London: S. Rentell & Co. Price 1s. net.—This well-known pocket-book has been improved by the omission of superfluous matter, and the addition of new sections dealing with coal-cutters, cables, power and lighting installations, wireless telegraph stations, the new Home Office Mining Rules, &c., making a net increase of 44 pages. It is a handy size for the pocket, and contains a vast amount of information useful to the electrician engaged in practical work.

"Poems." By Edmund L. Hill. London: *Electrician Printing and Publishing Co., Ltd.* Price 2s. 6d. net.

"Bulletin Mensuel de la Société Belge d'Electriciens." Vol. XXIX, No. 10. October, 1912. Brussels: Emile Bruylant. Price 1.75 fr.

"Bulletin of the Association des Ingenieurs Electriciens." November, 1912. Liège: The Association. Price 9.50 fr.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXI, No. 12. December, 1912. New York: The Institute. Price \$1.00.

"Proceedings of the Physical Society of London." Vol. XXV. Part 1. December 15th, 1912. London: The *Electrician Printing and Publishing Co., Ltd.* Price 4s.

"Journal of the Franklin Institute." Vol. CLXXIV, No. 6. December, 1912. Philadelphia, Pa.: The Institute. Price 50 c.

"Fortschritte der Elektrotechnik." By Dr. Karl Strecker. Berlin: Julius Springer. Price M. 14

"School of Mines Quarterly." Vol. XXXIV, No. 1. November, 1912. New York: Columbia University. Price 50 cents.

"Bulletin Scientifique de l'Association des Elèves des Ecoles Spéciales." November, 1912. Liège: The Association. Price 75 cents.

"Proceedings of the Engineering Association of New South Wales." Vol. XXVI. (With list of members.) Sydney: The Association.

"Journal of the Western Society of Engineers." Vol. XVII, No. 9. November, 1912. Chicago: The Society. Price 60 cents.

"Bulletin of the Bureau of Standards." Vol. VIII, Nos. 2 and 3. June and November, 1912. Index to Vol. VII, "Melting Points of Fire Bricks." By C. W. Kanolt. Washington: Government Printing office.

"Boletín de Ingenieros." Vol. III, No. 3. November 16th, 1912. Mexico: Departamento de Ingenieros de la Secretaria de Guerra.

**Catalogues and Lists.**—THE BRITISH THOMSON-HOUSTON CO., LTD., 77, Upper Thames Street, London, E.C.—We have received eight sections of the recently-issued complete catalogue of the B.T.H. lamp and wiring supplies. As the book was fully noticed here at the time, we need only mention the titles of the separately-bound sections:—A. Wiring Accessories (holders, ceiling roses, wall plugs, distribution boxes, &c.); B. Bells, Telephones and Batteries; C. Electric Light Fittings; D. Incandescent Electric Lamps; E. Theatrical Apparatus, Flashers, Signs and Motor-Car Accessories; F. S. Shades and Reflectors; G. Conduits and Accessories; H. Wires, Cables and Accessories. Each of the sections has a different coloured cover of stiff art paper, and, in order to protect the edges of the inside pages, the covers are of such a size as to overlap the latter.

MESSRS. J. KIRBY & CO., Alpha Street, Dewsbury Road, Leeds.—Illustrated pamphlet of eight pages relating to water-pressure driven pumping engines and Ramsbottom triple-ram water engines for mining and other purposes; also a four-page list showing and briefly describing their electric outfits for organ-blowing. Prices are stated in some cases.

THE SCHNIEWINDT ELECTRIC CO., 40 and 41, Stannforth Street, Birmingham.—New lists of resistance wires made by the Kratos-Werke Erlau, for whom they are sole agents in this country. Nickel-chrome heating wires in all sizes are stocked.

MESSRS. NATIONAL ALLOYS, LTD., Altior Foundry, 38, The Hill, Ilford, London, E.—Twenty-four-page catalogue describing their various manufactures, which include "Ivanium" aluminium alloys, "Cupranium" brasses and bronze, "Bear-ring" anti-friction metals, "Altior" manganese, aluminium and phosphor bronze, &c. A table is given of physical properties of metals.

**Trade Announcements.**—MESSRS. LODGE BROS. AND Co. have built large offices adjoining their works in Wrentham Street, off the Bristol Road, Birmingham, and during the holidays they removed into them. The change was imperative, owing to business expansion. All communications should be sent to Wrentham Street in future. Telephone No.: "Midland 2200" (two lines). We have received an illustrated leaflet of the "Lodge" sparking plug.

MR. GEORGE E. PIGGOTT, who has for the last 15 years made the subject of elevating a special study, has now associated himself with Messrs. Etchells, Congdon & Muir, Ltd., of Manchester, and will manage their London and South-Eastern Counties business at his present address—24, New Bridge Street, London, E.C. Samples of the various parts of apparatus are on view, including the automatic speed governor and collapsible gates.

MR. C. FRANKLIN TUBBS has increased his manufacturing accommodation, and taken new premises in Carlton Mills, Leeds, which cover a floor space about four times that of the old workshop. The extension was necessitated by increasing demand for "Nonpareil" apparatus, and prompt delivery of all classes of A.C. switchgear and other specialities will now be ensured. All correspondence should be addressed to 2, Craven Terrace, Carlton Hill, Leeds, as previously.

MR. P. S. DOHERTY, of 25, Victoria Street, London, S.W., has been appointed sole British agent for the sale of locomotives manufactured by the Société Anonyme de Saint Léonard, of Liège, and also for railway bridges, points and crossings manufactured by the Société Anonyme du Nord de Liège.

THE ARMORCUT MANUFACTURING CO., LTD., are making further large extensions at their Witton Works to cope with the increasing demand for their specialities.

Our Bradford correspondent writes that the PHOENIX DYNAMO MANUFACTURING CO., LTD., of Thornbury Works, Bradford, announce their intention to double the capacity of their works, and state that the cause of the necessity of this extension is the success of their specialised system of textile driving.

THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, London, announce that, owing to the large increase in the sales of E.A.C. high torque electricity meters, and both D.C. and A.C. motor control gear, they are again obliged to arrange for works extensions. A contract has just been entered into for the building of three additional shops, which will principally be devoted to the manufacture of the above apparatus. The present factory, built early in 1911, was a very large extension as compared with the old premises at Milford Works, and now the company have again practically doubled their premises. During the year 1912 they successfully introduced their apparatus abroad, and we understand that their export trade with Canada, South America, Australia, New Zealand, China and Italy is beginning to take on large proportions.

THE ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., of Cheston Road, Aston, Birmingham, advise us that they have just appointed Mr. W. Ogden Dayson, of 1, Mount Street, Swansea, to represent them for their electrical manufactures in South Wales. Mr. Dayson succeeds Mr. C. R. Hough, of Swansea, who has given up the agency in order to start business for himself in the Midlands. Mr. Dayson's telephone number is "914 Central."

THE NORTHERN ELECTRICAL AND VENTILATING CO., LTD., removed on 31st ult. from Dale Street, Liverpool, to 6, Williamson Square. New telephone number, "Royal 4364." A large selection of electric light fittings, shades, &c., will be on view in the new showrooms early in the New Year.

**New Vulcanised Bitumen Strip.**—A new form of vulcanised bitumen strip has just been introduced by MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, E.C., with which a homogeneous joint can be made in the insulation of V.B. cables, the difficulties hitherto met with in making a satisfactory joint having been overcome. The new material, which is called the "Clyde" tape, is of such a nature that the simple process of warming the lapped joint with a blow lamp causes it to become thoroughly adherent and to form a perfectly homogeneous joint. It is supplied in any of the usual widths, from ½ in. upwards, in rolls of about 1 lb., and in three thicknesses, packed in air-tight tins.

**For Sale.**—The Bristol electricity department has for disposal a 30-ft. electric launch, and a quantity of electrical plant and material. See our advertisement pages in this issue.

**Dissolutions and Liquidations.**—LIGHT RAILWAY SYNDICATE, LTD.—This company, meeting at the offices of the New General Traction Co., Ltd., London, on November 25th and December 2nd, resolved to wind up voluntarily.

INTERNATIONAL "Z" LAMP ASSOCIATION, LTD.—This company is winding up voluntarily with Mr. C. Field, Broad Street Avenue, E.C., as liquidator. A meeting of creditors is called for January 6th. Creditors must send in particulars of their debts, &c., by January 31st.

SUPERHEATERS, LTD.—A meeting is called for February 3rd at 19, Southampton Street, London, W.C., to hear an account of the winding up from the liquidator, Mr. G. W. F. Dawes.

**Bankruptcy Proceedings.**—WESLEY SUTTON, 62, Dale Street, Liverpool, lately trading in partnership with Samuel Lord and John William Garsden, under the style of the Howe Electrical Engineering Co.—This debtor attended at the Court House, Government Buildings, Victoria Street, Liverpool, last Monday, before Mr. Registrar Howarth, for his public examination. In reply to questions, the debtor disputed the allegation made that he had anything more to do with the books of the firm than Mr. Lord had, so far as investigating the condition of the business was concerned. When he left the partnership, the £100 he received was a figure arrived at by a balance-sheet, and at that time he was not aware that in law he was liable for certain amounts for which he had since been held liable. He attributed the failure of the company to the large amount of money spent on the development of certain patents, out of which they had expected to make their fortunes. From 1876, when he returned to England from America, to 1893, he was engaged in an engine-packing manufacturing business in London, Castleton and Manchester, from which he retired with about £2,000. Later, he had an interest in an "outside" stockbroking business in Manchester, in which he lost considerably. Afterwards he had another business in Birmingham, which he sold for about the same figure as he had given for it, and about 1895 he went to Liverpool and joined the Howe Electrical Engineering Co., into which he paid £300 capital. In October, 1909, that business was sold to a limited company. The case was adjourned, and certain accounts were ordered.

ALBERT EDWARD MARTIN (trading as the Midland Electrical Supply Co.), electrical engineer, 39, Great Charles Street, Birmingham.—January 8th is the last day for the receipt of proofs for dividend. Trustee, Mr. A. S. Cully, 191, Corporation Street, Birmingham.

**SAMUEL LORD**, director of a limited company, 18, James Street, Liverpool.—Mr. Registrar Howarth also held a sitting at Liverpool last Monday for the public examination of this debtor. Mr. Percy Martin appeared for the debtor, whose statement of affairs showed liabilities amounting to £3,312, and assets estimated at £5 10s., which sum was insufficient to cover the claims of the preferential creditors. Questioned by the Official Receiver, the debtor stated that he had formerly been in partnership with Wesley Sutton, who was his father-in-law. He (Lord) was at present manager of an electrical engineering company at a salary of £3 a week. About 18 years ago he joined two others in partnership under the style of the Howe Electrical Co. He brought in £600, obtained by an advance on a reversionary interest in his father's estate, and later he brought in further capital. About three years later one of the partners retired, and the business, which was carried on at Redcross Street, Liverpool, was continued by himself and Mr. Wesley Sutton, the other partner. At that time a Mr. Garsden was admitted a partner, and a branch of the business was opened at Blackburn. This gentleman also brought in capital. In September, 1909, the partnership assets, with the exception of the outstanding book debts, were sold to a company called the Howe Electrical Engineering Co., Ltd., for £1,200 in cash and £2,400 in shares, but the partnership liabilities were not to be taken over by the limited company. The partnership was dissolved in the following month, and he (the debtor) and Mr. Garsden paid Mr. Sutton £100 as his interest, and by the deed of dissolution agreed to indemnify him against all liabilities in respect of the late partnership. In February, 1911, the limited company went into voluntary liquidation, and part of the assets were acquired by a new company, of which he (the debtor) was now the manager. The debtor was questioned as to various sums borrowed from private persons and as to the overdrafts that were guaranteed at the bank and had been paid by the guarantors. He asserted that he knew very little about the financial affairs of the firm, as he left that mainly to Mr. Sutton, in whom he placed implicit confidence. In regard to the sale to the company, he stated that he knew very little about the figures, nor did he know how various amounts owing by the partnership were treated in the books of the firm. The Registrar ordered the case to stand adjourned, and intimated that the debtor must come prepared to give further information than he had given on the present occasion.

## LIGHTING and POWER NOTES.

**Argentina.**—Referring to the concession question in Buenos Ayres, the *Review of the River Plate* says:—In view of the fact that Messrs. Lacroze Bros. have now applied direct to the municipality for a concession under the same terms as those granted to the Alemana and Italo-Argentino Companies, we do not think that anything further will now be done in connection with this matter. By their application for a concession Messrs. Lacroze evidently do not intend to stand by the rights given them by the Government decree, and, therefore, if they do not adhere to those rights, in our opinion, no other company can claim the privileges established by that decree.

The Italian Argentina Electric Co. has secured, after a lively struggle, its concession to supply the city of Buenos Ayres with electric light. The society has, says *La Lumière Electrique*, a capital of 125 million francs.

**Australia.**—When the mail left Tasmania the works of the Hydro-Electric Co., Hobart, were about to be temporarily stopped. The explanation given was that more capital was needed to complete the works. "There is no doubt," said Mr. Ewing, one of the local directors of the company, in an interview with a Press man, "that the undertaking was under-capitalised considering the magnitude of the work that was contemplated."

A scheme for generating electricity by utilising the waters of the Yarra has just been under the notice of Mr. Graham, Minister for Agriculture and Water Supply. Power could be obtained from the Yarra between Evelyn and Horse Shoe Bend, 15 miles from Melbourne. A deputation on the subject pointed out to Mr. Graham that the Government should consider this in connection with the proposed electrification of the local railways. The Minister said that the suggestion would be laid before the State Rivers and Water Supply Commission for report.

**Baldon.**—The U.D.C. has sealed a memorial to the B. of T. applying for a prov. order for electric lighting.

**Ballyconnell (County Cavan).**—A scheme is on foot for the electric lighting of this village. The matter is in the hands of Messrs. T. McGovern and T. O'Reilly.

**Barking.**—Subject to the British Anti-Fouling Commission and Paint Co. guaranteeing a minimum consumption of 30,000 units per annum for a period of five years, the necessary extensions of mains are to be carried out to give the company an increased power supply. The Council's service main is to be extended across the Creek at an estimated cost of £225 to supply the northern outfall works of the L.C.C., subject to a guaranteed minimum revenue of £80 therefrom, plus interest on capital outlay.

**Basingstoke.**—With reference to the electricity scheme prepared by the borough surveyor, the T.C. has decided to obtain the services of an electrical engineer to report on the matter, and, if necessary, attend at the B. of T. in support of the application for a prov. order.

**Bentley (Yorks.).**—The Urban District Council has agreed to the suggestion that the Doncaster Corporation should supply electricity to Bentley at similar rates to those in vogue in Doncaster, and subject to arrangements being made between the Corporation and the local colliery company, which at present supplies electricity to certain parts of the Bentley district.

**Berwick-on-Tweed.**—The scheme of the Electric Supply Co. for a complete electrical installation at the barracks, has been accepted by the military headquarters. Under the scheme the entire premises will be lit by the electric light.

**Billerica (Essex).**—The R.D.C. has decided to have the electric light installed at the new hospital, at an estimated cost of £300, instead of purchasing a petrol air gas plant. The architect, Mr. Bird, has been instructed to obtain tenders.

**Bridlington.**—The T.C. has referred back to the Electricity Committee for further consideration a recommendation to apply to the B. of T. for consent to supply current outside the borough.

**Brighton.**—The engineer has been authorised to experiment with series high candle-power metal lamps for street lighting in place of series arc lighting.

It has been agreed to give the Brighton Railway a supply for lighting purposes on payment of £3 per kw. installed lighting demand per annum in addition to the charge registered through the power meter.

**Buxton.**—The U.D.C., with the idea of obtaining new consumers, has decided to distribute 1,000 circulars, which are to be followed up by a personal call. Sample radiators and other electrical appliances are to be fixed at the engineer's office for inspection by consumers.

The Council has decided to extend the mains to Buxton College, the necessary guarantee to meet interest on the outlay having been given.

**Canada.**—The operation of the Winnipeg electrical plant gives ample ground for hope that a 3 c. per kw.-hour rate may be established in that city during the next few months. The profit for the month of November, under the present low rates—about the lowest in Canada—was \$10,000. Prof. L. A. Herdt submitted to the Board of Control his recommendation for the erection of a second transmission line to Point Du Bois, adding two units to the plant there and enlarging the facilities at the McPhillips Street substation. The whole project would cost \$700,000, and would protect the city against all trouble that might occur.

Old Quebec City is rapidly becoming the centre of hydro-electric development. The Quebec Light, Heat and Power Co. had the field almost to itself up to a short time ago, but lately two new hydro-electric companies entered the field. The Stadacona Hydraulic Co. will be supplying energy about the middle of 1913, with some 10,000 H.P., practically all of which has been disposed of.

**SASKATCHEWAN.**—Mr. George Harrison, manager of the Saskatchewan Ironworks, states that there are about 10 million tons of good steam coal accessible at the Lake of the Rivers, and prophesies that, in due time, a great power station will be erected there to supply current to Regina, Moose Jaw and smaller towns. The Legislature has received the report of Mr. Wynn-Roberts on the feasibility of developing power at the Souris Valley coalfields.

**Castle Eden.**—The B. of T. has been applied to by the Cleveland and Durham County Electric Power Co. for consent to erect overhead mains at Castle Eden and Parklands, for the supply of current under the Acts of 1901 and 1903, at a pressure of 440 volts.

**Chile.**—Plans submitted for the establishment of an electric lighting installation in the city of Ancud have been approved.

**Cobham.**—The Epsom R.D.C. has declined the offer of the Leatherhead Electricity Co. to install electrically-worked pumps at the Cobham sewage works.

**Colne.**—Under the Colne Corporation Bill of 1913, powers are being sought to extend the area of supply of electricity, so as to include the districts of Trawden and Foulridge.

**Continental Notes.**—**AUSTRIA.**—Plans are being prepared for the establishment at Faal a. d. Drau, Styria, of what is expected to be the largest electricity generating station in Austria and Hungary. The Steiermarkische Electricitäts Gesellschaft is interested in the new undertaking.

**FRANCE.**—A company has lately been formed at Roisel (Somme) with a capital of £8,000, and the title *La Société Co-operative d'Electricité du Secteur de Roisel*, "to facilitate the agricultural industry by the supply of electrical energy for all purposes."

**ITALY.**—Under the auspices of the Società A.E.G. Thomson-Houston, of Milan, and a number of banks, a company has just been formed in Brussels with a capital of £60,000, to acquire an interest in electric tramway, light railway and electricity supply undertakings in Italy.

The new water-power generating station on the River Lima, belonging to the Società Ligure-Toscane d'Electricità has recently been completed, two 3,200 H.P. sets of turbines and dynamos being now in operation and connected up to the company's distributing plants at Luques, Leghorn, Pisa, Viareggio and Pescia. A new 1,000-H.P. Diesel engine has also been installed at the station at Luques and a new 2,000-kw. turbine and generator are being installed at the Leghorn plant. In addition, plans have been completed for a new generating station at Le Serchio.

**RUSSIA.**—A company has lately been formed at Bjalistock with a capital of 2,000,000 roubles and the title Die Bjalistockker Electricitäts Gesellschaft, to carry on the central electric lighting station which has been established in the town by the Deutsche Gesellschaft für Electricische Unternehmungen.

In order to meet the increasing demand for current, it has been found necessary to order a third gas engine and dynamo for the electrical power station in connection with the works of the Société Metallurgique Russo-Belge. When the new set is installed the plant will have a capacity of 11,000 H.P.

**Darlington.**—The Electricity Committee of the T.C. has adopted the recommendation of the engineer (Mr. J. R. P. Lunn) to carry out extensions to the electricity works, at an estimated cost of £10,790, and also to apply for loans of £8,000 for mains and services, and £1,500 for static transformers, for three years.

**Devizes.**—The T.C. has deferred until February consideration of an electricity scheme for the town submitted by a London firm.

**Edinburgh.**—The Inspector of Cleaning and Lighting for the city, after remarking on the efficiency of the street lighting, states that among the factors which have contributed to the present satisfactory condition of affairs may be said to be the electric lighting of the tramway routes, the erection of lamps on the islands at the car stopping places and the lighting of the garden side of Princes Street. The total lighting expenditure was £14,591.

**Esom.**—The R.D.C. has appointed a Committee to consider the application of the Leatherhead and District Electricity Co. for powers to supply current in the parishes of Stoke, Cobham, Great Bookham and Little Bookham.

**Fareham.**—The accounts, just issued, of the Council's electric undertaking for the year ended March 31st last, show a revenue of £2,428, and gross profit of £1,387, with which to meet interest and sinking fund payments amounting to £1,426. The deficit of £39 was made good from the reserve fund. Altogether 103,996 units were sold, and the maximum load was 86 kW.

**Farnworth.**—During the last two months the electric lighting of the main streets has been undergoing complete alterations. After exhaustive tests and experiments, it has been decided to adopt two 300-c.p. Osram drawn-wire lamps of 220 volts, in place of each of the Brockie-Pell 10-ampere arc lamps formerly used, and to fix them to the same poles by means of a two-armed bracket having a projection of some 36 in. from the pole, and fastened to it by cast-iron clamps. The lamps are now arranged at a height of 20 ft. centre of the lamp to ground, and are provided with suitable reflectors. The whole lighting scheme has been designed by Mr. Hutchinson, the engineer, and all the former feeders have been utilised.

**Glasgow.**—The T.C. has agreed to the proposal of the Electricity Committee to give very large supplies of power to Messrs. Beardmore & Co., Fairfield Shipbuilding Co., Messrs. Collins and Co., Messrs. Braby & Co., and other firms, on the basis of a fixed charge per kW. per annum, to cover charges plus a low-running cost charge, in lieu of a charge per unit. In connection with those and other applications a report was recently presented by Mr. W. W. Luckie, the chief engineer, in which he pointed out the maximum demand on the generating stations this winter had, so far, been 28,000 kW. (37,000 H.P.). This was the figure he estimated it would be in his report of September, 1912, and it was the maximum load the stations were capable of meeting. It was, therefore, absolutely necessary to put on order now, generating plant, not only for the winter of 1913-14, but for the winter of 1914-15, as the new works at Dalmarcock might not be available for the winter of 1914-15. The plant now proposed to be ordered would be installed in one of the existing generating stations and removed later to the Dalmarcock works. They already had two units of 4,000 kW. each, running at 750 R.P.M., but he recommended the T.C. to purchase the largest units of plant commercially available, running at 1,500 R.P.M., which would be found to be 7,500 kW. With a unit of this size they would get the lowest price per kW. of plant, and the maximum economy in steam and coal consumption. Quotations for two such units of plant should be got in at once, as the manufacturers were asking 12 months for the manufacture and delivery of such units, and the demand during the winter of 1913-14 would be at least 31,500 kW., and during the winter of 1914-15 at least 35,000 kW. These figures were exclusive of the idea of shutting down the steam plant at the Govan and Partick electricity works, and these works would continue to be called upon to meet their peak load with their own steam plant. The report was approved, and the engineer instructed to prepare the necessary schedules and specifications.

The T.C. has also approved of application for the consent of the Secretary for Scotland to borrow a further sum of £500,000 for the execution of capital works, which would raise the sum borrowed for that purpose to £2,500,000.

A deputation from the Birmingham Corporation is to make a tour of inspection of the Corporation electricity works and the power stations.

**Harrogate.**—The T.C. proposes to open a showroom, in which to exhibit and demonstrate the utility of electrical apparatus, in Swan Road. The B. of T. has been applied to for permission for the Council to supply current to premises outside the borough area.

**Herne Bay.**—The U.D.C. has adopted electric power for pumping purposes, and has entered into a seven years' agreement with Messrs. A. E. Hunt & Sons, for a supply of energy at 3d. per unit.

**Hoyleland (near Barnsley).**—The U.D.C. has been recommended by the Lighting Committee to defer for six months consideration of the question of lighting the township by electricity.

**Japan.**—One of the recommendations of the Special Committee of the Industrial Investigation Commission, which is at present holding an inquiry in Tokio as to the best means to be adopted for the encouragement of domestic industries, is that "the utilisation of hydraulic electric power should be carried to the furthest limits."

**Leeds.**—There is a proposal to extend the Whitehall Road Electricity Works, and a committee has been appointed to obtain the advice of a consulting electrical engineer. Mr. C. N. Hefford has been appointed temporarily as engineer of the electricity works.

**Liverpool.**—A large extension building has been opened by the *Daily Post and Echo* newspaper, in which, as in the old building, the plant is electrically driven. With a view to safeguarding the production of the paper, two Mirreles-Diesel engines coupled to Crompton generators have been installed in the basement, as a standby to the Corporation supply which is normally used.

**London.**—**POPULAR.**—The Electricity Committee reports having had under consideration the subject of the relationship of electric lighting contractors to the Council's undertaking. Contractors now canvass for custom for wiring and fittings, the work being carried out by the Council's staff, but as the Committee feels that the contractors should be encouraged to assist the undertaking by canvassing without the fear of losing work in this way, it has decided to place some orders with the contractors, to be carried out under the supervision of the department, for a period of three months, provided that all materials shall be obtained from the department; that the contractors work to a price list; add for labour and profit; pay Trade Union rates of wages, and that the acceptance of any estimate shall be at the discretion of the department. The question of lighting side streets is also under consideration. With regard to the breakdown which occurred recently to a 500-kw. engine at the generating station, the Committee states that it was not unlooked for, in view of the fact that the whole plant has been working for the past two months excessively overloaded in consequence of the unprecedented increase in the demand.

**ISLINGTON.**—The existing low-tension mains in Tufnell Park Road are to be extended, and provision is to be made at the same time for lighting that thoroughfare by means of flame arc lamps at an estimated total cost of £1,326—£968 for cable, and £357 for 13 arc lamps and columns.

**Maidstone.**—The Electricity Works Committee of the T.C. has recommended the installation of a new reciprocating engine at a cost of £5,260, and the extension of the engine house, &c., at a cost of £500.

**Perthshire.**—Messrs. Nicoll & Co., Dundee, have completed an installation of electric light for Stanley Parish Church, Perthshire.

**Portrush.**—The Coleraine Rural Council has declined to give consent to the inclusion in an order which the Portrush Urban Council is seeking of the right, in the event of its boundary being extended, of the latter to supply electric light to certain areas on the outskirts of the township, which are now situated in the Coleraine rural district.

**Portuguese East Africa.**—The Portuguese Government has signed a contract with an English capitalist group, for the supply of electric current for lighting and industrial uses in Lourenço Marques and neighbouring districts. The trust is bound to provide from 10 to 12 million units per year, at agreed prices. The charges are considered likely to stimulate the growth of local industries hitherto held back owing to the cost of imported coal.—*La Revue Electrique.*

**Rawtenstall.**—The Corporation has had under consideration a statement showing the present cost of street lighting, and the estimated cost of same when the main roads are lighted by electricity, on the basis of the charges submitted by a special sub-committee of the Tramways and Electricity Committee. It was decided that the borough electrical and tramways manager proceed with the electric lighting of Bacup Road, and that the Tramways and Electricity Committee be requested to state the terms on which it would be prepared to light and maintain the electric street lamps, provided the system of lighting is amended by not lighting the full number of lamps before 5.30 p.m.

**Romford.**—The County of London Electric Supply Co. has informed the R.D.C. that it intends acquiring compulsorily land at Dagenham on which to erect a generating station.

**Smethwick.**—The T.C. has decided to oppose the proposed transfer of the Smethwick E.L. Order from the Birmingham and Midland Tramway Co., to the Shropshire, Worcestershire, and Staffordshire Electric Power Co.

**South Africa.**—The Cape Town Municipal Council has considered a report from its electrical engineer, stating that general extensions of the electric lighting service in Cape Town

and its suburbs had become necessary, and submitting a list of wires and cables sufficient for six months, which he considers should be kept in stock. The list includes 33 miles of aerial braided wire, 15 miles of vulcanised rubber wire, one mile of concentric high-tension cable and 1,100 yards of three-core high-tension cable. The engineer states that it will also become necessary to increase the size of the sub-station for Green Point and Sea Point, and provide an additional feeder panel and two more transformer pillars. In addition, some 2½ miles of various sized armoured cables are required for underground services in Cape Town. It is proposed to invite tenders.—*Board of Trade Journal*.

**Stalybridge.**—The Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, on Monday, decided to apply to the L.C.B. for a loan of £20,000 for additional generating plant, owing to the plant at the power station being taxed to its limit.

**Todmorden.**—The T.C. has decided to advertise for an electrical engineer at £150 per annum.

**Truro.**—The T.C. has formally approved of the electric lighting scheme of Dr. Purves, of Exeter. The capital expenditure is estimated at £8,000.

**U.S.A.**—A recent *Times* article quotes the Census Bureau statistics for 1907, showing that there were then 4,711 central stations in the States, supplying during that year nearly 6,000 million units. Estimates as to the progress made in recent years place the number of stations in 1911 at 6,000, and the output at 10,000 million units. The *Financier* in a recent article states that the Southern Power Co. serves an area containing 420 cotton mills, with an equipment of 6 million spindles and 125,000 looms. Of these, current is supplied to 160 mills, with 2,373,000 spindles and 71,000 looms.

**Watford.**—The U.D.C. has decided to apply for a prov. order to enable current to be supplied to the parishes of Abbots Langley, Sarraft, and portions of Watford Rural.

## TRAMWAY and RAILWAY NOTES.

**Argentina.**—Mr. R. H. Rathland has applied to the Buenos Ayres Municipality for a concession for a service of electric trolley omnibuses between Flores, Belgrano, Plaza Constitucion and the Port.—*Review of the River Plate*.

**Belfast.**—On Monday afternoon, cars were run over the new extensions on the Stranmillis Road, Donegal Road, Ligonell and Oldpark Road, and everything passed off satisfactorily. The remaining extensions will be tested this week, and it is expected that all the routes will be open to traffic in about a fortnight.

**Burnley.**—The manager of the Corporation electrical tramways has reported upon the working of a goods wagon on the Harle-Syke section for three months, and the Committee has, as a consequence of the nature of that report, decided to continue the experiment, and extend it to the main line from Padham through Burnley to Nelson. The town clerk has been instructed to make application for the B. of T. consent.

The Tramways Sub-Committee has considered the means of communication to the Stoneholme and Burnley Wood districts. There has been a suggestion that branch lines should be run.

**Bury.**—After considering the report of a sub-committee on the question of car accommodation, and particularly the week-end requirements, the Tramways Committee has decided to purchase four small cars.

**Canada.**—Already running over 50 miles of track, the Ottawa Electric Railway Co. is planning an outlay of \$30,000 for an extension early next spring, to Ottawa South, an additional area taken into the city. Twenty new cars, of the pay-as-you-enter type, embodying all the latest ideas in steel construction, are being built at the Ottawa Car Works, one-half of which will be delivered on May 15th next. Owing to the interference of *frazil* or needle ice with the water generating system of the company's power plant, a steam auxiliary turbine has been ordered and will be installed near the present site, at the Chaudiere, at an estimated cost of \$200,000.

**Cardiff.**—Mr. Arthur Ellis, the Corporation tramway manager, has reported to the T.C. as to the provision of additional travelling facilities outside the city boundaries. He suggests that powers should be obtained for the running of petrol-electric buses or that railless electric traction should be adopted, which could ultimately be replaced by ordinary tramways when the traffic developed.

**Chesterfield.**—The Parliamentary agents to the Corporation have deposited for introduction into Parliament next session a Bill to authorise the Corporation "to provide and run vehicles by means of railless traction and for other purposes" at an estimated cost of £58,180.

**Conisborough.**—The Mexborough and Swinton Trackless Tramways Co. has deposited with the P.C. plans of the proposed tramway system to Rotherham. The Council has deferred consideration of the matter.

**Continental Notes.**—**BELGIUM.**—A new electric tramway network is projected in the suburbs of Brussels, which will be joined to the Brussels city network, and the existing steam suburban line from Overysche to Groenendaal will be converted to electric traction. The new network will have an extent of about 20 km., and is estimated to cost 2,500,000 fr., which will be jointly subscribed by the State, the Province, and the Communes interested. The Brussels Tramway Co. will permit the passage of the suburban cars as far as the boulevards of Brussels.

Electric tramway extensions are also projected on the outskirts of the city of Mons. As a preliminary, the Société Nationale des Chemins de fer Vicinaux have been requested to extend their Mons to Framerie line as far as the centre of the city, i.e., to the Grand Place. In the second place the several existing steam lines are to be electrified successively. It is proposed, in addition, to construct four new lines. The total disbursement contemplated is about 1,500,000 fr., which will be shared by the State, the Province and the Communes concerned.

**RUSSIA.**—A company has lately been formed at Anaya, with a capital of 600,000 roubles and the title, Die Gesellschaft für Electriche Trambahnen in Anaya und Umgegend, to construct an electric tramway in the town and district of Anaya.

**Dewsbury.**—The General Purposes Committee of the Corporation has had under consideration a proposal to extend the tramways to Dewsbury Moor and Shawcross, at an estimated cost of something like £50,000. The Committee came to the conclusion that the Corporation's powers are inadequate to meet in a successful and satisfactory manner, the requirements of Shawcross and Westborough, and the Committee is to consider the advisability of a physical junction being formed between the two tramways. Negotiations are also to be opened with the Batley Corporation for an extension of tramways from the borough boundary in Staincliffe Road to the Butcher's Arms.

A trial trip was recently made by the members and officials of the Corporation in a 40-H.P. Daimler omnibus. The demonstration was made at the request of the Daimler Co., and from the routes traversed, it appears possible that alternatives may be considered to the two tramways schemes, although the matter has not yet been discussed by the Electricity and Tramways Committee.

**Glasgow.**—As previously indicated in the REVIEW, the T.C.'s Special Committee has had under consideration further extensions of the tramways system; with the recent inclusion of several suburban burghs and rural territory into the municipal area, the understanding was that the present routes would be lengthened and others added, and the Committee now propose an extension which, if approved by Parliament, will mean the laying down of anything up to 20 miles of double track. Among the proposed extensions are Burnside to Cathkin Braes, about 2 miles; Reddie to Millerston, 1½ miles; Annisland *via* Scotstoun Hill to Dumbarton Road, about 2 miles; Baillieston to Coatbridge, 3 miles; and Clarkston to Busby, 3 miles. Application—should the T.C. approve—will be made to Parliament next November for construction powers, which, if granted, will permit the lines being completed within five years.

The Tramways Department still keeps piling up new records in connection with passengers carried and mileage run, since the doubling of the half-penny stage, though the total receipts are yet somewhat below those for the corresponding period of the last financial year. Since the beginning of the financial year on June 1st, 168,252,111 passengers have been carried, against 144,877,730, while the receipts have been £549,272, against £556,725. For the past week the takings were £20,016, and while the total number of passengers were not available, it was estimated that about 6½ millions were carried.

**Halifax.**—The Tramways Committee has decided to introduce a motor-omnibus service for Siddal, a suburb of the borough which is not reached by the tramways.

**Holmebridge.**—The Council has asked the Huddersfield Corporation to extend its tramways, and offered the same terms and conditions as the Corporation had approved with reference to the extension to Marsden.

**Huddersfield.**—It has been decided, subject to the Elland D.C. carrying out the necessary widenings on the route from the Elland Town Hall to West Vale, to continue the Elland tramway extension to West Vale: and that the Marsden extension be carried out at the original cost, viz., £14,500, the line to be double. The question of extending the tramways to Lepton and Whitley Upper has been before the Tramways Committee, and the matter has been referred to the Extension Sub-Committee for consideration and report.

**India.**—The Karachi Port Trustees have resolved to ask Mr. C. H. Merz, who has been engaged by the Bombay Port trustees to advise as to the electrification of the port railways, whether he is willing to visit Karachi and report on the electrification of the port railways there. The manager of the North-Western Railway is also to be asked if the railways are prepared to share the cost of a report by Mr. Merz.

**London.**—On Monday morning a defective motor led to the holding up of the Piccadilly tube line for about half-an-hour, while later a somewhat similar mishap held up the Wimbledon service of the District Railway for an hour, in both cases causing great inconvenience to the numerous travellers at that hour.

**Margate.**—A modern system of electric signalling it to be installed at the Margate West Station by the South-Eastern and Chatham Railway Co.

**Railway Power Proposals.**—According to a financial contemporary, it is proposed to form a syndicate of railway directors to draw up a Bill to empower associated railway companies to produce electrical power on a large scale for their own use and that of the towns and villages along their routes.

**Rochdale.**—The traffic receipts on the tramways since the commencement of the financial year are £58,580, against £53,845 last year, an increase of £4,600. There were 9,350,000 passengers carried, an increase of half-a-million; the mileage was 1,196,000, an increase of 113,700. Ten new cars have been delivered, making 69 in stock. All the cars are being fitted with side guards as an additional precaution against serious accident.

**Southampton.**—Boxing day will be remembered at Southampton for a very high tide in the Solent, which invaded the Corporation electricity works on the western shore, and led to the electric tramway service being suspended for three hours.

**Stirling.**—It is stated that for financial reasons the Corporation is not prepared to go into an electric tramway scheme for the town and district. The opportunity seems a good one for a private company, as the need for a more up-to-date system should ensure no obstacles being put in the way of such an enterprise.

**Swansea.**—Negotiations are to be entered into with the Swansea Improvements and Tramways Co., with a view to arrangements being made whereby the extension of the tramways system authorised under the Swansea Corporation Act, 1912, which deals practically with the connecting-up of all the existing tramways, shall be carried out jointly by the company and the Corporation. The engineer is of opinion that by adopting this course many difficulties will be overcome.

**Todmorden.**—There were angry recriminations at the T.C. last week, over a proposal to purchase more motor-buses. Alderman John Dawson declared it had cost £7,000 to keep buses running, which originally only cost £4,000. Mr. Rigby Dawson replied that Todmorden and Eastbourne had lost heavily by being the pioneers of municipal motor-buses, but the makers had profited by their experience. The Council had better buy more buses than spend money on powers to run railless cars, which would cost a 2s. rate. The proposal to purchase was adopted.

week-end cable letters to Australia and New Zealand is 18s. for 24 words and 9d. a word beyond 24, and for week-end cable letters for places in South and Central Africa, 15s. for 30 words and 2s. 6d. for each group of five words beyond 30. These rates include the charge for delivery by post from the offices of the cable companies in Australia, New Zealand and South Africa.

**Spain.**—A movement is on foot at Bilbao, the great re-exporting centre of Spain, to secure the establishment of a direct telephone line between that town and Paris.

**The Damaged P. & O. Liner.**—The *Narrung*, on her voyage through the Bay of Biscay, was badly damaged by the extraordinarily violent seas on Boxing Day, and sent out the wireless call for help. Mr. H. A. Reynolds, the wireless operator, was at work in the Marconi room for 40 or 50 hours on end. He stated that all through the gale the apparatus worked steadily, and there was little interference with messages. The "S.O.S." signal was responded to freely, and communication was established with a considerable number of vessels. None of them came nearer than about 60 miles, for the vessel was got under control and cancelled the call, returning to port under her own steam.

**The Marconi Agreement.**—On Monday Mr. F. Hall asked the Postmaster-General whether he would say what was the extent of the punishment inflicted on Mr. J. E. Taylor, staff engineer at the Post Office, owing to his purchase of Marconi shares; and were any other civil servants similarly punished for dealing in these shares?—Capt. Norton replied that Mr. Taylor had been reduced from the rank of staff engineer to that of assistant superintending engineer, the respective scales being £520 by £20 to £700, and £420 by £20 to £500. His actual salary was reduced from £540 to £500. No other officer of the department, so far as the Postmaster-General was aware, had dealt in the shares.

**Trans-Atlantic Wireless.**—For the first time the time signals emitted from the Eiffel Tower station were received in the early morning on Tuesday by the United States Government station at Washington, at a distance of 4,000 miles.

## CONTRACTS OPEN and CLOSED.

### OPEN

**Atherton.**—January 29th. One E.H.T. switchboard and one H.T. switchboard for the U.D.C. See "Official Notices" December 27th.

**Australia.**—VICTORIA.—January 10th. 14,500 metal-filament lamps, for the Melbourne City Council. See "Official Notices" December 27th.

January 28th.—Paper-insulated lead-covered cable for the P.M.G.'s department. See "Official Notices" December 20th.

February 21st.—Four 1,500-kw. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

February 4th. Thirty-six Morse keys, for the P.M.G.'s Department. See "Official Notices" to-day.

January 24th.—Portable ammeters, voltmeters, transformers, &c. for the Melbourne City Council. See "Official Notices" to-day.

WESTERN AUSTRALIA.—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" to-day.

QUEENSLAND.—January 29th. Detectors (Schedule 242), for the P.M.G.'s Department. See "Official Notices" December 20th.

**Belgium.**—February 28th. The municipal authorities of Lierre are inviting tenders for the concession for the establishment of a central station for the supply of electrical energy for lighting and power purposes in the town. Full particulars of the concession can be obtained for five francs from Le Secrétariat de la Ville, Lierre.

**Birmingham.**—January 27th. Stores for a year for the Corporation Tramways Department. Mr. A. Baker, manager, Congreve Street.

**Bispham-with-Norbreck.**—January 18th. One oil or gas engine direct coupled to a 100-kw. dynamo, for the U.D.C. See "Official Notices" to-day.

**Chile.**—September 10th. An advertisement appeared in the *Times* on Wednesday stating that tenders are invited for the establishment of an electric central station and the distribution of electrical energy at the port of Valparaiso. The basis and specifications of the works can be obtained at the offices of the Chilean Legation, 48, Grosvenor Square, W.

**Eastbourne.**—January 14th. One 1,000-kw. horizontal steam turbine and alternator, without condensing plant, for the Corporation. See "Official Notices" December 20th.

**France.**—COMPIEGNE.—January 20th. Tenders are invited for the supply of the following plant:—70-h.p. effective hydraulic turbine, sets of electric motors, high and low-pressure centrifugal pumps, three 75-h.p. oil engines and 480-volt continuous-current dynamos, and the mechanical and electric transmissions needed for the working of the whole plant. Particulars of the Mairie of Compiègne.

(Continued on page 23.)

## TELEGRAPH and TELEPHONE NOTES.

**Japan.**—Owing to the inclemency of the weather and other difficulties, it is announced by the Japanese Department of Communications that the work of repairing the submarine telegraph cable between Japan and the United States has been suspended until August, 1913.

**London-Paris Telephone.**—There was no communication with Paris by telephone on Boxing Day owing to the gale; telegraphic communication with Jersey was also interrupted.

**Marconi Wireless Patents in France.**—We are informed that judgment has just been delivered in the High Courts of Justice of France in the action for infringement brought by Marconi's Wireless Telegraph Co. against La Société Française Radio-Électrique, La Compagnie Générale Radio-Télégraphique, and La Société des Transports Maritimes à Vapeur. The case was heard by three judges, and the judgment was unanimous. In the result the Court declares the validity of all the claims of the Marconi patent of 1900. All the defendants are declared to be infringers, and an investigation of their accounts has been ordered, to arrive at the amount to be paid as damages to the Marconi Co. The Court further orders the confiscation of all infringing apparatus supplied by the defendant companies, and a perpetual injunction, the defendants to pay the costs. This judgment is of the highest importance, and will have far-reaching effects, for the defendant companies have supplied all the wireless installations to all the departments of the French Government, including the Post Office, the Colonies, the Navy, and the Army, which embraces the station of the Eiffel Tower.

**Reduced Telegraph Charges.**—On January 1st, the following reductions in the charges for telegrams came into operation:—

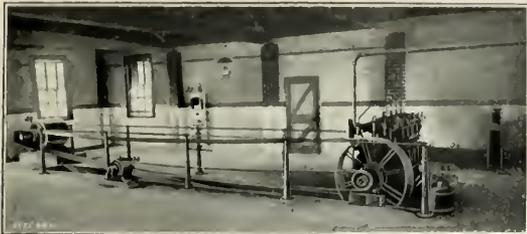
The rate for deferred telegrams to Canada, Newfoundland and the United States is reduced by 1½d. a word for messages sent *via* the Anglo-American, Direct United States and Western Union Companies' cables. In the case of day-cable letters (which will in future be known as "night-cable letters") the rates for places in the east of Canada and the United States are reduced from 6s. for 21 words to 3s. for 13 words, and instead of being delivered on the second day after dispatch, they will reach the addressees on the day after they are sent. In the case of "week-end cable letters," for which the charge was 6s. for 31 words, the new rate is 4s. 6d. for 25 words, and they will be delivered on Monday instead of on Tuesday as at present. The rates for both classes of telegrams to other places in Canada and the United States vary according to distance.

Services of week-end cable letters are introduced with Australia, New Zealand, the South African Union, Rhodesia, and British Central Africa (Nyassaland). These messages, which must be presented for dispatch not later than Saturday evening, will be delivered on the following Tuesday, except in the case of distant places, where delivery may be somewhat later. The charge for

## BRIDGING AUSTRALIA BY WIRELESS.

BY DR. ALFRED GRADENWITZ.

SHORTLY after the completion of the large Telefunken station at Penman Hills, near Sydney, another powerful wireless



GENERATING PLANT.

station ordered by the Commonwealth of Australia was installed at Fremantle, and has now opened communication with Sydney across Australia, over a distance of about 2,500 miles.

The new station is situated on a hill between Fremantle and Perth, on the southern bank of the Swan River. The hill, 136 ft. in height, is one of the highest in the neighbourhood, and is covered with woods, like the surrounding country. The station covers an area of 600 square metres, and is situated  $4\frac{1}{2}$  miles from the sea.

While mainly intended for purposes of defence, the new station is controlled in time of peace by the Postal Department, and is used almost exclusively for commercial telegraphic service with merchant ships and for the meteorological intelligence service. Since Fremantle is an important harbour, being the first point of connection for traffic *via* Colombo and Cape Town, the station is likely to render valuable services to navigation.

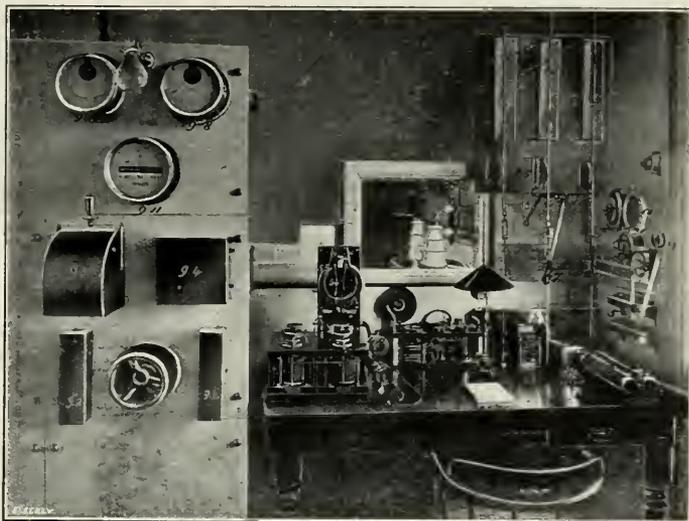
The centre of the area covered by the station is the highest point, and the tower there installed serves to carry the antennae. This iron tower, 120 metres in height, is designed on the well-known Telefunken system, standing on a ball

bearing, insulated from the ground by means of glass insulators, and is kept in equilibrium by three pairs of cables moored to concrete blocks, 150 tons in weight. Glass plates are used as insulators, and the antenna system, insulated from the tower, is arranged in umbrella fashion and comprises phosphor-bronze wires 3 mm. in diameter, joined up in three sets.

The leads enter the tower at 10 m. apart, parallel to one another. Each of the three sets is arranged between two pairs of tower cables, thus allowing the wires to be readily kept clear of these cables with a minimum elastic stress in the wires.

Since the sandy soil is extremely dry in summer (there is absolutely no rain during the six or seven summer months), while the underground water is at a depth of 42 m., much difficulty was experienced in establishing a satisfactory earth connection. An insulated counterpoise was therefore used, consisting of about 100 wires, 300 m. in length (phosphor-bronze of 2 mm. diameter), which radiate from the tower at 9 m. height, being insulated by means of four insulators arranged in series.

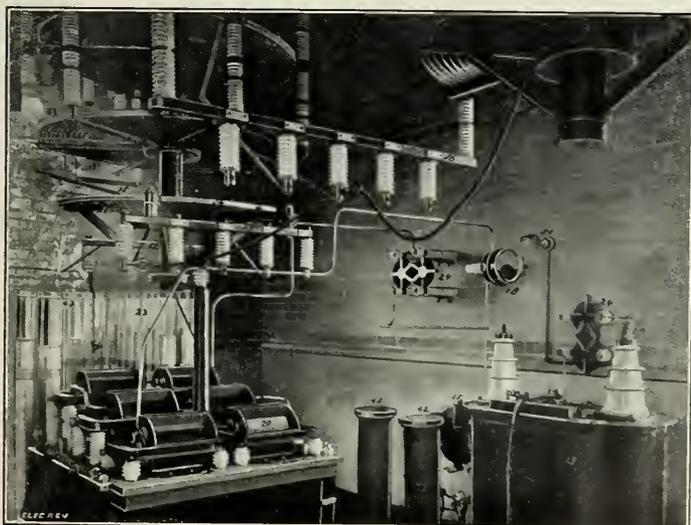
The wires are supported by three bronze wire circles suspended from telegraph poles, at 100, 200 and 300 m. respectively from the tower. The first circle comprises 12,



RECEIVING APPARATUS.

and each of the others 24 telegraph poles; the first is 7.2 m., the second 5.4 m. and the third 3.6 m. in height, so that the counterpoise gradually approaches the ground, which assists in endowing the vibratory circuit formed by the antenna and counterpoise with a more open shape, thus ensuring a more satisfactory radiation and a more outward reflection of the wave from the counterpoise.

In 16 wires of the counterpoise, the first 100 m. have been left out, and the free space thus obtained contains the buildings and the wires connecting the antenna with the apparatus house. In addition to the large umbrella antenna ( $\lambda = 1,400$  m.;  $c = 4,450$  cm.), which serves for the sending and receiving of waves upwards of 1,600 m. in length, two T-antennae for waves of 600 to 900 m. and a T-antenna for waves of 900 to 1,600 m. have been provided. The T-antennae are arranged opposite one another, thus eliminating any screening effect of the tower and allowing



HIGH-PRESSURE ROOM: SENDING APPARATUS

the antenna situated in the most favourable direction with regard to the corresponding station to be used. One end of these antennae is fixed to, but insulated from, the tower, the other being attached to a steel wire subdivided by insulators and stretched out from the tower. The points of suspension are situated at a height of 60 m., the horizontal part being  $2 \times 25$  m. in length. The constants of the two-wire antennae for waves of 600 to 900 m. are:  $\lambda = 570$  m.;  $c = 1,000$  cm., and those of the four-wire antennae for 900 to 1,600 m.:  $\lambda = 750$  m.;  $c = 1,600$  cm.



WIRELESS STATION, AND BASE OF TELEFUNKEN TOWER.

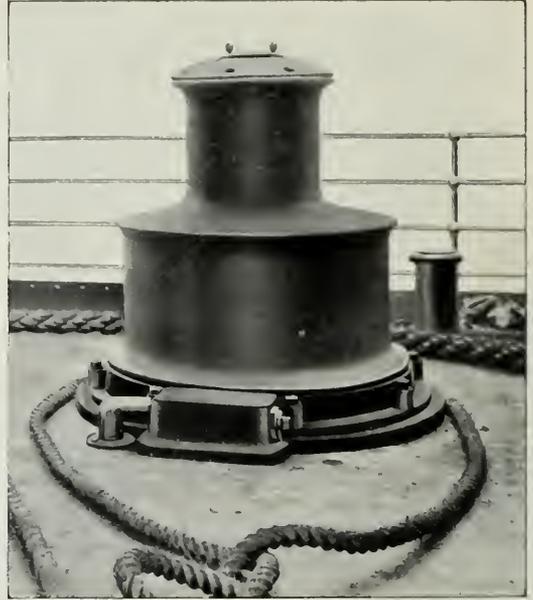
The station has its own generating plant, which is installed in a special room 25 m. from the reception building, so that the noise of the machinery and driving belts does not interfere with the receiving of telegrams.

The power plant includes an alternator of 60 K.V.A., at 500 volts and 500 cycles, driven by a four-cylinder Gardner oil engine of 75 H.P. The engine runs at a speed of 500 R.P.M., and the alternator at 1,500 R.P.M. Leather belts are used for power transmission, the distance between centres being 9.6 m. The engine can be fed with kerosene or gasoline, and compressed air is used for starting. Three water tanks are provided for cooling the cylinder. A continuous-current dynamo of 3 kW., also driven from the oil engine, serves to excite the alternator and to actuate the relays.

The wireless apparatus is installed in two rooms in a special building. One of these rooms contains the receiving table and switchboard, the Morse keys and switches actuating the high-pressure senders in the other room being installed on and beside the table.

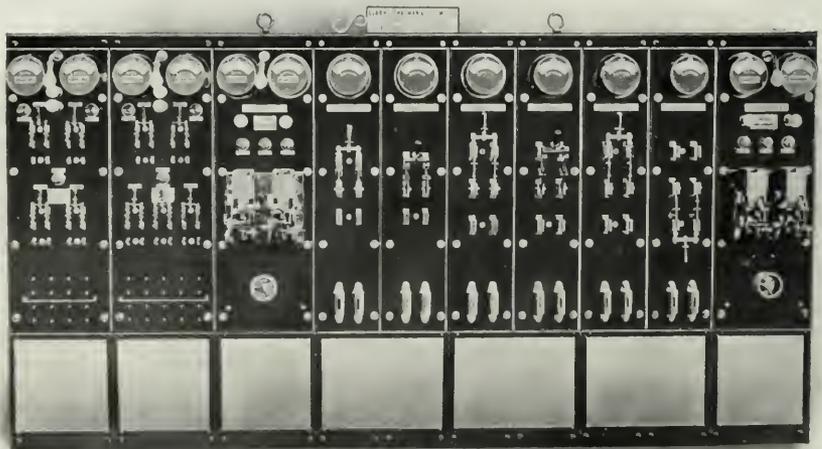
The operator is able to control from his table the whole of the apparatus, while getting through a window a good

view of the high-pressure apparatus and antenna ammeter. On the left hand is arranged the receiver, and on the right the key actuating the sender relay and the pressure regulator of the high-frequency machine. To the right on the front wall is situated the remote controlling gear of the variometer, and the sound tester and emergency receiving



ELECTRICAL CAPSTAN, SS. "FAUVETTE."

coils are suspended from the side wall. Other apparatus installed on the table are the call bell, the wave meter for testing the received signals and a contact button for actuating a signal bell in the power house. The receiver is equipped with an intermediary circuit and three parallel antenna condensers filled with oil.



MAIN SWITCHBOARD, SS. "FAUVETTE" (see page 21).

The sending apparatus comprises an A.E.G. high-pressure oil transformer for a ratio of 1:120, a condenser battery of 36 Leyden jars connected up in series in six sets, six spark gaps consisting of 16 sections, and a primary variometer. Two primary inductance coils are used to determine the

resonating position between the alternator and the high-pressure transformer, two secondary inductance coils protecting the transformer against high-frequency currents. Variable flat copper coupling coils are used to connect the closed vibratory circuit with the antenna circuit. A hot-wire ammeter in the antenna circuit, which can be observed from the operator's seat, indicates the current intensity in the antenna.

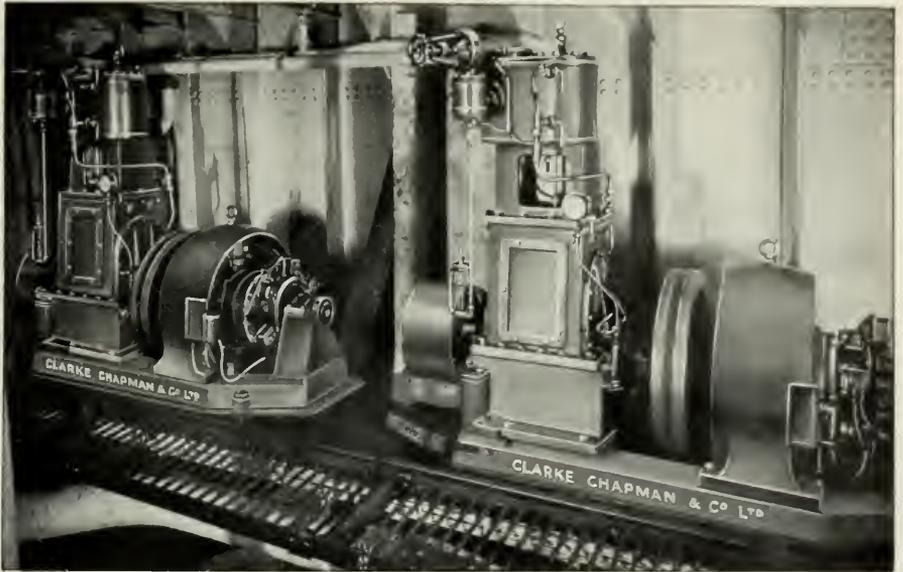
The capacity of the condenser battery is 11,000 cm.; in the case of long-wave operation two sets of jars are cut out, thus increasing the capacity to 16,500 cm. A fan for cooling the plates has been provided for each two sets of spark gaps.

As the high-pressure switch of the receiver and that of the high-pressure compartment are so arranged as to be handled simultaneously with the left and right hands respectively, only a second is required for switching over from "sending" to "receiving," and inversely. The switch at the same time actuates the spark-gap fans and the sender relay.

The new Fremantle station has been in operation since

## ELECTRICAL DECK MACHINERY ON THE SS. "FAUVETTE."

AN interesting addition has recently been made to the fleet of the General Steam Navigation Co. by the arrival in



GENERATING PLANTS FOR ELECTRIC LIGHTING, INSTALLED ON THE SS. "FAUVETTE."

London of the steamer *Fauvette*, which has been built by Sir Raylton Dixon & Co., Ltd., to the order of the owners for their passenger and goods service between London and Bordeaux. The vessel is interesting, as it is probably the

first vessel of the kind built in this country to the order of English owners in which the greater part of the auxiliary machinery is electrically driven.

This machinery has been supplied by Messrs. Clarke, Chapman & Co., Ltd., and consists of one windlass, two winches, six cranes and two warping capstans, with the necessary steam generating plants, switchboard and wiring.

The windlass is arranged to work 2-in. diameter cables, the winches lift 3 and 5 tons respectively, the cranes  $1\frac{1}{2}$  or 3 tons each, and the capstans exert a pull of 3 tons on the rope when warping the vessel.

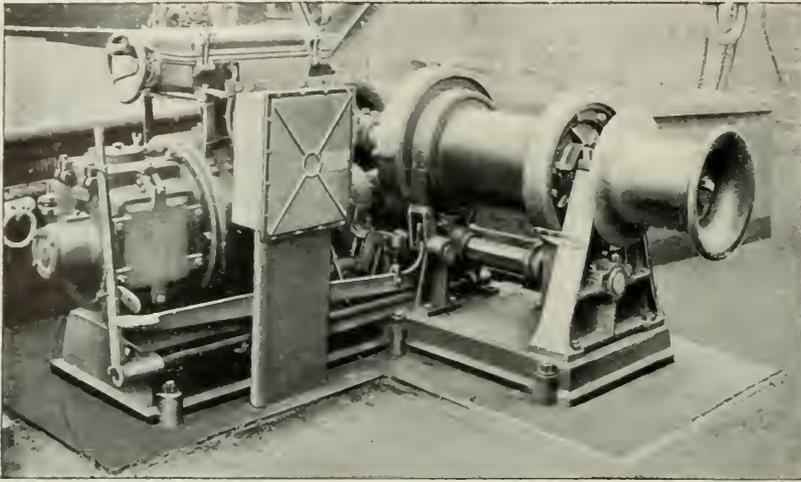
The machinery has been specially designed for the rapid and quiet discharge of cargo, and, being electrically driven, will be of

greater overall efficiency than steam equipment, as the power is concentrated in one large unit in which steam is used expansively, and the losses in the distribution of the



ELECTRIC CRANES ON THE AFTER DECK, SS. "FAUVETTE."

June last, and will shortly be taken over by the Government. In addition to communication with Sydney and with passing vessels, a regular Press service is carried on twice a day.



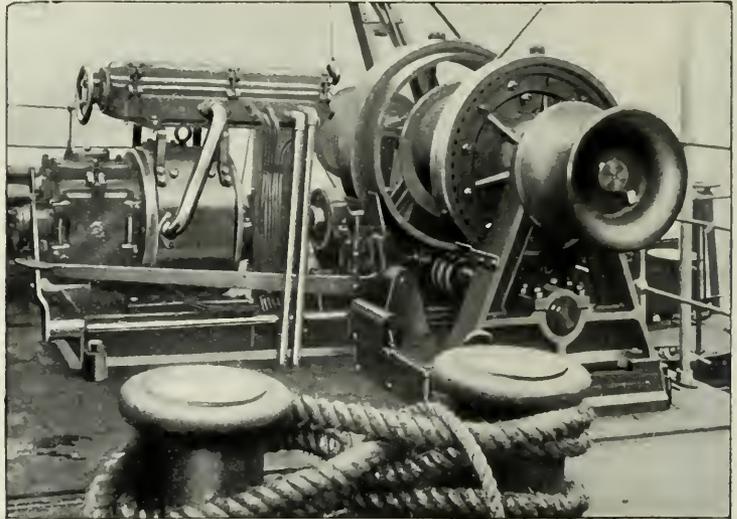
THREE-TON WINCH. SHOWING MOTOR, CONTROLLER, &C.

power are smaller than in the case of steam-driven machinery.

All the power cables are led under the deck, which makes a very neat and desirable arrangement for a passenger vessel, as leaking steam pipes along decks or frozen pipes in cold weather are obviated. The various machines will also be ready for starting up immediately steam is available at the generating plants, no warming up being required, as in the case of steam-driven auxiliaries.

The windlass is of the maker's direct-grip type, in which the whole of the power of the motor is transmitted to the cable-holders, arrangements being made, however, to prevent damage in the event of the anchors being drawn too quickly into the hawse pipes. Hand gear is also fitted to the windlass.

The winches are of the worm and spur-gearred pattern, with two lifting speeds, the second set of gearing lifting half the normal load at twice the normal speed;



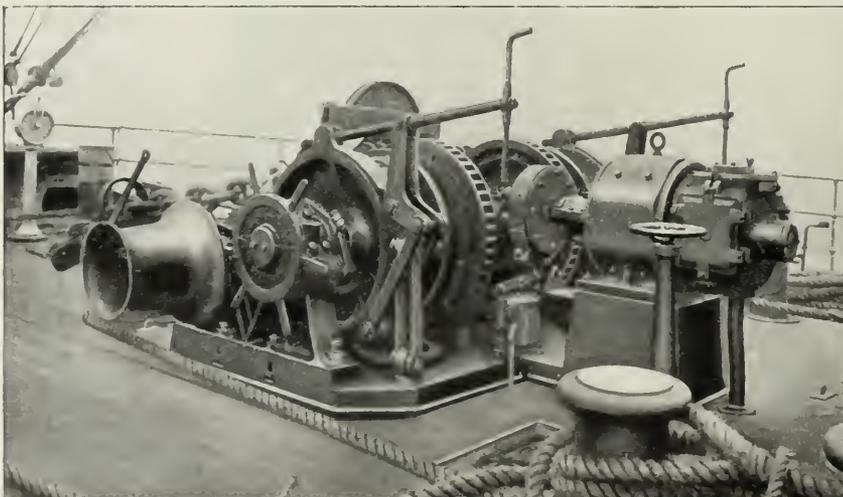
ELECTRICALLY-DRIVEN FIVE-TON WINCH.

a clear lead of rope is obtained either forward or aft from the lifting barrel.

In the cranes the load is both lifted and slewed by power, separate motors being fitted for these purposes.

The control of the cranes is very simple, and the operating platform is raised so as to give the driver an uninterrupted view of the load.

The capstans are of the "above deck" type, having the motor and all gearing accommodated inside the capstan barrel which is of larger diameter than usual, and consequently increases the life of the ropes used; two speeds of hauling are obtained with the two diameters of the barrel.



MOTOR-DRIVEN WINDLASS.

Two generating sets are installed, consisting of enclosed compound engines fitted with forced lubrication to all bearings, each plant being capable of giving an output of 100 kw., which output will meet the normal requirements when loading or discharging. The second generating set, therefore, acts as standby, and can be brought into use when dealing with heavy cargoes at high speed.

The switchboard is of the change-over type, having separate panels for the various machine circuits and arranged to couple the latter to either of the generating sets.

A complete system of circuit-breakers is also fitted to prevent damage in the event of excessive overloads.

The resistances for the various machines are of the electrical contractors' patent "Cracker" type, which are quite unaffected by vibration and are practically indestructible; these are made of an incorrodible metal in continuous strips, and mounted centrally so that each turn is free to expand or contract.

They are, therefore, eminently suitable for their duty, and the old trouble of replacing damaged units in a built-up resistance is entirely overcome.

At the trials all the machinery worked most satisfactorily, the machines lifting their test loads with ease and showing that they possess an ample margin of power. Simplicity of control was a noticeable feature, and the quiet working of the machines was favourably commented upon by the experts present, this being considered a most desirable feature as it would greatly decrease discomfort caused whilst loading or discharging. As cargo will be dealt with regularly at intervals of a few days, the installation will doubtless be a success from a financial as well as from an engineering standpoint, all the parts being carefully designed to withstand the heavy usage to which deck machinery is subjected. The vessel is efficiently lighted by electricity, this installation being supplied by the same contractors, but arranged quite separate from the power installation.

Energy in this case is provided by two generating sets either of which is capable of dealing with the normal load, the engines being of the enclosed type with forced lubrication to all bearings; separate lighting panels are arranged on the switchboard, these also being of the change-over type.

The wiring was carried out on the double-wire distribution-box system, the installation being divided into about 12 lighting circuits and six power circuits for the deck machinery.

The total number of lights is about 350, each cabin being fitted with two-way switches at the door and the bedside and provided for a portable light and ventilating fan.

The saloon, smoke-room and writing room are also adequately lighted and electrically ventilated, the fittings being of silver-plated white metal to a design which harmonises with the general scheme of decoration in each case.

A wireless telegraph installation has been fitted, and an electrical ship's log with speed indicator on bridge. The signal lights are all controlled from the chart room where a patent signal light indicator is fitted.

The cables throughout the accommodation are lead-covered, the power cables and other wiring throughout the vessel being of the armoured type.

In conclusion, we are indebted to Messrs. Clarke, Chapman for this short description of an interesting installation, and we would add a word of praise for the owners, who are among the very few who have shown practical appreciation of the undoubted advantages of electrical deck machinery. Several of the new oil engine vessels have, and are, adopting this method of driving auxiliary machinery, and its economy and efficiency cannot be disputed now.

## CONTRACTS OPEN.

(Continued from page 18.)

**Cuba.**—January 27th. "Dirección General de Comunicaciones," Havana. Establishment and working of a telephone system within a radius of 6½ miles of Real Campino. Término Municipal de Cienfuegos, Province of Santa Clara.—*Board of Trade Journal*.

**Glasgow.**—January 21st. Two 6,000-kw. turbo-alternators, with condensing plant and accessories, and water-tube boilers, for the Corporation. See "Official Notices" to-day.

**Harwich.**—January 13th. Four motor-driven centrifugal pumps, two motor-driven sewage rakes and screens, with switchgear, and about 400 yd. of 15-in. cast-iron rising main, for the Corporation. See "Official Notices" December 20th.

**Italy.**—The municipal authorities of Rome are about to invite tenders for the supply of the material required for the new electric tramway between the Piazza Indipendenza and the Porta Traionfale; the contract includes 600 tons of tramway rails, Mannesmann poles, the overhead conductors, trailing cars, &c.

**London.**—FULHAM.—January 9th. Steam dynamo, switchboard and connections for the Workhouse, Fulham Palace Road, W., for the Guardians. See "Official Notices" December 6th.  
**ISLINGTON.**—January 29th. Electrical and engineer's stores for the year, for the B.C. See "Official Notices" to-day.

**New Zealand.**—January 30th. Two vertical Diesel engines of 150 H.P., each coupled to shunt wound dynamos of 100 kw., switchboard, crane, overhead mains and street lighting equipment, &c., for electric lighting at Thames. Board of Trade Commercial Intelligence Department, London.

January 6th. Switchboards, for the Auckland Harbour Board. See "Official Notices" November 15th.

**Nottingham.**—January 14th. The Corporation Tramways Department is inviting tenders for the supply of (a) 350 tons, steel tramway rails Bs B1, 150 tons, steel tramway rails Bs B1 (Sandberg), and (b) 5 tons, mild steel tie bars. Specifications and forms of tender (£1 lb, each returnable) from Mr. A. Brown, engineer, Guildhall, Nottingham.

**Plymouth.**—January 23rd. Stores, for a year, for the Corporation Electricity and Street Lighting Departments. See "Official Notices" to-day.

**Rottingdean.**—January 7th. Installation of electrical fire alarms and private telephonic service, Warren Farm Schools, for Brighton B. of G. Mr. P. Coote, engineer, Central Chambers, North Street Quadrant, Brighton.

**Sheffield.**—January 23rd. General stores for the City Tramways Department. See "Official Notices" to-day.

**Southey.**—January 18th. The Fellwell New Fen Commissioners are inviting tenders for the supply, delivery and erection at Southey, Norfolk, of two centrifugal pumps having a capacity of 100 tons per minute, direct-coupled to two steam turbines. Specification and forms of tender (£3 3s., not returnable) from the consulting engineer, Mr. E. G. Crocker, Ely, Cambs.

**Spain.**—The municipal authorities of Torrecampo (province of Cordoba) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

**Sweden.**—January 8th. Fifty-ton electrically-driven trestle crane, for Alkareby power station. Time extended to January 8th.—*Board of Trade Journal*.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C. I. Department in London.

## CLOSED.

**Aldershot.**—The U.D.C. has accepted the tender of Messrs. Wm. Cory & Sons, for 600 tons of coal, for the electricity works, at 17s. per ton.

**Bedford.**—The Borough Education Committee has accepted the tender of Messrs. W. S. Wilton & Co., of Bedford, for electrical work for the ensuing six months.

**Belgium.**—The Belgian military authorities are equipping all the forts and redoubts in the Antwerp district with electric lighting and power plants. In connection with the same, the authorities of the State Gun Works in Liège, opened the tenders for the supply of 46 dynamos, when it was found that the lowest offer was that of the Compagnie Internationale d'Electricité, of Liège.

**BRUSSELS.**—The results of the adjudication on the tenders returnable November 20th, for switchboards are as follows:—The Antwerp Telephone and Telegraph Works, Antwerp, 1,882 fr.; the Bell Telephone Manufacturing Co., Antwerp, 2,173'30 fr.; O. von Millmann, Brussels, 2,458'75 fr.; C. Richez, Brussels, 2,499 fr.

The results of the adjudication on the tenders returnable November 15th, for the installation of bells, telephones and electric clocks at the Ecole Normale d'Industries are as follows:—Société Force et Eclairage à St. Gilles, 3,166'60 fr.; C. Richez, Brussels, 3,327'65 fr.; Biske Livron et Kalinowski, Liège, 3,486'90 fr.; Telephonie Privée, Liège, 4,148'25 fr.; Soc. Belge Siemens and Halske, Brussels, 4,203'30 fr.

**Bexhill-on-Sea.**—The T.C. has accepted the tender of Messrs. Stephenson, Clarke & Co., for 150 tons of coal for the electricity works, at 19s. 7d. per ton.

**Bridlington.**—The T.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, W., for an installation of electric fire alarms on the hire-purchase system, £14 2s. 6d. to be paid each half-year for seven years.

**Bristol.**—The Council has accepted the tenders of the British Westinghouse Co., Ltd., and Messrs. Bruce Peebles & Co., Ltd., at £903 and £2,187, for extra-high-tension and low-tension switchgear and one three-phase to direct-current converter respectively.

**Dundee.**—The Corporation Electricity Committee last week had under consideration the question of the machinery contracts for the extensions at the Stanverger station. A Sub-Committee was given powers to settle the matter.

**Glasgow.**—The T.C., at its last meeting, on a report by the electrical engineer, decided that the contract with the British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of rotary converters, be extended so as to include two additional rotary converters, with the necessary high and low-tension switchgear.

The T.C. has accepted the following offers for the Tramways Department works:—

Special trackwork.—Titan Trackwork Co., Ltd.  
Rawhide pinions.—Reid Gear Co.  
Traction lamps.—Siemens Bros. Dynamo Works, Ltd.; General Electric Co., Ltd.  
Double cotton-covered wire.—London Electric Wire Co., Ltd.  
Copper and bronze strip.—P. & W. MacLellan, Ltd.

**Greenock.**—The Corporation has accepted the offer of the Westinghouse Co. for 5,000-kw. plant, subject to the latter providing a condenser of 7,650 sq. ft. area. The new machinery will involve an expenditure of over £12,000.

**Halifax.**—The Tramways and Electricity Committee has accepted the following tenders:—

Babcock & Wilcox, Ltd.—Two water-tube boilers and superheaters, £9,060, and chain grate stokers, £810.  
British Thomson-Houston Co., Ltd.—Extra-high-tension feeder cell at electricity works, £82.  
Drakes, Ltd.—Fixing of steel mains and cast-iron bends, £69.  
Babcock & Wilcox, Ltd.—High-pressure steam piping and exhaust piping, £103.

**Luton.**—The T.C. has accepted the tender of Mr. Geo. Newbold, for about 2,500 tons of Whitwick slack coal for the electricity works, at 12s. per ton.

**Preston.**—The B. of G. has accepted the tender of Mr. E. Dewhurst, of Preston, for the renewal of the storage batteries for the electric lighting plant at Fulwood Workhouse, at £610.

**Rhondda.**—Messrs. Venner & Co. have received an order for equipping the Rhondda Tramways with Chamberlain and Hookham meters.

**Rugby.**—The U.D.C. has accepted the tender of W. T. Henley's Telegraph Works Co., Ltd., for 440 yards of 15 low-tension, three-core, paper-insulated and lead-covered cable.

**Walthamstow.**—The tender of Mr. G. P. Trentham has been accepted by the U.D.C., at £16,692, for carrying out alterations and additions to the permanent way.

## FORTHCOMING EVENTS.

**Junior Institution of Engineers.**—Friday evening, January 3rd. Paper, "Some Notes on the Practical Operation of Electrical Machinery for Power Purposes," by Mr. C. E. Catterston.

Wednesday, January 8th. At 8 p.m. At the I.E.E. Lecture on "Heating of Buildings by Means of Hot Panels," by Capt. H. Riall Sankey.

**Association of Engineers-in-Charge.**—Saturday, January 4th. At St. Bride's Institute, E.C. Social. Dance.

**Institution of Electrical Engineers (Newcastle Students' Section).**—Monday, January 6th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Phasing Out of Alternating-Current Apparatus," by Mr. J. Hacking.

**Institution of Electrical Engineers (Manchester Students' Section).**—Tuesday, January 7th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Automatic Circuit Breakers," by Mr. A. N. Haworth.

**Institution of Electrical Engineers (Glasgow Students' Section).**—Tuesday, January 7th. At 8 p.m. At the Royal Technical College, Glasgow. Debate.

**Rugby Engineering Society.**—Tuesday, January 7th. At 8 p.m. At Benn Buildings, Rugby. Paper on "Large Steam-Turbo Units," by Mr. J. P. Chittenden.

**Institution of Electrical Engineers (Birmingham Section).**—Wednesday, January 8th. Meeting at the University, Birmingham.

**Institution of Electrical Engineers (London).**—Thursday, January 9th. At 8 p.m. Paper on "The Design of Apparatus for Improving the Power Factor of A.C. Systems," by Prof. Miles Walker.

**Concrete Institute.** Thursday, January 9th. At 7.30 p.m. At 256, Vauxhall Bridge Road, S.W. Paper on "Concrete in its Legal Aspect," by Mr. W. Valentine Ball.

**Institution of Electrical Engineers (Dublin Section).**—Friday, January 10th. At 8 p.m. At the Royal College of Science, Dublin. Paper, "Notes on Self-Propelled Cars for Light Railway Work," by Mr. J. P. Tierney.

**Electro-Harmonic Society.**—Friday, January 10th. At 8 p.m. At the Hoborn Restaurant. Smoking Concert.

**London Telephone Service.**—With the new year, the Post Office opened new exchanges called the "Regent" and "Park" exchanges, and transferred some thousands of subscribers from one exchange to another. Twelve months hence, the "Charterhouse" exchange will relieve the "City" and "London Wall" exchanges, and the "Museum" exchange in Tottenham Court Road will be opened.

## NOTES.

**Index.**—The Index to Volume 71 of the ELECTRICAL REVIEW, July to December, 1912, will be published with our issue for next week.

**Inquiries.**—The name of the maker of the Harman electric hoist is inquired for; a correspondent wishes to get into touch with the makers of the electric table-cloth.

**Fatalities.**—An inquiry was held on December 26th by Coroner J. T. Proud, at Billy Row, a mining village in the county of Durham, into the death of William Nicholson, 52, a miner, who lived at Billy Row and worked at Bowden Close colliery. From the evidence it appeared that Nicholson was going home on Christmas eve from work at the pit with a man named Hetherington. The night was very stormy, and as the men turned into Institute Terrace, they fell over a live wire which formed part of the electric lighting installation. Both men received severe shocks and fell to the ground. At the same moment the electric light in the house of another pitman went out, and he went out to ascertain the cause of its extinction. Hearing shouts, he went forward a short distance, and saw Nicholson and Hetherington rolling on the ground. Assistance was at once obtained, but when removed from contact with the wire Nicholson was dead, but Hetherington was able, after attention, to go home. Mr. S. Wraith, the chief electrician for Messrs. Pease & Partners, the owners of the colliery, said the voltage of the current was from 225 to 230 alternating. It was not customary to protect such wires. Nicholson's damp clothes and his tin bottle would act as conductors. The jury returned a verdict that deceased had been accidentally killed by an electric current through the wires having been blown down by the storm. They were of the opinion that better means should be found to protect the wires crossing a public thoroughfare.

According to the *Australian Mining Standard*, Mr. A. M. Webb, an electrical engineer employed by the Adelaide Tramway Trust at the Port Adelaide power house, was killed last November through contact with a wire carrying 11,000 volts. When he was discovered he was still living, but all efforts to restore consciousness failed.

A young man named Ernest Lancaster (17) was killed on Saturday, 28th ult., at the Weardale Steel, Coal and Coke Co.'s by-product coke ovens at Tudhoe Ironworks. He was somehow caught by a live electric wire, and his death was instantaneous. He had only been at work a few months when the affair happened.

**A Committee Dissolved.**—Our readers may remember that several years ago there was formed a Committee for the Protection of Electrical Interests. We have just received from Mr. R. Borlase Matthews, the hon. sec., a copy of a circular which has been issued to the members, informing them of the dissolution of the Committee consequent upon the formation of an Industrial Committee by the Institution of Electrical Engineers, to which the work of the Electrical Committee has been transferred. The circular reads thus:—

"I beg to inform you that, in accordance with the directions of the Committee, a letter was addressed to the Institution of Electrical Engineers suggesting that they should take over the work of the Committee by the formation of an Industrial Section or Committee of the Institution.

"I have now the pleasure of advising you that the Council of the Institution, at its meeting on March 28th last, passed the following resolution:—

"1. That an Industrial Committee be appointed by the Council, to which there shall be referred, for consideration and report, all industrial matters coming before the Council, and whose business shall also be to report to the Council on any industrial matters which, in the opinion of the Committee, affect the electrical industry and in respect of which the Institution might usefully take action.

"2. That the Committee consist of:—

(a) Eighteen Members drawn from the Members, Associate Members and Associates of the Institution, at least six of whom shall be members of the Council;

(b) And, if so desired by the Council, other persons not exceeding six in number, connected with other organisations, and not necessarily members of the Institution.

"3. That the chairman of the Committee be elected by the Council.

"4. That the Parliamentary Committee be merged into the Industrial Committee, and that the latter take over the work of the existing Parliamentary Committee.

"5. That, subject to the Council's approval on each occasion, the Committee arrange for special meetings of various branches of the electrical industry in the Institution building, at which the chair shall be taken by a chairman appointed by the Council.

"6. That the Council inform other bodies of the appointment and existence of the Committee, and ask them to submit from time to time any matters which they consider should be taken up by the Institution.

"And an announcement has recently been made that the following Committee has been elected:—[These names have already been published in the ELECTRICAL REVIEW.—EDS.]

"... In view of the appointment of the above Committee, it is deemed desirable that our Committee for the Protection of Electrical Interests should be dissolved, and that the small balance of cash in hand be handed to the Institution of Electrical Engineers to be placed to the credit of the Industrial Committee, and unless I hear from you to the contrary, I shall take it for granted that you are in agreement with this course being pursued."

**The Midlands Electrical Engineers' Ball.**—The second annual ball given by the Midlands Electrical Engineers took place at the Grand Hotel, Birmingham, on Friday, the 20th ult., and was, if possible, a still greater success than that of the previous year, in spite of many absences owing to the unavoidable nearness of the event to the Christmas holidays. Many friends were able to be present from London and the North, and Mr. Chattock, who was chairman of the Dance Committee, is to be congratulated on having assembled such a representative gathering, and on providing such an enjoyable evening.

**Entertainment.**—On Saturday evening, December 21st, the Mechanics' Large Hall, Nottingham, presented a most animated appearance, the occasion being the Christmas entertainment provided by Mr. Jardine for the children of the employés at the various factories. This is the twenty-eighth year in succession that Mr. and Mrs. Jardine have entertained the children. The number present was over 1,500.

**E.T.B.I. Whist Drive.**—Mr. F. B. O. Hawes, the secretary, is organising on behalf of the Electrical Trades' Benevolent Institution a Whist Drive, which will be held at Slater's Restaurant, 50, Cannon Street, E.C., on the evening of Friday, January 17th, at 7 o'clock for 7.30. Prizes are being given by the directors of firms interested, and others. Tickets, price 2s. 6d. each, inclusive of music and refreshments, may be obtained from the following members of the Committee:—C. H. Champion, Union Electric Co.; B. E. Crowe, Sterling Telephone Co.; F. B. O. Hawes, Electrical Trades B.I. (18, Park Mansions, Vauxhall Park, South Lambeth Road, S.W.); A. J. Williams, General Electric Co. The object of the event is to make the Institution better known among those who ought to become members, and not to make any money out of the entertainment itself. Mr. Hawes will occupy a few minutes during the evening to explain the objects of the Institution, and the advantages of membership.

**Electricity for Train Lighting.**—Lieut.-Col. Sir H. A. Yorke's report to the B. of T. on the railway accident at Ditton Junction on September 17th, 1912, was issued on December 20th. Regarding the fire which broke out and destroyed several of the coaches, the Inspector says:—

The two horse boxes at the front of the train were lighted by oil lamps, the sixth and ninth carriages by electricity, and the remaining five vehicles by gas. There are two gas cylinders to a coach, each with a capacity (at 100 lb. pressure per sq. in.) of 56 cu. ft. of gas. In this case they were probably not more than half full. The cylinders of the three wrecked coaches, viz., the third, fourth, and fifth, were only dented, and were not broken or pierced in any way, but the pipes and connections leading from them were broken off, and the gas was free to escape. One of the witnesses (Porter Ryan) says that when the engine struck the bridge he saw a volume of flame burst from it, and this probably set fire to any gas that might be escaping from the carriages as they passed the engine. Apart from this, it is well known that a very small spark is sufficient to ignite gas when escaping into the air, and there must have been plenty of red-hot cinders from the engine, and sparks from the wheels, flying about the train during the process of destruction. The immediate appearance of fire, the rapidity with which it spread, the fierceness with which it burnt, and the manner in which it resisted for nearly two hours all the efforts to quench it, can, in my opinion, only be attributed to the presence of gas. The fire first showed itself in the heap of wreckage against the wall which supports the booking office. It soon enveloped the fourth and fifth coaches, which were burnt out. The leading end of the sixth coach, which was lighted by electricity, was also destroyed by fire, owing to the fact that it was entangled in the wreckage of the other two, by which it was set alight.

The arguments for and against the use of gas for lighting trains are fully given in Major Pringle's report dated 31st January, 1911, upon the collision which occurred at Hawes Junction, and it is not necessary for me to repeat them here. Major Pringle came to the conclusion that, although steps might be taken to lessen the risks attendant upon the use of gas, "electric lighting would still be the safer method," and "should be adopted wherever possible." It is to be regretted that up to the present time no unanimous action has been taken by the railway companies to meet the representations of the Board of Trade, which were based upon the above report. Some companies are in favour of electricity, while others champion the use of gas. The chief point on which opinions differ seems to be that of cost. I have been personally assured by responsible railway officers that gas is far the cheaper illuminant of the two, while other officers equally responsible have been confident that the balance is in favour of electricity. In view of these conflicting opinions, it may be assumed that the difference in cost does not amount to much, and depends chiefly upon what items are included in the term "cost." So far as safety is concerned, there can hardly exist in anyone's mind a doubt that electricity is the better, and I think the railway companies would be wise to recognise this fact and adopt electricity as the standard illuminant on all their main-line trains before they are compelled to do so by the pressure of public opinion.

In fairness to the London and North-Western Railway Co., I should say that gas has been used by it on its trains for 30 years, during which period, I am told, 2,937 millions of passengers have been carried, and this is the first occasion on which it has been suggested that gas has been concerned in the burning of one of its trains. A large number of its carriages are already lighted by electricity, and the number is increasing yearly. But the company has not as yet gone so far as to adopt electricity as the standard illuminant.

**University of Hong-Kong.**—We recently published a list of the machines required for the equipment of the engineering departments of the new University of Hong-Kong, of which Prof. C. A. M. Smith is the head, and urged our readers to take advantage of this unique opportunity of securing the finest of all advertisements in the eyes of the embryo engineers who are now joining the University. We have since heard from Prof. Smith that the first to respond to the invitation were the Chloride Electrical Storage Co., Ltd., who telegraphed to him promising to present a complete set of their well-known accumulators; the Hart Accumulator Co. have also presented a number of cells, and the Walsall Electrical Co., Ltd., have presented a quantity of electrical instruments. Messrs. Marshall, Sons & Co., Ltd., have cabled out offering a complete steam engine and condensing plant. Oil engines and all kinds of electrical apparatus are urgently needed by the University, as well as physical and scientific instruments.

Prof. Smith writes that the longer he is in Hong-Kong, the more convinced he is that the place is the "springboard" for British trade with China, and that our manufacturing firms will never get another chance such as this for creating an indelible impression upon the minds of our Oriental customers. Out of 55 new students, 37 are engineers. We may mention that, while the tonnage of shipping cleared at Liverpool in 1910 was 74 millions, that of Hong-Kong was no less than 11 millions—a far greater total than that of any other port in the British Empire, except London. Practically, the island is the gateway of British trade with China and the East, and its further development as the centre of scientific and engineering training in those regions will immensely increase its importance and prestige. There are no tariff walls to hinder our access to the markets of the vast population which is now bestirring itself and is beginning to devise ways and means of utilising the riches with which the country is endowed by Nature; we are on an equality with our rivals in this respect, and superior to them in the quality of our products, but if their manufactures are permitted to pervade the laboratories of the University and to impress themselves upon the student engineers, we shall be greatly handicapped in the battle for trade. As both an individual and national duty, we again urge upon our readers the importance of making those laboratories a first-class showroom and permanent exhibition of British manufactures.

**Appointments Vacant.**—According to an advertisement in the *Times*, the post of superintendent of the Magnetic and Geo-Physical Observatory at Eskdalemuir (Dumfriesshire) is vacant (salary, £400 to £500), and applications have to be lodged by January 31st. Particulars from the Assistant Secretary of the Royal Society, Burlington House, W.C.

One senior switchboard attendant (32s. 6d.), and two junior switchboard attendants (26s.), for the Salford Corporation. Junior telegraph engineer, for the Uganda Protectorate Government (£250). See our advertisement pages in this issue.

**Electricity in Spain.**—A Comision Permanente Espanola de Electricidad has just been appointed in Spain, under Government auspices. D. José Echegaray has been invited to become the first president of the new body.

**Billiards.**—The final of the billiard handicap for the Challenge Cup, presented by Mr. J. H. Cowell, manager of Blackburn Corporation Tramways, for competition amongst the employés, was played on Friday evening. The contestants were Inspector G. H. Woods and Mr. D. McEvoy, who was last year's winner. The cup was eventually won by Inspector Woods, who was also presented with a gold medal by Mr. J. L. Redmayne, whilst Mr. McEvoy was given a leather pocket wallet as a consolation prize. Alderman Houliker Watson made the formal presentation.

**Bradford Strike.**—At Bradford City Police Court, last week, Albert L. Raistick, of Idle, was fined 20s. and 23s. costs, for having, as a Trade Union picket, thrown an egg at an electrician named Charlie Mounsey, who had remained at work during the electricians' strike in Bradford.

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION).—There was an attendance of about 300 gentlemen at the annual dinner of the Scottish Local Section, which, as mentioned previously, was held on December 17th. Mr. Wm. M'Whirter, the chairman, presided. Engineer Commander Wood, who responded for the Navy after the "Imperial Forces" had been proposed by Mr. Robert Caird, LL.D., spoke of the connection between the electrician and the Navy. The electrician had shown that there was nothing too heavy or too light, nothing too large or too small for him to tackle. He weighed the anchor and mixed the dough for bread. He ventilated the ship and he lighted it. His were the means by which the captain in his cabin could tell the officer on the bridge what he thought of him, and also by which the admiral on the flagship could tell the captain what he thought of him. The electrician warmed the cabins and cooled the magazine. He hoisted the ammunition and the coal. He pumped the bilge water and flooded the seascape with light, and one day, no doubt, would take a hand in driving the ship. Lord Provost Stevenson responded to the toast of "Glasgow Corporation," and had much to say regarding the work of the electricity department of the T.C. in the effort to get rid of the black smoke in the atmosphere. He pointed out that it was the business of the electrical engineers to show the citizens how to carry on their industrial concerns without the smoke pall above them all the time. He understood that since the amalgamation of some of the neighbouring areas the electricity department has been inundated with orders from large manufacturing

concerns, and he could see the smoke fall visibly disappearing, because those orders for large power supplies from the department meant nothing if not a diminution of smoke. The more the electrical engineers convinced the users of power that that power could be supplied through electricity, the sooner would the smoke cloud be dispelled: the Corporation, therefore, looked to the electricians primarily for that evolution. He was delighted to hear from the chief electrical engineer, Mr. Lackie, that he was now developing 37,000 H.P. Mr. Lackie had shown them in the recent Smoke Abatement Exhibition that almost everything under the sun could be done by electricity. The toast of the "Institution of Electrical Engineers" was proposed by the Bishop of Glasgow and Galloway, and Mr. Duddell, the President, in response, said that while it was true that the membership had grown from 700 to about 7,000 after 40 years of existence, that, he took it, was an indication of the growth of the electrical industry, for to-day it was one of the most important industries in the country. As to the part played by electricity on board ship, his opinion was that the day was not far distant when it would play a far greater part. They had heard of the success of the Glasgow electricity department in abating the smoke nuisance, but they had also got to attack the domestic fire, which, after all, was the chief offender in their great cities. At the summer meeting of the Institution in Glasgow, Dr. Silvanus Thompson read a most interesting paper on "Magnetism and the Permanent Magnet." Arising very much out of that paper the Institution had decided to form a Research Committee, which was going to co-ordinate the electrical researches which were going on all over the country, and to start research on electrical subjects. In his paper Dr. Thompson showed very clearly the necessity there is of co-ordinating research on the magnetic properties of steel, and they hoped that that might form part of the work to be dealt with by the Institution. As to internal affairs, they had, he believed, a successful Students' Section in Glasgow; it had come to his knowledge that some of the students did not like being made graduates, and he wished it to be clearly understood that the Council in transferring many young men from the class of student to that of graduate did not wish them to remain permanently in that class. Many young men who had not had sufficient number of years in practice were advised to be transferred into the graduate class, but it was hoped that in due course they would apply to be transferred to associate membership and the other higher classes of the Institution. He was the first president who had climbed the Institution ladder, starting as a student and going through all the various grades, while another curious fact was that he happened to be the same age as the Institution. Acknowledging the Scottish Local Section, proposed by Mr. R. K. Morcom, Mr. McWhirter pointed to the fact that the Institution was growing increasingly useful to the whole membership. Their Local Section at its start 12 years ago had 158 members; to-day it had 400, drawn from all parts of Scotland. The chairman went on to review the growth of electrical industry and the tramways undertaking in Glasgow in the last 20 years, and concluded by urging those concerned to take steps for the provision of improved educational facilities on sensible practical lines, not too highly pitched for their apprentices who were too often hampered and discouraged by an overdose of mathematics at their entrance into a technical college.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS (EAST OF SCOTLAND BRANCH).—**The monthly meeting of the branch was held in Kircaldy on Friday, 20th ult., and took the form of an "open night," to which all interested in the handling of electrical plant were invited. A paper was read by Mr. A. B. Muirhead (Glasgow), on "The Maintenance of Colliery Electrical Plant," addressed particularly to the "authorised persons" under the new Electricity Rules.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS (WEST OF SCOTLAND BRANCH).—**At the last monthly meeting of the Branch Mr. Sidney A. Simon, B.A., Glasgow, read a paper on "The Speed Control of Three-phase Motors." While not holding a brief for the universal adoption of three-phase current, knowing that there were many applications of electric power for which direct current was undeniably superior, the author described the most important of the methods of three-phase speed control which had been successfully developed, and afterwards the methods of imperfect speed control. He did not favour the latter, as in each case the variation of speed was effected in steps, and intermediate speeds were only possible by wasting energy. The discussion was adjourned till the next meeting.

**THE SOCIETY OF ENGINEERS (INCORPORATED).—**The Council of the Society may award in 1913 a premium (the "Status Prize") to the value of £10 10s., for an approved essay on "A scheme for the registration of Engineers, including particulars concerning the registration of Engineers in British Colonies and foreign countries." The competition is open to all, but, before entering, application for detailed particulars should be made to the Secretary, 17, Victoria Street, Westminster. The last date for receiving essays is May 31st, 1913.

**ROYAL SOCIETY OF ARTS.—**On Monday evening, January 20th, Prof. Vivian B. Lewes will deliver the first of his Cantor Lectures on "Liquid Fuel." On January 27th the second will be delivered. "Co-partnership" is the subject of a lecture to be given on January 29th, by Mr. Aneurin Williams.

**Uniflow Engines.**—A correspondent asks, Why so much fuss about the uniflow engine, as though it were a new idea but recently put into execution? The uniflow engine has acquired a few names, but there its novelty stops. There have been two well-known examples of the principle at work for many years in very great numbers. The chief in point of number was the Willans

engine, which carried out the uniflow principle by means, not of a ring of exhaust ports round the cylinder to be uncovered by the piston, but by a central valve with exhaust ports at the piston face.

It was a well-founded claim of the Willans engine that good drainage was secured, for all water which reached the piston was able quickly to escape by way of the central valve. The engine filled a certain want, viz., the demand for an engine to run as quickly as a dynamo, and so avoid belt driving. The ideas of Mr. Ferranti were not then accepted as they are universally accepted to-day; the ideas which gave the little engine its success were those which produced long engine rooms with the vanishing point perspective view of a long line of engines, each of a few horse-power, exhausting preferably to atmosphere.

Then Mr. Raworth brought out a uniflow engine, in which the exhaust took place through a ring of ports in the cylinder, which were uncovered by the piston. The same idea is carried out in the Körting gas engine.

It is somewhat doubtful if either of the steam engines named gave any better dryness results than the horizontal Corliss engine which collected its water at the exhaust valve to which much of it was shot across the cylinder directly from the inlet valve. But a vertical engine without superheat is bound to be wet on its upper end, and drainage at the piston face level or near the cylinder middle shows good results. But it is very doubtful if the uniflow principle is worth the sacrifice of the double acting principle, for the water drainage ceases to possess any supreme importance when steam is superheated, for there should be none to drain.

It is questionable if a uniflow engine with exhaust only by way of the cylinder middle ports would satisfactorily clear itself of steam in the time these ports are open; that is to say, unless a very excellent vacuum exists, the steam remaining in the cylinder will compress to a considerable pressure on the return stroke. High compression has not usually been beneficial beyond the point at which it produces easy, quiet running of an engine, for, when all is said, power is absorbed in doing the work of compression and cannot all be recovered.

Novelties in steam engines have rarely lived long. The reciprocating engine seems to have reached a fixed type, and to have reached its best in the upright position as a thing with a backbone, just as the animal creation appears to have reached its height in an upstanding vertebrate with limbs. So the engine, which has gone through repeated cycles of horizontality, appears to have been always at its best when vertical, the locomotive, like all draught animals, being of horizontal type.

The turbine is the one uniflow engine in which the principle is at all fully carried out. No reciprocating engine has carried uniflow into practice better than the Willans or the Raworth, and there are objections to mid-cylinder ports. Indeed, all the advantages of mid-cylinder ports are probably to be got by a system of small drain holes only, to let out water and some of the steam, leaving the remainder of the steam to the usual exhaust valve. Indeed, did not the Raworth engine follow this plan?

**The Cost of Electric Vehicle Operation.**—An American contemporary, quoting investigations made by the Massachusetts Institute of Technology, states that for parcel delivery, with a nine-hour day, three trips, four parcels delivered per mile and with one minute consumed in each delivery, three-quarters of an hour being allowed for loading and the maximum load being half a ton, the horse-drawn vehicle does only two-thirds as much work a day as the electric or gasoline truck, at a cost per delivery of 5.9 cents, 5.4 cents and 6.5 cents, respectively. The cost per mile by horse is likewise between the two other costs. In the delivery of coal, which is a very different kind of delivery, at the heavy end of the scale, with loads of 5 tons, the horse wagon (three horses, one resting every third day) does only about half as much work per day as either of the motor-trucks. The cost per mile here runs in much the same way as with the light work, being 55 c. for horses, 47 c. for electric, and 58 c. for gasoline, while the costs per delivery are in the same order, \$3.91, against \$3.32 and \$4.07. Some experiments have been made in special service requirements as affecting the cost of operation, and for the parcel delivery two minutes per call has been allowed instead of one. This increases the standing time, reduces the mileage per day, lessens the distance factor and raises the cost of delivery.

**Gas Producers.**—Commenting on our article on the slugging type of producer, Messrs. Appleby & Co. call our attention to the Kerpeley gas producer, in which the fuel is supported by a conical rotating grate which automatically discharges ash, and is claimed to be capable of gasifying low-grade fuel, coking or non-coking, and coal of all grades from lump to slime. The lower part of the producer is a water casing, to which clinker cannot adhere, the upper part having the usual refractory lining. The grate stands up in the middle of a water trough, which forms a water bottom to the producer. This water bottom, with the upstanding grate, rotates bodily round a vertical axis upon balls in a circular ball race. A fixed scraper is arranged which discharges the ash from the water bottom over the edge of this, the scraper being fixed at such an angle that the ash slides up its face and drops outside the rotating dish bottom. The cone is not quite concentric with the axis of rotation, but its vertex is a trifle eccentric. As the grate rotates this eccentricity has a moving effect on the fuel, and assists to work the spent fuel downwards and outwards until it drops off the lower edge of the cone into the water bottom. The grate is not circular, but polygonally elliptical, so as effectively to crush up clinker in this forms lumps. Rotation is not rapid—one turn in 2½ to 4 hours. Owing to the cleanliness of the fire and its openness, secured by the effects of rotation, the producer works

freely, and it is said that in one installation of producers the percentage of CO<sub>2</sub> was only 3·8 per cent. Forced blast is used, even to 30 in. water gauge at times. With a Styrian brown coal a gas of 139 B.T.U. per cu. ft. was obtained. This producer appears to be well calculated to work steadily and continuously, and produce an even and steady quality of gas without waste of fuel and with a high efficiency of operation. So far, this producer appears to have been made as a pressure producer, and of large size, but there appears no *prima facie* reason why the same principles should not be applied to producers of suction type. The air and steam supplies to the producer are controlled separately, and it is stated that the producer will maintain its maximum efficiency when working on dusty, low-grade fuel.

**Will.**—According to the *Times*, Mr. C. D. Phillips, of Newport, to whose death we referred a short time ago, has left estate valued at £78,188.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The employés of the Leeds Electricity Department held a smoking concert on Saturday at the Grand Central Hotel in order to bid farewell to Mr. DICKINSON, the city electrical engineer. The deputy-chairman of the Tramways and Electricity Committee (Ald. Brown) occupied the chair, and during the evening Ald. Tetley presented Mr. Dickinson with two silver standard lamps and a silver cake basket which had been subscribed for by 350 past and present employés of the department. Ald. Tetley referred to the benefit which the city of Leeds had derived from Mr. Dickinson's 20 years' connection with its electricity supply, and referred to the many improvements which he had been instrumental in introducing to the city. Ald. Brown said that after a number of years' intimate connection with Mr. Dickinson, he was of opinion that there was not a better electrician in the country than the manager of the Leeds electricity undertaking. Mr. Dickinson responded, and, after thanking those present for their gifts, said that the Leeds electricity undertaking first started with a 20-kw. dynamo supplying 20 customers. The business had so extended, that now the capital was nearly 1,000,000, and the capacity of the dynamos 15,400 kW., whilst in 1913, when they obtained the new sets, the capacity would be increased to 22,940 kW. He was looking forward to the time when the railways would be electrified, and the use of electric current would be fully appreciated in the household. Mr. Dickinson was released from his duties on January 1st to take up his appointment in Liverpool, on the understanding that he will pay visits to Leeds for consulting purposes.

MR. H. E. MUNDAY, of Shrewsbury electricity works, has been appointed switchboard attendant at H.M. Dockyard, Devonport.

The Burnley Corporation Electricity Committee has recommended that the salary of MR. JAMES E. STARKIE, the electrical engineer, be increased from £400 to £500 per annum, as from January 1st.

MR. A. C. BLACK, formerly shift engineer to the Cleveland and Durham Power Co., Ltd., and now charge engineer at the Bootle electricity works, has been married to Dorothy Edith Halsall, daughter of the late John Charles Halsall, of Liverpool.

MR. W. HODGSON INMAN, for 11 years at the Lancaster Corporation electricity works, has commenced business as an electrical engineer, wiring contractor, &c., at 35, North Road, Lancaster. The staff at the Lancaster Corporation electricity works presented him with a combined ammeter and voltmeter.

MR. C. E. C. SHAWFIELD, electrical and consulting tramway engineer to the Wolverhampton Corporation, has given three months' notice to terminate his engagement, the reason being that he has been offered, and has accepted, a much more important appointment with a new local company, which is as yet in its comparative infancy, but in connection with which it is believed there are great possibilities. Mr. Shawfield went to Wolverhampton from Newcastle, and succeeded Mr. Harman Lewis 15 or 16 years ago as borough electrical engineer, and was later appointed consulting tramway engineer, the combined salary being £600 per annum. He saw the inception in Wolverhampton of the Lorain surface contact system of tramway traction, and under his direction the various routes were laid and equipped. At the present time he is President of the Municipal Electrical Association, and he is also President of the Wolverhampton and District Engineering Co. In this latter capacity he delivered his presidential address less than a month ago.

The Bexley U.D.C. has appointed MR. H. P. STOKES, borough electrical engineer and tramways manager at Ilkeston, as electrical engineer and tramways manager. There were 50 applicants.

The Hastings T.C. has appointed MR. WM. TRAVIS, of Southport, as chief assistant electrical engineer at £150 a year, rising to a maximum of £180.

**Tramway Officials.**—The Maidstone T.C. has increased the salary of MR. LAMBERT, tramway manager, from £200 to £225 per annum, as from the New Year.

The Darwen Tramways Committee recommends the appointment of MR. F. J. S. HOSKEN as tramway manager, at a salary of £200 per annum.

**General.**—The following announcement appeared in the *London Gazette* on December 24th:—

### ROYAL ENGINEERS.

"London Wireless Telegraph Company, London District Telegraph Companies, Royal Engineers (Army Troops).—LIEUT. AARON E. G. ABRAHAMSON resigns his commission. Dated December 25th 1912."

"Electric Light Company, Dorsetshire (Fortress) Engineers, Royal Engineers.—WILLIAM HENRY UPTON MARSHALL, M.I.E.E., A.M.I.Mech.E., to be Second Lieutenant. Dated December 31st, 1912."

Messrs. Sandycroft, Ltd., announce that they have accepted, with regret, the resignation of MR. W. O. ROOPER, their technical manager. Mr. Rooper is opening offices at 30, College Street, Cannon Street, London, E.C., where he will act as adviser to several well-known mining companies.

MR. H. L. KIRBY JOHNSON, late of Loxley & Co., Ltd., Leeds, has now joined the British Westinghouse Electric and Manufacturing Co., Ltd., and will be attached to the Glasgow branch in charge of the supplies department for Scotland.

The British Westinghouse Co.'s detail department held their annual supper and smoker on the 20th ult., under the chairmanship of Mr. J. Currie, the general foreman of the department. Advantage of the occasion was taken to "send off" MR. H. R. SCHULTZ, the chief switchboard designer, who is leaving to take up an important post in Sweden. He was presented with a gold watch on behalf of the office staff, and with a silver-mounted umbrella by the works staff. A silver *entrée* dish and a pipe also were presented to MR. W. A. COATES, the head of the switchgear sales section, who is leaving for Canada early in the New Year.

MR. R. C. HOUR, of Paris, and MR. C. W. DAYSON, of London, directors of the Warner International and Overseas Engineering Co., Ltd. were passengers by ss. *Curmania*, which left Liverpool on Saturday for New York.

MR. CLAUDE CROMPTON, manager of the lamp shop of Crompton and Co. Ltd., has severed his connection with the company.

The Postmaster-General has appointed MR. W. G. C. KIRKWOOD, Principal Clerk in the Secretary's Office of the Post Office, to be Secretary of the Post Office in Scotland, in place of Sir Edward Redford, C.B., who retired from the service on December 31st.

The *Times* states that MR. ANDREW WILSON TAIT and MR. HARRY FRED LEE ORCUTT have been elected to the board of Fraser & Chalmers.

The marriage took place on December 26th, at Lostwithiel (Cornwall) Wesleyan Church, of MR. THOS. HENRY VARCOE and Miss Martha Jennings, younger daughter of the late Mr. John Jennings, of Restormel, Lostwithiel.

MR. ROLLO APPELBYARD, departmental manager at the works of the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, has been appointed a Justice of the Peace for West Ham.

In the New Year Honours List we observe that "PAUL JOHANNES BRUHL, Esq., D.Sc., M.I.E.E., F.G.S., F.C.S., Professor of the Civil Engineering College, Sibpur, Bengal," has been appointed to Companionship of the Imperial Service Order. LIEUT.-COL. H. A. YORKE, C.B., Chief Inspecting Officer of Railways under the B. of T. since 1900, receives the honour of knighthood. DR. FRANCIS DARWIN, F.R.S., president of the British Association in 1908, has also been made a knight. Congratulations to these gentlemen.

**Obituary.**—MR. EDWARD TYER.—We regret to record that the death occurred on Christmas night, in his 83rd year, of Mr. Edward Tyer, of Tunbridge Wells, Assoc. 1861 Inst.C.E., M.I.E.E., F.R.M.S., F.R.G.S., &c., and the funeral took place on Monday last, at Busbridge, near Godalming. The *Times*, in the course of a full obituary of the deceased, published in its issue of December 25th, says that he "did more perhaps than any man now living to ensure by efficient signalling the safety of railways passengers, and . . . also first gave to the people of London the facilities of telegraphic intercommunication." It appears that his first interest in electrical matters was due to a Mr. Dempster, who kept a private school at Chiswick, and the interest thus begun was easily stimulated, and soon became almost a passion. After an attempt at office life, he returned to the interest in electrical apparatus, and in 1852, when he was 22 years of age, he patented an invention "by which an engine driver approaching a station automatically gave to the station inspector an electrical warning of his approach," receiving a reply indicating his right course of action. In association with others he formed the Railway Electric Signals Co., and "invention followed invention, and his system of block signalling became widely known." The *Times* writer continues:—

"In 1878 Tyer took out a patent for an improved system of electrical control, which came to be distinctively known as the tablet system, and has been very widely adopted." Further, "he advanced the cause of public telegraphic communication. Before 1859, while trunk lines and cables had their terminal offices in London, they were not linked up with each other. The inhabitants of London could not communicate with each other at all by telegram, and if they wanted to use trunk lines or cables had to go to the offices. Tyer saw the possibility of linking up these offices and of establishing subsidiary offices throughout London from and to which any person could telegraph. The London District Telegraph Co. was formed in January, 1859, under the chairmanship of Samuel Gurney, M.P., with Sir Charles Bright as consulting engineer. To Tyer was given the post of electrical engineer, and the laying down of underground and overhead wires and the manufacture of instruments devolved upon him. Thus was established the foundation of what afterwards was perfected under the

brilliant management of an old signalling competitor, Sir William Preece, and became the postal telegraph service in London, which absorbed all privately-owned systems."

Mr. C. H. GADSBY.—We deeply regret to record the death, which has occurred at the early age of 46 years, after a prolonged illness, of Mr. Chas. Herbert Gadsby, Wh.Sch., M.I.E.E., M.I.M.E., consulting engineer, of 20, Victoria Street, London, S.W. He passed away on December 24th, at Farnham, Surrey. Mr. Gadsby began his career as an apprentice at the Falcon Works, Loughborough, and, winning a scholarship, he went to Nottingham University for a year or two, afterwards returning to the Loughborough Works to finish his term. Later he went to Madras for Messrs. Crompton & Co., Ltd., in connection with the electric tramway system there, after which he came home and started as a consulting engineer. He was responsible in that capacity for work done for the British Electric Traction Co., Ltd., the design and construction of the Devonport tramways, and the Burton and Ashby light electric railway for the Midland Railway Co. His death at so early an age is greatly to be deplored.

Mr. F. A. HAMILTON.—We learn with regret of the death, which occurred at Halifax, Nova Scotia, on December 19th, at the age of 72 years, of Mr. Frederick A. Hamilton. Mr. Hamilton was born in Kent, England, and in his early years he was in the British Mercantile Marine, and visited Sicily in 1860-69. When Garibaldi was organising an army for the liberation of Rome, he joined Garibaldi's "thousand," landed in Italy, and marched on Rome. The Garibaldians were defeated by the French and Pontifical troops; Hamilton was taken prisoner, and held for some time in "honourable detention" by the Italian Government. The unity of Italy under Victor Emmanuel was subsequently effected and the Garibaldians released. Mr. Hamilton was afterwards employed by the Anglo-Mediterranean Telegraph Co. at Messina, from whence at the end of 1869 he returned to London where he joined the electrical staff of the Telegraph Construction and Maintenance Co., and took part in several cable expeditions in different parts of the world. He first visited North America in the summer of 1872 in the cable ship *l'Anessa*, belonging to the same company, which laid cables between Placentia, Newfoundland, and Sydney, Cape Breton Island. During this expedition his left hand was injured, and he entered the French Hospital at St. Pierre, Miquelon, where the thumb was amputated. He afterwards joined the Anglo-American service and was chief electrician of the c.s. *Minia* for nearly 20 years. He resigned from that company and started as a consulting electrician at Halifax, Nova Scotia, and was employed by the United States Government for some time on their c.s. *Burnside* in the extension and maintenance of the inter-island submarine cable system in the Philippines. After the completion of this work he joined the service of the Commercial Cable Co. as chief electrician of that company's c.s. *Mackay Bennett*, and held that position until his death. Mr. Hamilton probably tested and repaired more broken cables than any other man in the world. He was highly respected, a general favourite, and had a host of friends. Through his residence in Italy he had a great fondness for Italian literature. He was a man of scholarly and artistic tastes, and was conversant with several modern languages. He leaves a widow, a daughter of Judge Johnson, of Halifax, N.S., to mourn his loss.

**McWhirter & Son (Cardiff), Ltd.** (126,098).—This company was registered on December 21st, with a capital of £5,000 in £1 shares (3,000 preference), to carry on the business of electricians, mechanical engineers, suppliers of electricity for light, heat, motive power or otherwise, &c. The subscribers (with one share each) are:—A. S. McWhirter, 214, Holm Street, Glasgow, electrical engineer; Annie Heddie, 214, Holm Street, Glasgow, cashier. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitors, Gattis & Rodger, Glasgow. Registered by Blyth, Dutton, Hartley & Blyth, 112, Gresham House, E.C.

**National Electric and Motor Corporation, Ltd.** (126,074).—This company was registered on December 20th, with a capital of £500 in £1 shares, to take over the business of the Consolidated Electric Works and Appliances, Ltd. (incorporated in 1909), carried on at Northampton Grove, Canonbury, and the vendors' interest in a British patent granted to G. Ottino for improvements in rotary valve engines. The subscribers (with one share each) are:—J. Crawford, 10, Wine Office Court, E.C., publisher; E. S. Fry, 97, Gonder Gardens, Hampstead, clerk; J. McLaren, 8, Herne Grove, Peckham, S.E., traveller; H. P. Collins, 110, Leigh Road West, Leigh-on-Sea, cigar merchant; T. E. Ward, 2, Wallace Gardens, Canonbury, N., company director; F. H. Shimmell, 30A, Glenfield Road, Balham, S.W., clerk; J. Camp, jun., 14, Serjeants' Inn, E.C., clerk. Minimum cash subscription 25 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than seven; the first are T. E. Ward and four others to be appointed by the subscribers; qualification, 100 shares. Registered by C. Double, 14, Serjeants' Inn, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**United Sherardizing, Ltd.**—Particulars of £10,000 debentures, created September 2nd, 1912, filed pursuant to Sec. 98 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Grindell-Matthews Wireless Telephone Syndicate, Ltd.**—Charge on company's undertaking and property, present and future, dated December 9th, 1912, to secure a premium of 10 per cent. on an issue of £2,500 debentures, part of a series of £3,800. Holder: Otto Beit, Warford Court, E.C.

**White Bros. & Shaw, Ltd.**—Debenture dated November 25th, 1912, to secure £800, charged on the company's undertaking and property, present and future. Holder: Miss I. A. Andrews, Fair View, Alvestock, Hants.

**Yorkshire Waste Heat Co., Ltd.**—Particulars of £25,000 debenture stock, created December 8th, and secured by trust deed dated December 4th, 1912, filed pursuant to Sec. 98 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: Land in Barugh Parish, Yorks., with buildings thereon, present and future, &c. (Power is reserved to release part of the mortgaged property, if trustees are satisfied that stockholders' security will not be prejudiced.) Trustees: F. J. Kitson, Gledhow Grove, Leeds; and H. I. Bowring, Blackwood Moor, Alerton.

**Argentine Tramways and Power Co., Ltd.**—Trust deed dated December 2nd, 1912, to secure £250,000 debenture stock, charged on the company's undertaking and property, present and future, including uncalled capital (if any). Trustees: C. W. Trotter, Basildon House, Moorgate Street, E.C., and W. S. Poole, 8, Prince Street, E.C.

**Aetion Lamp, Ltd.**—Issue on December 11th, 1912, of £800 debentures, part of a series of which particulars have already been filed.

**New Phonopore Telephone Co., Ltd.**—Capital £10,000 in 9,000 ord. and 1,000 founders' shares of £1 each. Return dated November 7th, 1912; 7,141 ord. and 1,000 founders' shares taken up; £1 per share called up on 6,141 ord. and 600 founders' shares; £2,731 paid, leaving £10 in arrears; £1,400 considered as paid on 1,000 founders' and 400 ord. Mortgages and charges: £3,700.

**Pacific and European Telegraph Co., Ltd.**—Capital £100,000 in £10 shares. Return dated November 26th, 1912. All shares taken up; £4 per share called up; £40,000 paid. Mortgages and charges: £72,400.

**New St. Helens and District Tramways Co., Ltd.**—Capital £160,000 in £5 shares (20,000 pref. and 10,000 ord.). Return dated November 9th, 1912. 15,980 pref. and 9,000 ord. shares taken up. £125,410 paid, including £510 on 1,020 forfeited shares. Mortgages and charges: Nil.

**Ferranti, Ltd.**—Trust deed dated November 1st, 1912, supplemental to trust deed dated July 24th, 1905, and February 25th, 1910, securing £50,000 6 per cent. first mortgage debenture stock charged on leasehold hereditaments and premises in Fallsworth and the company's undertakings and property, present and future, including uncalled capital. Trustees: H. R. Boyce, Winchester House, E.C., and W. Jones, manager of Parr's Bank, Manchester. Also trust deed of even date to secure £50,000 6 per cent. notes of £100 each carrying interest at 6 per cent. per annum, charged on above-mentioned 6 per cent. first mortgage debenture stock. Trustees: Trust Union, Ltd., 18, Austin Friars, E.C.

**Titchfield and District Lighting, Ltd.**—A memorandum of satisfaction to the extent of £900 on December 14th, of debentures dated February 27th, 1912, securing £2,600, has been filed.

**Telephone Co. of Egypt, Ltd.**—A memorandum of satisfaction to the extent of £2,800 on December 18th, 1912, of trust deed and supplemental deeds dated from July 27th, 1904, to October 27th, 1909, securing £200,000 debenture stock, has been filed.

**Oriental Telephone and Electric Co., Ltd.**—A memorandum of satisfaction to the extent of £1,000 on December 18th, 1912, of trust deed and supplemental deed of acknowledgment dated June 23rd, 1905, and June 11th, 1907, respectively, securing £200,000, has been filed.

## NEW COMPANIES REGISTERED.

**Assisted Tramway, Light and Power Co., Ltd.** (126,196).—Registered December 28th, by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital, £60,000 in £1 shares (800,000 preference). Objects: To carry on the business of a tramway, light and power company in all its branches, to apply for, purchase or otherwise acquire, work and turn to account, any Parliamentary, municipal or other concessions, orders, rights and powers in Paraguay or elsewhere, and to adopt an agreement with the Paraguay Central Railway Co., Ltd. The signatories (with one share each) are:—F. W. Cowham, 118, Minard Road, Hither Green, S.E., clerk; S. H. Penwarden, 86, Peterborough Road, Leyton, clerk; F. H. Goodwin, 52, Totterhall Road, Palmer's Green, N., clerk; R. Dolby, 19, Park View Crescent, New Southgate, N., clerk; P. H. Wiggins, 141, Station Road, Finchley, N., clerk; F. J. Prosser, 58, Devonshire Road, Merton, S.W., clerk; A. T. Filier, 83, Helmlinch Road, Stamford Hill, N., clerk. Minimum cash subscription seven shares. The directors are to number not less than three or more than seven. The Paraguay Central Railway Co., Ltd., have the permanent right to appoint and remove two directors. The other first directors are to be appointed by the signatories; qualification, £200; remuneration as fixed by the company. The company takes power to pay not more than 60 per cent. underwriting commission.

**Nu-Lines Manufacturing Co., Ltd.** (126,075).—This company was registered on December 20th, with a capital of £8,000 in £1 shares, to acquire and develop the patent and other rights relating to a telephone recorder, a "teletype lock," and a calculating machine, the invention of C. C. Chapman, together with the goodwill and assets of the Nu-Lines Manufacturing Co., of Leicester. The subscribers (with one share each) are:—J. Thomas, Rowton Buildings, 11, Bowling Green Street, Leicester, accountant; G. Ineson, 22, Charles Street, Leicester, rag and waste merchant. Private company. The number of directors is not to be less than two or more than five; the first are C. C. Chapman and G. Ineson; qualification, £50. Registered office, 11, Bowling Green Street, Leicester.

**J. W. Brettall, Ltd.** (126,006).—This company was registered on December 18th, with a capital of £1,000 in £1 shares (500 6 per cent. pref.), to carry on the business of electrical engineers and contractors, and lighting, heating and ventilating specialists, &c. The subscribers (with one share each) are:—W. Brettall, 16, Adam Street, W.C., electrical engineer; F. W. S. Napier, Thirston, Belkirk, N.B., gentleman. Private company. The first directors are J. W. Brettall and F. W. S. Napier. Registered office, 18, Adam Street, W.C.

## CITY NOTES.

**Metalite, Ltd.**

MR. W. STEWART (chairman) presided on Tuesday at 20-22, Christopher Street, E.C., over the second annual meeting of the Metalite Co. There was no report or accounts presented, as it was stated in the notice convening the meeting that the audit was not complete, and it was proposed to adjourn the meeting till February 28th. There were about 20 shareholders present.

The CHAIRMAN said: Ladies and gentlemen, this meeting has been called solely to comply with the terms of the Companies' Consolidation Act, 1908, which necessitates an annual general meeting being held before the end of the calendar year. You will remember that, at the last annual general meeting, a point was made of the fact that this company had then secured the option of the purchase of the exclusive rights in this country for the production of a new filament, which the directors believe will be better than any other existing filament. You will be glad to hear, therefore, that the negotiations have been satisfactorily concluded, and that this company now hold the sole licence for the United Kingdom to manufacture the filament known as the Boran filament. Prior to signing the contract, a great deal of experimental work was done in our own laboratory, and the directors feel assured that once in the position to put the lamps in large quantities on the market, they are on the right road for making a substantial profit. Owing to a notice in a journal, the company has been practically inundated with orders for this new lamp, and it seems only a matter of the company having sufficient funds to turn out the lamps in regular quantities in order to yield very handsome results. For all practical purposes, the manufacture of the new lamp commenced from November 1st, 1912, and thus the directors considered it best that the accounts for the present financial period should be made up to October 31st instead of July 31st, and it is for this reason that we propose to put a resolution to the meeting asking them to adjourn it until February 28th next, when the accounts will be available, and I shall then have much pleasure in giving full particulars regarding them. However, I regret to add that owing to exceptional difficulties and lack of financial resources, the directors will not be able to recommend the payment of a dividend for such period. I now beg to move that this meeting do stand adjourned until Friday, February 28th next, at this warehouse at 11.30.

MR. LEE (a shareholder) seconded the motion.

MR. HARRISON: I will propose an amendment, that the meeting be not adjourned until a Committee of inquiry, or some inquiry into the accounts of the company is made.

A DIRECTOR: That amounts to a direct negative.

The motion was then put and carried, with three dissentients.

The CHAIRMAN: I declare this meeting adjourned accordingly until February 28th next.

MR. HARRISON: Can I ask further questions on the position of the company?

The CHAIRMAN: The meeting is now concluded.

MR. HARRISON: But outside the meeting?

The CHAIRMAN: Mr. Harrison, if you will come to me I shall be pleased to answer questions.

MR. HARRISON: I have asked previous questions and got no satisfaction. This is a serious matter.

MR. DUNLOP (a shareholder): This is quite irregular. If this gentleman wants any information, he is able to ask you for it. It is not to the interests of any member of this company that any person should get up and make statements which may be calculated to injure our interests. We are here to consider our own interests, and I object to allowing any gentleman to injure them, and if it is information he really wants, he can easily obtain it by acquiring it at the proper place.

MR. HARRISON: No, Mr. Dunlop, I can't.

A SHAREHOLDER: Mr. Stewart, allow me to congratulate you on your successful tactics.

The meeting then closed.

**Bryant Trading Syndicate, Ltd.**—The annual meeting of this company was, we understand, held at 8-9, Broad Street Avenue, London, E.C., on Tuesday, and was adjourned until March 7th. In a circular issued under date December 23rd, signed by "Wm. Stewart," it was stated:—"The reason the directors desire the meeting to be adjourned is that they have certain plans and negotiations on hand which will, I believe, mature during the next two months, and which they consider would be of benefit to the shareholders of this syndicate." After referring to other matters in which the syndicate is interested, the circular continued:—"With regard to Metalite shares, as you are aware, we still hold some 30,000 fully-paid shares in this company, in addition to 60,000 partly paid, and as Metalite, Ltd., are in the fortunate position of having a new lamp and in view of the large number of orders offered them, it is believed that they will shortly be sufficiently financed to place them in a sound position, so that that part of the assets of this company should be of considerable value. In conclusion, I wish to point out that my co-directors with myself, in view of their belief in the ultimate success of this company, have personally assisted by way of loans in addition to giving their personal guarantee in many matters in order to enable the company to continue and with a view of its ultimate success, this personal liability amounting to over £20,000." The circular is signed "Yours fraternally."

**Blackpool, Lytham and St. Annes Tramways Co.**

At the annual meeting at Blackpool, on Monday last week, Mr. George Nicholson (Liverpool), who presided, said they could not congratulate themselves on the result of the year's working. The year opened with great encouragement, the receipts for the first six months being £1,079 up, but unsettled weather for four months in the summer season caused a decrease in revenue of £2,968, while the expenditure had increased by £1,377 on account of upkeep of permanent way, so that there was a shortage of £1,100, as compared with 1911. He complained that the Corporation of Blackpool charged them 2d. per unit for electrical energy, whereas the average price all over the country was 1'10d. per unit. It was absolutely essential, he continued, that they should renew a portion of the track at a cost of £2,000. They had to face increased cost of materials and the additional burden imposed by the Insurance Act. The report was adopted, and Mr. T. Blane, of Blackpool, was re-elected chairman of directors. Arising out of a portion of the report announcing that the trustees of the debenture-holders, upon the recommendation of the directors, had intimated their intention of paying 1½ per cent. on account of the arrears of interest due on the debenture stock, and to enable this payment to be made, the annual payment to the sinking fund had been suspended for the year, an animated discussion took place, led by Mr. Thos. Preston, of St. Annes, who suggested that the Blackpool Corporation should take over the tramway. It was, he said, utterly illogical and absurd that shareholders should come to a meeting to manage a concern in which they had not a farthing's worth of interest. The Chairman said the debenture-holders were entitled to the line until they were paid out, and in view of the cost of the line, and the great interest arrears, he thought there was no chance of the shareholders getting a penny. A committee of shareholders was appointed to confer with the directors, to see if some improved position could be devised.

**Mexican Fuel and Power Co.**—The directors' report for the year ended September 30th last, states (according to the *Financial News*) that the company having been engaged upon construction work only during the period covered by the report, no profit and loss account is submitted. The issued capital of the company is £70,000 in 20,000 preference shares of £1 each, and 50,000 ordinary shares of £1 each, leaving 30,000 preference shares in reserve. In December, 1911, the company acquired from the vendors, the Peat Industry Co., a concession granting rights over the large peat deposit situated at Lake Xochimilco, about 12 miles from Mexico City. The area covered by the concession is over 7,000 acres, and contains a practically inexhaustible supply of raw peat. The company also acquired certain plant and machinery for the manufacture of fuel from this peat. The amount expended by the Peat Industry Co. prior to the incorporation of this company on plant, machinery, &c., was estimated at £37,000, and the accounts show a further sum of £9,360 expended up to September 30th, 1912, on additional buildings, machinery, power, plant, &c. The work of erecting the additional plant has been carried on energetically, in the face of considerable difficulties and delays due to the political disturbances in Mexico. The work is now almost completed. The directors anticipate that as soon as the plant is in full working order an output of about 50 tons of fuel a day may be expected. Already several inquiries have been made for the company's products in substantial quantities.

**Stock Exchange Notices.**—Application has been made to the Committee to allow the following security to be quoted in the Official List:—

Cordoba Light, Power and Traction Co., Ltd.—Further issue of 127,553 ordinary shares of £1 each fully paid.

The Committee has (1) appointed special settling days as under:—

Wednesday, January 8th.—British Columbia Electric Railway Co., Ltd.—Further issue of £200,000 deferred ordinary stock; £200,000 preferred ordinary stock; and £200,000 5 per cent. cumulative perpetual preference stock.

Thursday, January 10th.—Compañía de Electricidad de la Provincia de Buenos Ayres, Ltd.—Further issue of £150,000 5 per cent. first mortgage gold bonds of £20 each (Nos. 37,501 to 45,000).

And (2) ordered the undermentioned securities to be quoted in the Official List:—

British Columbia Electric Railway Co., Ltd.—Further issue of £200,000 deferred ordinary stock; £200,000 preferred ordinary stock; and £200,000 5 per cent. cumulative perpetual preference stock.

New York Telephone Co.—£250,000 additional 1½ per cent. first and general mortgage bonds of £100 each (Nos. C37,501 to 40,000).

**Continental.**—GERMANY.—The report of the A.E.G. Lahmeyer-Werke Gesellschaft, of Frankfort-am-Main, for the last financial year shows a profit of £31,960, as compared with only £28,867 in the preceding 12 months. A dividend of 6 per cent. is being declared.

**Rio de Janeiro Tramway, Light and Power Co., Ltd.**—The directors have declared a dividend of 1½ per cent.

**Sao Paulo Tramway, Light and Power Co., Ltd.**—The directors have declared a dividend of 2½ per cent.



SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Dec. 31st.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Dec. 31st.	Rise + or Fall	Present Yield p.c.
Bournemouth & Poole, Ord.	10	5 1/2	81	..	5 4 9	Kensington & Knightsbridge, Ord	5	9 1/2	78-84	..	5 10 9
Do. 4 1/2 % Pref.	10	4 1/2	83	..	4 12 4	Do. 4 % Deb.	Stock	4 4	92-96	..	4 4 8
Do. Second 5 % Pref.	10	5	10-10 1/2	..	5 14 8	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 1/2	78-82	..	5 9 9
Do. 4 1/2 % Deb. Stock	Stock	4 1/2	96-98 xd	..	4 11 10	London Electric, Ord.	5	2 1/2	14-2	..	3 15 0
Brompton & Kensington, Ord.	5	10 9 1/2	81-82	..	5 8 1	Do. 6 % Pref.	5	6 6	42-52	..	5 14 8
Do. 7 % Cum. Pref.	5	7 7	83-9	..	3 17 9	Do. 4 % First Mort. Deb.	Stock	4 4	88-91	..	4 8 0
Central Electric Supply, 4 % Guar. Deb.	100	4 4	95-98	..	4 1 8	Metropolitan	5	4 4 1/2	4-42 xd	..	5 8 3
Charing Cross, West End & City	5	5 5 1/2	48-52	..	4 17 7	Do. 4 1/2 % Cum. Pref.	5	4 1/2	44-44	..	5 2 10
Do. 4 1/2 % Deb.	5	4 1/2	48-42	..	4 14 0	Do. 4 1/2 % First Mort. Deb.	Stock	4 1/2	67-100 xd	..	4 10 0
Do. City Undertaking 4 1/2 % Cum. Pref.	5	4 1/2	37-43 xd	..	5 2 10	Do. 5 1/2 % Mort. Deb.	Stock	5 1/2	84-88 xd	..	4 1 5
Do. Do. 4 % Deb.	5	4	92-94	..	4 5 1	Midland Electric Corporation	100	4 1/2	97-99 xd	..	4 10 11
Chelsea, Ord.	5	5 4 1/2	41	..	5 0 0	4 1/2 % First Mort. Deb.	100	4 1/2	97-99 xd	..	4 10 11
Do. 4 1/2 % Deb.	Stock	4 1/2	96-99 xd	..	4 10 11	Newcastle-on-Tyne 5 % Pref.	5	5 5	48-48	..	5 2 7
City of London, Ord.	10	8 8 1/2	16-18	..	4 9 0	Non-Cum.	5	5	4 1/2	..	4 18 6
Do. 6 % Cum. Pref.	10	6 6	12-13 1/2	..	4 9 0	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	5 5	98 1/2-101 1/2	..	5 11 7
Do. 5 % Deb.	Stock	5 5	116-120	-2	4 3 4	Notting Hill, 6 % Non-Cum. Pref.	10	6 6	97-102 xd	..	5 11 7
Do. 4 1/2 % Second Deb.	100	4 1/2	99-101	-1 1/2	5 0 0	Orford	5	7 1/2	64-68	..	5 9 6
County of London, Ord.	10	6 6	114-12	..	4 9 1	St. James' and Pall Mall, Ord.	5	10 10 1/2	98-104	..	4 17 7
Do. 6 % Pref.	10	6 6	112-124	..	4 19 0	Do. 7 % Pref.	5	7 7	63-72	..	4 16 7
Do. 4 1/2 % Deb.	Stock	4 1/2	103-105 xd	..	4 5 9	Do. 5 1/2 % Deb.	100	5 1/2	84-87 xd	..	4 0 6
Do. 4 1/2 % Second Deb.	Stock	4 1/2	98-101	..	4 8 8	Smithfield Markets, Ord.	5	2	14-14	..	5 18 4
Edmundson's, Ord.	£3	Nil	4-5 1/2	-1 1/2	Nil	South London, Ord.	4	5	24-28	..	5 18 4
Do. 6 % Cum. Pref.	5	Nil	3	-1 1/2	..	Do. 5 % First Mort. Deb.	100	5 5	16-99 xd	..	5 1 0
Do. 5 % Non-Cum. Pref.	5	..	11-12	-1 1/2	..	South Metropolitan, 7 % Pref.	1	7 7	13-13 1/2	..	5 9 5
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	84-87	..	5 3 6	Do. 4 1/2 % First Deb. Stock	100	4 1/2	86-99	..	4 11 3
Folkstone	5	5 5	48-52	..	5 17 1	Urban, Ord.	£3	Nil	..	..	..
Do. 5 % Cum. Pref.	5	5 5	48-52	..	4 17 7	Do. 5 % Cum. Pref.	5	2 1/2	24-28	..	5 2 3
Do. 4 1/2 % First Deb.	100	4 1/2	92-96	..	4 14 9	Do. 4 1/2 % First Mort. Deb.	100	4 1/2	85-88	..	5 8 1
Hove	5	9 8 1/2	73-8	..	5 12 6	Westminster, Ord.	5	10 9 1/2	82-92	..	4 7 10
						Do. 4 1/2 % Cum. Pref.	5	4 1/2	41-62 xd	..	..

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6 6	54-56	..	5 6 8	Monterey Ry. Light & Power,	100	5 5	86 1/2-88 1/2	+1	5 13 0	
Calcutta, Ord.	5	5 7 1/2	68-74	..	5 19 4	6 % 1st Mort. Deb.	100	8 9 1/2	227-232	..	3 17 7	
Do. 5 % Pref.	5	5 5	48-52	..	4 16 5	Montreal, Lt., H. and Power	£100	8 9 1/2	227-232	..	3 17 7	
Calgary Power, 1st Mort. Bds.	100	5 5	94 1/2-97 1/2	+ 1/2	5 3 8	Northern, Lt., Power and Coal,	£500	5 5a	25-30	..	..	
Canadian Gen. El. Com.	£100	7 7	113-114 xd	-1 1/2	5 19 8	5 % 1st Mort. Bonds.	500	5 5	25-30	..	..	
Do. 7 % Pref.	£100	7 7	118-122	..	5 14 9	River Plate, Ord.	Stock	10	..	225-235	..	4 5 1
Cordoba Lt., Power and T., Ord.	1	8 5	118-122	..	5 5 9	Do. 6 % Non-Cum. Pref.	Do.	6 6	166-111	..	5 5 8	
Do. 5 % Pref.	100	5 5	95-98	..	5 2 0	Do. 5 % Deb. Stock	Do.	5 5	100-102 xd	..	4 18 0	
Do. 4 1/2 % Deb.	100	6 6	92-94	..	6 7 8	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	4 1/2	98-100	..	4 10 0	
Elec. Lt. and P. of Coobabamba,	100	6 6	92-94	..	6 7 8	Shawing Water, Capital	£100	5 5	143-147	+4	3 8 0	
6 % Bonds	100	6 6	92-94	..	6 7 8	Do. 5 % Con. 1st Mort. Bonds	£500	5 5	107-109	..	4 11 9	
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5 5	84-87 xd	..	5 14 11	Do. 4 1/2 % Per. Deb.	Stock	4 1/2	100-102	..	4 8 3	
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	£50	5 5	95 1/2-97 1/2	..	5 2 7	Toronto Power, 4 1/2 % Deb.	Do.	4 1/2	98-100 1/2	+1	4 9 7	
Kalgoolie Elec. P. and L., Ord.	100	Nil	..	..	Nil	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5 5	98 1/2-96 1/2	..	5 8 8	
Do. 5 % Pref.	1	5 6	..	..	8 14 6	Victoria Falls Power, Pref.	1	11 1/2d.	17 1/2d.	..	..	
Kaministiquia Power, 5 % G. Es. Madras, Ord.	£500	5 5	104-106	..	4 14 4	West Kootenay Power and Lt., 1st Mort. 6 % Gold.	100	6 6	103 1/2-105 1/2	..	5 13 9	
Melbourne, 5 % 1st Mort. Deb.	100	5 5	100-103 xd	..	4 17 1							
Mexican El. Lt., 5 % 1st M. Bds.	5	5 5	67-89	+ 1/2	5 12 4							
Mexican Lt. & Power, Common	£100	4 4 1/2	83 1/2-85 1/2	..	4 12 6							
Do. 7 % Cum. Pref.	£100	7 7	103-106	..	6 12 1							
Do. 5 % 1st Mort. Gold Bds.	..	5 5	95-97	..	5 3 1							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4 4 1/2	7-7 1/2	..	6 0 0	Monte Video Telephone, Ord.	1	6 6 1/2	13-1 1/2	..	5 13 0
Do. 5 % Deb. Red.	Stock	5 5	97-99	..	5 1 0	Do. 5 % Pref.	1	5 5	82-82	..	5 18 6
American Telep. & Teleg., Cap.	£100	8 8 1/2	141-143 xd	+ 1/2	5 11 11	National Telephone Def.	Stock	6 6	137-140	..	4 11 2
Do. Collat. Trust	£1000	4 4	93-96	..	4 4 3	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	97 1/2-98 1/2	..	4 11 2
Anglo-American Telegraph	Stock	5 5	87-89	..	4 7 0	Oriental Telep. and Elec.	1	5 5 1/2	138-138	..	4 9 10
Do. 6 % Pref.	Do.	6 6	111-112	+ 1/2	5 7 2	Do. 6 % Cum. Pref.	1	6 6	138-138	..	4 18 6
Do. Del.	Do.	80/-	252-262	+ 1/2	5 14 10	Do. 4 % Red. Deb.	Stock	4 4	87-89 xd	..	4 8 11
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5 5	102-104	..	4 16 2	Pacific and European Tel., 4 % Guar. Deb.	Do.	4 4	98-100 xd	+2	4 0 0
Chill Telephone	5	7 7	7 1/2-7 1/2 xd	..	5 3 3	Reuter's	10	10 10 1/2	10 1/2-11	..	9 1 10
Commercial Cable, 5 1/2 % Deb.	Stock	4 4	80-82 xd	+1 1/2	4 17 7	Submarine Cables Trust	Cert.	6 6	127-130	..	4 12 4
Cuba Telegraph	10	6 6 1/2	83-83	..	6 6 4	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	Stock	4 1/2	97-99 xd	..	4 10 11
Do. 10 % Pref.	10	10 10	16-17	..	5 17 8	United River Plate Telephone	5	8 8	7 1/2-7 1/2	-1/2	5 4 1
Direct Spanish Telegraph, Ord.	5	4 4 1/2	92-92	..	5 6 8	Do. 5 % Cum. Pref.	5	5 5	5 1/2-5 1/2	..	4 7 11
Do. 10 % Cum. Pref.	5	10 10	6 1/2-7	..	7 2 10	West Coast of America	2 1/2	2 1/2	1 1/2-1 1/2	..	4 0 0
Direct United States Cable	10	5 4	7-7 1/2	..	6 13 4	Do. 4 % Deb., 1 to 1,500	100	4 4	96 1/2-96 1/2	+ 1/2	4 0 5
Direct W. India Cable, 4 1/2 % Reg. Deb.	100	4 1/2	99-101 xd	+2 1/2	4 9 0	West India and Panama Telep.	10	2 1/2	3-8 1/2	..	5 12 8
Eastern Telegraph, Ord. Stock	Stock	7 7	133-136	..	5 3 0	Do. 6 % Cum. 1st Pref.	10	6 6	10 1/2-10 1/2	..	6 0 0
Do. 8 1/2 % Pref. Stock.	Do.	8 8 1/2	77-79	..	4 8 7	Do. 6 % Cum. 2nd Pref.	10	6 6	9 1/2-10	..	4 17 1
Do. 4 % Mort. Deb.	Do.	4 4	96-98	..	4 1 8	Do. 5 % Deb.	100	5 5	101-103 xd	+1	5 8 8
Eastern Extension	10	7 7 1/2	133-134	..	5 3 8	Western Telegraph, Ltd.	10	7 7 1/2	94-96 xd	+ 1/2	4 3 4
Do. 4 % Deb.	Stock	4 4	96-98	..	4 1 8	Do. 4 % Deb.	Stock	4 4	94-96 xd	+ 1/2	4 3 4
East and S. Africa Tel., 4 % Mt. De. Mauritius Sub.	25	4 4	98-101	..	3 19 6	Western Union 4 1/2 % Pdg. Bonds	£1000	4 1/2	97-100	..	4 10 0
Globe Telegraph and Trust	10	5 5 1/2	102-102	..	5 10 4						
Do. 6 % Pref.	10	6 6	12-12 1/2	..	4 13 2						
Great Northern Telegraph	10	18 18	27 1/2-29 1/2	..	6 2 0						
Indo-European Telegraph	25	18 18	56-58	..	5 12 1						
Maokooy Companies Common	£100	6 6	85-88	..	5 13 8						
Do. 4 % Cum. Pref.	£100	4 4	67-70	..	5 14 4						
Marconi's Wireless Telegraph	1	20	4 1/2-4 1/2	..	4 3 4						
Do. 7 % Cum. Partic. Pref.	1	17	..	..	4 0 0						

\* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ Rs. in Funded Dividend Certs

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations Dec. 31st, Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations Dec. 31st, Rise or Fall, Present Yield p.c.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations Dec. 31st, Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations Dec. 31st, Rise or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

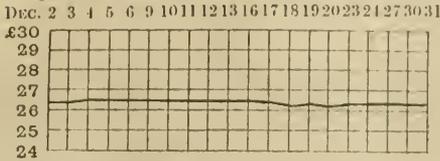
Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations Dec. 31st, Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations Dec. 31st, Rise or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

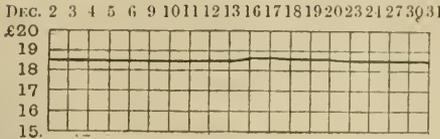
**METAL MARKET.**

Fluctuations in December.

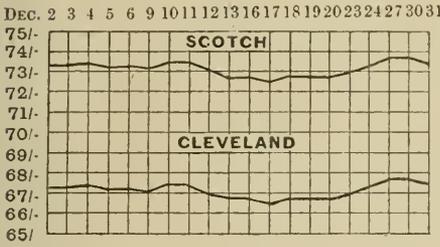
**SPELTER (G.O.B.'s.).**



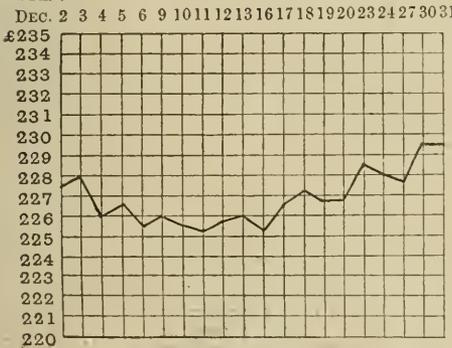
**LEAD (ENGLISH).**



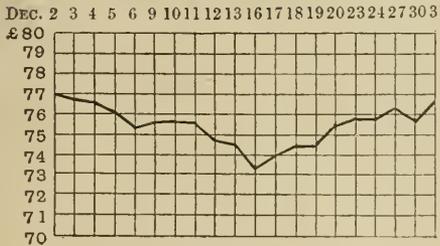
**IRON.**



**TIN.**



**COPPER (G.M.B.'s.).**



**THE PROTECTION AND PRESERVATION OF STANDING TELEGRAPH AND TELEPHONE POLES.\***

PRACTICALLY all poles fail at the ground line because of decay, and on account of this weakening at the base, have to be replaced or cut off and reset, while the top portion is still sound.

In what is known as the "Lamb" pole treatment, the decay which has already started is rendered innocuous, and the ground line portion of the pole is then sealed with an impervious preservative coating, which prevents the evaporation of the preservative previously applied and prevents further decay by entirely excluding air and moisture.

The whole process is simple and inexpensive, and consists of first removing the soil around the base of the pole to a depth of 2 to 2½ ft. and scraping or cutting off the decayed portions of the wood. A hot brush treatment of coal-tar creosote is then applied liberally, which kills the living organisms of decay and penetrates the outer tissues of the wood. A fire-proof casing is then placed around the pole, the upper portion extending about 6 in. above the ground line and the lower portion from 18 in. to 2 ft. below, making a total length of from 2 to 2½ ft. This casing is held out from the pole by spacing rods, which leave about ½ in. opening between the pole and the casing at the solid portions, and a greater space where decay has occurred.

After the casing is in place, the soil is tamped in at the bottom up to the base of the casing, and inside of the form is poured a hot preparation of pitch which will yield a distillate of high-boiling and high-gravity creosote oil. The pitch, after it hardens, will form a perfect bond with the creosoted surface of the wood and entirely prevent the entrance of air, moisture, or other agencies favourable to decay, and at the same time prevent the evaporation of the creosote which was applied by brush treatment to the decayed surface. The creosote in the pitch acts as an additional toxic agent in destroying and preventing all forms of decay. Experiments have shown that this pitch filler will not only form a perfect bond with the wood and remain in absolutely close contact in all climatic changes, but it also entirely fills all surface cracks, and, to a slight degree, penetrates the wood. After the pitch has been poured in and has cooled, the soil is thrown back around the pole and tamped tight, and a protective fireproof covering or a cap of cement is applied; or, if the filler is poured to within only about 2 in. of the top, the edges of the fireproof casing can be bent over and tacked to the pole, thus obviating the use of a cement cap.

Under average conditions, one year's increase in the life of a pole will pay for the treatment. The average pole (cedar) has a life of about 10 years, and the cost of replacement is averaged at \$10; hence the annual charge on a 4 per cent. compound interest basis amounts to about \$1.25 per pole. If properly treated at the ground line, a conservative estimate places the increase in life at from 5 to 10 years.

**Electric Light Advertising.**—A striking means of advertising the existence of an electric power house in a locality and its ability to supply energy to all who require it has been adopted by the Consolidated Gas, Electric Light and Power Co., of Baltimore. This company uses a 24-in. marine type searchlight manufactured by the General Electric Co., mounted on the top of an abandoned smoke stack about 200 ft. from the ground. The projector is motor-driven for revolving in a horizontal plane and also has a motor for operating in a vertical plane. It has been used for about a year for advertising purposes, the lamp revolving continuously in one direction at a fixed elevation, and the searchlight being switched on each night after dark. The structure on the top of which the searchlight is mounted is a square brick erection, on three faces of which there are large electric signs. The idea in placing the searchlight on the stack was to call attention to the signs, causing public question as to the source of light, which could be seen in favourable weather 18 to 20 miles from Baltimore, and so to speak show the public "how far the light will go." During the Democratic Convention which was held at Baltimore recently, the searchlight was removed to the top of one of the largest structures in Baltimore, and used very effectively in connection with the scheme of special decoration adopted by the city during that period. Some experimental work has been done with coloured screens, using sheets of coloured gelatine framed and placed in front of the projector, but owing to the lack of penetration of coloured light the scheme met with only fair success. In the projection of colours, however, it was found that a white centre with a coloured rim of light was very effective. The idea, for particulars of which we are indebted to Mr. E. D. Edmonton, the general superintendent of the company, may be usefully adopted in this country in connection with gala displays in which electricity participates.

**Manufacture of Potash.**—A Swedish engineer named Lindblad has solved the problem of making potash from felspar, by melting potash felspar together with coal and iron in an electric furnace. There are great quantities of potash felspar in Sweden's rocks.—*Daily Telegraph.*

**Belfast Electricity Supply.**—At a meeting of the Tramways and Electrical Committee, a motion was moved and seconded for the rescinding of the report of Mr. S. L. Pearce and the electrical engineer on the proposed extension of the electrical undertaking, and was defeated by 8 to 2. It was stated that the extension scheme would be laid before the Finance Committee at an early date. It was reported by Messrs. Dick, Kerr & Co. that they had completed the route on five more roads under their permanent tramway contract. Mr. Nance reported that the Glengormely route had been doubled.

\* E. A. Sterling, in the Canadian *Electrical News.*

## REPORT TO THE BOARD OF TRADE ON THE UNDERWRITERS' LABORATORIES (INC.), CHICAGO.

### Its Formation, and Scope of Operations, with their Effect on the Importation of British Manufactures into the Dominion of Canada.

By C. HAMILTON WICKES.

#### THE UNDERWRITERS' LABORATORIES, CHICAGO, INCORPORATED.

THE U.L.C. is located in a specially-designed building at 207, East Ohio Street, Chicago, Ill., with a plant and equipment valued at £20,000. It was granted a charter in November, 1901. The U.L.C. has one Branch Testing Laboratory (recently erected) at New York.

The establishment of the Underwriters' Laboratories, Chicago, was brought about doubtless by the great and disproportionate destruction of property by fire throughout the United States, and in consequence of the heavy losses that resulted, which fell on the insurance companies (fire underwriters).

It should be understood that the problem the insurance companies had to solve, in view of the conditions prevailing throughout the United States, and it may be said North America, was to evolve some method which would tend to reduce the great danger existing of fire hazard and the consequent restriction of business. Among other difficulties appertaining to the position differing from the United Kingdom was:—(a) The common use of wooden buildings; (b) the great area of the territory; (c) the high voltage of the electric current transmitted by overhead wires, even through the main streets of their cities; (d) the large number of manufacturers, good, indifferent and bad, intent only on selling their products, in many instances to firms with little or no technical knowledge, who styled themselves contractors, architects, &c.; (e) the compelled employment of careless, indifferent and incompetent workmen; (f) together with the practical impossibility of obtaining anything like skilled inspection or supervision of the work, even in the towns.

To use the phraseology of "The National Board of Fire Underwriters (New York)," "it was found necessary to provide means for securing a correct solution of the problems presented by reason of the great and disproportionate losses by fire, and to bring to the 'user' the one best obtainable opinion on the merits or demerits of appliances in respect of fire hazard."

This is a high and proper ideal, but however great the necessity might have been for an institution of this character, that would not in itself necessarily have brought about the inception, nor given the U.L., Chicago, the power, and, practically, the absolute control, it exercises to-day over all articles, appliances, material or devices styled "articles for public utility" affecting fire hazard used in buildings throughout the country. It is due to the hearty support which came to be accorded as the value of the Laboratories' work became recognised by the insurance companies—British, American, German, French and Canadian—carrying on business in the North American Continent.

The Laboratories had quite a humble beginning, and I am informed that at the first they confined their attention to certain classes of electric material and fittings, e.g., the "National Electric Code" standards were first compiled in 1896-7 (see later), but their influence has steadily grown and they cover to-day (*inter alia*):—

(a) Machines and fittings which may be instrumental in carrying a fire, gas and oil appliances, electric fittings, wiring, conduits, fuses, &c. Machines and appurtenances used in lighting or heating chemicals.

(b) Fire extinguishers, automatic sprinklers, pumps, hand fire appliances, hose, hydrants, nozzles, valves, &c.

(c) Material and devices designed to retard spread of fire, structural methods and materials, fire doors and shutters, fire windows, &c.

President of the Corporation, chairman of the Board, Mr. Henry C. Eddy, of Chicago (resident secretary, Commercial Union Assurance Co., and the Palatine Insurance Co.); secretary and treasurer, Mr. Wm. H. Merrill, Chicago. The board of directors consists of 10 other gentlemen, of whom four represent British companies, and six American insurance companies. (Particulars, see Appendix A.)\*

There are, therefore, including the two British insurance companies represented by the president, six British and six American companies represented on the Board of the U.L.C.

The board constitutes the governing authority, handles its finances, and directs all matters of policy, including appointment of "the Council," the manager and members of the engineering staff.

#### TECHNICAL STAFF OF UNDERWRITERS' LABORATORIES (INC.), CHICAGO.

The manager is Mr. W. H. Merrill; the chief engineer, Mr. W. C. Robinson (who recently visited England), and there is a staff of over 50, which includes consulting, electrical, gas and oil, and chemical engineers, with numerous assistant engineers, a superintendent of labels, cashier, &c. (Names, see Appendix B.)

#### THE COUNCIL.

A body having important functions connected with the U.L.C. is "the Council." The members are nominated by the "board of directors of the laboratories," as stated above. "The Council"

consists of gentlemen who, either in their individual or corporate capacity, have the requisite knowledge or employ technical men on their staff, able to advise them in respect of "the Reports" forwarded for their consideration by the Underwriters' Laboratories. It will be noted that among the members of the Council are Mr. W. H. Merrill, manager of the Laboratories, Mr. W. C. Robinson, his chief engineer, and Mr. Hadrill, who, as secretary to the Canadian Fire Underwriters' Association, has under him quite a number of technical men.

It is by "the Council" that the technical work at the Laboratories is supervised, and it is not until "the Reports" are approved by "the Council" that they are promulgated.

The Council numbers 22 (names and such particulars as are obtainable will be found in Appendix C).

The technical staff, having carried out the experimental work and tested the merits or demerits of each article, device, appliance, material or system submitted, with a view to their bearing upon fire hazard, proceed to draw up a detailed and extremely elaborate "report." This report is forwarded to each member of the Council, and in due course is returned to the Laboratories with such endorsements, amendments or criticism as each member of the Council may consider necessary or advisable. The points raised, if any, are then printed and again circulated to all the members until a "decision" has been obtained. The final decision, whether favourable or otherwise to the article, device, appliance, material or system, is bulletined, i.e., a summary of the Laboratories' Report is distributed on "printed cards," filed according to classification, to the various insurance organisations and companies subscribing to or co-operating with the Laboratories' work. A copy of the bulletin (printed card, presumably) and the detailed report is furnished to the applicant, who originally submitted the article for inspection.

There can be no doubt that the greatest care is taken in the experimental work and tests carried out by the Laboratories, and equal care in the preparation of the Report in its final shape before any article, appliance, material, device or system receives the final approval of the U.L.C.

It may be observed here that cabinets containing these cards are maintained at the offices of the principal Boards of Underwriters and inspection bureaus in the United States and Canada and a few in other countries, at many of the general offices of insurance companies, certain municipal departments, and at the local offices of the Laboratories in the larger cities. There are also "lists" compiled by the Laboratories, which are freely distributed, of "approved and permitted devices," with the manufacturer's name. (See Appendix D.)

#### SPECIFICATIONS, RULES AND REQUIREMENTS UNDER WHICH THE EXPERIMENTAL WORK IS CARRIED ON AT THE LABORATORIES.

The specifications under which the experimental work is carried on by the technical staff of the U.L.C. are based upon the rules and requirements of the National Board of Fire Underwriters, New York, as "recommended by the National Fire Protection Association, New York." This is the present practice; previously the various Committees acted solely under the direction of insurance authorities. These have been transferred to the National Fire Protection Associations, in which "all interests are represented."

Many of "The Rules and Requirements" referred to above are printed in pamphlet form. A list is appended herewith (marked "Appendix E"). Printed copies of these pamphlets are filed with the Board of Trade.

#### INSPECTION AT MANUFACTURERS' FACTORIES AND LABELLING.

The article, appliance, device, material or system submitted to the U.L.C. having been tested and approved, the Laboratories step in and say, "Before the article may be 'marketed' it must come under our supervision before we will issue 'a label or tab' to indicate that the same has been inspected and passed by us."

The older form of supervision is: A contract to be entered into between the manufacturer and the U.L.C. whereby the maker agrees to construct appliances in exact duplicate of the sample approved, and to pay a certain fee annually, ranging from \$5 to \$30.

The second or newer form of supervision consists in inspection by Laboratory engineers of the devices and materials at factories, and the labelling of standard goods by stamps, transfers, or metal labels, whereby they can be recognised wherever found. The cost of the service is partially defrayed by charges made for the labels. These vary according to the nature and extent of the inspection needed.

A "schedule" of the charges for labelling certain "standard goods" will be found, as a guide, in Appendix "F," together with specimen lithographed labels. The sale of these labels includes the following costs:—

1. Cost of manufacturing the label.
2. Salaries and expenses of agents and inspectors of branch offices.
3. Salary of supervising engineer at home office.
4. Salary and travelling expenses of special agent.
5. Overhead charges.

\* The various Appendices, &c., mentioned are not reprinted here. They may be seen at the Board of Trade Commercial Intelligence Department, in London.

## INSPECTION.

Throughout the United States the U.L.C. has officers who inspect and pass articles, appliances, devices, material or the system installed in any building which the owner requires to insure. It is these inspectors who accept or refuse articles because they have not the U.L.C. label or tab. So far as the Dominion of Canada is concerned, the inspectors are appointed by the Canadian Fire Underwriters' Association (concerning whom, see later). The contention is that the inspection departments of insurance organizations find it easier to pass upon an installation in which nothing but labelled material is used—and this it is contended tends to a better class of installation.

It should not be inferred that the inspector's duty is confined to checking the labelled material. It is important from the manufacturer's point of view, but from the insurance companies' standpoint, the inspector has to see that the workmanship of the wireman and electrician, for example, is good, and that the work has been carried out in accordance with the Rules and Regulations dealing with the design and layout of the installation. Generally, his skill in judgment and experience is called for in interpreting these rules and requirements in accordance with the particular kind of building which he is inspecting for the time being.

An important factor is the question of danger to life "should a fire occur." This, I fear, is not taken into account, in fact, I understand it cannot come within the inspector's consideration, so long as the installation complies with safeguarding fire hazard.

## COST OF EXPERIMENTS AND TESTS, WITH SOME PARTICULARS TO INTENDING APPLICANTS.

Blank forms, for use in making applications for tests will be furnished on request to the U.L.C., 207, East Ohio Street, Chicago, although no fixed form of application is necessary. A letter addressed to the Laboratories, setting forth all the claims made for the article, "enclosing the preliminary fee," and giving notice of shipment, is sufficient. All shipments should be consigned to Underwriters' Laboratories (Inc.), 207, East Ohio Street, Chicago. The latter are not responsible for damage in shipment, and cannot undertake to repair damaged goods, or to assemble or erect apparatus shipped in parts.

Freight or express charges must be prepaid.

Goods from the United Kingdom should be shipped in bond. It is understood that Customs charges, if any, are paid by the Laboratories.

It will be noted in the particulars given below that in respect of articles coming within Groups A to E, there is "a maximum" cost, which will not, under any circumstances, be exceeded.

The Laboratories will, on receipt of an application accompanied by description of the article to be tested, advise as to necessary charges in each case, and in all instances where the costs do not aggregate the amount of the preliminary fees, the balance will be returned to the applicant, to whom, at the conclusion of the "test," a full and detailed account is rendered, and, as stated above, a copy supplied of "the Bulletin," as well as the "detailed Report." The fees are as follows:—

Group A.	Preliminary fee,	\$100.00	Total cost not to exceed	\$250
" B.	" "	50.00	" "	100
" C.	" "	25.00	" "	75
" D.	" "	10.00	" "	50
" E.	" "	5.00	" "	25

Group F.—Under this group are classified experimental work and researches covering subjects or appliances for which standard requirements are not accepted. The amount of preliminary fee is \$100.00, and bills are rendered monthly as the work proceeds.

The various articles, appliances, materials, devices and systems thus far tested (1909), are classified into the various Groups A to E. (Particulars will be found in Appendix G.)

## GENERAL REMARKS.

The parent body of the Underwriters' Laboratories, Chicago, is "the National Board of Fire Underwriters, New York," under whose "general direction" the work at the Laboratories is carried on. In practice, however, the power of the parent body may be said to be vested in "The Board of Directors." The chief financial support is derived from the parent body, the Laboratories not being in business for "profit"; it is not believed that it has made any profit; the U.L.C. is a corporation for fire protection and fire prevention and not for profit. The insurance companies are the largest contributors. They receive regular appropriations from the National Board of Fire Underwriters, the Western Insurance Union, and other organizations, as well as from a number of individual companies who desire special service in the matter of reports.

It will be noted in going through the Report that the Rules and Requirements are adopted by the N.B. of F.U. (N.Y.) under the recommendation of the "National Fire Protection Association, of New York" (secretary's office, 87, Milk Street, Boston). This important Association, whose President for the year 1912-13 is Mr. H. L. Phillips, of 5, Haynes Street, Hartford, Conn. (vice-President, Mr. G. M. Robertson, of San Francisco; and secretary-treasurer, Mr. F. H. Wentworth, 87, Milk Street, Boston); with a chairman and executive committee of 15 gentlemen, five of whom retire yearly) dates from the year 1896-7, about which time a "National Conference" was held at New York.

Standard electrical rules were drawn up as the result of the united efforts of the various insurance, electrical, architectural and allied interests; the National Conference was disbanded, the work (of

the Underwriters' National Electrical Association and of the National Conference) being taken over by the National Fire Protection Association. The following Associations, formerly members of the National Conference, are represented on the Electrical Committee of the N.F.P.A. :—

American Electric Railway Association.  
American Institute of Electrical Engineers.  
Associated Factory Mutual Fire Insurance Co.  
National Board of Fire Underwriters.  
National Electric Light Association.  
National Electrical Contractors Association.  
National Electrical Inspection Association.

The work of the National Fire Protection Association, of New York, is directed by "Special Committees," of which there are no less than 29, and covers subjects as wide apart as "safes and vaults" and "hose," "electric railway, light and power properties," "automatic sprinklers," "fire pumps," "gravity tanks," "mine fires," "laws and ordinances," "signalling systems," &c. A list of these Committees giving the names of their chairmen will be found in Appendix H.

The "report" of proceedings of the sixteenth annual meeting held at Chicago, May 11th, 15th and 16th, 1912, accompanies this "report," and "The Year-Book" of the National Fire Protection Association (September, 1912) gives the membership, from which further detailed particulars can be ascertained.

The membership of the N.F.P.A. consists of four classes. Active, who only have the power to vote—membership 102, with a subscription of \$15 per annum; Associate, over 1,200 members, annual subscription \$5; Subscribing, over 600 members, annual subscription \$5; Honorary, 3 life members.

The Active class comprises 102 members, including (1) National Institutes, Societies and Associations interested in the protection of life and property against loss by fire, (2) State Associations, whose principal object is the reduction of fire waste, (3) Insurance Bodies and Insurance Associations having primary jurisdiction. Out of these 102 Active class members 82 are Insurance Companies (fire underwriters) or Associations connected therewith, such as inspection bureaus, actuarial bureaus, &c. Twenty may be styled business associations. Among the latter are the following:—

American Institute of Electrical Engineers, New York.  
American Institute of Consulting Engineers, New York.  
American Electric Railway Association, New York.  
American Institute of Architects.  
American Warehousemen's Association, Pittsburg.  
Canadian Manufacturers' Association.  
Electrical Supply Jobbers' Association, Chicago.  
National Association of Manufacturers, New York.  
National Hardware Association, Philadelphia.  
National Paint, Oil and Varnish Association, New York.  
National Electric Light Association, New York.  
National Electrical Contractors' Association, Utica, New York.  
National Association of Sheet Metal Contractors, Philadelphia.  
Canadian Fire Underwriters' Association, Montreal and Toronto.  
Mainland Fire Underwriters' Association, Vancouver, B.C.  
New Brunswick Board of Fire Underwriters, St. John, N.B.  
Nova Scotia Board of Underwriters, Halifax, N.S.  
Western Canada Fire Underwriters' Association, Winnipeg.

CANADIAN FIRE UNDERWRITERS' ASSOCIATION. Offices, 535, Coristine Building, Montreal. Secretary, Mr. A. W. Hadrill.

At the present time 60 insurance companies are members of this Association. I might mention that while this is by far the most important of the Underwriters' Associations in the Dominion of Canada, there are four others, as stated above.

Of the present list of 60 members of the Canadian Fire Underwriters' Association (full list, Appendix I), 28 are British, or their capital is controlled in Great Britain, 19 are American, 12 Canadian, 1 French.

The British insurance companies—headed by the Royal Insurance Co.—together underwrite some 55 per cent. of the total fire risks in the Dominion of Canada, and therefore occupy an important position in the Associations of Fire Underwriters throughout Canada. Their position and influence in the United States of America are also considerable.

## BRITISH MANUFACTURERS v. THE OPERATIONS OF THE UNDERWRITERS' LABORATORIES, CHICAGO.

The experimental work carried out by the Laboratories at Chicago, their method of drawing up reports and labelling approved articles, followed by inspection, already dealt with, is no doubt advantageous, not only to the fire insurance companies, but also to the American manufacturer carrying on business in the United States. I would also be prepared to concede that the U.L.C. are desirous of not placing difficulties in the way of the foreign manufacturer (which includes British) utilising the facilities offered by them. It is nevertheless an intolerable state of affairs that the British manufacturers, as well as the Canadian, should be compelled to send samples and particulars of their goods to a foreign corporation, to be "approved or rejected," before they are able or permitted to do business in a portion of the British Empire, viz. the Dominion of Canada.

I will briefly outline some of the more salient points which operate to the disadvantage of the British manufacturer desiring to do business in the Dominion:—

1. The British manufacturer has to incur the expense of packing and freighting the articles forwarded to the Laboratories at Chicago, with the consequent delay. Whether the article is approved or otherwise, he is still unable to ship the goods to the Dominion, as no means exist of examination and labelling at the

factory in the United Kingdom, which the Laboratories properly insist on.

The suggestion has been put forward that such goods shipped to Canada might be examined and labelled, as the Laboratories require, at "the port of discharge" in the Dominion. The objection to this course is that besides the expense of maintaining a qualified inspector, there is a real risk incurred of the goods not being passed (rightly or wrongly), with consequent loss to the British shipper, in all probability followed by the return of the goods to the United Kingdom, with the great expense thereby entailed.

2. The Laboratories are officered by consulting and other engineers expert in regard to various lines, as has been shown. It may be conceded that they exercise a wise and discriminating care in the carrying out of their duties in regard to American manufacturers, but when it comes to experimenting and testing articles of British or European manufacture, devised on different lines and manufactured to standards other than the rules, requirements or standards laid down by the N.F.P.A., under which the Laboratories carry out their work, the technical staff, without any experience in regard to the reliability of the article submitted in actual use, not infrequently find themselves obliged to withhold their authorisation. To this the British manufacturer very properly objects, and he feels the more indignant when he is aware that his manufactures in every way meet the more stringent requirements in other parts of the world. I think he should be supported in this objection unless, indeed, we are prepared to concede that the United States engineer is the repository of all the wisdom of the world in regard to every class of article, appliance, system or device dealing with fire hazard, which has been, or is to be, invented in the world. (See Mr. Merrill's letter, giving another reason.)

3. *System of Inspection.*—This amounts, in practice, to the inspectors appointed seeing that certain labels or tabs are appended to articles. In time, no doubt, they become more or less experienced, but the idea is to throw the responsibility of the real inspection of the article on the Laboratories at Chicago. The inspector is, apparently, expected to work on rule-of-thumb lines. He is, I gather, not expected to do otherwise than see that labels or tabs of the U.L.C. are properly attached to the article, device or system to be installed in the various buildings.

The tendency is for this attitude to become accentuated; pressure has been, and is being, exercised by the Laboratories on the Canadian Fire Underwriters' Association not to allow any article to be installed, within their jurisdiction, without the Laboratories' label or tab. In Winnipeg the use of the Laboratories' label has been made the rule by the Western Canadian Fire Underwriters' Association. In Montreal they have been, I am informed, not quite so strict up to the present, but Mr. Hadrill, secretary of the Canadian Fire Underwriters' Association, confesses that their inclination is to draw the line tighter and only permit goods with the label or tab of the U.L.C. to be utilised.

I might mention in this connection that complaints, difficult to prove or disprove, are made by British manufacturers or their representatives of prejudice on the part of inspectors against British goods, and of the necessity, as they allege, of gaining the inspector's goodwill by means of a *douceur* in order to facilitate the passing of material submitted. This difficulty is probably in respect of articles without the customary Laboratories' label or tab.

I would refer to what has been stated before, and that is, that the Inspectors' skill and judgment is called for in regard to the application of the Rules and Requirements, e.g., the workmanship of the wireman or electrician generally regarding the design and lay-out of the installation, taking into consideration the particular kind of building in which the work is being carried out.

I would also repeat that I understand there are no regulations to guide the Inspector with reference to "danger to life" in the event of fire breaking out; in other words, that the wiring and other matters which he inspects are looked at purely and only from the point of view of fire hazard to the building, without regard to the matter of hazard against life (shock fatality, and so forth).

4. It will be readily recognised in view of the manufacturing and other Mercantile Associations which are "active" members of the N.F.P.A. and the American composition of the Council, and the experience practically based on American practice, so far as I know it, of the technical staff of the Laboratories, that the introduction of new methods or fresh standards might meet with considerable opposition, and, in addition, there would probably be a natural reluctance to give a definite finding in respect of articles which may be practically unknown either in respect of their form or in regard to their reliability.

5. It should be mentioned that particulars are filed in this office of instances in which the parties alleged discrimination and unfair treatment, in respect of both electrical and other classes of goods submitted to the Laboratories. Personally, I find it hard to believe that any discrimination has been shown beyond what may be easily explained by the composition of the Laboratories, the council and the associations under whose direction the work is carried on. An incident which happened in Montreal in August last illustrates another phase of the difficulty met with by British goods sent to Canada. A sample of wire was sent to the Chief Electrical Inspector in Montreal, and I have a copy of his letter in which he stated, "the samples of wires enclosed are acceptable." In Toronto the following month, in regard to the same article, I have a copy of the original letter from the Chief Electrical Inspector, in which he writes as follows:—"We beg to advise that neither of the two pieces comply with new code requirements." Of course, in the latter instance, the reason was that the wires were not labelled and tabbed with Laboratory labels.

The above is a sample of a number of similar instances which it can be readily understood cause considerable heart-burning to the

parties injured, particularly where the goods are of high class, and, in fact, manufactured to a much higher standard than is required by the Laboratories themselves. Nevertheless, the inspector must reject them in many parts of Canada if they have not evidence of the approval of the U.L.C.

I will close my remarks on this heading by an extract from a letter from Mr. W. C. Robinson, chief engineer, after his visit to England, to Mr. Merrill, manager of the U.L.C., Chicago:—"As a result of all my conferences in England with manufacturers, insurance men, and others, I am of the belief that in a considerable number of cases English manufacturers will be likely to object to sending their products to any authority in the United States in order to secure insurance approvals for Canada."

The chief engineer of the U.L.C. was in England as recently as August-September last, and saw the managers and representatives of a number of British insurance companies while staying in London—Mr. Robinson having also visited Manchester, Liverpool and Birmingham, in accordance with Mr. Merrill's desire that he should endeavour to ascertain the attitude of English manufacturers towards the Underwriters' Laboratories. A copy of Mr. Robinson's letter or report to Mr. Merrill, dated September 20th (see Appendix J), should be carefully studied. I give the following extract as stated above, in London:—

The following was presented for the consideration of the Insurance Managers, and was discussed to some extent:—

"1. The possible desirability of in some way establishing the Underwriters' Laboratories in England in order to facilitate its business with English manufacturers and avoid misunderstandings relative to the approval of goods shipped into the United States and Canada.

"2. The question of what connections could be made and the best method for the conduct of the business in case it was considered desirable to establish the Underwriters' Laboratories in England."

I am of the opinion that there is a genuine desire on this side, both by the Canadian Fire Underwriters' Association and the U.L.C., to remove any cause for complaint which the British manufacturer labours under, but the insurance companies are not going (I think rightly) to permit uninspected goods to enter and be used from the U.K. or elsewhere, because they consider the risk is too great; an alternative method, therefore, safeguarding the insurance companies operating in Canada, should be evolved. The solution might be by—

1. A laboratory in Canada on the lines of the U.L.C.
2. A purely British laboratory, referred to at the end of Mr. Robinson's letter as "an independent agency."
3. A laboratory in England, to be practically an offshoot of the U.L. Chicago—run on similar lines, utilising the experience gained at Chicago, employing equally competent but British consulting and technical engineers. "The article," approved by label or tab, to be accepted by both the British and Chicago Laboratories. The same system of careful experiment and tests to be followed by careful consideration of reports before they are issued, and the adoption of the same or a similar system of "labelling and tabs," accompanied by some similar system of inspection.

I am of the opinion that the last, No. 3, would be to the advantage of the British manufacturer (No. 1 is open to many of the objections raised against the Chicago Laboratories); it would throw open to our British manufacturers not only the Canadian but the American market (see Mr. Robinson's letter), as the labels or tabs would carry equal consideration by inspectors throughout North America. Moreover, the policy should be extended, I believe, and made operative in Australia, New Zealand, South Africa, India—in fact, throughout the Empire, wherever British insurance companies operate and are in a position to insist on its adoption.

I venture to believe that, if our leading manufacturers are wise, they will join with the insurance companies and contribute towards the initial cost of starting such a laboratory and by annual subscription assist towards its upkeep. An understanding between our manufacturers on the one hand, and the insurance companies on the other, should lead to the happiest results. It should bring about the extension of the trade to British manufacturers of articles, appliances, materials, devices or systems dealing with fire hazard in the overseas markets, and be of advantage to British insurance companies in the direction of reducing the risks of "fire hazard."

### The Value of the Elementary Electric Charge.—

At the meeting of the American Physical Society on November 30th a paper was read on "The Value of the Elementary Electric Charge," by Dr. R. A. Millikan, Professor of Physics in the University of Chicago. Dr. Millikan's demonstration of the ionic theory by the behaviour of droplets of oil in air when subjected to electric forces has attracted wide attention. The present paper gives a report of the results of the redetermination of all the factors that enter into the evaluation of the elementary electric charge by the oil-drop method. The chief modification of the method consists in working at all pressures between 2 cm. and 76 cm. of mercury in order to get an accurate value of the correction term to Stokes's law. The final result was:  $e = 4.774 \times 10^{-20}$  absolute electrostatic units,  $e$  standing for elementary electric charge. The probable error is not more than 0.2 per cent.—*Electrical World*.

## TRADE STATISTICS OF AUSTRALIA.

The following statement, showing the imports of electrical and similar goods into Australia during the year 1911, is taken from the recently issued official trade statistics. The figures for 1910 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1910.	1911.	Increase or decrease.
	£	£	£
<i>Plumbago or graphite.</i>			
From United Kingdom ...	6,000	4,000	— 2,000
„ Ceylon ...	1,000	1,000	—
„ United States ...	1,000	2,000	+ 1,000
„ Other countries ...	2,000	1,000	— 1,000
<b>Total ...</b>	<b>10,000</b>	<b>8,000</b>	<b>— 2,000</b>
<i>Gas and oil engines.—</i>			
From United Kingdom ...	125,000	114,000	— 11,000
„ France ...	1,000	4,000	+ 3,000
„ United States ...	40,000	41,000	+ 1,000
„ Other countries ...	—	9,000	+ 9,000
<b>Total ...</b>	<b>166,000</b>	<b>168,000</b>	<b>+ 2,000</b>
<i>High-speed reciprocating steam engines.—</i>			
From United Kingdom ...	124,000	classification	—
„ Germany ...	11,600	altered	—
„ United States ...	40,000	(see below)	—
„ Other countries ...	4,000	—	—
<b>Total ...</b>	<b>179,000</b>	—	—
<i>High-speed reciprocating steam engine, portable and traction.—</i>			
From United Kingdom ...	not	120,000	—
„ United States ...	separately	61,000	—
„ Other countries ...	shown	2,000	—
<b>Total ...</b>	—	<b>183,000</b>	—
<i>Other.—</i>			
From United Kingdom ...	not	73,000	—
„ United States ...	separately	10,000	—
„ Germany ...	shown	4,000	—
„ Other countries ...	—	1,000	—
<b>Total ...</b>	—	<b>88,000</b>	—
<i>Dynamo-electric machines up to 200 H.P., static transformers, induction coils, electric fans and parts thereof.—</i>			
From United Kingdom ...	129,000	141,000	+ 12,000
„ Germany ...	23,000	36,000	+ 13,000
„ United States ...	73,000	90,000	+ 17,000
„ Sweden ...	5,000	6,000	+ 1,000
„ France ...	3,000	5,000	+ 2,000
„ Italy ...	4,000	4,000	—
„ Switzerland ...	2,000	1,000	— 1,000
„ Other countries ...	4,000	1,000	— 3,000
<b>Total ...</b>	<b>243,000</b>	<b>284,000</b>	<b>+ 41,000</b>
<i>Dynamo-electric machines over 200 H.P., and parts.—</i>			
From United Kingdom ...	22,000	17,000	— 5,000
„ Germany ...	1,000	2,000	+ 1,000
„ United States ...	3,000	9,000	+ 6,000
„ Other countries ...	—	1,000	+ 1,000
<b>Total ...</b>	<b>26,000</b>	<b>29,000</b>	<b>+ 3,000</b>
<i>Generators for direct coupling to steam engines.—</i>			
From United Kingdom ...	5,000	26,000	+ 21,000
„ Germany ...	7,000	—	— 7,000
<b>Total ...</b>	<b>12,000</b>	<b>26,000</b>	<b>+ 14,000</b>
<i>Regulating, starting and controlling apparatus for all electrical purposes, including distributing boards and switchboards, except telephone switchboards.—</i>			
From United Kingdom ...	19,000	21,000	+ 2,000
„ Germany ...	3,000	7,000	+ 4,000
„ United States ...	17,000	23,000	+ 6,000
„ Other countries ...	2,000	1,000	— 1,000
<b>Total ...</b>	<b>41,000</b>	<b>52,000</b>	<b>+ 11,000</b>
<i>Flue-heated economisers, mechanical stokers, steam traps, steam turbines, superheaters, water purifiers.—</i>			
From United Kingdom ...	56,000	82,000	+ 26,000
„ Other countries ...	—	1,000	+ 1,000
<b>Total ...</b>	<b>56,000</b>	<b>83,000</b>	<b>+ 27,000</b>

1910.

1911.

Increase or decrease.

£

£

£

*High-speed reciprocating steam engines for direct coupling or directly coupled to electric generators or to pumps.—*

From United Kingdom ... 30,000 37,000 + 7,000

*Motive-power machinery not elsewhere specified.—*

From United Kingdom ...	192,000	214,000	+ 22,000
„ France ...	5,000	11,000	+ 6,000
„ Germany ...	6,000	9,000	+ 3,000
„ Switzerland ...	1,000	3,000	+ 2,000
„ United States ...	72,000	91,000	+ 19,000
„ Other countries ...	3,000	5,000	+ 2,000
<b>Total ...</b>	<b>279,000</b>	<b>333,000</b>	<b>+ 54,000</b>

*Electroliers, gasoliers, pendants, brackets, &c.—*

From United Kingdom ...	26,000	26,000	—
„ Germany ...	2,000	1,000	— 1,000
„ Other countries ...	1,000	1,000	—
<b>Total ...</b>	<b>29,000</b>	<b>28,000</b>	<b>— 1,000</b>

*Electric fittings and appliances: switches, fuses and lightning arresters.—*

From United Kingdom ...	20,000	29,000	+ 9,000
„ Germany ...	6,000	8,000	+ 2,000
„ United States ...	6,000	9,000	+ 3,000
„ Other countries ...	3,000	1,000	— 2,000
<b>Total ...</b>	<b>35,000</b>	<b>47,000</b>	<b>+ 12,000</b>

*Electric heating and cooking appliances.—*

From United Kingdom ...	2,000	2,000	—
„ United States ...	—	1,000	+ 1,000
<b>Total ...</b>	<b>2,000</b>	<b>3,000</b>	<b>+ 1,000</b>

*Other electric light and gas appliances (except gas meters).—*

From United Kingdom ...	79,000	88,000	+ 9,000
„ Germany ...	43,000	47,000	+ 4,000
„ United States ...	19,000	22,000	+ 3,000
„ Other countries ...	13,000	14,000	+ 1,000
<b>Total ...</b>	<b>154,000</b>	<b>171,000</b>	<b>+ 17,000</b>

*Rails, fishplates, &c., for railways and tramways.—*

From United Kingdom ...	400,000	499,000	+ 99,000
„ Belgium ...	15,000	43,000	+ 28,000
„ Germany ...	34,000	211,000	+ 177,000
„ United States ...	372,000	309,000	— 63,000
„ Other countries ...	—	18,000	+ 18,000
<b>Total ...</b>	<b>821,000</b>	<b>1,080,000</b>	<b>+ 259,000</b>

*Telephones, telephone switchboards and appliances.—*

From United Kingdom ...	46,000	67,000	+ 21,000
„ Germany ...	5,000	7,000	+ 2,000
„ Belgium ...	10,000	18,000	+ 8,000
„ Sweden ...	40,000	32,000	— 8,000
„ United States ...	3,000	10,000	+ 7,000
„ Other countries ...	1,000	3,000	+ 2,000
<b>Total ...</b>	<b>106,000</b>	<b>137,000</b>	<b>+ 32,000</b>

*Electrical articles: Accumulators, arc lamps, arc lamp carbons, cable and wire covered, carbon in blocks of 12 sq. in. and over, electrical vacuum tubes, measuring and recording instruments, prepared insulating tape.—*

From United Kingdom ...	277,000	430,000	+ 153,000
„ France ...	3,000	3,000	—
„ Germany ...	61,000	106,000	+ 45,000
„ United States ...	10,000	18,000	+ 8,000
„ Other countries ...	7,000	16,000	+ 9,000
<b>Total ...</b>	<b>358,000</b>	<b>573,000</b>	<b>+ 215,000</b>

*Iron and steel wire.—*

From United Kingdom ...	116,000	111,000	— 5,000
„ Belgium ...	14,000	21,000	+ 7,000
„ Germany ...	381,000	320,000	— 61,000
„ United States ...	180,000	267,000	+ 87,000
„ Other countries ...	9,000	27,000	+ 18,000
<b>Total ...</b>	<b>700,000</b>	<b>746,000</b>	<b>+ 46,000</b>

**Patent Revocation.**—An order has been made revoking patent No. 26,810 of 1909, granted to the Mining Engineering Co., Ltd., and Charles Christiansen for "Improvements in chucks for rock drills."

## ANOTHER VIEW ON THE CO-PARTNERSHIP QUESTION.

By W. T. WARDALE, A.M.I.E.E.

THE idea of co-partnership is at present the fashionable remedy for all industrial unrest, and there is in many quarters a good deal of surprise expressed that the idea has not caught on with the industrial classes to any very great extent. In the opinion of the writer the cause of this want of enthusiasm, outside of one or two monopolistic trades, is to be found in the fact that whilst the immediate reward in the shape of extra wages is not great, the reward offered in the form of capital interest in the concern is also slowly acquired, and, moreover, for a long time the effect on the weekly income of the workman is quite insignificant. There is also the fact to be recognised that the method in which capital is allotted to the workman savours too often of charity or condensation and carries with it the yielding up of treasured rights in the way of strikes, &c. Now all of these schemes in one way or another tend to make the workman feel that he is under restriction, they do not give him any great incentive to strenuous personal efforts owing to the comparative smallness of the reward, and they are in many cases open to the fatal objections that the capital so obtained must not be disposed of without special permission from the firm, and often in return to some extent for this capital being held up as indicated, the interest is guaranteed. Both the above points are bad; they do not give the workman the elementary right of every holder of property to dispose of it when and how he desires; the man, therefore, has the feeling that the shares do not really belong to him as they should do, and that he has been led into surrendering old-established and valuable rights in return for something and nothing. In the opinion of the writer a most serious objection is that, the interest being guaranteed, the workman does not experience the effect of the ebb and flow of trade through his dividend, and therefore is as far as ever from realising from practical experience that the holding of share capital in any industrial concern does not mean the sure and rapid acquisition of wealth. Given the sympathy of the working classes most of the labour troubles will vanish, but this sympathy cannot be obtained for trifling advances in wages and the holding of small amounts of share capital under privilege. To get the best result it is necessary to make the workman and the shareholder as far as possible into the same person, but the share capital must be his without doubt and free from all restriction. The only way to enable such conditions to obtain is to enable the men to earn by their increased and maintained efforts considerably more than an ordinary week's wage. It will doubtless be at once suggested that piecework and premium bonus systems have been tried, and that where they have been a marked success the workman has through his trade union objected to and got rid of them. Whilst this statement is partly correct, it does not, however, include all the factors which are necessary to properly consider the situation. The reason must be sought as to why the men have been anxious to get rid of these systems. The old stock argument that the men are blinded by their leaders into accepting the opinion of the latter to the effect that these systems are hurtful to the men individually and as a body, is altogether too vague and true of only a small proportion of the men: a large body of men will not allow themselves to be deprived of a much larger income than is usual, merely in order to please their Trade Union leader, without there being some initial grievance to start the matter. In those works in which no advantage has ever been taken of the men in order to drop their prices on the flimsiest of pretexts, bonus and piece systems have, and still do, work well. But where it is a rule that, as soon as a man regularly earns more than a quarter above the usual time wage, the price per piece is dropped, and this game is carried on until the men are working at exceptional speed, merely for a trifle over the wage obtained under day-work terms, trouble is sure to ensue. That this rule held good in a certain district, the writer knows beyond dispute, and also the fact that, in the face of a most definite promise

not to cut the rate under a premium bonus system unless the design had been altered or more efficient tools given to the men, the most trifling and useless differences have been made in the shape of one or two portions of the particular piece, and this piece brought forward as an entirely new job, with a new job number, and, of course, a much lowered price per piece. It is these tactics which have been the means of confirming in the minds of the men the tradition handed down to them, and kept alive by their leaders, that the employer is their natural and inveterate enemy, using his better education to trip up and take advantage of them at every possible chance; we usually then have the spectacle of the persons who have been responsible for these tactics soundly abusing the men because they do not work to turn out and earn as much as they could do.

Would any of us who are in official positions, I wonder, feel encouraged to increase the efficiency of our particular departments, if, by doing so, we found, at the end of the half-year, that we should in future be required to take charge of, and be responsible for, turning out a matter of 50 per cent. more work for no further increase in salary, but a good chance of the work demanded for the same salary again increasing if we had another record half-year?

There must then be established, first of all, in connection with any such scheme the absolute confidence of the men, and it also follows that this confidence must never in any way be shaken. Given this, the writer suggests the establishment of a regular piecework or bonus system depending on the class of work carried out. The men to understand that the man earning the biggest wage will be the man best liked in the place, and that in event of trade becoming bad, the men who are capable of and willing to earn the big wages, will be the men who will be kept on, and that any men not earning the amount they might will be supplanted by others who will. Then offer to take care of any savings the men may make until the amount reaches £10: when this amount is reached, issue in return for it a share certificate for the full amount, the firm paying all charges, such as stamp duties, and hand the certificate over to the man with the absolute right to sell it the next minute if he so desires. If the qualification for a directorship be, say, £100, then allow the shareholding men to elect from amongst their number a representative on the board for every £100 so held. Whilst the men have their money on deposit with the firm, it would pay the firm to allow 5 per cent. interest on the amount deposited, on the understanding that if, when the necessary £10 were saved, the money was not invested with the firm, it must be drawn out and the chance of the 5 per cent. interest lost. A man, of course, could be allowed to invest as many £10 as he could save.

The question then arises, can the men under any such system earn sufficient to enable them to lay by enough money in a short time to accomplish this idea? The answer is undoubtedly in the affirmative.

The following incident will amply illustrate this. About a year ago the writer was invited to read a paper before the Engineering Society in a northern textile town, and chose for his subject the question of factory driving. The only person known in the town was a solicitor, who was good enough to propose tea at his club, and the support his presence would afford at the reading of the paper. During a pleasant chat over tea a gentleman joined us who was, with his brothers, one of the largest textile men in the town, as they owned six large mills. It was not long before my friend mentioned the object of my visit, which at once led to an interesting conversation on power production. Then came the following observation: "It is, of course, always acceptable to us to have you engineers showing us how, by adopting various methods, we can save so much a year: but can you show us how to stop a waste which costs the mills, which belong to our firm alone, thousands of pounds per week?" "I refer," he continued, "to the waste which takes place owing to stuff not being produced, which ought to be produced, and which could be produced by our people if they would." He then unfolded a tale of deepest interest to employer and workman alike. Before one process in their mills could be carried out it was necessary for a pattern card to be made, and these patterns had to be made on hand-worked looms. In going into the matter of their costs of production, he was constantly met by the fact

that they were being delayed time after time by the waiting for patterns.

It was not only inconvenient to the firm to put down further hand looms for this work, but he was convinced that it was quite unnecessary, provided that the men would turn out the amount which they were able to. His firm, he informed me, had always paid for this work 30s. per week, though the district rate was 28s. a week. He announced to his brothers that he intended to take this matter in hand, and to that end called his pattern card men together, and told them that the firm had come to the conclusion that more work could be obtained from those looms than was being done, adding that he had considered what he could offer them as a commercially possible proposition, in order to make it worth their while to turn more work out. He then offered them an advance of 2s. a week, making the wage 32s. a week, and 4s. above the regulation trade rate being paid in the town. Work was settled down to under these conditions, and for a time some increase took place in the amount of work done per loom; but still the amount was less than what the owners thought easily possible. In one or two cases men had to be stopped for definitely refusing to try to turn out more work, though they took the extra money readily enough; to each applicant for a vacancy, and the conditions being known there were numerous applicants, the following statement was made:—"This is the best offer which we can make you for a weekly wage on this class of work, the conditions under which we have to compete for orders prevent us offering any more; we are offering you better terms than anyone else; what, therefore, are you prepared to do for us in return?" The usual reply was, "Well, I can make a pattern card as well as any man, and I am prepared to do so." The man was then greatly surprised to be told that this was not the point, the matter being then stated again definitely, "We are doing the best we can for you; are you in return prepared to do your very best for us—to turn out all the work of which you are capable?" The usual reply was that they would try to make the very best use of their time and abilities. The system settled down, and for a time the output increased, but not to the extent which the proprietors thought to be easily possible.

The next step taken in the matter was to call the pattern card hands together, and to inform them that the cost to the firm of their patterns was too high—viz., 4s. 6d., and that the extra weekly wage was to be abolished. The firm then set the whole of the pattern hands on to work at a piece price of 3s. 6d. per pattern woven. At this point my friend asked if there had been any objection to the price named, the manufacturer replying, "Yes, to some extent, but we have always treated our people fairly, and so they elected to try it. Now then," he said, "mark the result: to-day these same people, who were turning out their utmost—at least, so they assured us—on a weekly wage of 32s., are now drawing regularly, week by week, 42s., 45s., and some even as high as 52s. and 55s. in the case of one or two very expert men. Our patterns now cost us only 3s. 6d. each, we get twice the work through the pattern department at least, and that with the same capital cost for machines as before, the same cost for land value, taxes, rates, lighting and insurance of the buildings, and also for the insurance on account of the Compensation Act, and we have been enabled to set to work a large number of weavers in other departments of our mills whom we could not employ previously, as we could not get the patterns through fast enough to keep them employed."

"Now, then," he finally asked, "what is your remedy, as engineers, for this state of affairs? If it could be applied all round, wherever possible, both our workpeople and our manufacturers would be very much better off, and we should have such a pull in the markets of the world that this country would always be full of work." In bidding him good evening, after listening to his most interesting account, I half answered this question as to what engineers, who seek so strenuously after efficiency, are going to recommend in the matter, by reminding him that it was a totally different matter to come down to a plant which was wrong, and set it right, and to deal with so complex a quantity as human nature in the shape either of workmen or manufacturers. I could not, however, help thinking how great a pity it was

that similar conditions could not be arranged for many other industries.

Just for a moment or two let us consider the effect on the daily life conditions of the people of such a movement. Here is a body of operatives brought up on, and living according to their own ideas on, a weekly income of 28s. By means of some method similar to that just described, the income of each individual operative is increased to say only 40s. a week, is it then impossible to the British workman's nature to act as follows:—Suey 7s. per week spent in making life better worth living and more comfortable, and 5s. paid regularly week by week into the share purchasing fund as outlined previously. Surely if the workmen be assured of freedom from the old style iniquitous price-cutting system, the better end of them will soon readily grasp the idea and gladly fall in with it. The workman would thus become a shareholder solely by his own self-denial and in his own rights without any suggestion of charity or condescension about the matter, and with absolute freedom if he so desired to raise a loan at the bank on his share certificate either for backing his favourite at the Derby or any other little foolishness or wisdom.

Doubtless many of the present-day Trade-Union members may object to such a scheme on the grounds that it is only another fancy method of persuading the workman to speed up and ultimately to entice him from the Trade Union. If the Union leaders will not give any such system a trial, then they may depend upon it that they will suffer the loss of the most intelligent of the workers one by one as they make trial of and find such a system a great help and benefit to them in their efforts to obtain something better than a fixed rate of wages on a somewhat low level, which wage and conditions are enjoyed by their fellows, be they far less skilful and willing or not. It must also be remembered that as Government sickness and out-of-work provision may become general to all trades, the benefits to be obtained solely from a Trade Union will not be so numerous as they are to-day, whilst the fact that the policy of the Union is against the better opportunities offered for a man to make himself more independent will take away many possible members. There need be no fear that the Unions would be gradually deprived of their members and also of their usefulness, as there would always be the necessity for the discussion of prices, with the difference from the present day price discussion, that the workers would have amongst their number many who had a distinct interest in the firm, and who would therefore be more inclined to see both sides of the question. There would also be plenty of work for the Unions to do in such matters as encouraging the younger members to fit themselves for managerial positions by providing scholarships at the local technical institutes for such of their members who had passed at least three years in the works and who were developing into reliable craftsmen—youths who had already shown by their efforts at the evening schools that they were capable of something better than a working position, and also that they were ready to do the necessary study to fit themselves for the higher posts. Another way in which the Unions could do useful work would be in making firmer and extending the superannuation benefits.

If, however, the attitude of the unions is to be one of bitter hostility, then they will have to face the fact that the speeding up will nevertheless take place, and that it will take place under the present rates of wages, the workman thus being worse off to the extent of the extra money he could have earned under some such system as indicated. When he finds that this has been the result of following the advice of his leaders, will he still be willing to obey and follow out their further advice? Will not the danger be then that the Unions will fall to pieces owing to the fact that they have rendered things worse and not better for their trade? Depend upon it, that just as the workman of to-day is sufficiently educated to refuse to work under conditions which his father thought to be heaven-sent and inevitable, so will the time soon come when the new generation will see, and see clearly, that it will either be some form of partnership or an increased speed of work for the present rate of wages.

Co-partnership under the above conditions can and does work successfully in more than one industrial works, which

have to compete in the open markets for work. They are successful because they are scrupulously fair to the workman and not in any way charitable.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 28,929. "Tube coupling for electrical circuits and other purposes." J. H. JACKSON. December 16th.
- 28,930. "Engine starting apparatus." P. M. JUSTICE. (North-East Electric Co., United States.) December 16th. (Complete.)
- 28,934. "Apparatus for connecting conducting and other wires." A. FODOR. (Addition to 21,618 of 1907.) December 16th. (Complete.)
- 28,953. "Salicylate electrolytes for use in the electrolytic deposition of metals or metallic alloys." P. MARINO. December 16th. (Complete.)
- 28,967. "Electric current transformers." E. C. WESCOTT. December 16th. (Complete.)
- 28,977. "Electric circuits closing apparatus." H. WADE. (Protective Signal Manufacturing Co., United States.) December 16th. (Complete.)
- 28,979. "Conduits and electric conductors." H. G. COVENTRY and G. RIBBON. December 16th.
- 28,997. "Apparatus for the electric stimulation of muscles." L. B. MILLER. December 17th.
- 29,006. "Air-driven turbine for generating electric current for driving an electric motor-car." J. T. BUCKLER. December 17th.
- 29,025. "Miners' electric lamps." J. MORRISON and R. S. GREENHALGH. December 17th.
- 29,036. "Electric telephones." L. G. HAMMER. December 17th.
- 29,042. "Devices for cleaning the globes of electric arc lamps and the like." R. L. IRELAND and C. A. CHAPLIN. December 17th.
- 29,057. "Printing telegraphs." E. C. R. MARSH. (General Engineering and Construction Co., Ltd., Canada.) December 17th. (Complete.)
- 29,082. "Gyroscope which may be used in combination with a non-magnetic compass or with other instrument or apparatus." E. KLARN. December 17th. (Complete.)
- 29,091. "Ignition systems." C. F. KETTERING. (Divided application on 28,908 of 1911, December 22nd. Convention date, April 17th, 1911, United States.) December 17th. (Complete.)
- 29,104. "Electric gas lamps." F. SKADPY. (Convention date, April 18th, 1912, Germany.) December 17th. (Complete.)
- 29,122. "Apparatus for injecting fuel into internal-combustion engines, and means for igniting the same." E. C. BLACKSTONE, F. CARTER and E. CARTER. December 18th.
- 29,131. "Methods of measuring and recording electric currents." H. FLINN. December 18th.
- 29,149. "Electric lamps for motor vehicles." A. A. GODIN. December 18th.
- 29,160. "Electric arc lamps." F. R. BOARDMAN, R. V. BOARDMAN and F. BOARDMAN. December 18th. (Complete.)
- 29,176. "Electric bandages, compresses, and the like." E. MORISOT. December 18th. (Complete.)
- 29,201. "Illuminators or reflectors applicable to electric or other advertising signs, and the like." W. GOULTON. December 18th.
- 29,244. "Secondary batteries or accumulators." G. C. KNIGHT. December 19th.
- 29,263. "Obtaining unidirectional high-tension discharges." SIR O. J. LODGE and L. LODGE. December 19th.
- 29,269. "High-tension insulators." SIR O. J. LODGE and L. LODGE. December 19th.
- 29,281. "Incandescent electric lamps." E. A. GRAHAM and W. J. RICKETS. December 19th.
- 29,297. "Electric transformers." BRITISH THOMSON-HOUSTON CO., LTD., and E. B. WEDMORE. December 19th.
- 29,302. "Electric bull's-eye lanterns or the like." S. STERN and BRITISH EVER READY ELECTRICAL CO., LTD. December 19th. (Complete.)
- 29,310. "Device for facilitating the removal or attachment of electric lamp shades." W. S. ROSS. December 20th.
- 29,311. "Toll-take or alarm mechanism for use in connection with engineering telegraphs." H. SMITH. (J. D. Smith, High Seas.) December 20th.
- 29,328. "Working Tye's railway block telegraph instruments and the like." W. RICHARDSON and MAJOR McCALLUM. December 20th.
- 29,334. "Apparatus for locating ignition faults in explosive engines." A. C. BENNETT and E. O. BURN. December 20th.
- 29,338. "Regulation of the pressure of electrical generation systems employing rotary converters." SIEMENS BROS. DYNAMO WORKS, LTD., and J. C. WILSON. December 20th.
- 29,349. "Electrical connector." H. HIRST and G. MAURICE. December 20th.
- 29,350. "Construction of electric irons." H. HIRST and G. MAURICE. December 20th.
- 29,351, 29,352, 29,353, 29,354, 29,355, 29,356, 29,357, 29,358, 29,359, 29,360 and 29,367. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) November 20th. (Complete.)
- 29,372. "Electric contact devices of the Swan type." R. HADDAN. (Ludenscheider Metallwerke Akt.-Ges. vorm. Jul. Fischer and Basse, Germany.) December 20th. (Complete.)
- 29,375. "Method of charging condensers in parallel and discharging them in series." COMPAGNIE GENERALE RADIO-TELEGRAPHIQUE. (Convention date, December 21st, 1911, Germany.) December 20th. (Complete.)
- 29,384. "Method of reproducing electric variations." H. DE FOREST ARNOLD. (Convention date, July 15th, 1912, United States.) December 20th. (Complete.)
- 29,389. "Refractory materials." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 20th.
- 29,396. "Means for securing the globes, shades or the like of electric light fittings." E. LAL. December 20th. (Complete.)
- 29,409. "Method of diminishing the electromotive forces induced in the commutation zones of commutator machines." A. HEYLAND. (Convention date, December 20th, 1911, Germany.) December 20th. (Complete.)
- 29,416. "Telegraphic receiving apparatus adapted to actuate a perforator, typewriter or analogous device." A. C. BARONIO and K. L. WOOD. December 20th.
- 29,422. "Gear for electrically operating machine tools and the like." J. P. HALL. December 21st.
- 29,450. "Combined windmill and dynamo-electric machinery." J. A. LREMING. December 21st.
- 29,456. "Electric accumulators." B. HEAF and CHLORIDE ELECTRICAL STORAGE CO., LTD. December 21st.
- 29,461. "Means and method of operating liquid electric controllers and starters." R. F. BAERLOCHER and A. WEST & Co., LTD. December 21st.

- PROCESS FOR REDUCING SOLUBLE METAL SALTS FOR THE PURPOSE OF SUBSEQUENTLY ELECTROLYTICALLY DEPOSITING THE METALS PRESENT IN SAID SALTS. P. MARINO. 24,562. November 4th.
- ILLUMINATED SIGNS, ILLUMINATED ADVERTISEMENTS AND THE LIKE. C. P. Grundy and J. W. Brown. 27,007. December 2nd.
- ILLUMINATED SIGNALLING APPARATUS OR THE LIKE. Westinghouse Brake Co. and H. G. Brown. 27,375. December 5th.
- MATRICES FOR ELECTROTYPES. F. F. Pershke, E. H. Rudd and W. Matthews. 27,330. December 6th.
- PRIME POWER GENERATOR KNOWN AS A HYDRODYNAMO. C. H. Howland-Shearman. 27,623. December 8th.
- MINERS' SAFETY LAMP ELECTRIC LIGHT FITTING. D. Morrison. 28,420. December 18th.
- SECONDARY OR STORAGE BATTERIES. W. Clark. (Compagnie Internationale des Accumulateurs Veledka.) 29,318. December 29th.

### 1912.

- ELECTRIC CLOCKS. British Thomson-Houston Co. and F. Holden. 721. January 9th.
- METHOD OF NEUTRALISING ELECTRIC CHARGES FORMED ON TEXTILES, FIBRES, PAPER AND LIKE MATERIALS DURING THE WORKING PROCESSES. Siemens Bros & Co. (Siemens & Halske Akt.-Ges.) 1,564. January 19th.
- ELECTRIC HAND LAMPS. H. Lucas and W. H. Edwards. 3,011. February 6th.
- ELECTRIC HEATING DEVICES. G. Cooper. 4,399. February 21st.
- MAGNETIC CHUCKS. H. Humphreys. 6,133. March 12th.
- APPARATUS FOR PRODUCING ELECTRIC CONTACTS AT ADJUSTABLE PERIODIC INTERVALS. Soc. A. GRANOUX et Cie. 8,989. April 16th. (October 10th, 1911.)
- TIMING DEVICES FOR THE ELECTRIC IGNITION OF INTERNAL-COMBUSTION ENGINES. F. H. Bosch. 12,379. May 24th. (July 15th, 1911.)
- TELEPHONE REPEATERS. Western Electric Co. (Western Electric Co.) 12,604. May 28th.
- ELECTRIC BOAT HOISTS. Sir W. G. Armstrong, Whitworth & Co. and R. Wright. 12,761. May 30th.
- COPYING OR LIKE TELEGRAPHIC APPARATUS. A. E. Rappenecker. 13,425. June 7th.
- ELECTRIC MOTOR. H. L. Zabricki. 13,467. June 8th. (July 15th, 1911.)
- PNEUMATIC LOCKS FOR MINERS' ELECTRIC OR OIL SAFETY LAMPS AND MEANS FOR ACTUATING SUCH LOCKS. E. A. Hallwood. 20,302. September 6th. (Divided application on 21,905 of 1911, November 2nd.)
- ELECTRIC FURNACES. E. Stasano. 21,281. September 18th. (Addition to 8,901 of 1911.)

## Accumulators for Submarines.—The accumulators

carried by a submarine are a most important part of its equipment. The battery is charged from petrol-electric generators when the vessel runs awash, and supplies the whole motive power when the vessel is submerged. Absolute reliability on the part of the cells is imperative, and no acid must be spilled, even if the vessel tilts considerably. Maximum energy must be stored in minimum space and weight, and the cells must be capable of maintaining a very high discharge rate for considerable periods, since the speed of the vessel depends on this, and speed is all-important. First cost is not a primary consideration, but it is essential that the storage battery, weighing  $\frac{1}{2}$  ton or so, should need minimum attention and repair, once it is installed in the hull of a submarine. The difficulty of thoroughly inspecting the cells in this confined space (let alone cleaning or repairing them) is enormous.

In 1901-2, the Lab. Centrale d'Electricité (Paris) tested a number of types of cells, in order to determine which was most suitable for use in submarines. Only five among 21 cells withstood 250 discharges. From the best cell 4,040 watt-hours were withdrawn during this period per c. dcm. of cell volume (i.e., 950 watt-hours per kg. of cell weight). One of the five cells had specially large surface positive plates; the others were of pasted construction. The maximum energy output reached 23 $\frac{1}{2}$  watt-hours per kg. of cell weight (discharge in 54 hours), and the maximum power output was 516 watts per kg.

In some modern submarine cells recently tested, the plates are of grid type, and the positives are surrounded by asbestos sheathing, which greatly increases their durability. The plates are separated by perforated insulating sheets with vertical ribs, and the lugs of similar polarity are connected to lead strips by autogenous welding; two connecting strips per pole are sealed through the cover plate of each cell. The containing vessels are of ebonite, and are mounted in an oak frame. The plates rest on ebonite supports, ample space being left for the collection of sludge. A non-spilling gas escape valve is provided in the cover of each cell.

Tests on the new cells show an energy capacity of 30 watt-hours per kg.—a specific energy capacity 27 per cent. greater than was realised in the best 1901 cells. The progress denoted by this figure is even more remarkable when taken in conjunction with the long life of the new cells. The best result obtained during the recent tests was 456 discharges, corresponding to a total output of 1,336 $\frac{1}{2}$  kw.-hours, i.e., 6,202 watt-hours per kg. of cell weight, or 23,910 watt-hours per c. dcm. of space occupied. As compared with the 1901 cells, the best of the new types shows a life 6 $\frac{1}{2}$  times as long, measured by total watt-hours output per kg., or 5 $\frac{1}{2}$  times as long, measured by total output per c. dcm. of space occupied.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

JANUARY 10, 1913.

No. 1,833.

## ELECTRICAL REVIEW.

## THE ELECTRIC LIGHTING OF VILLAGES.

Vol. LXXII.]

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WE have for a long time taken a keen interest in the extension of electric lighting to small towns and villages, and have on various occasions drawn attention to the possibilities in this direction, besides publishing descriptions of actual installations whenever the opportunity offered. Since the introduction of the high-voltage metallic-filament lamp the matter has gained very greatly in importance, for obvious reasons, and the gradual relaxation of the dislike evinced by the Board of Trade for overhead wires, as well as of the opposition of the small local authorities, has facilitated the execution of the work on a commercially satisfactory basis. We therefore welcome the article on this subject, written at our request by Mr. W. T. Wardale, which appears elsewhere in this issue, and we commend it to our readers as a remarkably interesting and useful exposition of the methods which ought to be adopted, and the considerations which must be borne in mind by those who contemplate the cultivation of this almost virgin field of operations.

The author points out that such schemes—if properly carried out—are financially sound, and that private enterprise is in a more favourable position to deal with them than the local authority, which is hampered by statutory obligations to a degree inversely proportional to its own importance; moreover, owing to the impossibility of paying an adequate salary to a competent engineer, such an authority could not hope to run the concern on the same economical basis as a private company, which can handle a number of these small undertakings, and thus distribute the cost of superintendence over a large area.

Another point to which our contributor draws attention is that it is absolutely essential for the promoters of the undertaking to carry on the business in its entirety—wiring houses, selling fittings, &c., and even undertaking work in connection with private installations that have no connection with their mains. We know for a fact that such work, under the circumstances, is very lucrative, and we can well believe that its performance makes all the difference between success and failure, while it would be out of the question for a small municipality to handle it.

The shrewd remarks of Mr. Wardale regarding the desirability—indeed, the necessity—of engaging the interest and influence of the local notabilities will be appreciated, and his warning against rash conclusions with regard to the utility of small water-powers should be heeded: for intermittent operations like those of a sawmill or flour mill, such water-power is often perfectly suitable, but where a continuous supply of power is indispensable, as in the case of electricity supply, an independent source of power must usually be installed, and the resultant cost may prove to be much greater than that of a complete steam or gas-engine installation.

The fact that competition has not to be feared in connection with these small undertakings is a feature of great value; the residents are eager to have a supply of electricity, and are willing to pay a fair price for the convenience and safety of the system. They are also well acquainted with each other's doings, and the spirit of emulation which prevails in a small community ensures that the example set by

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's.)

# 1913 EDITION

In the Press.

**H. ALABASTER, GATEHOUSE & CO.,**  
4, Ludgate Hill, London, E.C.

one consumer will be quickly followed by his neighbours. The truth of this is clearly manifested by the statement that in practice no difficulty is experienced in inducing people to install the electric light.

While continuity of supply is very desirable, it has not the same pre-eminent importance in a rural district as in towns where competition is met with, and, in view of the necessity of keeping down the capital outlay, there is no need or justification for the provision of a large proportion of stand-by plant. We fully agree with Mr. Wardale that there is no better reserve under the circumstances than a storage battery, in conjunction with generating plant of a thoroughly reliable description. The battery also facilitates the economical working of the undertaking to a very great extent, and the objections to the use of storage which have weight in the case of a large undertaking are absent from village lighting.

The importance of the personal element is obvious: the man in charge on the spot is largely responsible for the success or failure of the whole scheme, and it is impossible to be too careful in the selection of a suitable person. Fortunately, the work is of an exceptionally attractive nature, and if generous terms are offered, there should be no difficulty in getting a first-class man to throw his whole energy into the business. There are thousands of British villages waiting to be supplied with electricity, and we look forward to the development of this class of business at a rapid rate during the next few years.

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**L.G.B. Procedure.** ONE of those irritating points of procedure which are so frequently met with in connection with Government offices, was recently raised by an Auditor of the Local Government Board in connection with the accounts of a municipal electricity department. The auditor, while finding no fault with the accounts, laid down the requirement that in future all orders for goods required in the electricity department must be signed by the Clerk to the Council; for years previously they had been signed by the manager, after having been submitted in the form of a requisition to the Stores Committee, and no trouble had arisen. We believe that it is the usual practice for the manager (*i.e.*, the electrical engineer) to sign all such orders below a limit of value imposed by the Council, and we see no reason whatever for objecting to this procedure; the signature of the Clerk to the Council would be a mere formality, for the Clerk could not possibly exercise any discrimination in the matter, being neither technically qualified to do so nor officially authorised to supervise the decisions of the Stores Committee and the electrical engineer. Nor would he be in a position to check the delivery and consumption of the goods, even if he wished to overstep the bounds of his duties to such an extent—which is in the last degree improbable. We see in this new stipulation neither sense nor reason; it could only result in an apparent subordination of the engineer to the clerk, with the inevitable consequences of friction and irritation between two otherwise friendly departments. Perhaps some of our central-station readers would like to express their views on this question before the L.G.B. has committed itself definitely to an undesirable policy.

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**The "Paragon" Oil Engine.** THE ingenious cycle devised by Mr. W. P. Durnall, of which we give a description elsewhere in this issue, shows that there is still scope for invention, even where the ground has been so well trodden. Even if the over-all efficiency of the engine were not increased, the advantage of a cool and noiseless exhaust would be worth having, but the inventor claims a thermal efficiency from 15 to 25 per cent. greater than that of the ordinary type of engine. That a greater proportion of the heat contained in the products of combustion will be converted into work by virtue of their complete expansion is obvious, but whether

the over-all efficiency of the engine will be materially improved appears to be less certain. In this connection, we find Mr. Durnall's comparison of his indicator diagram with that of a Diesel engine rather incomplete, for while he points out that the compression space in the latter type would be twice as great [with the same length of stroke] as in the case of the Paragon cycle, he does not explain that the expansion curve of the Diesel would be higher than that of the Paragon diagram; the compression curve would also be higher, but the net result would be a greater output from a given cylinder, and probably a higher mechanical efficiency, although the consumption of fuel would be greater. With the small compression space of the Paragon engine, the amount of fuel oil that can be completely burnt would appear to be restricted, so that a cylinder of given size could not have the same output as a Diesel cylinder. The inventor states, however, that the weight of his two-cycle engine for a given output is lower than that of most engines that are on the market, and it would be interesting to have from him a more detailed comparison between the old and the new system, throwing light on the points mentioned above.

As regards the cushioning action claimed for the Paragon four-cycle engine, we may point out that this only occurs in every second revolution, and is therefore not so effective as would appear at first sight.

Apart from these minor points, however, the new cycle is certainly interesting; we understand that Paragon engines of considerable power are under construction, and we shall be glad to receive particulars of the results obtained in actual working.

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**The Fire Risk.** THE regrettable fire which recently shut down Salford's electricity supply, following as it did closely on other occurrences of a similar nature, both in this country and abroad, raises a question of considerable moment to electricity supply authorities.

Every business depends more or less on the goodwill of its customers, and electricity supply being a highly competitive business—despite all assertions to the contrary—its dependence on the goodwill of the consumer is absolute.

The consumers really rule the roost, and the collective impression left upon their minds dominates the future of supply work. Whether the impression left by the happenings of the last few weeks will be good or bad, we can safely leave our central-station friends to decide; many of them would barter their souls to ensure continuity of supply, and it is therefore not difficult to estimate their feelings in the matter. One thing is certain: the time has arrived when means must be found for safeguarding the supply generally, and ensuring beyond doubt adequate illumination for the time being of the streets, hospitals, large emporia, theatres, &c., even if a switchboard fire, as at Salford, or a faulty machine, as at Sheffield recently, does cause a temporary shut-down at the generating station.

For some purposes electricity is indispensable, but for a great many of its applications the advantages which have served to popularise its use are not such as entirely to outweigh a general, even though unjustified, impression of unreliability gathered from reading the daily newspapers. We do not wish to create an erroneous impression; complete and even partial shut-downs of electrical stations, considering the total number of plants involved and the years they have been running, are comparatively insignificant in extent—but unfortunately the consumer is unaware of this, and his tabloid news summary is apt to produce an exaggerated idea of the trouble. It is for the central station engineer to appraise the pecuniary value of reliability; our own impression is that any means which will ensure that public lighting, for instance, is not wholly dependent on the perfection of the mechanical, electrical, and human agencies at the power station, is well worth paying handsomely for.

The battery sub-station for special services, for both D.C. and A.C. supply, merits more attention than it has received, and even central-station arrangements are capable of improvement, assuming, of course, that some sacrifice in other ways is justified on the score of reliability.

## THE ELECTRIC LIGHTING OF VILLAGES.

BY W. T. WARDALE, A.M.I.E.E.

It is very generally assumed that the electric lighting of country villages, otherwise than from the mains of a large power company whose lines cross the district, or by the plant at a local colliery or other large works, will not pay its way. This opinion, however, is not correct, and provided that the plant is carefully laid out to suit the local conditions, with the capital outlay kept rigorously low, village electric lighting schemes can and do pay their way. For some time past the writer has been interested in such small schemes, and from experiences and results gathered from several such plants, offers the following suggestions as to the lines on which such schemes should be run.

In the first place, it should be recognised that a company can be formed to carry out the work for a considerably less outlay of money than the local governing authority, and for that reason the scheme should, at any rate, be started and established by a small company which must have the active sympathy and encouragement of the local council. The reason for this state of affairs is that whilst a small company having the goodwill of the council can start a supply without an order, and without other expensive preliminary outlays on sanctions and permissions, the local authority must have these inquiries, and on such small jobs they increase the capital expenditure to such an extent that the concern cannot make ends meet. A company, however, should never be formed or start working without an agreement in writing with the local council that the said council will encourage and protect the enterprise of the promoters. If this is not done, then the writer can state from actual being in touch with people whose enterprise has been simply ruined by the iniquitous policy of the local governing body, that the gravest possible risks may have to be encountered. The best course is to get the leading local men and the Council in favour of the scheme. This may be accomplished either by means of private conversations or by arranging a public meeting with an influential local chairman and strong local support, and explaining the advantages of electricity as a means of lighting, heating, cooking, and also as a handy method of working farm, garden, or water supply machinery. Many of the larger houses have plants for lighting by acetylene or petrol gas systems. At the suggested meeting it should be explained that electricity in the home does not involve trouble with burners and pipes which corrode, or if oil lamps are used, it should be pointed out that the labour of servants in trimming such lamps will be saved. At such a meeting it should be possible to enlist financial support from some of the most influential men in the district, and this accomplished, the progress of the concern will, as a rule, be very smooth. This part of the matter has been treated at length, owing to the fact that the writer knows from experience that it is the neglect of these points which generally lands the concern in financial straits.

The goodwill of the Council having been obtained, the necessary capital should then be decided on, and this will be settled by the size of the localities to be supplied. In a locality of from 800 to 1,000 inhabitants, a start can be made with a generating plant of 10 kw. and a battery of 300 ampere-hours, supplying through overhead mains, for an outlay of less than £500. This figure will vary locally to some extent, owing to the cost of obtaining the necessary site and a suitable building in which to house the plant. In one case at least the writer knows of a plant which has started up and run successfully on a less outlay than £500. In drawing up the company's articles, it should, however, always be stated that the company is entitled to raise a capital of at least £1,000 to £2,000. The whole of the capital need not be issued at first, but it will be required when the company has been established a couple of years, and on such small schemes bank interest on loans, and the usual worrying of the bank to have the company's debit account reduced, are extremely trying. Another point to be included in the articles of association, is that the company is authorised to generate and supply electric energy in the districts of X.Y.Z. and elsewhere; this point allows the company to extend its operations to other districts

which promise a return on capital spent. One point is absolutely essential if the company is to pay, and that is that the company is empowered not only to generate and supply electricity, but also to carry on the business of wiring contractors, to deal in and sell fittings and lamps, motors, heaters and cookers, and every electrical appliance. Power should be claimed under the wiring contractor clause to fit up and keep in repair installations at private country seats, as many places too far from the mains will be glad of the services of a competent engineer near at hand. The reason for the wide scope which it is advised to take, is that experience shows that the hours of running in such small plants are so short, and the revenue at first from electricity supply so small, that the cost for attendance would be prohibitive if men were employed on station work alone. Also, it must be remembered, that there is in such small localities, no chance for a resident wiring contractor to make a good living apart from an electricity supply; therefore, if all wiring has to be done by firms sending men from the near town, the cost of installing the light would be unnecessarily high, and would thus retard progress.

Overhead mains must, in the majority of places, be used if the concern is to pay, and it is fortunate that to-day there is little objection to them in country places. Another mistake to be avoided, is the use of the three-wire system. Certainly, the writer knows of a village plant which is run successfully with the three-wire system and underground mains, but there are reasons in this case which do not obtain in the usual village; and though the place pays, yet it would naturally pay better with the simpler system. In choosing the site for the generating station, the usual features of nearness to the railway or river, and a plentiful supply of water, should not be overlooked, whilst the roads to the site should be inspected with more than usual care. This latter may seem an obvious point, but it is often overlooked: and in country places the difficulty of getting stuff on to and away from the works may easily be serious. Again, do not assume because there is a supply of water running through or by the site, that the purchase of the site also carries the right to free and full use of the water; the writer has known more than one or two plants let in for quite unexpected rent charges over this point. Perhaps the site which has to be looked on with the greatest amount of suspicion is that of an old water mill, having the apparent advantages of a weir ready made and the water rights. This sort of place should be most carefully inspected, the points to be noted being whether the dam is in good working order, and what is the amount of power which can be depended on throughout the year, when, either due to shortage of water in very hot summers or to heavy floods at any time of the year, the power available is at its lowest. Neglect to note these points has led small village concerns into purchasing an old water mill at a fair price, and then finding out that the necessary repairs to the dam, alterations to the wheel, and awkwardness of the site in regard to the rail and main roads, have so increased the capital cost that the company has never really been able to pay its way, especially as often an oil engine has to be installed ready to take the load when the water-power is not available, due to either floods or shortness of water. The matter of purchasing or leasing the site must be settled locally; perhaps one of the best methods is a 42 years' lease.

The site and system having been settled, the next consideration is the purchase of the generating plant, and in this matter, as in all others connected with village lighting, capital must be kept low. If there is no system of lighting in the locality, except by oil lamps or private lighting plants, a high price per unit can be obtained, and the locality still be benefited by using the electric light. The following investigation carried out some years ago by the writer whilst on the staff of the electricity works in a cathedral city will show the cost under careful use, of lighting by oil lamps a six-roomed house. The house, though near the main road, had neither wiring nor gas pipes laid, so the lighting was carried out as follows: The second room being the living room was lighted by a swinging lamp suspended from the centre of the room and about 3 ft. 6 in. above the table; this gave a nice soft light to work by on the table or to read by at the fireside, the lamp giving about 30 c.p. As a means of obtaining information, as well as keeping the cost down,

the cost and results were carefully noted. A smaller lamp which rested on the kitchen mantelpiece did duty for the kitchen, and was seldom used for more than 5 or 10 minutes at a time; this and a small hand lamp used for upstairs work comprised the lighting apparatus of the house. In winter it was just possible by very careful use to keep the necessary light going on 1 gallon of paraffin, costing 8d., whilst there was also an expenditure of, say, 2d. for candles, making the weekly lighting bill under the most careful management possible, about 10d. In summer this charge came to 6d. one week and 4d. the next week for oil, so that the average charge was 5d. Taking current at 7d. per unit and a good class metallic-filament lamp of 35-c.p. in the living room and a 20-c.p. lamp in the kitchen, each lamp taking 1.3 watts per candle, the living room lamp could be used for 40 hours and the kitchen lamp for 10 hours per week at a cost for current for 1s. 2d. This, of course, involves careful use of the light, but the writer ventures to say that few people would have run the oil lamps in the same house under that charge. The cost of the electric light can be kept down by switching out for a few minutes when the light is not wanted, a thing which is impossible with oil lighting; also, there is the fact to be considered that the tenant had to do the inside painting and decorating, which item would be much less with electric than with oil or gas lighting, whilst the time saved in doing the necessary trimming to the oil lamp is no small item. Thus, with current at so high a price as 7d. per unit, electric light becomes very attractive. Under such circumstances the generating plant will not need to be of superlative efficiency, but it must be absolutely reliable. It will be apparent that in any place where capital is not too easily raised, and where a fairly early promise of a return must be shown in order to encourage the shareholders, the policy is to keep down the cost of the generating plant, preferring a plant having only moderate economy but low in cost, to one which gives the best possible economy but takes so much of the capital that little is left for development. Many really good second hand plants can be bought for such places at very cheap prices, providing that the buying is done by an engineer, as if a person not an engineer buys such plant there is very grave risk of him getting a very poor bargain.

Concerning the type of plant to be used, this matter will, to a large extent, be settled by the price of coal locally. Where coal can be obtained for 10s. a ton or less, the claims of the self-contained steam plant should always be considered. Even with the most heavy drawbacks, such as working non-condensing, and with cold feed-water, such plants can, where prices as high as 7d. and 8d. per unit can be obtained, pay for their use, and as they can be obtained second-hand for less than half the capital cost of new plant, it is policy in such places to use this type of plant and spend the capital so saved on the development of the load by running extra feeder and service lines. In fact, the writer knows of places where the scheme would have never paid quickly enough to encourage further capital if this policy had not been adopted. When the concern is well on its feet, then capital can be spent in buying the more efficient types of plant for extensions, being more easily obtainable then. Where capital is not too tight and in too great a hurry for its first return, then the best and most efficient type of plant to put down in any concern needing sets of less capacity than 15 kw. at the start, is the internal-combustion engine; but where the first sets installed are of 15 kw. or more, and coal for steam plant can be obtained at 15s. per ton or less, the over-type superheated steam engine, as made by Messrs. Garrett, of Leiston, should be considered. When a good supply of condensing water and water of good quality for boiler feed is available at a reasonable rate, then this engine gives highly economical results, added to which is the certainty of operation which is the distinctive feature of steam plants, and also the fact that these plants have a high overload capacity, which reduces their capital cost per horse-power actually obtainable to a very low figure. The stand-by losses on such a plant are greater than on the suction-gas engine plant, but they need not be excessive if the furnace door and ashpit are fitted with airtight covers to be put on at shutting down, and the chimney damper and engine and boiler lagging kept in good condition. The inquiries for prime movers should, however,

always include three or four different types of internal combustion engines. The deciding factor in most cases will be the cost of suitable fuel for the suction gas plant, or for the crude oil engine. Although the suction gas plant can now be made to use bituminous coal to some extent, the writer prefers to use this type of plant on anthracite, for the following reasons. Anthracite is the cleanest fuel to use, and in spite of all statements to the contrary, the suction or pressure producer working on ordinary coal has always the risk of sending tar over to the engine, and, in any case, needs the engine to be taken down oftener for cleaning of the cylinder liner, piston and valves, than when anthracite is used. There is also the fact that as the tar, which is a valuable heat-containing constituent, has to be taken out of the gas in order to ensure successful working, the amount of coal used per unit is considerably higher than when anthracite is used; hence the lower price for the bituminous coal does not give all the economy which at first is suggested. The gas engine working on a suction producer is, when properly installed, a most reliable prime mover, and if when buying the producer it is specified that the producer shall generate sufficient steam itself to make the use of anthracite peas practical and sure, it will be generally found that the anthracite scheme is in every way the more attractive. It should always be borne in mind in comparing the two types of producer, that not all bituminous coals are safe to use for producer and gas engine work, and that the field to be selected from is not as wide as it appears to be.

In considering the crude-oil engines, whether of the Diesel or semi-Diesel type, two points must always be borne in mind. One, and a most important one, is that the control of the necessary fuel is in the hands of one or two people, the supply at present is strictly limited, and the price has risen very greatly during the past year, and shows signs of still further increase. The other point applies more to the Diesel than to the semi-Diesel engine, and is that this engine cannot be attended to successfully by an ordinary type of engine attendant, thus the wages cost will be increased to some extent; whilst recent happenings have shown that the Diesel has problems of its own in connection with the matter of safe working, causing rates for insurance to be higher than with gas-engine plant. If it were not for the uncertainty of the future of the oil market, the crude oil engine, working on the semi-Diesel principle, would be ideal for the purpose of village lighting plants, there being no stand-by losses and no producer house necessary. The whole matter must be carefully summed up with regard to local circumstances. With any producer-gas engine installation, the effluent from the producers must not be turned into a clear stream; it should be either led into the ashes and clinker, and sent away with them, or should be loosed into the stream when the same is in flood; the stuff is then in so small a proportion to the amount of water in the stream, and so quickly swept away, that no damage will result. With every type of internal-combustion engine, the great point is to buy it large enough for its work. The Institution of Mechanical Engineers' Gas Engine Investigation Committee recommended that, for continuous working loads, a gas or oil engine should be purchased at 15 per cent. above the makers' rated load—that is, if a 20-h.p. load is needed continuously, then select an engine giving, according to the makers' rating, 23 h.p. at the least. This will increase the capital cost, but is the only safe way of ensuring satisfaction. Several of these small village plants with which the writer is in touch are run with suction-gas engines, and the owners speak uniformly well of their performance over periods of five years or more. In any such installation do not overlook the fact that the exhaust silencing arrangements must be more than usually ample.

With every such plant as we are considering, a 24-hour per day continuous supply is contemplated, and for this purpose, and for the economical working of the load, a battery is indispensable. In putting in a battery, the mistake to be avoided is that of installing one so small as to be useless in about two years. Along with the question of the battery must be settled the voltage of supply. Some plants are supplying at 100 volts, but the majority of these places would, if possible, change over to a higher voltage now that the metallic lamp is available at pressures as high as 230 volts. This pressure is about as convenient a pressure for

all-round considerations as any; the generator should be capable of giving 215 volts, as this allows for drop on a possibly heavily-loaded mains system, and gives some amount of room in which to control the station voltage. It is not possible to work the battery down to 1.8 volts per cell, and a battery of 125 cells will give the necessary 230 volts without getting down to the 1.8 limit, and will allow four regulating cells. A good idea of the size of battery to install is to put in, for an installation starting with a 10-kw. set, a battery capable of giving 30 amperes for three hours. Such a size of battery will allow the load in the very early days of the supply to be carried by the engine running, at the most, on four days per week; this feature helps matters considerably, by allowing the greater part of the time of the man in charge to be devoted to getting consumers connected up, whilst, when the load increases to such an extent that the engine must be run every evening, the battery is a good stand-by, and assists economical working. It will, of course, be understood that the three-hour rate of the battery means that it will be able to give a discharge of seven or eight amperes for 20 hours.

The switchboard should be as simple as possible, the number of instruments being as few as will conveniently work the board: in some cases the use of an automatic battery regulator allows the plant to be left to a considerable extent and has been found to give no trouble or risk over a long period.

The cable system should, in the majority of cases, be on the overhead bare-wire system; both copper and aluminium have been found to give satisfaction. The question of way-leaves over land belonging to various people must be settled by a personal and tactful interview, and to-day permission is rarely refused; needless to say the overhead line, when erected, should be as neat a job as possible and not offensive to the eye; special wire, fittings and insulators are now produced for this work in large quantity, and an example of the stuff used will be given. The services are often taken in through the window frames, and here in particular the neatness of the work will do much to remove any natural prejudices against overhead lines.

On the question of charging, by meter or by contract, it is found that experience and opinions differ: at least one very successful plant prefers the use of meters, and finds them economical and efficient, this installation serving a population of only 800 people. The majority, however, prefer the contract system of payment, and do their utmost to encourage it by quoting favourable rates.

No difficulty is experienced in getting consumers to come on, the obvious advantages of the electric light bringing requests for connection as fast as they can be dealt with; positively every place with which the writer is in touch tells the same story—"We do not find it necessary to offer any special inducement to get people to put in the light." Most places find that a very satisfactory job can be put in for 12s. to 14s. per point, this being done in wood casing and including a plain fitting and metallic-filament lamp; some places find for works and other than house lighting that twin lead-covered rubber gives a serviceable installation at rather less cost. All concerns agree that a cheaper system would be welcome to some extent, and most of them prefer not to use slip-joint conduit, although it is cheaper than most present systems.

A point of the utmost importance in such places is the arrangement of the men to work the place. The man chosen to take the lead is often a local man having a good training in running such small plants, and in the proper wiring of premises. Many such men are to be found who have obtained their experience mostly in the running of country house plants, and in wiring the same. It might be thought that sufficient money could not be offered to attract any but the man looking for experience. This mistake, however, arises from the fact that the wiring side of the business is left out of the reckoning; on the generating side alone the money cannot be provided, but when it is realised how very little the up-to-date small plant requires in the way of attention, and that the salary is earned on the installation side as well, the matter becomes plain. Some companies find that they prefer to pay a regular salary, increasing with the number of units generated, and a salary as manager of the wiring department; others

pay a contract price per unit generated to the responsible man, and find that it pays both them and him; he also has the proportion of the profits due to him as manager of the installation work. The combined salary is in most cases one which many chief assistants in towns having a population of 50,000 inhabitants would be glad to earn, whilst the position allows most valuable experience to be gained; the secretarial work is generally carried out in the office of a local solicitor having an interest in the company.

A brief mention of one or two plants will be of value in showing what is actually being carried out.

The Caergwrle and District Electricity Supply Co., Ltd., supplies the village of Caergwrle, near Wrexham, the population being 800. The supply is at 100 volts, two-wire. A simple Davey-Paxman under-type steam plant is used, which works to atmosphere and on cold feed. Two Johnson & Phillips dynamos of 7 kw. and 3.8 kw. respectively, and a 200 ampere-hour Chloride battery comprise the plant. The mains are of bare copper run overhead on wooden poles. The company has no provisional order, but its relations with the Parish Council are very good; the matter of the company doing the street lighting is at present under consideration, and should the Council decide to take over the concern, it will be on terms fair to both parties. The company was started by a few local public spirited gentlemen, and it is encouraging to know that they declare the financial result to be decidedly satisfactory. The price charged is 8d. per unit, and consumers are coming on faster than they can be dealt with. The mains system is interesting, and will be briefly described.

Wooden poles 31 or 32 ft. long  $\times$  9 in. diameter at the ground level, tapering to 7 in. at the top, are planted about 5 ft. 9 in. in the ground, at distances apart of 50 yards on straight runs. On some lengths this distance has been shortened to 40 yards to avoid causing annoyance by the poles coming in front of gates or windows. This distance is observed in the case of the main wires, which are No. 1 s.w.g., but in the case of a very light distributor of No. 11 s.w.g., the span has been lengthened to 72 yards. Each pole carries an oak cross-arm, 4 in.  $\times$  3 in. section, on which the insulators for the feeders are set 2 ft. apart. These insulators are made by the British Insulated and Helsby Cables Ltd., and are their K. 45 Indian pattern, shown in fig. 1. For services a double J insulator bolt with arms at 60°, shown in fig. 2, is used. The bolt on the

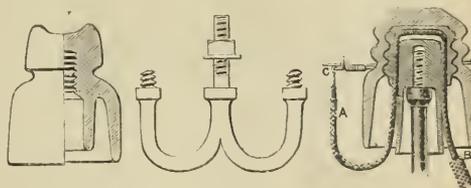


FIG. 1.

FIG. 2.

FIG. 3.

pole carries ordinary insulators, that on the houses the "Sinclair-Aitken" No. 1 pattern. This is shown in fig. 3, and is used as follows:—For a length from A to B, the lead of the twin lead-covered rubber-insulated cable is removed and the cable is pushed up into the groove as shown, the outer cover of the insulator is then put on and the service from the pole can be attached. Mr. Griffiths, the company's engineer, has adopted this method in order to get a dry patch between the bare copper at c, and the lead covering of the twin service cable, as he found that unless this precaution was taken, electrolytic action between the lead and copper corroded away some of the positive wires. Since this method has been used the trouble has vanished. The lead-covered twin service is then stapled along the house wall and taken in through the window. There is no gas supply in the village, and last year the total units generated were 5,000. Mr. Griffiths, unlike most engineers controlling small plants, prefers to use and charge by meter. The staff are paid under a contract, and find it mutually satisfactory.

Encouraged by the success of Mr. Griffiths at Caergwrle, Mr. Richard Edwards started a supply at Llanuwchllyn. Near

Bala. The population is 500, the supply being at 100 volts, two-wire, mostly overhead. The plant is driven from the surplus power available from a water-wheel which works a mill. Mr. Edwards is himself an engineer and millwright, and works the lighting supply in conjunction with his other business. The surplus power available is only  $1\frac{1}{2}$  h.p., this being helped by a 200-ampere-hour battery. The price per unit sold is 5d.: the village street and library are lighted under a yearly contract, and the total output last year was 1,500 units. The capacity of the plant is about 50 units per day, and more consumers are asking to be connected than the present plant can accommodate. Mr. Edwards states that the financial result is quite satisfactory.

The supply works put down at Cald, near West Kirby, in Cheshire, show another phase of village supply work. The "Cald Manor Estate Co." have full charge of the development of the district, which is a high-class and somewhat exclusive residential village about three or four miles from Hoylake, the "Mecca" of English golfers, and within an hour from Liverpool. The writer has spent two summer holidays in the district, and can testify to the quiet, restful nature of the place, situated on the Dee estuary, and looking across to the Welsh mountains. As a quiet residence for a city man, the place is ideal. Gas could easily have been brought in from Hoylake, but the estate company meant to be satisfied with nothing but the best. The electric lighting plant was, therefore, put down, but although it belongs to the estate company, the accounts are kept quite separately, and the venture pays a satisfactory return on the capital invested. The capital available in this case was fairly ample, and in order that the village should not be disfigured by the electric light station, the well-known London architect, Mr. Guy Dawber, was instructed to design the generating station buildings, and the result is an admitted ornament to the district. The present population is 200: no overhead wires are used, the system being a three-wire one at 115 and 230 volts. A 32-kw. Siemens dynamo, direct driven by an 85-h.p. suction-gas engine plant, and a 540-ampere-hour Tudor battery, comprise the plant, the battery having an automatic controller fitted. The plant is at present too large for the needs of the place, but in spite of this drawback, the total generating costs, including all capital costs, come to 1.8d. per unit—a highly creditable figure. The price per unit for lighting is 6d., and for power 3d. per unit. Last year 6,100 units were sold. Here then we have a village supply in which capital has been spent freely and in order not to spoil the appearance of the district, yet which, on a very small output, pays.

At Wormit, a suburb of Dundee, the electric light is successfully competing with gas at 3s. 3d. per 1,000 cb. ft. The village has about 200 houses and 1,000 inhabitants. At present 90 of the houses are supplied, the size of house ranging from 5 to 12 rooms; wiring costs on the average about £3 10s. The generating plant is a belt-driven suction gas plant, and overhead mains are used. Most of the consumers are supplied by contract on the basis of 4d. per unit; a few of the consumers prefer to pay by meter, and for their convenience the company provides a meter when required, making the price per unit 6d. The supply is at present chiefly lighting, but arrangements are being made for a campaign to capture the cooking load which, during off-peak load hours, will be stippled at 1d. per unit. The voltage of supply is 230 with a two-wire system. The company is managed by Mr. E. A. Stewart, and was founded on a previous company; since Mr. Stewart has taken charge of matters the company has turned the corner, and it is encouraging to know that Mr. E. Stewart, the engineer to the company, is at present in Ireland carrying out the reconstruction of another similar village lighting project.

At Lyme Regis, in Dorsetshire, we have a rather larger community of 2,300 people—this size of township, however, being generally thought too small for an electric light scheme to pay. The plant here is driven by oil engines using ordinary paraffin at a cost of 6d. per gallon. This price for fuel oil is to-day very high as compared to the crude oil so much in use, but the company paid 4 per cent. in its second year. The oil engines are of Messrs. L. Gardner and Sons' make, and have given every satisfaction; they are assisted by a turbine driven from a small stream. The total cost of running and managing the place is 3d. per

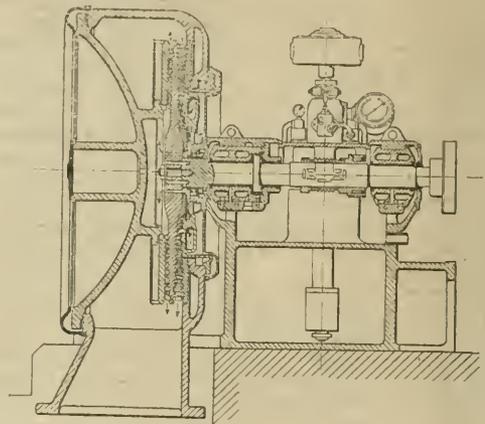
unit; 6d. per unit is charged for lighting and 4½d. per unit for power. Last year 26,500 units were sold. An interesting feature is that overhead aluminium mains are used—two-wire at 110 volts. There is also an agreement in force with the local authority to light the public lamps for 10 years from June 1st, 1909.

These are not by any means all the examples which could have been chosen. They have, however, been described, because they illustrate the different aspects of village lighting very clearly.

## THE EYERMANN STEAM TURBINE.

[BY OUR BERLIN CORRESPONDENT.]

THOUGH nearly all steam turbines in practical operation are worked on the axial-flow system, radial-flow turbines possess some undoubted advantages of their own. The concentric arrangement of blade rings on one disk, in fact, utilises more satisfactorily the available material, the two faces in addition to the edges being used for the arrangement of active elements. Another advantage obtained in the case of steam



EYERMANN 1,200-H.P. RADIAL-FLOW TURBINE.

admission from the inside outwards is due to the increasing circumference of blading, which allows increasing cross-sections to be provided for the passage of the steam, with growing expansion. Another essential point in the economy of radial-flow turbines is a far more advantageous mode of working of the steam. In fact, in axial-flow turbines, the steam in the rotating blades is thrown outwards by centrifugal force, thus assuming higher pressures, and returns inwards in guides free from centrifugal force, which obviously impairs the efficiency of the blading. Furthermore, in any fairly long blades there are considerable differences inside and outside respectively in the average steam cross-section, as compared with the cross-section of the blade material and the peripheral speed, so that the blade angles frequently show considerable departures from the most advantageous positions. All these drawbacks are done away with in the radial-flow turbine which, on account of its homogeneous steam passages, gives rise to no harmful secondary motion of the steam.

The fact that in spite of all this the axial-flow turbine has gained its present supremacy is due, on one hand, to the serious constructive difficulties offered by radial-flow turbines, and, on the other, to the prevailing opinion that one or two disks would not be sufficient for the arrangement of a sufficient number of rings of blades. This, however, is quite possible when designing the first pressure stage fairly large (e.g., from 12 to 2 atmospheres abs.), the resulting speed energy being converted in one or two rotating blade rings, and the remainder of the gradient being utilised in a limited number of blade-ring pairs working on the reaction principle.

Much attention has been recently given to the radial-flow turbine designed by Mr. W. H. Eyermann, of Steglitz, Germany, which has achieved remarkable success. This turbine has its blade rings arranged concentrically on a

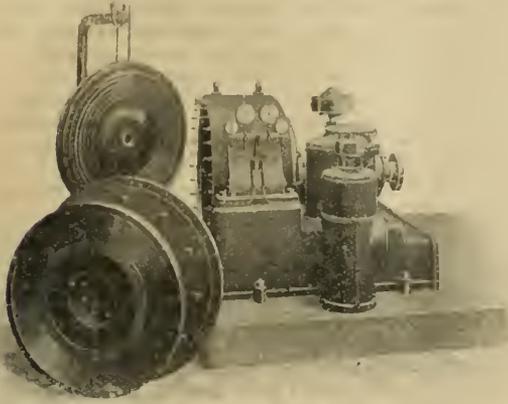
The following data relate to the steam consumption of some turbines recently constructed, as ascertained from official tests. A back-pressure turbo-dynamo of 100 kw., the exhaust steam from which is used for heating, gave the following data:—

Output eff. H.P.	Admits on pressure, lb. Atmos. abs.	Admission temperature °C.	Back pressure, lb. Atmos. abs.	Steam con- sumpt. in kg. H.P.-hour.
150 ... ..	9.21	305	1.01	12.5
112 ... ..	9.36	287	1.01	13.5
75 ... ..	9.54	286	1.01	15.1

The 1,200-kw. (1,700-h.p.) turbine of Messrs. Gebrüder Otto, Unterboihingen, gave the following results:—

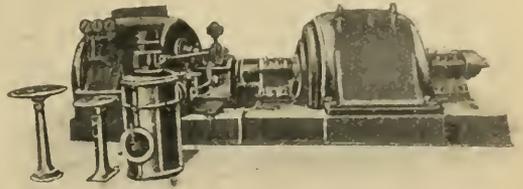
kw.	Atmos. abs.	C.	Atmos. abs.	Kg. kw. hour
1,200 ... ..	12.35	331	0.025	6.18
720 ... ..	11.25	325	0.022	7.25

Turbines of up to 1,700 h.p. have so far been constructed, and there seems to be nothing to prevent the design of much larger units on the same system. The most

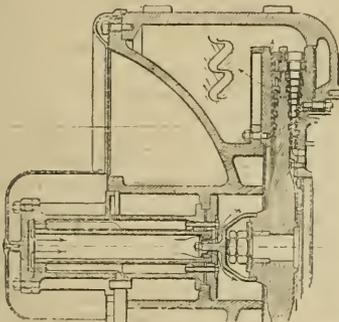


DISMANTLED TURBINE SHOWING BLADED DISK.

single disk, which, of course, involved a number of constructive difficulties. In order to reduce the weight of the rotor, such strains as would result in the disk being bent had to be balanced by counter-forces. The steam expanding on its way through the blading exerts a very



EYERMANN 1,200-H.P. STEAM-TURBINE SET.



ARRANGEMENT FOR AXIAL THRUST COMPENSATION.

considerable axial pressure on the disk. This pressure is balanced by a small amount of steam expanding at the back of the disk in a number of labyrinth grooves, in a similar way to the working steam on the front side. In

stringent tests made by the foremost turbine experts have borne out the claims of the inventor, showing the superiority his turbine possesses in many respects over the axial-flow turbine.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Kelvin.

With reference to the remark made by Mr. A. P. Trotter at the Institution of Electrical Engineers, reported in your issue of the 27th Dec., may I make some comment?

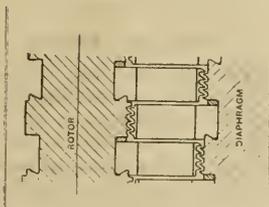
Unfortunately, it is impossible to snub a Government department, or at least, it seems so—perhaps, in this case, because it is represented by such a charming man. The rebuff the Board of Trade have received to their efforts, during the past 20 years, to introduce the name Kelvin instead of kw.-hour, would have silenced any self-respecting individual, but not so the Board. They tell us that in 1882 they graciously gave us permission to use the word Kelvin, and nothing more need be said—and this in the face of Lord Kelvin's obvious disapproval.

I trust that the industry will show its officials that, when it desires a new name for anything, it is able to dictate to them, and that it has too great an appreciation of the magnificent work done by Lord Kelvin to flout his obvious wishes—wishes both relative to this particular use and, in general, to the use of a non-decimal system.

So strongly did Lord Kelvin feel about the latter, that he said at Philadelphia, in 1884, "I look upon the English system as a wickedly brain-destroying piece of bondage under which we suffer. I say this seriously; I do not think that anyone knows how seriously I speak of it."

I have previously suggested as an alternative a more logical unit, viz., 10<sup>7</sup> joules, but this, I think, fails to do complete justice to the clear thinker whose memory we wish to honour, although it does not flout it.

The only proper excuse for the introduction of a new



SECTION SHOWING BALANCING GROOVES BEHIND DISK.

order to allow the amount of balancing steam to be adjusted, the turbine shaft is so arranged as to allow an axial displacement of about 1/2 to 1 mm., thus altering the width of an annular throttling slot constituted by the stuffing box and the turbine disk, which slot is traversed by the balancing steam. Another factor liable to result in the bending of the disk is the centrifugal force of the blading arranged on one side. In order to compensate this, counter-weights, which also carry the labyrinth grooves, are arranged on the back in a similar manner to the blades provided on the front of the disk.

name is the saving of mental energy. No honour is conferred on Lord Kelvin by giving his name, unless this result is brought about. Particularly in the case of such a thinker as Lord Kelvin does this apply, as he, of all people, would be gratified at anything which conserves "brain."

There must be some much more appropriate unit. Do the advocates of the use of Kelvin for kilowatt-hour know that before many years have passed we shall have got so far advanced in the use of electricity, that names will have had to be found for many quantities at present not in common use, that they are willing to waste Kelvin's name upon a crude multiple, adding to instead of reducing mental effort! It is as though we had erected a statue upside down, for all who pass to scoff and jeer at.

Percy Good.

London, S.E., *January 1st, 1913.*

#### High-Tension D.C. in Mines.

I should like to thank the gentlemen who have written to you upon the above subject for their criticisms upon my article, and to say that I should gladly welcome any further criticism. I am preparing a paper to be read before the Western Section of the Institution of Electrical Engineers upon the subject, in which I shall be able to deal very much more fully with the whole matter than I could possibly do within the limits of the article you were good enough to print. You were very kind, indeed, to allow me so much space, seeing the demand there is for space in your columns; but as I think everyone will recognise, even that space was only sufficient to touch the fringe of the subject. As in the paper I am preparing I shall not be limited as to length, I hope to deal with the whole matter very fully. I may mention also that it was partly with the hope that some criticisms might be forthcoming in your columns, that I requested their hospitality in opening the campaign.

I may, perhaps, be allowed to say that I have no pecuniary interest whatever in the Thury system. I have been watching its development for a long time, and it has occurred to me that it would be more suitable for mines than three-phase.

I should like to deal very shortly with two points raised by Mr. Roper. He asks whether I am serious in saying that the liability to short, with three cores, is six times that with two cores. I thought I had made it clear that I referred to the case of a three-cored cable, either inside of lead casing, or armoured, or both: the armour being earthed and the neutral earthed. With that arrangement, as I understand the matter, there are three chances of shorts between the cores themselves; and there are three chances of shorts between the individual cores and the casing.

The other point I should like to deal with is the question of joint-boxes. Will Mr. Roper give the size and weight of the smallest joint-box that he would consider satisfactory for the cable supplying a coal-cutting machine, and having to be taken through a gate road, in a seam with a bad roof? The coal-cutting machine will take normally from 12 h.p. up to 30 h.p., and on occasion may take as much as 50 h.p. Gate roads are made as short as possible, but under the conditions I have in mind, there might be several joints required within the length of one gate road.

Sydney F. Walker.

Bath, *January 4th, 1913.*

I am quite unable to follow Mr. Sydney F. Walker's idea in proposing the use of the Thury D.C. series system in mines, with concentric cables.

It is true that the p.d. across each individual motor would be comparatively low, but the same would not apply to the p.d. between the whole motor and earth, which would depend upon what part of the circuit the motor was connected in. Let us suppose, for the sake of example, that we have 30 motors in the mine, each taking on an average 200 volts, or a maximum of 6,000 volts when all the motors were running. Then, if the circuit were earthed at one end, a motor at the other end of the circuit would have both terminals, and the whole of its windings, at a pressure of almost 6,000 volts above earth.

In the same way, while the p.d. between the two conductors supplying any motor, and in particular one of the smaller motors near the face of the coal, would be comparatively small, both the conductors might be at a high potential as compared with earth. The concentric type of cable is not suitable for these conditions at all; it is suited for cases where the outer conductor is at earth potential, and not for cases like that under consideration, where the outer would be, not at earth potential, but at a potential not greatly differing from that of the inner.

Mr. Walker appears to suggest that the proposed system would obviate the necessity for earthing the frames of motors, or for providing the cables with earthed armouring. How so? If you have a motor, the whole of whose windings are at a pressure of, say, nearly 6,000 volts above earth, surely it would not be safe to leave its frame unearthed, even though the p.d. across the terminals of the motor were only 200 volts? On the other hand, it would be very difficult, if not impossible, to construct D.C. motors, at any rate, at a reasonable price, which would stand a working pressure of thousands of volts between windings and frame, such as would occur if the frame were earthed. I believe that with the Thury system it is the practice to insulate the frames of all the motors, as well as of the generators, by mounting them on insulating supports and surrounding them by insulated floors, which would obviously be impossible in a mine. But unless these impossible precautions were taken, it would not be safe to touch the motors—unless the frames were earthed. And even if the frames could be earthed, precisely the same difficulties and dangers would then present themselves as with the three-phase system.

In a large mine the maximum voltage would have to be very high, to keep the main current (which, as your correspondents in your last week's issue have pointed out, would flow through every part of the circuit) within reasonable limits. Take the case of the 5,000-kw. plant suggested by Mr. Walker. With a pressure of 20,000 volts, the main current would be 250 amperes, and this current would have to be conveyed to every motor, large and small. Think of the cost of cables and the copper losses. Then imagine a D.C. motor with its windings and commutator at a pressure of 20,000 volts and its frame earthed—or, if you prefer, not earthed. I am assuming that the motor is at one end of the circuit and the earth at the other; by earthing the circuit in the centre the maximum pressure to earth could be limited to 10,000 volts, but that would be bad enough.

I believe the speed of the brushes round the commutator is regulated by shifting the brushes round the commutator—not a method that strikes one as being particularly suited to mining conditions, especially in a mine that is at all fiery.

Altogether, it seems to me that mining work is about as unpromising a field for the Thury series D.C. system as could well be imagined.

G. C. Allingham.

Golder's Green, N.W., *January 6th, 1913.*

#### Earthing the Neutral.

In your current issue, Mr. Fedden gives an interesting description of the earthing arrangements in use at Sheffield, and as the subject is now so much to the fore, I feel that it would be of great service to all of us if he would give some further details of its working, in the light of his experience.

Mr. Fedden says that the earthing transformer has a delta-connected secondary, which ensures that the neutral point of the primary shall always be at earth's potential. By this he means, I presume, under normal working conditions, since it does not seem possible that, on the occurrence of a fault on one of the feeders, resulting in a dead earth, a transformer taking, say, 50 amperes out-of-balance current, could "anchor" the neutral point.

This being so, I am not altogether clear as to how the arrangement differs in its effect from a resistance connected to the neutral points of the generators or transformers, and so proportioned as to allow 50 amperes to pass in the event of an earth. On the other hand, the latter arrangement has one distinct advantage of its own, namely, that no power is consumed under normal conditions.

The use of the resistance, moreover, need not be subject to the disadvantage suggested by Mr. Fedden, namely, that with an earth on a feeder, the supply would be cut off, since the discriminating devices used at Sheffield could equally well be employed, or the still simpler arrangement outlined in fig. 1 of Mr. Peck's paper, which, as I pointed out in the discussion, admits by a slight modification of the inclusion of overload protection, as well as protection against earths, and this, moreover, without the use of any additional gear. The overload and earth fault relays are quite independent of one another, so that the latter can be set to trip with as small a current as may be required, without interfering with the overload settings.

The cost of the earthing resistance arranged for 50 amperes in the way suggested would not be more than a fifth of that of the corresponding transformer, as installed at Sheffield.

As Mr. Fedden points out, there are three questions which have to be decided in this connection.

1. Whether to earth the neutral at all?
2. If so, whether to earth through a resistance?
3. In that case, what should be the value of this resistance, or, in other words, what should be the value of the current to earth, on the occurrence of a dead earth?

As to questions 1 and 2, I think that all engineers are now pretty well agreed that they should be answered in the affirmative.

As regards the third question, there may be some differences of opinion on the subject, but I am personally in entire agreement with Mr. Fedden in his contention that so long as the earth current is sufficient to trip the feeder breakers, the smaller it is the better for the system.

**Kenelm Edgcombe.**

London, S.W., *January 6th*, 1913.

#### The Case of the Sub-Man.

As a result of the recent correspondence in the *ELECTRICAL REVIEW*, it has been decided to form an Association, and a meeting is to be held in London during the coming week (as advertised). Inquiries have come in from all over the British Isles, and the idea has been enthusiastically received.

It has been suggested that the "Association" should include shift engineers, switchboard attendants, sub-station attendants, mains assistants, &c., and it is hoped that as many as possible will attend the meeting.

Owing to the large amount of work entailed in answering the many correspondents, inquiries are being answered in strict rotation.

**J. W. Ebben.**

London, E., *January 6th*, 1913.

I am not one of those worms that take a pleasure in that interesting pastime of personal abuse, but I cannot but pass some remark on Mr. Potter's letter which appeared in last week's *REVIEW*. Amongst several remarks, he states that the correspondence of a few weeks ago bristles with contradictions; that we assume we are "a sort of aristocracy," and then he finishes up with the milkman and yardman question.

Well, in the first place, this Association of Electrical Shiftmen intends to put a stop to such as milkmen and yardmen taking charge of sub-stations, or having anything to do with our branch of the profession. As regards a "sort of aristocracy," it might be information for Mr. Potter to know that there are gentlemen in power and sub-stations, and that these are not entirely run by milkmen and such. The majority of attendants are well educated, have had a college training, some hold Honours Certificates from the City and Guilds of London Institute, while several have University degrees. I, therefore, cannot see how they can be compared to the common wiremen, who more or less are from the middle and lower class. I, myself, started by serving my time with wiring contractors (for which I am not sorry), and as an apprentice was sent out with the professionals. I remember one particular case where we were working in a flour mill, and one morning the professional whom I was with asked the foreman for 2d. to buy candles, which he said he required when working in a dark corner; he was given the 2d., and on

arriving at the mill I asked him whether he had bought the candles. The reply I received was: "Sure we don't want candles at all—wasn't it for a pint I got the 2d.?"

There is a specimen of your wiremen. Do they try to improve their knowledge as regards their trade? No, but they attend the technical schools, not to learn anything, but to increase their kit of tools at the expense of the workshop, and the result is that they do not know the difference between an ampere and a volt.

Then how would it possibly be practicable to be a member of the same Trade Union as the wiremen who are working under our direction in the stations? There would be no respect for us, and the result would be "Hey! Bill, is this right?" and discipline would be all awry. Another reason is that if we started an ordinary Trade Union we should be just as ordinary tradesmen (not that that is a disgrace to any man), but we hope, with Mr. Potter's permission, that we are a step above the average tradesman.

One cannot but think that Mr. Potter is of a Socialistic turn of mind from the tone of his letter. In a study of human nature Mr. Potter will see that in every class, from the very poorest to the millionaire, snobishness is to be found; it cannot be helped, for it is born with man, and even the electrical shift engineers are no exception.

The close of Mr. Potter's letter very much resembles a well-thought-out advertisement. Is he afraid that the Association of Electrical Shiftmen will rise in opposition to the Electrical Trades Union? Let him not tremble, we will not affect him financially or otherwise, and he may be sure that we will keep as far away from Trade Unionism as possible, even though the House of Commons dabbles in it.

Perhaps it will interest Mr. Potter to know that I have heard that hundreds of individuals have already joined the Association of Shiftmen.

I take this opportunity of making it clear to readers of this *REVIEW* that the "Association of Shift Engineers" and the "Association of Shiftmen" are identical. It was a mistake of mine that changed the name of the former.

#### Motor-Generator.

With reference to the letter of Mr. J. Potter in last week's issue of the *REVIEW* on this subject, there are two things that must have been noticed by your readers in his letter, namely:—First, it is typical of the majority of the effusions that have emanated from the E.T.U.; secondly, it is remarkable by being so wide of the mark, and offering no feasible or workable suggestions.

Mr. Potter touches on a number of points, and is careful to avoid following them out too far. He speaks of yardmen, &c., carrying out central-station engineers' duties, as though this state of things were peculiar to the central-station staffs; but he does not mention anything about those members of the E.T.U. who, a few years ago, were navvies, and such like. Mr. Potter would have us believe that the only thing to do for our benefit is to join the excellent organisation with which he is connected; but if we look back a little on the achievements of the E.T.U., and upon its methods, we cannot find the slightest reason why those members of the profession who are now seeking to improve their position should join its ranks.

What a brilliant success the E.T.U. was in the recent events at Bradford and Glasgow (success, I don't think!). Again, Mr. Potter states that there are already central station men in the E.T.U., but he does not mention anything as to the status of these members: seeing that it is only necessary to show that one has been three years at the trade in order to qualify for membership of the E.T.U., I can quite believe his statement about having central-station men as members—station wiremen, jointers, and such like. As to the question of Trade-Union methods not being applicable to the profession, I think any person who is at all conversant with central-station work will see the reasons for this. If it were to serve any useful purpose, I could enumerate a good many reasons, but central-station men are conversant enough with the question, also the matter of wage rates, and such are a question for consideration and adjustment, and not to be settled rashly or haphazardly, as I am sorry to say, is done by some Trade Unions.

The best work Mr. Potter and his friends could do is to set about making the E.T.U. what it is not at present—an efficient organisation, and one whose ranks would contain only qualified men. Then, and only then, will the E.T.U. obtain the recognition and respect which it is aiming so blindly for at present. Mr. Potter shows up his object very clearly in concluding his letter, by saying that the "E.T.U. will welcome recruits"; this seems to be about the only decided line of the organisation—"gather 'em in"—but to talk of central-station shift engineers finding a remedy for their grievances by joining this Union is too rich altogether. The shiftmen can, and intend to, form an independent Association, and can do so very nicely without the assistance of Mr. Potter and his friends.

There are many other points in question which could be gone into in print, but to attempt to discuss the matter with those who are wandering so wide of the mark as Mr. Potter is doing would be only a waste of time and space. Let him get some first-hand knowledge of the subject, and he will find that his organisation is as far removed from the business of the shiftmen, as Jupiter is from the place where they don't use radiators.

Zantha.

I have read with interest Mr. Potter's letter in last week's issue, and, being a subman myself, I cannot agree with him in a lot of things he states.

According to Mr. Potter, the interests of wiremen and station engineers are alike, or both classes are trades, and Trade-Union principles apply to both.

We unfortunates in sub-stations are badly enough off without putting ourselves on the same level as the tradesmen; in the first place, the average shiftman is a man of some education, and a very large number of them are gentlemen. They have some technical training, and they are socially well above the average wireman. The average wireman, on the other hand, is usually a man drawn from the lower classes; he has practically no education worth talking of, he does his work, no doubt, all right, but the most elementary question in electricity would stagger him.

Again, the average wireman can never become more than a wireman on account of his lack of education and technical knowledge; he will get his Union pay (with luck) all right, but will he ever rise beyond that? For that reason the E.T.U. is of no use to us.

Mr. Potter accuses us of "snobbishness": but, personally, I fail to see how we are guilty in that respect. It is no crime for gentlemen to keep apart from men who do not enjoy the same social position as they do, even if it is their misfortune to be "shiftmen."

How many of us, I should like to know, would like to get our start in life again at any of the other professions which, at least, protect their men, if we only knew then what a miserable business was in store for us, where money and influence, not brains, was the principal road to success.

As to the engineers who have joined the E.T.U., what have they to look forward to? A wireman's wage at the outside, with luck, and it is quite enough for them if they class themselves as such.

I am glad to see that the "Association of Shiftmen" is being formed, and the idea is being taken up in all parts of the country.

Booster.

The Preservation of Telegraph Poles.

We notice an article on page 33 of your issue of January 3rd, which, of course, refers to uncreosoted or unpreserved cedar poles in America, and we think this is not made quite clear, as the method suggested of preserving the same is no doubt excellent, but should be quite unnecessary with properly creosoted poles in this or other countries.

For Richard Wade, Sons & Co., Ltd.,  
CHRISTOPHER WADE, Managing Director.

Hull, January 6th, 1913.

THE PHYSICAL SOCIETY EXHIBITION.

(Concluded from page 12.)

Crompton & Co., Ltd.

Besides their standard potentiometer, and various patterns of switchboard instruments, this firm exhibited a new D.C. testing set (fig. 8). This instrument consists of a moving-coil indicator

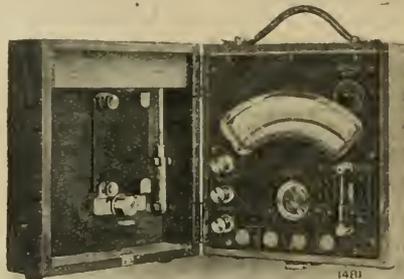


FIG. 8.—CROMPTON D.C. TESTING SET.

mounted in a light and strong portable oak case. It can be used either as an amperemeter or as a voltmeter, a selector switch being provided for coupling the instrument. The voltage range is altered by means of a volt-range switch, so arranged that on closing the case the switch is automatically and certainly set to the highest range; this reduces the risk of applying a high voltage to a low-voltage range. The shunts are specially designed, and are of manganin, the smaller shunt being inside the instrument. The 150-ampere shunt is used externally, but is fixed inside the lid when the instrument is being carried about. The instrument is magnetically shielded, and is adjusted to a definite resistance and degree of sensibility. Without its shunts or resistances it forms a milliamperemeter reading up to 15 milliamperes, or a millivoltmeter reading up to 75 millivolts. Any slight change of zero which may take place can be corrected from outside by turning a screw buried in a bush near the lock or catch; a suitable screw-driver is fitted in the lid. The apparatus is standardised as a voltmeter for six ranges, from millivolts to 600 volts, and as an ammeter from milliamperes to 150 amperes. Additional external shunts can be provided for higher ranges.

Mareconi's Wireless Telegraph Co., Ltd.

Several interesting novelties were shown by this company. Amongst these was the radiogoniometer in its fully-developed form, or, in other words, the wireless direction-finder on the Marconi-Bellini-Tosi system; this device, when installed on board ship, enables the direction from which signals are received to be determined within a few degrees, a matter of great importance in time of

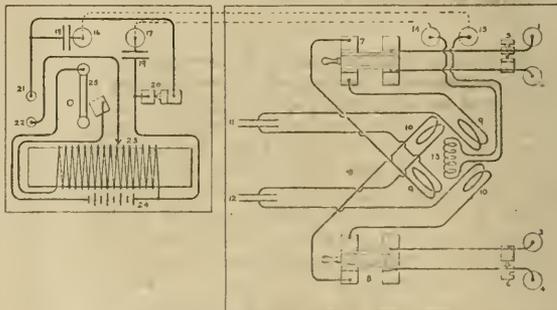


FIG. 9.—CONNECTIONS OF THE RADIOGONIOMETER.  
1, 2, Terminals of first aerial loop; 3, 4, Terminals of second aerial loop; 5, Protecting gap for first aerial; 6, Protecting gap for second aerial; 7, Switch for first aerial circuit; 8, Switch for second aerial circuit; 9, Fixed coil of first aerial circuit; 10, Fixed coil of second aerial circuit; 11, Condenser for first aerial circuit; 12, Condenser for second aerial circuit; 13, Exploring coil; 14, 15, Terminals for connection to detector; 16, 17, Terminals for connection to direction finder; 18, 19, Blocking condensers; 20, Crystal holder; 21, 22, Terminals for connecting to telephones; 23, Potentiometer; 24, Battery of dry cells; 25, Battery switch.

fog or when seeking a vessel in distress. It can also be used for directive signalling over a moderate range. The special aerial employed consists of two equal loops suspended in vertical planes and crossing one another at right angles; each of these is connected in series with a coil and a condenser. The coils are of equal size and cross at right angles; the condensers are also equal, and can be simultaneously adjusted for tuning the aeriels. A third

oil, inside the crossed coils (see fig. 9), is called the exploring coil, and is mounted on a vertical spindle; it is connected with a detector consisting of a pair of telephones and a crystal rectifier. The principle of the instrument is as follows: Each aerial loop is a directional aerial, which receives best when its plane is in the direction of the sending station, and receives nothing when its plane is at right angles to that direction. Usually both aeriels are more or less inclined to the direction of the signals, and receive signals of corresponding intensity, the resultant effect of which is communicated to the exploring coil; when the latter is in the position which gives the maximum strength of signals, the pointer attached to the spindle indicates the direction of the sending station—assuming, of course, that the instrument has been properly fixed with regard to the aeriels. A simple testing instrument is used to verify the orientation, resistance and insulation of the aeriels.

Improved adjustable ebonite disk and air condensers were exhibited, and a complete portable outfit for communicating up to 15 miles, to be carried in knapsacks by four men. A new "Universal Crystal Receiver" was also shown, intended for a range of 300 to 3,000 m. wave-length, and provided with adjustable condensers in the aerial and detector circuits.

**Nalder Bros. & Thompson, Ltd.**

In addition to the well-known ammeters, voltmeters, insulation testing set and other instruments shown by this firm, there was a novel device in the form of an insulation recorder and leakage-current indicator for A.C. circuits. The principle involved is that of applying a direct-current E.M.F. from a battery or exciter between the A.C. mains and earth as illustrated in fig. 10, which refers to an unearthed three-phase system. The choking coil limits the alternating current to earth in case of a bad fault. The recorder and relay, which are permanent-magnet instruments, are operated by the direct current flowing round the circuit *via* the insulation resist-

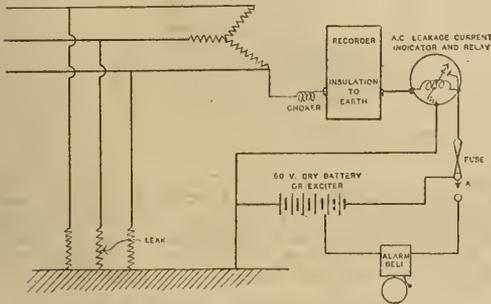


FIG. 10.—CONNECTIONS OF NALDER INSULATION RECORDER AND LEAKAGE INDICATOR.

ance. The recorder is calibrated to register the insulation to earth, and operates on the tapping principle. The relay is calibrated to indicate the maximum A.C. leakage current flowing from main to main consistent with the resistance recorded at the moment.

When the insulation resistance falls below a predetermined value, the relay makes contact, throwing the fuse directly across the battery; the fuse blows, allowing the alarm-bell circuit to be completed at A, and cutting the instruments out of circuit. These sets of apparatus have already been installed in many high and low-pressure systems both with and without the neutral earthed.

**Helsby Wireless Telegraph Co., Ltd.**

The Helsby vibration-proof crystal detector and rotary quenched-spark discharger were shown.

**Weston Electrical Instrument Co.**

This company showed a great variety of switchboard and portable instruments of the Weston type, as well as testing sets, laboratory instruments, frequency and power-factor meters and synchrosopes.

**Cambridge Scientific Instrument Co., Ltd.**

The Féry bomb calorimeter, and various instruments for the measurement of temperature, were shown. The principal feature, perhaps, was the Cardiograph, which consists of an Einthoven galvanometer, photographic apparatus for making records either on plates or on a continuous roll of paper, an automatic projection arc lamp, a switchboard and time-marker. The whole forms a very convenient outfit for producing records of the heart's action over any desired length of time, with the minimum amount of trouble. With the aid of an auxiliary microphone apparatus, graphic records of the sounds of the heart can be made.

**Kelvin & James White, Ltd.**

The Kelvin balances and other familiar standard instruments were shown, with the Aitken portable dust counter. The Fullarton vibrometer was also exhibited; this is a simple little instrument with a vibrating reed, which can be tuned by various adjustments to resonance with the vibration to be determined, and gives a comparative indication of the intensity of vibration in any given plane.

**Dubilier Electrical Syndicate, Ltd.**

This exhibit included condensers of mica and tinfoil, for working pressures up to 15,000 volts, as well as a quantity of high-frequency apparatus for therapeutic purposes, which could be used on any public supply system.

**THE "PARAGON" CYCLE INTERNAL-COMBUSTION ENGINE.**

NOT content with devising the "Paragon" system of electric propulsion of vehicles and ships, Mr. W. P. Durnall has invented a new cycle for internal-combustion engines, which appears to possess marked advantages over the well-known systems in current use. His purpose is to expand the products of combustion down to atmospheric pressure, thus obtaining more useful work from a given quantity of fuel, and discharging the gases noiselessly at a low temperature. According to a descriptive article by the inventor in the *Railway Times* of December 28th, his attention was drawn to the subject by the need for a suitable prime mover for use in combination with his Paragon system of oil-electric locomotive for hauling railway trains, in place of steam locomotives; his colleagues, Messrs. H. H. B. Deane and G. T. Bowles, were associated with him in the development of the new system.

In fig. 1 is given a diagrammatic section of the Paragon internal combustion engine as arranged on the two-cycle Diesel principle for use with crude oil. It will be noted that the exhaust ports

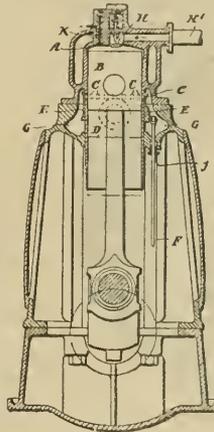


FIG. 1.—DIAGRAMMATIC SECTION OF PARAGON ENGINE.

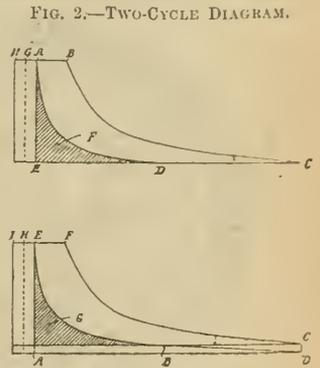


FIG. 2.—TWO-CYCLE DIAGRAM.

FIG. 3.—FOUR-CYCLE DIAGRAM.

cc are situated at the middle of the stroke of the piston, and are covered by a sleeve E, which is operated from the crankshaft by a rod F. Also a pipe H<sup>1</sup> supplies air at a pressure slightly above atmospheric pressure, through a valve H.

In the figure the piston B is at the top of the compression stroke, and the compression space is supposed to be filled with air at a pressure of 500 lb. per sq. in., and at a temperature of about 1,000° F. As the crank turns the centre, the fuel oil is sprayed into the cylinder through the valve K, and burns during a portion of the stroke; afterwards expansion takes place, but the exhaust ports are kept closed by the sleeve until the end of the stroke, so that the gases expand almost to atmospheric pressure. The ports are then opened, and as the piston returns, the air in H<sup>1</sup>, being at a higher pressure than the contents of the cylinder, opens the valve H and scours the cylinder, so that when the piston covers the exhaust ports the cylinder contains only pure air, which is then compressed, as before.

The indicator diagram obtained is shown in fig. 2; here E G is the compression space, while E H is said to represent the corresponding compression space in an ordinary Diesel engine; E C is the atmospheric pressure line, and compression starts at D, the shaded area F representing the work of compression.

The principle can be applied also to the four-cycle type of engine, in which case the scavenging air supply is not required. Fig. 3 shows the diagram in this case. Here, on the suction stroke, the air induction valve is closed at the point B, and the piston runs on to D, expanding the air to a point below atmospheric pressure by the amount C D; the difference of pressures inside and outside the cylinder cushions the stroke and helps the working parts to turn the outer centre without shock, also accelerating the parts on the return stroke. On arriving at B, the piston commences to compress the air, bringing it up to 500 lb. at E; injection of fuel takes place, followed by expansion down to C, and on the return stroke the piston expels the burnt gases. Engines working with gas on the four-cycle system, with compression only to about 80 lb., can be operated on similar lines.

Particulars are given in the article quoted of engines which have been designed of 230 B.H.P. at 900 R.P.M. on the author's system.

for Colonial orders, to be used in conjunction with the Paragon system of electric transmission. A 300-h.p. petroleum-electric locomotive for passenger train service on one of the leading British railways, weighing 35 tons, is also described and illustrated; each of the four axles is driven by an induction motor, with a gear ratio of 3.35 to 1, and 10 running speeds are provided, while the engine runs always at constant speed. The fuel consumption per axle horse-power-hour is estimated to be 0.6 lb. of crude oil. A small exciter is provided, as well as a small storage battery capable of lighting, heating and ventilating the locomotive and train. The cooling water is carried in a radiator on the top of the locomotive, and special means are employed to vary the rate of circulation, so as to keep the water at a constant temperature. The author states that the system can be applied to locomotives up to 1,000 h.p., weighing 80 tons, with a drawbar pull at starting of 15 tons.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### The Record Patent D.C. Moving-Coil Instrument.

The desirability of a long scale in a measuring instrument is well understood, but hitherto the angular deflection of the pointer of a D.C. moving-coil instrument has been limited to an arc of 90° or so by the requirements of design of the coil and the poles of the magnet, many attempts have been made to overcome this drawback, but with indifferent success. The usual design, moreover, necessitates either a very long air-gap (with no core to the coil) or

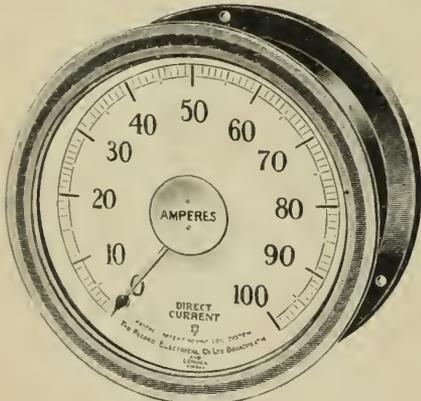


FIG. 1.—NEW "RECORD" AMMETER.

two air-gaps in series, the latter being the customary arrangement. The attempt to shorten the air-gaps has led to marvellous accuracy in the construction of the coil and pole-pieces, but the coil is large and has a fairly high moment of inertia, and any defect in manufacture or fitting leads to fouling.

THE RECORD ELECTRICAL CO., LTD., of Caxton House, S.W., have now developed an entirely new design, giving a scale subtending 300° not far from a complete revolution of the pointer—and avoiding the difficulties above-mentioned. Fig. 1 shows this feature in the case of an ammeter, and it will be noticed that the scale, which is sensibly uniform throughout, is remarkably clear and easily read; moreover, the divided scale is placed outside the bold figures, thus giving the largest possible



FIG. 2.—MAGNET SYSTEM.

space for the divisions and facilitating accuracy of reading. The scale of the 8-in. dial switchboard instrument illustrated is 17 in. long, and that of the 15-in. instrument is no less than 3 ft. long—in each case about three times as long as in the usual type.

The method by which this large deflection—which can be increased to 330° if necessary—is obtained is shown in figs. 2 to 4. Fig. 2 shows the magnet and pole pieces, which are arranged on the sandwich plan, so to speak, one ring-shaped pole (which also forms the core of the coil) being placed between the two extensions of the other; the shape of the magnet is eminently suited to enable it also to form the backbone of the instrument, carrying the lighter portions. The inner pole-piece is made in halves to admit the coil. There are two air-gaps, bounded by flat surfaces, which are therefore easily made true, and of large area:

these also are not in series but in parallel, so that the magnetic reluctance is very low, and this enables a strong working field to be secured, together with great permanence of the magnet and freedom from external interference.

The coil is shown in fig. 3; the active conductors are the upper and lower ones, and the idle length of conductor is short compared with the useful portions: the small coil is therefore of very low resistance, and can be used with shunts giving the usual drop of

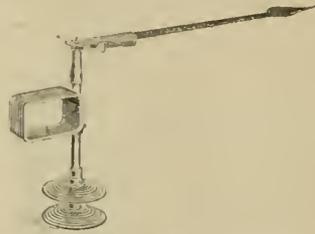


FIG. 3.—MOVING-COIL SYSTEM.

0.075 volt. The pointer acts as a counterbalance to the coil, and the moving system is very light and well damped, being almost dead-beat. Large clearance is provided at the ends of the coil, and a considerable slackening of the bearing will not cause fouling. The instrument assembled is shown in fig. 4.

These meters are made both for switchboard and laboratory use, with suitable modifications, the latter type having a mirror and knife-edge pointer. In conclusion, we are informed that the three-fold deflection is obtained without any increase in the expenditure

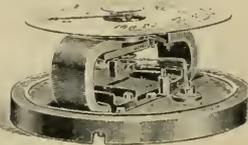


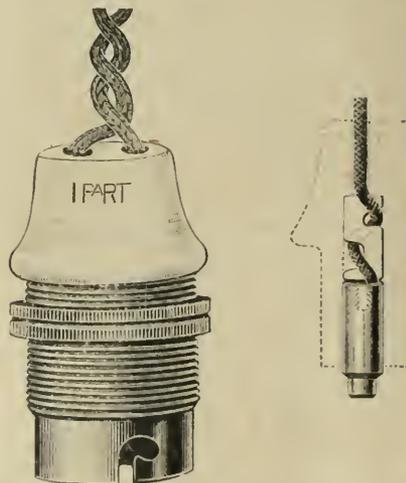
FIG. 4.—INTERIOR OF RECORD INSTRUMENT.

of energy, or, if preferred, advantage may be taken of the long scale to enable the same range to be obtained with one shunt as the ordinary type gives with three shunts. The workmanship is of a very high order, and we were much impressed with the merits of the instrument which was submitted to us for examination. Ammeters and voltmeters are made of all the usual ranges.

### "One-Part" Lampholder and Plug.

We have received from MESSRS. G. ST. JOHN DAY & CO., of Mumps Electrical Works, Oldham, samples of their One-part lampholder and One-part plug, both of which represent a marked advance in simplified construction on previous efforts of the kind.

It may be remembered that, last year, we described in these columns one or two ingenious lampholders which, by comparison



FIGS. 5 AND 6.—"ONE-PART" LAMPHOLDER, AND ARRANGEMENT OF TERMINAL.

with the ordinary pattern, were a considerable improvement, and that one of them was the "Mumps" lampholder by the same firm.

The One-part holder consists merely of a porcelain interior with two holes running through from top to bottom, each hole enclosing one wire of the flexible and a terminal plunger, while a standard screwed barrel with bayonet sockets and shade ring is permanently secured to the lower part of the porcelain.

The terminal parts are a sliding fit in their holes and are withdrawn for the purpose of wiring, the bared wire being first pushed through the porcelain and attached to the terminal top by a screw, which has a peculiarly shaped head, projecting some  $\frac{1}{2}$  in., with notches on either side, round which the wire is looped for greater security; the terminals, once wired, are simply drawn up into their respective cavities by pulling the flex, above the holder.

The above description also applies practically to the plug, which consists of a plain wood or porcelain body with two through holes for wires and plain terminal contacts (instead of plungers). These are also wired in a similar manner to the above.

In either case it will be noted that there is practically no chance of a "short," the leads being separated throughout; the wiring is easy and no tool is required beyond that necessary for preparing the wire itself; the two terminal fittings are the only detachable parts in either holder or plug.

**A Cavity-head Screw.**

A screw with a head of a novel pattern is being placed on the market by Mr. S. SUTCLIFFE, of 3, Central Street, Halifax. As shown in the accompanying fig 7, the head is cupped, and the groove is cut to a larger radius than that of the cup. To turn these screws, a screw-driver with a curved edge is used. Everyone who has had to drive a screw knows the annoyance, and often the



FIG. 7.—CAVITY-HEAD SCREW.

damage, that results when the driver slips laterally out of the groove, but it will be seen at once that these new screws can be driven with ease and certainty, even in the dark. Care is taken to design them so that the head is not weakened, and the spherical cavity is polished, giving a handsome appearance to the finished work. There is less chance, too, of the driver slipping and defacing the head of the screw.

**New E.A.C. Car-switch Lift Controller.**

THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.W., have devised a controller for high-speed passenger lifts, consisting of automatic reversing gear interlocked with an automatic starter on the same panel. The two

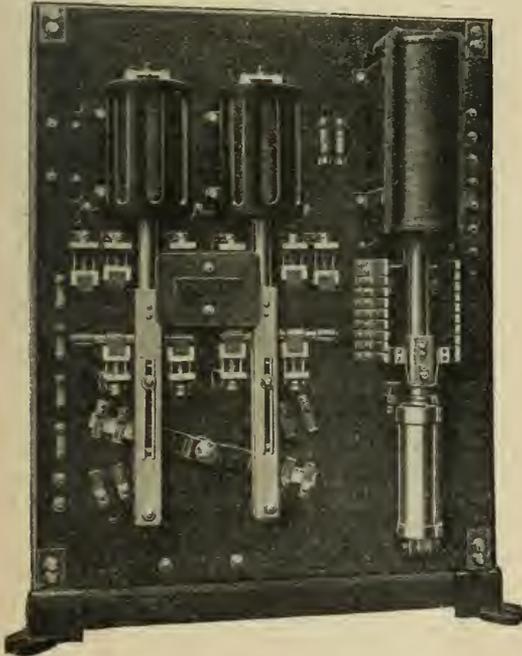


FIG. 8.—E.A.C. LIFT CONTROLLER.

smaller solenoids seen in fig. 8, are for up and down direction respectively, and the centrally pivoted switch at the bottom of the controller (operated by the same solenoids) is for reversing the armature connections. The long solenoid cuts out the starting resistance, the operation being as follows:—When the

lift attendant moves the car switch to the "up" or "down" position, the corresponding solenoid on the controller is energised, and its plunger pulled up. During its upward movement the armature reversing switch is closed in the right direction, and finally the circuits to the brake magnet, the starter solenoid and line are completed, and the motor is started with all resistance in. Resistance is cut out step by step by the automatic starter, the speed of which is retarded by a dashpot. The rate of acceleration can be varied by turning a screw on the outside of the dashpot. Current is never made or broken on the armature reversing switch or on the rheostat, the contact-making parts being the cross arms fitted with renewable copper rollers, which engage with large renewable carbon blocks, cushioned and partially hollowed, in order to ensure a definite contact.

As an additional security, a powerful magnetic blow-out is employed, the front shield of which is seen in the illustration, hiding the two line contactors from view. By changing one link on the panel, the control can be removed from the lift cage to two push buttons in the top left-hand corner of the panel, so as to enable the lift to be tested from the motor room with the cage empty. The apparatus is completely interlocked, and it is impossible to start up the motor until the starting resistance is all inserted. An electrical as well as mechanical interlock prevents any possibility of the up and down solenoids lifting together.

**New G.E.C. House Service Cut-Out.**

The accompanying illustration shows the new pattern of house service cut-out, recently introduced by the GENERAL ELECTRIC CO., LTD. In this design, Home Office requirements have been strictly adhered to; the case is of cast-iron, enclosing the fittings in a very neat manner. There is efficient insulation between the case and

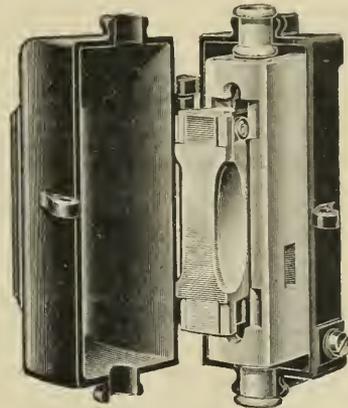


FIG. 9.—G.E.C. HOUSE SERVICE CUT-OUT.

the fittings, and a liberal rating of metal parts. The contacts are sunk in a recessed porcelain block, thus rendering it impossible to make accidental contact with live parts when replacing the fuse holder. The fixing holes are drilled under the porcelain cable bushes. The capacity of the cut-out is 10 amperes.

**B.T.H. Theatre Dimmers.**

THE BRITISH THOMSON-HOUSTON CO., LTD., of 77, Upper Thames Street, E.C., are supplying metallic dimmers in several types, for fixing flat against, or at right angles to, wall or switchboard, and

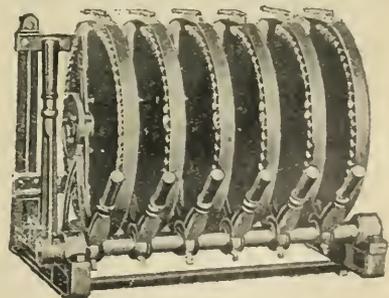


FIG. 10.—B.T.H. THEATRE DIMMER.

for mounting in dimmer banks. Dimmers consisting of two or more plates may have a single lever for the control of all plates, interlocking individual levers, or non-interlocking individual levers. Every dimmer is made up of one or more standard plates, which can be added to or decreased in the same way as a sectional book-case. It is thus possible to modify the equipment without waste of time, material or money.

In the B.T.H. design, fig. 10, a perforated cast-iron plate encases a special composition, embodying resistance elements having a negligible temperature coefficient, which are held firmly in place by

cement, which is a highly efficient heat conductor and electric insulator. The contact segments are arranged to ensure against the possibility of arcing from point to point, and to prevent the accumulation of dirt between the segments. The use of wall type dimmers is recommended where only a few lamps are to be controlled, as in small cinematograph theatres, churches, &c. In the interlocking two-wire type each plate has an individual lever, which can be interlocked by a slight twist of the handles, so that any one or all of the plates can be operated by the master lever. In the interlocking three-wire type, each pair of plates is controlled by a small lever which, when interlocked, can be operated by the master lever in a similar manner. The levers are attached to a shaft which is carried on self-centring bearings and an extension of the horizontal arm of the end frame. This method of mounting is used for both the interlocking and non-interlocking types.

## BUSINESS NOTES.

**Consular Notes.—Russia.**—The Austrian Consul at Kieff reports that quite small electric motors find a very good sale in his district, and there is also a fair market for large dynamos. There are quite a number of purchasers who prefer foreign machinery to the home constructed variety. In consequence of the high duty on steam engines and dynamos, steam turbines coupled to dynamos have recently been imported. These machines actively compete with separate steam engines, Diesel motors, &c. Incandescent and arc lamps are being imported in larger quantities, but it must be borne in mind that the home production of carbon incandescent lamps is showing an important development. There are two works in Moscow and one in Warsaw for the production of these lamps, which have also taken up the manufacture of metal-filament lamps, and have dealt a serious blow to foreign manufacturers. The result will be that one or other of the large foreign works will establish branch establishments in Russia. The demand for arc lamps has been appreciably affected by the high power metal-filament lamps. For lighting materials in general, Germany is the chief supplier, but Austria has recently begun to show active competition, one Vienna firm having achieved considerable success. Imports of dynamos, electric motors of every kind, and transformers, in 1911 amounted to 234,000 pounds, valued at 5,838,000 roubles, as compared with 162,000 pounds, valued at 4,471,000 roubles, in 1910.

**Russia.**—The British Consul at Riga reports that imports of machinery, which rose considerably in 1910, increased still further in 1911. The greater part of the machinery imported is destined for industrial use, and goes in transit for the interior. If we compare the years 1910 and 1911, we find that in the former year 5,690 tons of agricultural machinery, and 10,478 tons of industrial machinery were imported into Riga, whereas for 1911 the figures were 6,349 and 18,992 tons respectively. If we go back as far as 1901, we find the respective figures given as 824 and 5,248 tons; this serves to indicate the great advance in imports of machinery in late years. The United Kingdom is by far the greatest supplier of industrial machinery. According to available statistics, Sweden holds first place in the supply of agricultural machinery at Riga. She is improving her position in the production of industrial machinery, and thus threatens Germany's position as the country second in importance to the United Kingdom in this branch of Riga's imports.

Later in his report the Consul states that the consumption of electrical energy has developed each year from 1906 to the present time. The electric station has met a greatly increased demand for light, but the most notable feature in 1911, as in the previous year, was the increased demand for electricity for power. In 1911 more than 2,000 electric meters came into use, or nearly as many as the total number in use in the first four years of the electric station's existence (1905-9). The increased demand for electricity made it necessary to extend the electric station, and a turbine-generator of about 3,000 H.P. was accordingly added. This was supplied by a German company. The total length of the electric trams in the end of 1911 was estimated roughly at 42 km. No new lines were constructed during the year.

**Brazil.**—The Austrian Consul at Sao Paulo reports that in 1911 18 new concessions for telephones were granted, so that the number of existing telephone companies increased to 61. The system covers over 4,500 km. The Government proposes to bring about the further improvement of the telephone service, and to help to remove existing difficulties which result from poor material, thin wires, and faulty personnel. Moreover, a reduction of the subscription is proposed, the present annual subscription within the kilometre radius being 160 milreis.

Later, in his report the Consul states that the extraordinarily favourable industrial condition of Sao Paulo must naturally lead to a large expansion of trade. Most of the business is done through large importing merchants, and the investment of capital in the district has been an important factor in securing trade. A firm wishing to establish itself in Brazil, and to participate in the trade, must be so well capitalised that it can make considerable sacrifices to begin with, can undertake a strenuous advertising campaign, and—what is particularly important in the machinery trade—give long credits, as well as share in financing new undertakings from which orders may be looked for. Almost daily, at the present time, details of new undertakings appear in the papers, of which only about 50 per cent. are more than unformed ideas. Readers of

such notices are apt to take it for granted that these notices all refer to *bona fide* undertakings, and may just happen to pitch on one that is not. Experience leads them to ignore these notices in future, and thereby they may miss an excellent opportunity. All that is required is a knowledge of local conditions, and a power of discrimination, and these requirements can only be obtained on the spot by means of an efficient representative.

**Uruguay.**—The British Consul at Monte Video reports that on January 8th, 1912, a decree was published making obligatory wireless telegraphy installations on all passenger ships carrying passengers between Uruguay and other ports from May 1st, 1912, but the operation of the decree was subsequently postponed to August 15th, 1912. By the decree, ocean-going steamers must have apparatus powerful enough to receive and transmit messages from and to a distance of 400 km. (248½ miles). The Marconi station at Maldonado was closed down on March 23rd, its work being taken over by the Government installation at Cerrito (Telefunken system). The proposed installation in Lobos Island, referred to last year, has not yet been taken in hand, and the erection of a lighthouse on English Bank has also been deferred; but the wireless station on English Bank is now working, and will be a great boon in stormy weather.

Elsewhere in his report, the Consul points out that the principal impediment in the way of British firms not already established in the Uruguay market is the difficulty of finding British agents in Monte Video. The British firms already existing in Monte Video are, in most cases, so occupied with their present business that they have little desire to take up new agencies, especially if the goods are new to the market and the terms nothing exceptional. This applies also to Uruguayan firms, with whom there is the further difficulty of dealing in Spanish. Accordingly, letters from British firms to traders in Uruguay offering agencies frequently find their way to the waste paper basket, or meet with an evasive reply, for it is now axiomatic in Monte Video that if a foreign firm has business worth offering, it will send a competent member of the firm to choose an agent. The fact is well known to British importers to South America, whose commercial travellers now include Monte Video in their South American itinerary. Some, however, have concentrated on the larger market of the neighbouring metropolis of Buenos Ayres without seriously considering the possibilities of business in Uruguay. Where British agents are unobtainable in Uruguay it is better policy to appoint Uruguayans, in preference to any of the firms of the nationalities of our competitors. It would seem hardly necessary to repeat the perennial warning that the metric system is enforced by law in Uruguay, where tradesmen are fined for using any other system, and that correspondence with Uruguayan firms should be conducted in Spanish, were it not that catalogues and circulars are still sent to Monte Video, printed in English, with quotations in British weights and measures. Perhaps the greatest obstacle to the expansion of the import trade is the high protectionist Customs tariff, which dates from 1870, with subsequent alterations imposing in most cases additional duties. The United Kingdom is, however, on the same footing as her European and North American competitors, as there is practically one uniform tariff for all countries, without any preferential scale. In 1907 a new Customs tariff was published, further increasing the duties, but was not adopted. In view of the recent increases in public expenditure, it is feared that no remission of Customs duties is to be hoped for, although the best authorities are of the opinion that the Customs revenue would not suffer by a reduction by 10 per cent. of the present duties. The Customs duties at present provide over 60 per cent. of the public revenue. A Bill was introduced in July, 1912, for raising considerably the duties on iron and steel and certain other goods. The main purpose of the Bill, as explained by the proposer, was to enable local manufacturers to carry on business without loss in the event of an Eight Hours' Bill becoming law. The tendency is to meet the expense of new public works by means of temporary additional Customs duties, but unfortunately when the work is completed and paid for, the temporary duty remains as a permanent one. This policy has done much to increase the cost of living, which is now alarmingly high—having increased by about 50 per cent. in 10 years.

**Germany and the Sales of Large Gas Engines.**—A Sales Syndicate has recently been established in Cologne by all the German builders of large gas engines. The object of the syndicate, which has been formed for a period of six years, is to equalise the orders given out between the different builders, and to institute a uniform set of sale and delivery conditions.

**Spain.**—La Sociedad Espanola de Electricidad Allemana Svenska is the name of a new company which has lately been formed in Madrid, with a capital of £30,000, to develop the sale of the Swedish Electrical Co.'s productions in Spain.

**Calendars and Diaries.**—FROM MESSRS. ALFRED GRAHAM & Co., St. Andrew's Works, Crofton Park, London, S.E., we have received a blotting pad worthy of a place on any desk, with a blotter diary at left hand, with ample daily spaces and calendars for 1913-4. Another souvenir of equally practical value from this firm takes the form of a useful pocket volume of some 250 pages containing speed and tide tables for 1913—daily tide tables for the principal seaports of the United Kingdom, port charges, knot tables, distance tables, electrical terms, engineers' tables, weights and measures, postal information and blank pages for memoranda.

THE WESTINGHOUSE BRAKE CO., LTD., of 82, York Road, King's Cross, London, N., has issued a wall calendar for 1913, with tear-off monthly sheets, each of which contains a half-tone illustration of a Westinghouse-Morse chain drive.

MESSRS. W. H. WILCOX & Co., of 38, Southwark Street, London, S.E., have issued their usual date remembrancer for the year. Each

monthly sheet being conspicuous for the abundance of illustrations of the manufactures supplied by them.

MESSRS. NAIDER BROS. & THOMPSON, LTD., of 34, Queen Street, London, E.C., have issued one of their new quite familiar handy-sized calendars, with monthly tear-off slips for 1913.

From MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., of Blomfield Street, London Wall, E.C., we have received a wall calendar of artistic design, with date slips for the year, each of which gives six working days, these slips being for the most part appropriately illustrated with pictures of the company's manufactures, &c.

Considered from some standpoints, the 1913 calendar of the JANDUS ARC LAMP AND ELECTRIC CO., LTD., is as "taking" as anything we have this year seen, though others, as we have already stated, are excellent from their special point of view. The picture, we understand, is reproduced from an original water-colour drawing, prepared for the firm by M. Connorton. It is quite different in style from their productions of the last year or two, and as there is no title or explanatory note we are left to guess the nature of the thoughts which give the charming damsel such heavenly satisfaction. We will resist the temptation to break forth into poetry concerning my lady's eyebrows, pretty lips, a thornless rose, and other features which move the soul even of the prosaic technical journalist. The Jandus Co. (Hartham Road, London, N.) will be pleased to send a copy to anybody interested in their manufactures.

MESSRS. MAJOR & COULSON, LTD., of 47, Broad Street, Mile End, Glasgow, have prepared a wall calendar for the year with monthly date slips with very plain figuring. An illustration of the "Pick-Quick" electric coal-cutter adorns the card.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, have issued a wall calendar consisting of 13 large monthly sheets up to, and including, January, 1914. Each sheet has the current month's dates in large type, and the previous and following months above in smaller type on the left and right hands respectively. Between these upper date spaces there is, on each sheet, a photographic half-tone reproduction of a colliery power station or textile installation, haulage gear, or other feature of the company's manufactures.

From the LIVERPOOL ELECTRIC CABLE CO., LTD., of Liverpool, we have received a very neat wall calendar for 1913. The monthly tear-off slips have very plain figuring. The upper half of the card contains a general view of the company's new works which were opened in June last.

As a New Year souvenir the BENJAMIN ELECTRIC, LTD., of 117, Victoria Street, London, S.W., have issued to all the London central station engineers and contractors one of their Benjamin telephone cards, whereon are printed the names and telephone numbers of all the leading wholesale distributors of electrical supplies to whom the engineer or contractor can telephone for his requirements. Spaces are left wherein to add the names and numbers of other firms with whom the recipient does business.

**Book Notices.**—*Willing's Press Guide*, 1913. London: 125, Strand. Fortieth annual issue.—Nothing new occurs to us in regard to this book. As we have said repeatedly, we find it a very conveniently arranged guide to the Press, whose cost (1s.) brings it within the reach of everybody having a use for such a publication.

"The Märkische Electricity Works." By Prof. Dr. G. Klingenberg. Fully illustrated description. From the Allgemeine Electricitäts-Gesellschaft, Berlin.

**Dissolutions and Liquidations.**—VACUUM ENGINEERING CO., LTD.—This company is winding up voluntarily, with Mr. J. A. Heiron, 30, Moorgate Street, E.C., as liquidator. A meeting of creditors is called for January 16th.

GEORGE REED, heating and electrical engineers, 11, Chapel Ash, Wolverhampton.—Messrs. G. Reed and F. W. Stubbs have dissolved partnership. Mr. Reed will continue the business, and attend to debts.

ELECTRICAL ADVERTISING CO., LTD.—This company is winding up voluntarily, with Mr. N. C. Meredith, 13 and 14, Abchurch Lane, London, E.C., as liquidator.

NATIONAL TELEPHONE CO., LTD.—Creditors must send particulars of their debts, &c., to the liquidator, Mr. Geo. Franklin, Telephone House, Victoria Embankment, E.C., by February 1st.

MICA SUPPLY CO., LTD.—A meeting is to be held at 19, St. Dunstan's Hill, London, E.C., on February 6th, to hear an account of the winding up from the liquidator, Mr. P. Farnan.

**Catalogues and Lists.**—THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Revised edition of the firm's telephone list (between 60 and 70 pages). This list differs from the last edition mainly in respect to the prices quoted, most of them being completely changed; contractors and others interested should, therefore, secure copies at once. The list is fully illustrated, and the contents cover direct-working, battery call and intercommunication telephones, central battery, military, navy and traction telephones, fire alarms, water level indicators, watchmen's tell-tales, &c. Also new small leaflets relating to "Magnet" nursery requisites, "Ideal" electric toasters, and Holophone office shades.

THE BRITISH INSULATED AND HELSBY CABLES, LTD., Prescot.—New leaflet (P. 122) containing illustrated description with prices of the Prescot automatic motor starters for continuous-current motors.

THE ENDOLITHIC MANUFACTURING CO., 61½, Fore Street, London, E.C.—Leaflets with samples of their metal, ivory and bone labels; also a sample of a metal advertising knife, with 6-in. rule marked thereon.

THE METALLIC SEAMLESS TUBE CO., LTD., Meta House, Birmingham.—Illustrated and priced leaflets relating to their popular lines of glass lamp shades.

MESSRS. SIMPLEX CONSULTS, LTD., 116, Charing Cross Road, London, W.C.—Four-page supplementary list, V2(453), in which they give prices and illustrated description of C.C. dynamos and motors, starters and slunt regulators. They are now introducing a range of these motors up to 20 H.P. and dynamos up to 17 kW. Another publication, Z1 (460), contains particulars and prices of the firm's new types of electricity meters, in addition to those shown in the recently issued general catalogue. Prices have been revised.

MESSRS. D. H. BONNELLA & SON, LTD., 58 and 60, Mortimer Street, Cavendish Square, London, E.C.—Electric bell catalogue, containing 44 pages of illustrations and clearly stated prices of a great variety of electric bell accessories, bells, indicators, batteries, wires, pushes, and so on.

MESSRS. AUSTIN WALTERS & SON, 57, Lower Mosley Street, Manchester.—22-page well illustrated and descriptive price list relating to their stage arc lamps, flame lamps, bunch lights for theatres and music halls, theatre dimmers, theatre battens, cinematograph stand-by resistances, &c. The firm have put down new machinery for the manufacture of electrical signs, and the list shows some of these—interchangeable letter signs, cinema signs, &c.

MESSRS. LANDIS & GYR, LTD., 28, Denman Street, London, S.E.—16-page catalogue containing illustrated particulars with tabulated prices of D.C. amper-hour and watt-hour meters, single-phase and polyphase meters, A.C. indicating wattmeters, special-tariff meters, change-over switches, time switches, and other manufactures of the same class. Diagrams of connections, also dimension sketches, are given.

MESSRS. WILSON HARTNELL & CO., LTD., Volt Works, Leeds.—New eight-page catalogue, containing general and technical description of their polyphase induction motors, with tabulated prices, dimensions, shipping weights, &c., for sizes from 2 to 100 H.P. A couple of pictures of the works are included.

**Trade Announcements.**—Mr. J. W. F. WARREN has left the service of the British Westinghouse Electric and Manufacturing Co., Ltd., to take up the management of Messrs. George Cradock & Co., Ltd., wire rope manufacturers, Wakefield. Messrs. Cradock have had a branch office in Johannesburg since 1897, and in addition to selling their own products have represented other British firms. We understand that they are now prepared to further represent electrical firms. Mr. Warren will sail for South Africa about the middle of February.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 109/111, New Oxford Street, London, W.C., announce that from 1st inst. they have taken over the agency of the Vereinigte Isolatorwerke, of Berlin, covering the whole of their manufactures with the exception of traction material, viz., Ambroin handles, shields, washers, bushes, terminal blocks, circuit-breaker and controller, arcing shields, insulated bolts, switch bases, meter boards, &c.

Owing to increased business, the STANDARD ELECTRICAL ENGINEERING CO. have acquired larger premises. Their address is now 39, Eastcheap, E.C. Telephone: "4934 Avenue."

MESSRS. W. V. WAITE & CO., LTD., have now established themselves at the Alpha Works, Taffs Well, Glam. They have concluded an agreement with Messrs. W. Partington & Co., of Taffs Well (who have for some years carried on business in electrical repair work), for whom they will now act as sole concessionaires.

THE "RADIUM" ELECTRIC CO., of 82, Hatton Garden, London, E.C., announce that in order to avoid patent litigation they have given up the sale of their "Radeo" squirted filament lamp—except for export—and have now been appointed special factors by the Tungsten Lamp Association for drawn-wire Osram, tantalum, Mazda, Wotan, or any other conference lamps, which they can offer at the full conference discounts. They will hold large stocks of all these makes.

MESSRS. FITTERS PATENTS, LTD., have taken additional offices in the City in order to cope with increasing business. All communications in future should be addressed to 20, Bishopsgate, London, E.C. Telephone No.: "London Wall 6779."

THE ARMORDUCT MANUFACTURING CO., LTD., of Farringdon Avenue, London, E.C., have acquired the sole licence for the manufacture and sale of Mr. Napier Prentice's "Lightning" cooking oven, which will be on the market some time in February.

**Annual Dinner.**—The Annual Dinner of the drawing office staff of MESSRS. WILLANS & ROBINSON, LTD., was held at the Grand Hotel, Rugby, on Friday, December 20th. The chair was taken by the chief draughtsman, Mr. E. R. Briggs, who presided over a large and representative gathering, including Mr. Peache, Mr. Davenport, Mr. Bennett, and representatives from all departments. Telegrams of regret were received from Mr. Hemmings, who was away on the company's business, and from Mr. Symonds (an old Willans man), of the Brush Co.; Mr. Cox and Mr. Elborne were also unavoidably absent. After the usual loyal toast, the chairman proposed the health of "The Directors," and expressed great satisfaction in being able to welcome two directors this year to their dinner. Mr. Davenport, in the course of an appreciative reply dealing with the company's work, bore special testimony to the spirit of loyalty and honest work that was so prominent a feature in all ranks of the company's staff, and expressed the opinion that such an asset, coupled with the confidence which customers were exhibiting, were hopeful omens for the company's future. Mr. Peache also spoke, and said that Mr. Briggs had told them that he had made a special journey to Rugby on purpose to be present at the dinner, and he could only say that in finding himself among them all he felt fully rewarded. His connection

with the company dated back many years, to the days when the building of steam launches on the Thames constituted its main business. It was a regret to him that he saw to-night so few of the old faces round him. It rested with each one to do his level best and back up Mr. Davenport in his arduous task, and to see that so far as in him lay the company should win back to its old prosperity. Mr. Prosser proposed the health of "Friends, Absent and Present," and noted that the company was losing the services of Messrs. F. W. Stokes, J. Burns and the Brothers Pfeleiderer. He wished them every success in their new sphere of work. Mr. Wood responded to the toast. Mr. Pocock and Mr. Wells, who represented the company in Australia and Canada, were remembered by letters of greeting, which were signed by everyone present. The toast of "The Ladies" was proposed by Mr. Bennett, and Mr. Nitschke responded on their behalf. An excellent musical programme was arranged by the secretaries, Mr. Gardner and Mr. Seymour.

**Trade in 1912.**—We have received an advance proof of the "Annual Trade Review of the Chamber of Commerce Journal." It is an interesting and valuable document, and in the Section relating to electrical trade statistics the following values and weights are given to show the course of the export and import trade in electrical goods for the 11 months ended November 30th, 1911 and 1912:—

**EXPORTS:—**

Electrical goods and apparatus (other than machinery and telegraph and telephone wire)—	1911.	1912.
British ... ..	£2,607,052	£4,049,758
Foreign ... ..	179,588	205,699
<b>Electrical machinery—</b>		
British ... ..	20,601 tons	21,838 tons
Foreign ... ..	£1,638,849	£1,780,832
	530 tons	5,242 tons
	£54,136	£63,486

**IMPORTS:—**

Electrical goods and apparatus (other than machinery and telegraph and telephone wire) ... ..	1911.	1912.
British ... ..	£1,296,848	£1,320,182
Foreign ... ..	974,627	1,056,181
" " ... ..	8,673 tons	8,145 tons

Messrs. Switchgear & Cowans, Ltd., of Salford, report that their works in Springfield Lane were fully occupied during 1912. The more interesting items constructed included E.H.T. transformers ranging from 40,000 volts to 60,000 volts and from 5 to 50 kw. Remote-control oil switches for very large capacities operating chiefly at 6,600 volts and at 12,000 volts also deserve to be mentioned as forming a feature of last year's output. The firm's patterns of mining switchgear have been standardised, and a draw-out system has been developed. Star-delta and automatic transformer starters have been remodelled and their operation made entirely independent of the attendant, who has merely to switch on. A new patent has been applied for, for improvements in the Statter patent time lag, and patterns have been standardised, providing for independent adjustment both of the time and the current settings. Complete central-station equipments of switchgear for several important stations at home and abroad have been completed during the year, and the contracts in hand include switchgear equipments for Manchester, the London County Council, Hull, Kingston-upon-Thames, Montreal, Windermere, Seville and other places.

Messrs. Leopold Farmer & Sons, surveyors, auctioneers and factory specialists, London, report that the sales and letting of factory property, wharves, land, &c., in the year under review, show better results than was the case in 1911, the boom in trade in the industrial world having given a great impetus to the development of new industries, and the consequent establishment of new works. Prices have been maintained, and sales transacted at good times prices. They would not, however, convey to the reader that the standard of values has been kept up, as hardly two factory properties are alike. The tendency is for the price to rise, consequent on the improvement by development in certain manufacturing areas which have special advantages in rail, waterside and other facilities, but the migratory movement amongst manufacturers is to districts outside large towns where the lowest possible cost of manufacture can be obtained. The values of industrial properties have not to any great degree been affected by the Budget Taxation of 1909, but as regards other securities in landed property, a shrinkage is noticeable. It is difficult to say which branch of any particular manufacture more than any other has progressed in the year 1912, as there are many influences affecting industrial operations and the development of commercial enterprise. Acquiring of factories, &c., building of works consequent on re-organisation and extension in many trades, are always in progress. Owing to the flourishing state of trade, great developments have taken place in the year under review, especially in the following:—Engineering, milling, chemical, spinning, motor and rubber trades. The effects of the Patents and Designs Act are still well to the front, a sum amounting to about 1½ millions having been expended in the acquiring of land, building of factories and plant, and machinery equipment, and the consequent employment of some thousands of workpeople. Foreign holders of English patents are still on the lookout for factory property to comply with the requirements of the Act, and several areas in and around London and the provinces have been developed in consequence of the establishment of important industries which give employment to thousands, and additional rates to local and other attendant authorities. The out-

look ahead for further deals in factory property is good, as there is every likelihood of a continuance of prosperous activity in the industrial world.

A Scottish correspondent writes:—"Electrical engineering firms in the West of Scotland are active and have an excellent order book. Trade has been good of late months, particularly with firms who specialise in work of a distinctive type. Messrs. D. and J. Tullis, Ltd., Glasgow, have in hand important contracts in connection with the equipment of electrically-driven steam laundries on board large passenger ocean liners. Another Glasgow firm, Messrs. Drysdale and Co., Ltd., do a large trade in fitting up electrical-driven pumping sets for power stations. They have work in hand to supply establishments at home and abroad, and look forward to the new year with satisfaction. In connection with marine work the introduction of electricity as applied to steering gear is taking a firm hold. Especially is the patent electric hydraulic steering getting into favour with marine engineers. A set is at present being supplied to a British warship now building. Messrs. John Hastie & Co., Greenock, are doing a considerable amount of work with the "Hele-Shaw-Martineau" electric hydraulic steering gear: and are executing orders for motor-driven ships. Messrs. Davis and Primrose, Leith, specialise in bevelling machines, for which they hold the patent. One of their bevelling machines for the British Naval Dockyards is for dealing with angle and other sections up to 14 in. broad and 1½ in. thick. This machine weighs more than 20 tons, and is driven by two electric motors. Another machine is on its way to Japan; and machines have been supplied to Portuguese, French, Russian and Norwegian shipyards. Messrs. Mavor & Coulson, Glasgow, are busily engaged upon electrical mining apparatus. At present an extension of workshop accommodation is in hand. Messrs. Osborne & Hunter, of Glasgow, are equipping a factory with a 100-h.p. Diesel oil engine to drive the electric generating plant. Messrs. Anderson & Munro, Ltd., Glasgow, have a considerable amount of work on the domestic side of electric power. The Electric Control, Ltd., have shipped abroad a large number of automatic lift controllers of all types. The automatic control gear, with special speed-regulating and unloading devices, is being supplied to the Admiralty and to shipbuilding firms for the economical control of compressed air plants. Messrs. Frederick Braby & Co., Ltd., Glasgow, have had their electric-welding department working at the highest pressure. They turn out large quantities of large steel-riveted and welded cylinders, cisterns and tanks for oil, petrol, and other purposes. Sir William Arrol & Co., Glasgow, have a considerable amount of work in hand at their crane works, Parkhead. Messrs. Brown Brothers & Co., Ltd., Edinburgh, have an extensive order department for their steering gears, particular attention being given to the electro-hydraulic type. In the textile engineering trade electricity is being introduced in various ways in connection with improvements in detail of spinning and weaving machinery. One of the most recent is the electric rove-stop motion for the spinning frame. Demonstrations in Dundee have been very satisfactory, and the apparatus is now seen in several of the Dundee mills."

## LIGHTING and POWER NOTES.

**Accrington.**—At a meeting of the Electricity Committee it was reported that the L.G.B. had sanctioned the borrowing of £300, repayable within 30 years, for the erection of the Clayton-Leamons electrical sub-station.

The question of adopting an improved system of lighting in the Accrington Market is to be gone into by the Town Hall and Market Sub-Committee in consultation with the electrical engineer.

The B. of T. has consented to the scheme of overhead street lighting and wiring, subject to the work being in accordance with regulations, the Board reserving the right to review at the end of five years. The electrical engineer reports that the gas-making plant is almost complete. Last week the plant was run 10 hours daily under full-load conditions with not one involuntary stop, and all indications point to a successful issue of the installation.

**Batley.**—Very active opposition is being displayed against the proposals of the Corporation Electricity Committee to expend £16,000 in extensions to the electricity works, and the controversy is arousing considerable interest in the heavy woollen district. Ald. Blackburn, one of the opponents, maintains that the advocates of extension, upon their own estimates, if they spend £16,000 on new steam generating plant cannot hope to reduce their bare generating costs to less than 0.533d. per unit, exclusive of management, distribution, interest, depreciation and sinking fund charges.

**Bath.**—A L.G.B. inquiry has been held into an application by the Corporation to borrow £8,000—£3,000 for extension to Weston (being part of the added area under the boundaries extension scheme) and £5,000 for prospective expenditure in the next three years—in respect of the city's electrical undertaking. The application was stoutly opposed by the Bath Gas Light and Coke Co. The town clerk, replying to the criticisms of counsel, pointed out various directions in which the undertaking was hampered, and he trusted the Inspector would report to the L.G.B.

that the undertaking was suffering from certain serious disadvantages, that they were entitled to sympathy, that they had struggled for a long period against adverse circumstances, and when substantial loans matured they hoped to be able to put into the pockets of the ratepayers some dividend.

The E.L. Committee has decided to recommend the Council to accept from the Diesel Engine Co., Ltd., the engine supplied, as one of 340 kw. (instead of 450 kw. as originally contemplated), at the cost of £4,240, instead of the original price of £5,451, the company also paying the Corporation the sum of £1,730 as compensation for the delay which has taken place, and for the loss of economics resulting from the reduction of capacity. The Council is also recommended to apply to the L.G.B. for the necessary modification of consent to borrow, which has been issued for the sum of £7,500 and will be now required only for the sum of £6,289, covering cost of engine, auxiliaries, foundations and fixing.

**Belfast.**—An influential deputation representing large ratepayers attended before the T.C. last week in connection with the proposed extension of the Corporation's generating plant. A memorial was presented asking that the matter should be delayed, partly because the present time was unfavourable for borrowing large sums of money, and partly because the rapid development of the Diesel engine might, in a year or two, enable the Corporation to effect substantial savings if it were adopted. It was pointed out that Messrs. Harland & Wolff were taking a great interest in the Diesel engine, and that their view of its future could not be ignored. The chairman promised to give the matter full consideration.

**Bridlington.**—The Overseers have decided to ask the B. of G. to call in the services of an expert to reassess the undertakings of the Bridlington T.C., including the electricity works.

**Continental Notes.**—**GERMANY.**—The Newmark Electrical Union (Elektricitäts-Verband Neumark) will have, on the 1st of the current year, no fewer than 62 localities connected to its high-pressure distribution system in the province of Brandenburg. —*Elektro. Zeitschrift.*

A union of municipal electricity undertakings in Saxony has lately been formed in Dresden. Among its objects are (1) the maintenance of municipal ownership; (2) to endeavour to prevent monopolies being secured by private capital; and (3) the establishment of a joint purchasing office.

**NORWAY.**—The municipal authorities of Christiania have decided to develop the water power of the Hallfred-Sollberg Falls, situated some 40 km. from that city. Their capacity is equal to 27,000 H.P. The installation costs, including that of the long-distance mains, are estimated at 11,000,000 marks. In connection with this departure the T.C. intends to disburse a sum of 1,750,000 marks in the extension of the equipment of the municipal power station, including the acquisition of two three-phase turbo-generators of 5,000 and 6,000 kw. each.

**BELGIUM.**—Two new engines and dynamos, each of 2,000-kw. capacity, have recently been added to the central station of the Société d'Electricité du Brabant, at Oisquereq. The company has now secured the concession for the supply of current to 15 small towns and villages in the district, its power station having a capacity of 6,000 kw.

**Conway.**—At a meeting of the Lighting Committee the question of electric lighting came up for consideration, and it was decided, before adopting any particular scheme, to inspect the electrical plant at the Oakwood Park Hotel.

**Cromer.**—At a ratepayers' meeting on Friday, convened by opponents of the proposed transfer of the electric light undertaking by the U.D.C., there was a majority of 53 against the proposal. The votes registered numbered 133, three of which were invalid.

**Cuckfield (Sussex).**—Subject to certain stipulations, the U.D.C. has decided to give its consent to the prov. order for electric supply being applied for by the Mid-Sussex Electric Light Co.

**Dartford.**—A supply is to be given Messrs. Vickers, Ltd., at their works at Crayford, over the light railway cables, at a charge of 1d. per unit for a guaranteed consumption of 100,000 units per annum.

**Dewsbury.**—The Corporation has come to an arrangement with the Yorkshire Electric Power Co. under which the latter agrees to give the supply of electricity for lighting purposes in Thornhill through the Corporation.

**Eccles.**—The L.G.B. has sanctioned the borrowing of £870 for the purposes of the electricity undertaking.

The Electricity Supply and Public Lighting Committee has decided to ask the Member for the Division to support the Sheffield Members of Parliament in the endeavour to re-instate in the House of Commons, Clause 83 of the Sheffield Corporation Bill, 1912, dealing with electrical fittings.

**Hebburn and Felling.**—The Northern Counties' Electricity Supply Co., Ltd., is seeking powers to purchase the electrical undertakings of the Hebburn and Felling U.D.Cs., which it is at present working under agreements.

**Kettlewell (Yorks).**—The formation of a private company, composed of villagers and including the local postmaster and schoolmaster, at Kettlewell, a village high up in the Yorkshire Craven hills, adds one more to the growing list of small places

which, for their lighting facilities, are jumping straight from the use of the primitive oil to electricity. Amongst these places the Craven district already contributes Ingletton, Gillingham, Clapham and Horton-in-Ribblesdale. In the case of Kettlewell a capital of £625 has been gathered by the company. As is usual in such places the village stream is to be harnessed as the means of generating current.

**London.**—**WOOLWICH.**—The Electricity Committee reports having considered the desirability of arranging reciprocal supplies with adjoining electricity supply undertakers, in order that applicants in outlying districts of the borough and also in adjoining areas may be supplied at a minimum of cost to the undertakers concerned in the laying of feeders, &c. To carry out this proposal, it has been decided to make application to the B. of T. for its permission to give and take a bulk supply from the West Kent Electric Co., and for a give-and-take supply from the South Metropolitan Electric Light and Power Co. £19,000 is to be borrowed on account of carrying out extensions at the Globe Lane works.

**Northwich.**—The R.D.C. has consented to the application to the B. of T. by the Weaverham Electricity Supply Co., for a prov. order for electric supply within the Council's area.

**Nottingham.**—Some time ago we referred to the proposal by a member of the Corporation, that expert advice should be obtained as to the hydro-electric possibilities of the Trent near the city. In the result, Mr. E. W. Monkhouse has now reported on the proposal, showing that to equip plants at Beeston and Colwick weirs would cost £52,869; that these plants, working at 61 per cent. load factor, should yield a profit of over £12,000, but if working at 22 per cent. load factor a loss of £191—while a modern steam station at the same capital cost and 22 per cent. load factor would yield a profit of about £9,000 per annum.

Taking into account the uncertainty of the hydraulic conditions and other circumstances, Mr. Monkhouse considers that the Corporation would be well advised to give up the idea of utilising the Trent and to utilise modern steam plant.

In view of the extraordinary ideas as to water power which prevail, it is interesting to note that Mr. Monkhouse finds that 160 B.H.P. can be obtained from the Trent at Beeston and 180 B.H.P. at Colwick, at low water; the power increases to a certain point with higher water and then decreases to nothing as the weirs are "drowned."

**Nova Scotia.**—According to the *Financier*, steps are being taken to develop the local River Mersey, from which it is estimated that about 30,000 H.P. can be obtained. Four power plants already exist in the lower reaches, and it is now proposed to raise the level of First Lake some 20 ft. and build three other dams at intervals, with a view to making further use of the water power.

**Oldham.**—The Electricity Committee has had under consideration a report by Mr. Newington, the engineer, embodying proposals for an extension of the plant which has become necessary owing to the exceptional increase this year in the maximum demand for lighting and power purposes, and to an application having been received from two mills for a supply of energy for power purposes, requiring in all about 800 or 900 H.P., or, say, 650 kw. The engineer recommends the immediate installation of one turbo-alternator of 1,500 kw., and two motor alternators of 500 kw. each, together with the necessary condensing plant, switchboards, foundations, &c., and one additional motor-driven pump for raising the water to the cooling towers, at a cost estimated in round figures at £13,000. The Committee decided to recommend that application be made to the L.G.B. for sanction to borrow £30,000, which is made up as follows:—Additional plant at the station, £13,000; mains, £9,500; transformers and switchgear, £1,200; future mains, £5,000; future transformers, £1,300.

**Reigate.**—The T.C. has decided to extend the lighting mains to the Reigate Lodge estate, which is being developed, on condition that current is used for all the public lighting there.

**St. Helens.**—The Electricity Committee of the T.C. has decided to supply current for heating purposes at 1d. per unit.

**South Africa.**—Two more sets of turbines and generators, each of 10,000 kw. capacity, have just been completed by the A.E.G., of Berlin, at the Vereeniging station of the Victoria Falls and Transvaal Power Co.; two additional 12,000 kw. sets are nearly ready, and when completed the capacity of this station alone will be about 70,000 H.P. The total generating capacity of all the stations erected and equipped by the A.E.G. for the Victoria Falls and Transvaal Power Co. will then be no less than 230,000 H.P.

**South Africa.**—The Durban Corporation is proposing to spend £176,000 on electrical construction and plant during the year. Electric lighting schemes are being promoted in Ladybrand, Somerset West, and Umtali (Rhodesia), and an extension of the town supply to adjoining areas at Pretoria.—*South African Export Gazette.*

**Tilbury.**—The U.D.C. has now given its consent to the application of the County of London Electric Supply Co. Ltd., for a prov. order for electric supply.

**Tyldesley.**—The Power Co., which holds the rights of supply of electricity in the township, has made arrangements with the Tramways Co. to give it a supply of current in bulk, and a plot of land in Castle Street has been taken for the erection of a transformer station.

**Turton (near Bolton).**—The U.D.C. has agreed to the Lancashire Electric Power Co. laying a trunk main cable from Horrobin Mill to Belmont Bleachworks.

**Wakefield.**—A Committee of the West Riding C.C. has accepted the offer of the Wakefield Corporation to supply electricity for the County Offices and adjacent offices, at the current rate for the time being, provided the rate does not exceed 4d. per unit, and subject to a discount of 11 per cent. Consideration had been given to a scheme for the C.C. to generate the electricity needed.

**York.**—A recent debate in the York City Council on the proposed purchase of the Gas Co.'s undertaking is of more than usual interest, as the leading advocates of this purchase are the chairman, vice-chairman and other members of the Electricity Committee. We cannot pretend to understand the reason for their attitude, as the electricity supply department will be the loser by the stifling of competition which naturally follows when both electric and gas supplies are controlled by the Corporation. Moreover, there is every indication that the price of electricity can and will be greatly reduced in the near future, and that the prospects of competing gas undertakings will be correspondingly affected—this being already apparent in some localities.

The manager having reported that he can undertake the electrification of the proposed tramways extension at a saving of £353 on the lowest tender received, the Committee has decided to recommend the Corporation that the work be carried out by its own staff.

## TRAMWAY and RAILWAY NOTES.

**Argentina.**—The Buenos Ayres correspondent of the *Daily Telegraph* writes as follows:—"There is a startling sequel to the recent decision in the injunction proceedings of the Anglo-Argentine Tramways Co. v. the Metropolitan Railway, which were decided in favour of the plaintiffs, on grounds that permission was never given to the defendants to make tunnels, and that the municipality so certified. The Metropolitan Railway now produces a certificate of Intendente Giraldez, showing a decree of Intendente Bullrich in 1901 authorising the tunnelling; and also correspondence with the Director of Public Works referring to the opening of shafts. Evidently a serious mistake has been made, and the vexed question as to who owns the real right to construct underground lines is still undecided."

**Australia.**—According to the *Financier*, the New South Wales Minister for Works announces that steps will be immediately taken to put into operation a portion of the scheme drafted by Mr. Hay, for dealing with Sydney's traffic. It is proposed to carry out the first section of the city underground railway, at a cost of between £250,000 and £300,000. In view of the completeness of Mr. Hay's report upon Sydney's traffic problem, the Minister considers a reference to the Works Committee unnecessary, and proposes to introduce a short enabling Bill in Parliament in lieu thereof, which will effect a considerable saving of time and money.

**Bristol.**—At the last meeting of the C.C. the question was debated as to the desirability of tramway purchase by the municipality. After some discussion, a committee was appointed to deal specially with the matter, and to report as to the desirability or otherwise of exercising the option vested in the Corporation of purchasing the tramway undertaking within the city.

**Barton-upon-Irwell.**—The Board of Guardians has decided to approve the recommendation of the Assessment Committee to appear as respondents in the appeal of the Salford Corporation Tramways Committee against the present valuation and assessment of the tramways in the Eccles and Swinton areas. Mr. Everett (chairman of the Assessment Committee) said there had been several objections by Salford during the past two or three years as to the amount of the tramways assessment, and last year a temporary arrangement was arrived at involving considerable loss to the rates. There had been conferences with the Salford Tramways Committee, and the town clerk had formulated a new scheme that all tramways ought to be valued for assessment on the parochial system, i.e., a method whereby inspectors take a special census of the tickets issued to and from the localities concerned, and then it is decided what proportionate value of such tickets is due to Swinton and Eccles. This had been done on a given day by the tramways authority, and on the basis of that result they were appealing against the assessment. Barton Union covers an area through which three tramway authorities have running powers, and the point at issue is a very important one for both rating authorities and tramway committees.

**Clayton-le-Moors.**—There has been a good deal of talk in the Clayton-le-Moors district of Lancashire about a scheme for the construction of a light railway connecting Clayton with the Lancashire and Yorkshire Co.'s main line between Acerrington and Huncoat, but the railway company (who agreed, after the scheme had been set on foot locally, to take the project over and secure the necessary Parliamentary powers) have now intimated that owing to "financial and other considerations" there is no immediate prospect of the construction of the line.

**Cuba.**—La Sociedad Tranvias de Matanza has secured a concession for the construction and working of an electric tramway—on the overhead trolley system—in the town of Matanza.

**Continental Notes.**—**FRANCE.**—A new company has lately been formed at Bayonne, with a capital of £40,000, and the title *La Compagnie des Tramways Electriques de la Ville de Bayonne*.

**ITALY.**—La Società Tranviaria Elettrica Littoranea Viareggio-Versilia has entered into an arrangement with the municipal authorities of Carrara for the construction and working of an electric tramway to connect the town of Carrara with the sea-coast. A scheme for the construction of an electric tramway between Viareggio and Carrara is also at present under consideration.

The proposed conversion to electric traction of the railway between Napoli Pozzoli and Torre Gaveto, with the doubling of the track between Terme and Fuorigrotta, has received Government sanction.—*Giornale dei Lavori Pubblici*.

**SWITZERLAND.**—A company has lately been formed in Andermatt with a capital of £48,000, and the title *Die Schollenenbahn Gesellschaft*, to construct and work an electric railway between Schollenen and Goschenen.

The Berner Alpen Railway authorities, who are electrifying their Lotschberg section, are reported to have placed orders with the Oerlikon Co. and with Messrs. Brown, Boveri & Co., of Baden, for the electrical equipment for 12 2,500-H.P. electric locomotives.

**HUNGARY.**—Plans have been completed for the construction of an electric railway between Czinkota and Ratosliget for the Budapest Local Railway Co. The work is expected to be commenced in the spring.

**RUSSIA.**—According to the local Press, the Commission for New Railways has approved the project for an electric railway from Riga to Riga Strand, subject, however, to the assent of the Riga Municipality being obtained. This condition was inserted because a section of the proposed line would run through the suburbs of the town.—*Board of Trade Journal*.

**GERMANY.**—An electrically-operated ventilating installation is being carried out at the Kaiser Wilhelm railway tunnel near Treves. A shaft is being sunk from the mountain top to the centre of the tunnel, which is described as being the longest in Germany. The plant, which will be of several hundred horse-power, will be located on the mountain, and will draw the foul air from the tunnel up the shaft. The necessary electrical energy for the plant is to be supplied from the Treves Municipal electric lighting station.

**Eccles.**—A deputation has been appointed to meet the Salford Tramway Committee with a view to discussion of the terms of future supply to avoid, if possible, the costs of an arbitration.

**Halifax.**—The Corporation Parliamentary Bill, which has been issued in printed form to the members of the Council, includes application for borrowing powers for tramways, amounting to £147,738, for electrical equipment and other works in connection with the said tramways, £25,000; and rolling stock, £22,200. The most important clause in the Bill provides that notwithstanding anything to the contrary in Sec. 13 of the Tramways Act, 1870, a local authority shall not purchase the tramways in its district before the expiration of 31 years from the passing of this Act. The tramways embodied in the Act are to be completed within five years, and the Corporation's powers shall then lapse. In the case of Brighouse, it is agreed between the Halifax and Brighouse Corporations, that the extension to Rastrick shall be carried out within 18 months. Agreements are set out in the schedules of the Bill with Brighouse, Soyland, Stainland, Greetland, the Halifax Rural District Council, Shelf, Sowerby Bridge, and Hipperholme, but not with Hebden Bridge or Elland.

**Lancs. and Yorks. Electrical Lines.**—The newly-electrified (H.T., D.C.) line between Bury and Holcombe Brook is expected to be completed in the course of the next month.

**Liverpool.**—Another remarkable increase is shown in the Corporation tramway receipts for 1912. The full returns are not yet published, but from January 1st to December 28th the receipts amounted to £625,163, an increase over 1911 (which was a record) of £26,977. The passengers carried numbered 133,228,898, as against 128,206,669, an increase of 5,022,229. The mileage in 1912 was 12,496,300, being an increase of 141,968 miles as compared with 1911.

**London.**—With a view to facilitating the loading and unloading of the trains during rush hours, the Piccadilly Tube authorities have been experimenting with systems of centre doors on the coaches, and have apparently satisfied themselves as to the merits of a type of double swing door, with electrical indicating lamps, to show when shut or open, on the conductors' and drivers' platforms. If the arrangement is adopted it is assumed that the other Tube lines will take it up.

**Manchester.**—The question of the provision of light glass shelters over the pathways at the principal car-stopping places in the city is to be brought before the City Council, with a view to securing the consideration of the Tramways Committee.

**Nelson.**—At the T.C. on January 2nd the chairman of the Tramways Committee said that he and the tramways manager discussed recently the question of providing a double track between the centre and Hildrop Road. A lot of time was lost through cars having to wait on the loop, and people could walk the length in the time.

**Rotherham.**—The Parliamentary Committee reports having had under consideration the proposal of the Mexboro' and Swinton Tramways Co., to apply for powers to run trolley vehicles in certain districts adjoining the town. The Committee has decided

to obtain from the company an undertaking that if, in the event of the Corporation not opposing its application to run trolley vehicles to Conisburgh, it will agree, if the Corporation applies for powers to run trolley vehicles to the same place, not to oppose the proposal of the Corporation.

**Sheffield.**—The Joint Sub-Committee of representatives of the Tramways and Electric Light Committees has issued its report as to whether, in connection with providing an additional supply of energy for the tramways, the two separate generating stations at Kelham Island and Neepsend should continue to be extended on different systems, entirely isolated, so that the tramways could not obtain any assistance from the large Neepsend station, or matters should be so arranged that these two large supply stations would both be available for supplying energy to the tramways. After going into the matter fully, the Sub-Committee recommends:—(1) That it is not advisable to continue to develop the Kelham Island power station as a separate and isolated unit, but that it is advisable to take steps at once to connect the two stations and install converting plant at Kelham Island; and that a supply of energy be taken as and when thought necessary and advisable by the tramways department from the Neepsend station, by which means both stations will in future be available for the supply of energy to the tramways; (2) that two 1,500-kw. converter sets be put down at Kelham Island as early as possible to deal with the power supply from the Neepsend station; (3) that the prices and conditions which the electric supply department offer for this purpose be adopted. [The charge is based on £4 per kw. per annum plus 25d. per unit supplied, and ranges from '615d., 30 per cent. L.F., to '360d. 100 per cent. L.F.] (4) That tenders be obtained for the necessary plant, &c., for the carrying out of the arrangements. In arriving at its decision the Sub-Committee states that whilst the supply from Kelham station has been regularly maintained at a low working cost, the tramways had developed on larger lines than was originally expected when the Kelham site was decided upon and plant first installed there. The position of the Kelham station is such that there must always be a considerable handicap attached to the working of the station. The Neepsend site and station has been developed on larger lines as a result of more modern experience gained during recent years, and can now supply and provide in the future the additional power required for the tramways.

It has been decided by the Tramways Committee, by resolution, to recommend the grant of £2,000 from the special purposes fund of the tramways, towards the cost of the extension buildings in connection with the Applied Science Department of the Sheffield University. The decision to make the grant is the outcome of a letter from Sir Joseph Jonas to Sir Wm. Clegg, in which Sir Joseph stated that the efforts to obtain from the Treasury a special grant had been unsuccessful, and it was therefore necessary to raise what was required from other sources. The total sum required is £12,000, and this amount Sir Joseph has set out to obtain.

**Siam.**—It is reported that La Compagnie Mutuelle de Tramways, of Brussels, is negotiating the formation of a large new company to undertake the establishment of an electricity station in Bangkok for the supply of current for lighting and power purposes, and for tramway operation in the Siamese capital.

**South Africa.**—According to the *South African Export Gazette*, the Durban Corporation has decided to spend £150,000 on tramway extensions; the extension of the Pretoria municipal area will involve further tramway construction; and the Krugersdorp Council, although considering the preliminary use of petrol-electric buses, has earmarked £45,000 for a future tramway scheme.

**U.S.A.**—According to the *Financial News*, the beginning of the electrification of the trans-Continental railways is marked by the grant to the Great Falls (Montana) Power Co. of permission to transmit power for the electrification of 450 miles of track on the main line of the Chicago, Milwaukee and Puget Sound Railway between two points in Montana and Idaho.

**Warrington.**—The Electricity and Tramways Committee has decided that the tramways manager prepare a map showing the existing tramways and his suggestions for new routes for the proposed motor-omnibuses, and that a copy thereof be supplied to each member of the Committee.

## TELEGRAPH and TELEPHONE NOTES.

**Brazil.**—The Brazilian Government has concluded an important contract with Marconi's Wireless Telegraph Co. for the provision of powerful stations at Rio de Janeiro, Santa Martha, Bauru, and Ladario, the two last-named being important towns in the Sao Paulo and Matto Grosso regions. These stations will form the Southern nucleus of the Brazilian internal wireless network first proposed by Dr. Bhering, the delegate of the Brazilian Government to the recent London Radiotelegraphic Conference. In all, not fewer than 30 such wireless stations will be required for the main lines of Dr. Bhering's scheme to be realised, and the Marconi Co.'s success in obtaining the contract for the four stations now to be erected in the South is the result of the very satisfactory working of the Manaus and Porto Velho stations which form the Northern nucleus of the general scheme. These stations are situated in the tropics on the Amazon River, where severe electrical storms are almost continuously experienced.

**France.**—The French Post and Telegraph authorities have decided on the establishment of a large new telephone exchange in Paris, on the site of part of the old Cherche-Midi Military Prison.

**Japan.**—Some difficulty is being experienced by the Japanese telegraph service owing to the damage caused to the submarine cables off the coast of Japan by fishing trawlers. Owing to the profitable nature of the business, there has recently been a large increase in the number of trawlers, with the result that an interruption of the cable service is frequently caused. The authorities of the Government Telegraphs and Agriculture Departments are at present conferring as to the steps to be taken to overcome the difficulty.

**Persia.**—The Minister of Posts and Telegraphs has authorised the Indo-European Telegraph Department to reconstruct the Arabian telegraph lines with iron poles. The result will be to ensure reliable international telegraphic communication with such places as Ahwaz, Shusta and Mohamerah. All the existing concessions of the Department have been renewed until 1915.

**New Zealand.**—Our Wellington correspondent reports that owing to the rapid rate at which subscribers are being added at the four principal cities, it has been decided to make any future extensions such that the exchanges can ultimately be converted to automatic working.

The Wellington and Auckland exchanges are nearing the limit of their capacity, and the Minister of Post and Telegraphs has announced that tenders are to be called immediately for automatic exchange apparatus to be so constructed that it can be used in conjunction with the existing magneto system. The chief electrician of the Department made an extended tour recently through the United States, England and the Continent, and has reported very favourably on automatic systems generally. The Strowger Co. erected a demonstration board of about 20 lines in Wellington, and this has been in operation for several months with satisfactory results. The growth of several of the smaller towns is proceeding at such a rapid rate that there is a probability of several of them also being served on the automatic or semi-automatic systems.

**South Africa.**—Telephone developments to cost £8,000 are contemplated at Durban.—*British and South African Export Gazette.*

**The Imperial Wireless System.**—On Wednesday, January 1st, the Select Committee of the House of Commons resumed the inquiry into the Marconi contract. Major Archer-Shee, M.P., gave evidence, repeating his contention that the Marconi Co. had received special consideration from the Post Office, and stigmatising as a monstrosity the clause which bound the Government for five years to adhere to the Marconi system (the clause has been dropped). If the Marconi Co. received £50,000 a year from the royalty, he said they would be able to buy up rival patents. He suggested that the agreement of 1909 gave the Postmaster-General power to use any Marconi patent, and said that the Government should invite tenders, and have the stations built under their own control. He had been offered shares in the Poulsen Syndicate in 1911, and again last year, but refused them, being interested in a State-owned Atlantic cable. Mr. Gandil, who represented the Danish owners of the patents, had informed him of the way in which the Post Office had dealt with the offer of the Poulsen Co. He had no interest in any wireless company. The speed of transmission contracted for was totally inadequate. The Poulsen Co. had proved that they could send messages over 2,000 miles at a speed exceeding 100 words a minute. Other systems were, or soon would be, capable of sending at the same rate. The speed contracted for should be subject to revision after five years. In December, 1911, by trial he found that the Marconi trans-Atlantic service took three times as long as the cable to transmit a message; but on December 30th, 1912, it got through much more quickly. In his opinion, the cable system was more efficient, but wireless would be a most valuable auxiliary. He suggested that the Committee should present an interim report, recommending that the acquisition of sites and the erection of buildings should be proceeded with immediately, while the best system was selected at leisure by a technical Committee. Under the agreement the Marconi Co. would be able to create a great wireless trust.

Mr. Viggo Gandil, representing the owners of the Poulsen-Pedersen patents, said that early in 1911 he was forming a British company to work the system, and to establish a service between the United Kingdom and Canada. Learning in October, 1911, that an Imperial scheme was under consideration, he asked the Post Office for an opportunity to tender, and on January 11th, 1912, he voluntarily submitted an offer to build six stations for £40,000 per station, including the power house and foundations. For the wireless equipment alone of the Indian station he named a price of £22,000. On January 18th, 1912, he met the Postmaster-General, and offered to give a demonstration of wireless telegraphy across the Atlantic in six or, at most, eight months; he pointed out that it was impossible to raise capital for a wireless scheme without a guarantee that the Government would grant a licence, that the stations would not be liable to be acquired by Government on its own terms, and that the Government would not erect competing stations. On January 19th, on behalf of the Postmaster-General, Mr. Farnall asked if he would sell all the unsold Poulsen patent rights for the whole world, but he declined. He further offered, on January 29th, to build stations in Ireland, Cyprus and Canada, provided that if these were satisfactory the Government would adopt his system for the first six stations. On February 19th, the offer was refused. He was then in touch

with financiers who could have provided funds to carry out the Imperial scheme, and had since formed a British company primarily for trans-Atlantic work; but it was always told him that nobody but Marconi would be allowed to do Government work. He had made it clear to the Postmaster-General in January, 1912, that if he were allowed to tender he could prove that he had the necessary financial support, and that he would ask for no payment from the Government unless the latter were satisfied with the stations. Dr. Poulsen and Prof. Pedersen were scientists of the highest eminence, and had a staff of experienced engineers; they had almost completed the designs for two trans-Atlantic stations for the Universal Radio Syndicate, Ltd., which was registered in September last, with £100,000 capital, and would own all the Poulsen rights except for Germany and the United States.

On Thursday Mr. Gaudil was closely cross-examined on a statement which he had made to the effect that Sir Alex. King's assertion that he had been told by Government experts that the Poulsen Co. had not communicated, and never could communicate, over a distance of 2,000 miles need not be taken seriously, in view of the evidence of the experts themselves. He admitted that at the time they had no regular service over 2,000 miles, but had pointed out always that they undoubtedly could do it. He could not name any places between which his company was communicating regularly by day. The system could be tested between Honolulu and San Francisco. Sir Alex. King knew nothing about wireless; Mr. Madge and Mr. J. E. Taylor, the Government experts, had expressed the opinion that his company could do it. It was true that his company had not yet communicated over 2,000 miles, but the system had done it. At the time they could have taken a contract for six stations at £40,000 each. The syndicate was called the Continental Syndicate for Poulsen Radio-Telegraphy, with headquarters in Copenhagen, and it had the right by the contract of sale to all improvements made in America. He learnt from Sir W. Hall-Jones, the High Commissioner for New Zealand, that the stations were to be 2,000 miles apart, and that the Marconi Co. had not got the contract, before he wrote the letter of January 11th, 1912. He was not told by the Postmaster-General on January 18th that the conditions laid down by the Imperial Wireless Committee were a demonstration of working over 2,000 miles and a waiver of the restriction in communication with foreign countries; had he known, he could have given the demonstration within the time allowed, and would have seriously considered the question of the waiver.

He would have been prepared to erect the stations at a less cost than £60,000 each, and to guarantee that the system would work at high speed, at a lower working cost, and without reservation regarding atmospheric disturbances, as well as to guarantee financial ability to carry out the work, but he never had the opportunity to tender. There was no difficulty, to an engineer, in extending the range from 1,000 to 2,000 miles. They might be able to have the stations in Ireland and Canada at work in August, and could give a demonstration of practical working over 2,000 miles within six months. He had not heard until that day the conditions prescribed by the Committee.

**The P.O. Telephone Staff.**—Great dissatisfaction has arisen among the Post Office Telephone outside staff at Leeds, and the trouble threatens to become national. The allegations are that they have been deprived of "walking time," and can only earn 22s. per week, and that a system of espionage is permitted, with the result that men are dismissed without explanation.

**Venezuela.**—Owing to the frequent interruptions in the submarine telegraphic connections with Venezuela, the Government of that country, at the instance of the Chamber of Commerce of Caracas, has established a daily steamer service between the Port of Cristobal Colon (Macuro) and the Island of Trinidad, in order that cables for Venezuela may be transmitted to Trinidad and then conveyed by steamers to Venezuela, so ensuring a minimum of delay.

## CONTRACTS OPEN and CLOSED.

### OPEN

**Abertou.**—January 29th. One E.H.T. switchboard and one H.T. switchboard for the U.D.C. See "Official Notices" December 27th.

**Australia.**—VICTORIA.—January 28th. Paper-insulated lead-covered cable for the P.M.G.'s department. See "Official Notices" December 20th.

February 21st.—Four 1,500-kw. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

**WESTERN AUSTRALIA.**—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" to-day.

**Birmingham.**—January 27th. Stores for a year for the Corporation Tramways. Mr. A. Baker, manager.

**Bispham-with-Norbreck.**—January 18th. One oil or gas engine direct coupled to a 100-kw. dynamo, for the U.D.C. See "Official Notices" January 3rd.

**Canada.**—January 24th. Chairman, Winnipeg Board of Control; three 2,700-kw. step-down transformers. Plans, &c., Civic Light and Power Department, Winnipeg. Tenders endorsed "Tender for step-down transformers."

February 13th.—Machines, motors, cranes, &c., for Transcona Railway shops. Specifications, forms of tender, Mr W. J. Pree, engineer, Ottawa.

February 10th.—One 1,500-kw. steam turbine and generator for the City of Moose Jaw, Sask. See "Official Notices" to-day.

**Chile.**—September 10th. Tenders are invited for the establishment of an electric central station and the distribution of electrical energy at the port of Valparaiso. Inquire at the offices of the Chilean Legation, 48, Grosvenor Square, W.

**Clacton-on-Sea.**—January 29th. One 250-kw. Diesel oil engine, generator, switchboard, &c., for the U.D.C. See "Official Notices" to-day.

**Eastbourne.**—January 14th. One 1,000-kw. horizontal steam turbine and alternator, without condensing plant, for the Corporation. See "Official Notices" December 20th.

**Glasgow.**—January 21st. Two 6,000-kw. turbo-alternators, with condensing plant and accessories, and water-tube boilers, for the Corporation. See "Official Notices" January 3rd.

**Harwich.**—January 13th. Four motor-driven centrifugal pumps, two motor-driven sewage rakes and screens, with switchgear, and about 400 yd. of 15-in. cast-iron rising main, for the Corporation. See "Official Notices" December 20th.

**India.**—January 24th. Bombay, Baroda and Central India Railway invites tenders for rotary converter plant. See "Official Notices" to-day.

**London.**—STEPNEY.—The B.C. Electricity Committee is about to invite tenders for two 5,000-kw. turbo-alternators, four water-tube boilers, condensers, switchgear, &c.

**L.C.C.**—January 20th. Electrical installations at Camberwell School of Arts (with fire-alarm bells and wiring for power and electrical clocks), and at Vauxhall Street Elementary School. See "Official Notices" to-day.

**Nelson.**—February 3rd. One traction battery, one automatic reversible booster and switchgear, one D.C. motor-generator and switchgear, for the Electricity and Tramways Committee. See "Official Notices" to-day.

**Norway.**—CHRISTIANIA.—The T.C. will shortly be in the market for the purchase of two three-phase turbo-generators of 5,000 and 6,000 kw., respectively, for the municipal power station. Particulars from the T.C.

**Nuneaton.**—January 21st. One water-tube boiler, with valves, fittings, &c., for the Corporation Electricity Department. See "Official Notices" to-day.

**Plymouth.**—January 23rd. Stores, for a year, for the Corporation Electricity and Street Lighting Departments. See "Official Notices" January 3rd.

**Sheffield.**—January 23rd. General stores for the City Tramways Department. See "Official Notices" January 3rd.

**South Africa.**—February 3rd. Cables, trolley wire, fittings, poles, converters, switchgear, &c., for the Germiston municipal trackless trolley scheme. Specification, &c., can be seen at the Board of Trade Commercial Intelligence Department in London.—*Board of Trade Journal.*

**Spain.**—January 18th. Municipal authorities of Riaza (province of Segovia). Concession for the electric lighting of the town during a period of ten years. Tenders invited.

January 18th. Municipal authorities of Suria (province of Barcelona). Concession for the electric lighting of the town during a period of ten years. Tenders invited.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

**West Ham.**—January 24th. Engine-room stores, chemicals and A.C. house service wattmeters, for the Council's electricity department. See "Official Notices" to-day.

### CLOSED.

**Batley.**—The Corporation has accepted the tender of the Tudor Accumulator Co., Ltd., for the maintenance, for a period of 12 years, of the battery which it supplied to the electricity works.

**Bristol.**—The Electricity Committee has accepted the following tenders:—

British Westinghouse Co., Ltd.—Extra-high-tension and low-tension switchgear for Temple Back sub-station, at £408.

Bruce Peebles & Co., Ltd.—One three-phase to direct-current converter (No. 1) for Temple Back sub-station (ol 1,000 aw.), £2,187.

**Canada.**—The Hart Accumulator Co., Ltd., have secured the contract for the supply of the storage battery, 1,190 ampere-hours capacity, required for Yellowgrass electricity works, Saskatchewan, Canada.

**Chile.**—TALCAHUANO.—Messrs. Gillespie & Beales, purchasing engineers for Messrs. Martin Bros., Valparaiso, have placed the following orders for this electric lighting scheme:—

Generators.—Laurence, Scott & Co.

Battery, &c.—Hart Accumulator Co.

Switchboard.—Ferranti, Ltd.

Cable.—W. T. Glover & Co.

Crane.—Holt & Willetts.

Steel poles.—Stewarts & Lloyds.

Lanterns and fittings.—Hadyr Harrison.

Asphalte flooring.—Limmer Asphalte Paving Co., Ltd.

**Colchester.**—The T.C. has accepted the tender of Messrs. H. G. Merry & Co. for 550 tons of Gelling and Shirebrook nutty slack coal for the electric light works, at 14s. 8d. and 11s. 10d. per ton respectively.

**Eccles.**—The Corporation has accepted the tender of the British Westinghouse Electric & Manufacturing Co., Ltd., for 12 months' supply of consumers' electricity meters.

**Guilford.**—The tender of Messrs. Carling, Gill and Carling, Ltd., of Guilford, has been accepted for the electric light installation at the new schools.

**London.**—STEPNEY.—The B.C. Electricity Committee received tenders for the supply of cable during the period ending December, 1915, from which the engineer has prepared the following statement:—

W. T. Henley's Telegraph Works Co., Ltd. (accepted)	£8,886
British Insulated and Helsby Cables, Ltd.	9,069
Callender's Cable and Construction Co., Ltd.	9,100
W. T. Glover & Co., Ltd.	9,176
Western Electric Co., Ltd.	9,198
Siemens Bros. Dynamo Works, Ltd.	9,285
St. Helena Cable Co., Ltd.	Unable to tender.

The specification includes a clause which provides for the adjustment of the price of cable according to the market prices of copper and lead at the time of ordering. The Council, consequently, does not guarantee to purchase any minimum quantity of cable, but the amounts of the tenders are calculated on the estimated quantities required.

For the supply of conduits, troughs and covers required during the same period, the engineer prepared the following statement on tenders received:—

	Stoneware conduits.	Fibre conduits.	Troughs and covers.
Albion Clay Co., Ltd. (recommended)	£2,481	—	—
Henley's Teleg. Works Co., Ltd.	2,664	£2,713	£1,269
Key Engineering Co., Ltd.	—	2,530	—
Siemens Bros. & Co., Ltd. (recommended)	2,754	2,530	1,258
	(Less 2½ %)		(Less 2½ %)
B.I. and Helsby Cables, Ltd.	—	Unable to tender	—
Callender's Cable, & Co., Ltd.	—	Do.	—
W. T. Glover & Co., Ltd.	—	Do.	—
I. R., G.-P. and Teleg. Wks. Co., Ltd.	—	Do.	—
Western Electric Co., Ltd.	—	Do.	—

The specification provides either for the supply of stoneware conduits or fibre conduits, and, having regard to the difference in the amounts of the tenders for the two kinds of conduits, and to the suitability of the stoneware conduit, the last-mentioned is recommended, the Albion Clay Co., Ltd., to supply the stoneware conduits, and Messrs. Siemens Bros. & Co., Ltd., the troughs and covers.

**HACKNEY.**—The B.C. Electricity Committee has accepted the tender of Messrs. Geipel & Co. for fume arc carbons, at £2 15s. per 1,000 pairs; also that of the Sloan Electrical Co., Ltd., for long open type arc carbons, at £3 8s. per 1,000 pairs, and for short open type carbons, at £2 17s. per 1,000 pairs. The other tenderers were the G.E. Co., Ltd., Crompton & Co., Ltd., Siemens Bros. Ltd., Messrs. Ship Carbons Ltd., were unable to quote for open type, as their entire production up to the end of February, 1913, was already sold.

According to the *Railway Gazette*, the L. and N.W. Railway has placed a contract (valued at £500,000) with the firm of Walter Scott & Middleton, Ltd., for widenings and alterations, also 16 ft. 4 in. diameter cast-iron tube railways, in connection with its suburban electrification scheme. The same firm is also carrying out work on the extension of the Bakerloo tube from Paddington to Queen's Park, where it will link up with the L. and N.W. electric lines.

**Runcorn.**—The B. of G., which accepted the tender of Messrs. F. W. Smith & Co., of Manchester, for an engine for the electric light plant to be installed in the Children's Home, has given an order to the same firm for a duplicate engine.

**Salford.**—The following tenders have been accepted by the T.C.:—

A. E. Dean & Co.	—Additions to switchboard, &c., at dispensary, £60.
General Electric Co., Ltd.	—Electric fittings, £75.
E. M. Evans & Sons.	—Wiring and fixing electric fittings, £26.
Clifton and Kersley Coal Co., Ltd.	—500 tons No. 4 washed steam nuts, for the electricity works, at 12s. 11d. per ton.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, January 13th.—"A" Company.	Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.
Tuesday, January 14th.—"B" Company.	Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.
Thursday, January 16th.—"C" Company.	Company training, 7 to 10 p.m.
Friday, January 17th.—"D" Company.	Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.
Saturday, January 18th.—"D" Company.	Week-end run at Fort Coalhouse. Dress—Service dress, putties and greatcoat. No arms or equipment will be taken. Parade at Fenchurch Street Station, Midland, London and Tisbury section, at 3 p.m., for Low Street Station. Railway tickets will be issued by the senior N.C.O. present. Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adj.,  
For Officer commanding L.E.E.

## PROPOSED EXPENDITURE ON ELECTRICAL WORKS UNDER PRIVATE BILLS.

The following estimates of proposed expenditure on electrical undertakings under powers sought in Private Bills this year appear in either the deposited estimates or the Bills:—

London County Council.—Tramways	£311,500; subway	£91,000; street widenings	£216,820	£655,320							
Hove Corporation (H. H. Scott, borough engineer).—	Extension of electrical undertaking of the Corporation after the date of the transfer to the Corporation of the undertaking of the Hove Electric Lighting Co., Ltd., and the construction and provision of mains, works, fittings and apparatus, and additions to plant for and in connection with the electricity undertaking of the Corporation			30,000							
Huddersfield Corporation (K. F. Campbell, engineer for tramways and street improvements, and R. H. Wilkinson, electrical engineer).—	Permanent way for tramways	£83,575; electrical equipment for tramways	£33,845; tramway rolling stock	£11,250; electrical equipment of trolley vehicles	£2,804; trolley vehicles	£1,500; motor-buses	£7,500; street works	£2,530	143,004		
London Electric Railway (H. H. Dalrymple Hay and A. R. Cooper, engineers).—	No. 1 railway, 6 furlongs 140 chains, double	£220,784; No. 2, 1 furlong 225 chains, single	£33,682; No. 3, 1 furlong 2 chains, single	£23,299; No. 4, 1 furlong 450 chains, single	£45,566; No. 5, 1 furlong 53 chains, single	£59,351; deviation railway, No. 1, 165 chains, single	£5,496; deviation railway, No. 2, 175 chains, single	£5,751; No. 6 railway, 4 furlongs 490 chains, single	£238,635; No. 7 railway, 3 furlongs 535 chains, single	£32,664	465,231
Central London Railway (Mott & Hay, engineers).—	No. 1 railway, 2 furlongs 11 chain, single	£32,363; No. 2, 1 furlong 916 chains, single	£175,545; No. 3, 1 furlong, single	£23,302; No. 4, 2 miles 15 chains, double	£597,248; No. 5, 3 furlongs 39 chains, double	£88,614				759,072	
Leeds Corporation (J. B. Hamilton, general manager of tramways).—	Construction of tramways	£63,958; provision of tramcars	£6,000; provision of trolley vehicles	£22,500; provision of electrical equipment and construction of other works necessary for the tramways and trolley vehicles	£43,645; land for sub-station and depot for tramways and trolley vehicles	£3,000; sub-station and depot and plant and cables in connection therewith	£34,438			173,541	
City and South London Railway (Basil Mott and D. Hay, engineers).—	Enlargement of 7 miles 3 furlongs 68 chains of tunnels	£346,000; contingencies, 15 per cent.	£51,900; easements	£92						398,892	
Chesterfield Corporation Railless Traction (R. L. Acland, electrical engineer).—	Buildings, car-sheds, depôts	£2,000; overhead equipment and the construction of other works necessary for the working and lighting of trolley vehicles	£33,780; provision of trolley vehicles	£6,400; motor-omnibuses and expenses in connection with running thereof	£16,000					58,180	
Derby Corporation (J. Ward, borough engineer).—	Construction of tramways	£24,000; provision and erection of posts, standards, brackets, and other apparatus for the purpose of the tramways	£6,000; provision and equipment of motor-buses	£5,000; street works, &c.	£79,000					114,000	
Dundee Corporation.—(J. Thompson, engineer)—	Tramways									13,000	
Halifax Corporation (J. Lord, W. M. Rogerson, and J. W. Galloway, engineers).—	Permanent way of tramways and tram-road	£147,738; tramway rolling stock	£22,200; electrical equipment	£24,975; motor-buses	£11,000; street works	£50,055				255,968	
Nottingham Corporation (A. Brown, city engineer; J. Aldworth, tramways manager; and H. Talbot, electrical engineer).—	Construction of tramways	£19,250; tramway rolling stock	£14,600; electrical equipment and other works	£9,950; provision of trolley vehicles	£15,500; electrical equipment and construction of works necessary for trolley vehicles	£8,950; provision of motor-omnibuses	£39,375; land and buildings for trolley vehicles and motor-buses	£8,775		116,400	
Mezborough and Swinton Tramways (F. E. Stanley, engineer).—										600	
Metropolitan District Railway (A. R. Cooper, engineer).—	Widening of Fulham extension									26,739	
Metropolitan Railway (W. Wilcox, engineer).—	Railways and lands.									552,165	
Southport Corporation (A. S. Black, electrical engineer and tramways manager).—	Trolley vehicles	£3,000; electrical equipment for trolley vehicles	£6,500; motor-buses	£2,000						13,500	

Western Valleys (Mon.) Railless Electric Traction (J. W. Szlumper, engineer).—Roads, £300 ... ..	£300
West Bromwich Corporation (A. D. Greatorex, engineer).—Provision of trolley vehicles, £20,000; provision of motor-buses, £8,000; lands and street improvements, £15,000 ... ..	43,000
Leicester Corporation (E. G. Mawbey, engineer).—Tramways, £69,627 ... ..	69,627
Brighton Corporation.—Purchase of land and construction of sheds with underground cableways and cables, £9,000; overhead line equipment, shelters, &c., £5,300; trolley vehicles, £4,900 ... ..	19,200
Colne Corporation.—Working capital of light railway to be acquired, £2,000; reconstruction and improvement of light railway, £10,000 ... ..	12,000
East Ham Corporation.—Purchase of equipment of trailer cars ... ..	1,000

### FORTHCOMING EVENTS.

**Institution of Electrical Engineers (Dublin Section).**—Friday, January 10th. At 8 p.m. At the Royal College of Science, Dublin. Paper, "Notes on Self-Propelled Cars for Light Railway Work," by Mr. J. P. Tierney.

**(Western Section).**—Monday, January 13th. At 4 p.m. At the South Wales Institute of Engineers, Cardiff. Discussion on paper on "Overhead Transmission Lines" to be resumed. Address on "Automatic Telephones," by Mr. W. Aitken.

At 6.30 p.m. At the Park Hotel, Cardiff. Dinner.

**(Manchester Section).**—Tuesday, January 14th. At 7.30 p.m. At the University, Manchester. Paper on "Starting and Speed Control on Induction Motors," by Mr. F. C. Aldous.

**(Scottish Section).**—Tuesday, January 14th. Meeting at 8 p.m. At 207, Bath Street, Glasgow.

**(Yorkshire Section).**—Wednesday, January 15th. At 7.15 p.m. At the University, Leeds. Lecture on "Comparative Notes on Independent Steam Condensing Plants," by Mr. W. A. Dexter.

**(Students' Section).**—Wednesday, January 15th. At 7.45 p.m. Paper on "The Conditions Influencing the Design and Minimum Manufacturing Cost of Induction Motors," by Mr. E. T. Driver.

**Electro-Harmonic Society.**—Friday, January 10th. At 8 p.m. At the Holborn Restaurant. Smoking Concert.

**Institution of Post Office Engineers (Metropolitan Section).**—Monday, January 13th. At 6 p.m. At the I.E.E. Paper on "The Electrophone Service," by Mr. J. H. Pattman.

**Institution of Mechanical Engineers (Graduates' Association).**—Monday, January 13th. At 8 p.m. Paper on "Electric Accumulators," by Mr. W. C. Padlock.

**Institution of Mechanical Engineers.** Friday, January 17th. At 8 p.m. Paper on "Indicators," by Mr. J. G. Stewart.

**Association of Mining Electrical Engineers (West of Scotland Branch).**—Saturday, January 18th. Meeting at 4.30 p.m. At the Royal Technical College, Glasgow.

### NOTES.

**Metallic Illusions.**—Mr. T. Vaughan Hughes A.R.S.M., writes pointing out that users of metals and alloys in general do not sufficiently realise that many cases of corrosion of their copper pans and boilers, mysterious breakages of chains and railway accessories, and sudden failures of condenser tubes and copper pipes are due to two easily preventable causes described below.

In order to satisfy the demand for beauty of form, or the modern craving for cheapness, many ingenious mechanical devices have been evolved by manufacturers' works staffs, which put upon the metallic articles while being made uneven strains, or introduce in antiquated furnacing appliances deleterious compounds, which ultimately render the articles useless, and often enough dangerous to human life and property. An attempt is made to remove these strains by annealing in unevenly heated furnaces.

A few manufacturers, whose products are subject to constant physical tests, are quite alive to the situation. It must also be conceded that manufacturers of ferrous and non-ferrous metals and alloys spare no pains to free them while in the molten state from deleterious substances. They employ expensive deoxidisers—ingenious devices to prevent contact of the liquid metal with the air during the casting operations, all tending to produce soundness in the ingots or castings, *i.e.*, to free them from blow-holes and segregations.

No sooner is this desirable end attained, than the metal or alloy is introduced into furnaces wherein hot gases containing free oxygen, sulphur and other objectionable elements are allowed to impinge upon, or envelop, the metal. While hot they are brought out of the furnace into the air and mechanically treated in an atmosphere containing oxygen. This operation is often repeated several times. In cases of cold working the metal is, with few exceptions, annealed between processes in furnaces to which the air has access. After this heat treatment it is withdrawn and allowed to cool, sometimes in approximately closed receptacles—often in the air. Not only is the surface of the metal oxidised or tarnished, but during the whole time of heating, and partly in cooling, solution of oxygen and other gases takes place, with formation of compounds in intergranular spaces, or in the body of the

metal or alloy, which form centres or areas of corrosion when in use. In the last year or two exact investigations and experience have proved beyond doubt that both the above defects in heat treatment are prolific causes of corrosion and other breakdowns.

Mr. Hughes therefore submits that the time has arrived for all engineers and users of metals and alloys to insist and specify that, at least, two causes of failure of metals and alloys under the control of the makers shall be removed, namely, (a) Uneven heating appliances; (b) Antiquated heat treatment in chemically and physically active atmospheres.

Incidentally, the public health will benefit, because all the appliances on the market capable of bringing about the above results are smokeless when in operation. The present unnecessary and wicked waste of one of our natural resources, *viz.*, coal, will also be curtailed.

### "Centralians" and Cable Laying at the Antipodes.

—Graduates of the Central Technical College, South Kensington, now called the City and Guilds (Engineering) College, are, as is well known in the engineering world, at work "keen in their vocation" in all quarters of the globe. It is not, however, a common occurrence that five Associates of three different years find themselves together on a single job. This recently happened on the occasion of laying submarine telegraph cables between Sydney and Auckland (N.Z.), 1,200 miles, and Doubtless Bay (N.Z.) and Auckland, 140 miles. The photograph reproduced here



shows the group on board the cable steamship *Silvertown*, owned by the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., the contractors for the manufacture and laying of the cables. Starting from the left-hand side, the men are: Bernard S. Lion (1909-12), Frank P. Swann (1906-9), Nelson J. Perryman (1908-10), Edgar A. Beavis (1909-12), and Thomas H. Solomon (1909-12). Mr. Perryman went out as representative of the consulting engineers, Messrs. Clark, Forde & Taylor, and the other four were employed by the contractors as assistant electricians on the *Silvertown*. The work of laying the cables was completed early in December, 1912, and the photograph reached the College as a Christmas card.

**Electricity in Mines.**—Part 2 of the Report of the Chief Inspector of Mines, just issued by the Home Office, is rather a belated document, as it only deals with 1911, but there is a good deal of interesting information in it, especially with regard to the use of electricity in mines. Mr. Nelson, the Electrical Inspector of Mines, who during the year made a number of underground and surface inspections of electric plant in mines, besides investigating accidents at mines due to electricity, reports that electricity was newly introduced into 46 mines in 1911, as against 40 in 1910. The districts were:—Scotland, 20; Newcastle, 1; Durham, 2; Liverpool and North Wales, 2; South Wales, 13; and Midland and Southern, 5. The electricity special rules in force during 1911 merely required that the introduction of electricity should be notified, but this has been remedied by the Coal Mines Act, and a complete classification of the different systems of distribution, together with a measure of the growth of the use of electricity in mines, will be made possible for the future. Such particulars as are now available show that the high-pressure alternating-current system was introduced into five mines, the medium-pressure alternating-current system into 11 mines, the medium-pressure direct-current system into 13 mines, and the low-pressure direct-current system into four mines. In the latter case the current was introduced in each instance for lighting purposes only. The number of electrically-driven coal-cutting machines in use at the end of 1911 was 998, an increase of 125 over those in use at the end of 1910. During the year 14 fatal accidents were reported and investigated, causing in all 15 deaths, but of these two, causing three deaths, strictly speaking, had no connection with the use of electricity in or about mines. In 1910 there were 21 fatal accidents. Of the 12 deaths in 1911, all but one were electric shock accidents, the remaining one being due to an ignition of fire-damp by electricity. Three underground fires were reported to have been due to electricity. It is also stated that the possibility of the application of wireless telegraphy to mines opens out an interesting field for speculation, and it is obvious that it might prove a valuable aid during rescue operations. We shall refer to the matter more fully in a later issue.

**International Time Conference.**—In connection with the proceedings of the recent conference on wireless time signals, *La Technique Moderne* quotes a note of M. G. Bigburdan communicated to the Academy of Sciences, giving the following list of stations which will probably be in a position by July 1st, 1913, to act as centres for the emission of time signals, at the hours named.

	Hours (Greenwich time).
Paris ... ..	0 midnight
San Fernando (Brazil) ... ..	2
Arlington (United States) ... ..	3
Manilla ... ..	4 (provisional)
Mogadiseio (Italian Somaliland) ... ..	4
Timbuktu ... ..	6
Paris ... ..	10
Norddeich-Wilhelmshaven ... ..	12 (noon)
San Fernando (Brazil) ... ..	16
Arlington (United States) ... ..	17
Masouah (Erythrea) ... ..	18
San Francisco ... ..	20
Norddeich-Wilhelmshaven ... ..	22

The signals will be sent out in accordance with the plan here illustrated, covering the four minutes immediately preceding the hour of the signal; from the end of the 57th minute warning signals are sent for 50 seconds, followed by the first time signal,



the close of which marks the beginning of the 59th minute. The time signals then follow every 10 seconds for two minutes, ending precisely at the hour; these signals consist of "dashes" lasting one second and dots lasting  $\frac{1}{4}$  second, with intervals of one second. The wave-length employed will be about 2,500 m.

**Electricity Supply Rifle League.**—The following are the results of the matches shot during December in connection with the above League:—Westminster (H. A. Pearman, 98), 572, r. Stepney (Jager, 99), 554; Westminster (Neville, 98), 572, r. Central (Brackley, 94), 550; Stepney (Barber, 99), 547, r. Shoreditch (Weekes, 99), 571; Ilford (Haeger, 96), 554, r. Central (Gaze, Cope, Wells, 96), 567.

**FINAL POSITION OF CLUBS.**

Club.	Shot.	Won.	Lost.	Drawn.	Points.	For.	Against.
Westminster ...	10	10	0	0	20	5,685	5,499
Central ...	10	7	3	0	14	5,552	5,520
Shoreditch ...	10	6	4	0	12	5,614	5,519
Stepney ...	10	3	6	1	7	5,470	5,552
Ilford ...	10	2	8	0	4	5,403	5,557
Hackney ...	10	1	8	1	3	5,426	5,503

**Automatic Pipe Cleaner.**—The latest development of the penny-in-the-slot machine is a device in which is incorporated a small electric motor, driving a self-adjusting revolving scraper, to clean the bowl of a tobacco pipe; a jet of compressed air cleans the stem. We understand that these machines are about to be placed about London.

**R.A.C. Trial of an Electrical Delivery Van.**—We are glad to learn that a trial of an electrical delivery van is this week being carried out under the supervision of the Royal Automobile Club. The vehicle, which has been entered by Mr. J. F. Monnot, of 41, Great Portland Street, W.C., is fitted with a battery of Edison accumulators. The trial, which started on Monday last, will extend for six days.

**National Physical Laboratory.**—The exhibit of the N.P.L. at the Ghent Exhibition this year will relate to the special researches which have been carried on at the Laboratory in connection with aviation. Remarkable and important results have been obtained with the elaborate equipment provided for this purpose, which will exert a considerable influence on the design and construction of aeroplanes, and the exhibit will be of great interest and novelty.

**Accident.**—A daily paper reports that at Sunderland last week a boy was badly burned about the neck, by a burning carbon falling from an electric arc lamp on to his celluloid collar.

**Electro-Harmonic Society.**—To-night at 8 p.m. there will be a smoking concert of this Society at the Holborn Restaurant (King's Hall), with Mr. David Smith in the chair. The preliminary programme is as follows:—Vocalists: Mr. Gwilym Richards, tenor; Mr. Norman Williams, baritone; Mr. Robert MacLachlan, bass. Flute and harp: Messrs. Arthur Hands and Lorenzi. Character impersonator: Mr. Ernest Cherry. Stories and imitations of actors: Mr. Lewis Benet. Entertainer at the piano: Mr. Harold Montague. Solo pianoforte and accompanist: Mr. Bernard Flanders, A.R.A.M.

**Eviction.**—The *Times* and other papers report that on New Year's day there was a *mélee* at the headquarters of the Amalgamated Society of Engineers in Peckham Road, London, when, in consequence of the dispute arising out of the proceedings of the recent delegate meeting in Manchester, the executive council was forcibly evicted from the offices. The eviction was carried out by a number of members of the Union connected with branches in and about London, said to be acting on behalf of the trustees recently dismissed by the executive. Four persons sustained injuries.

**Provisional Orders.**—The Board of Trade (Harbour Department) has issued a printed list of applications for provisional orders that have been deposited with the Board for consideration during the 1913 Session. Names of promoters and agents are given.

**How to Become an Electrical Engineer.**—At the meeting of the Trim Board of Guardians, on Saturday, a letter was read from the Local Government Board relative to the proposal to allow a sum of £20 a year to the master for superintending the electric light, asking to be informed whether the master possessed the technical knowledge necessary for the performance of the work in question, and when he acquired it. Mr. Shannon: Tell them that he was with the man erecting the plant, and that the Board are satisfied that he possesses a sufficient knowledge of the working of the plant.

**Board of Trade and Electric Lighting.**—The *Journal of Gas Lighting* is greatly chagrined to discover that the B. of T. will have nothing to do with obsolete systems of lighting (such as gas) when it can obtain electric light. It appears that a local gas manager offered his assistance in rearranging the lighting in a new labour exchange in the North; to his surprise he was officially notified from Westminster that it was impossible to use gas as the Board had decided that "electric light should be installed wherever available throughout the country."

**Davis Cup Football League.**—The majority of the matches in this League, composed of large electrical firms in London, have now been played. The present standing of the teams is as follows:—

	P.	W.	L.	D.	Goals for.	Goals against.	Points.
G.E.C. ... ..	4	4	0	0	16	0	8
Ediswan ... ..	3	1	1	1	5	8	3
St. James' ... ..	4	1	2	1	10	9	3
Drake & Gorham ... ..	2	1	1	0	4	7	2
Elec. Installations ... ..	3	1	2	0	4	5	2
Glengall Works ... ..	2	0	2	0	1	11	0

**Fatalities.**—**PRUDHOE-ON-TYNE.**—An inquiry was held at Prudhoe-on-Tyne on December 31st, by Coroner Rutherford, into the circumstances of the death of Joseph Wormald, the driver of an electric motor. Mr. J. E. Forster said he was the contractor for a new coal drift at Hedley Park, near Prudhoe. He was in the blacksmiths' shop on the preceding morning, 30th ult., and Wormald was standing at his motor 5 yards away, with his hand on the lever. Witness turned his back to him for a minute, and when he turned round again deceased was lying on his back, partly on the platform on which he worked, and partly on the floor. Witness went to him and found him unconscious. Deceased had evidently touched something through which electric current was passing. Mr. John Graham, electrical engineer, said the current was supplied from Mickley Colliery,  $\frac{2}{3}$  miles away, at an average pressure of 450 volts D.C. Wormald was working a small 10-h.p. motor (portable haulage). His duty was to put the clutch into the gears, and start his motor. Witness examined the motor after Wormald's death, and found nothing wrong. In his opinion, Wormald's right hand must have come into contact with the live part of the switch. He thought the man had touched the live part in inadvertence. Dr. Robert Blair Lockhart said there were no marks on Wormald's body. In his opinion death was due to an electric shock. The jury found that the deceased died from electric shock caused by coming into contact with electric machinery at which he was working, and recommended that some protective means should be at once adopted to prevent similar accidents.

**NEWCASTLE-ON-TYNE.**—An inquiry was held on the 3rd inst. into the circumstances of the death of William David Varley, a fitter, who died at the motor works of Armstrong, Whitworth and Co., Elswick, Newcastle-on-Tyne, on December 23rd, while using an electric drill. Evidence by a fellow-workman showed that Varley was working a portable electric drilling machine when suddenly he fell backwards on to the floor. Artificial respiration was tried, without effect. James McKinnell, foreman electrician, said he examined the machine and found it all right. He showed how a shock could be received from the machine. Dr. Snowdon said Varley's heart weighed 20 oz., whereas a normal one weighed

11 oz. Death was due to heart failure, brought about by some external cause (such as an electric shock), or by the condition of the heart itself. The heart had been in that condition for many years, and the man might have died at any time. The jury returned a verdict that death was due to heart failure, but how brought about there was not sufficient evidence to show.

LEEDS.—Elijah Jackson, aged 36 years, of St. James' Place, Holbeck, Leeds, an electrician employed by the British Thomson-Houston Co., Ltd., died in the Leeds Infirmary on Saturday from injuries received in an accident at the works, when both his legs were broken.

TUDHOE.—An inquest was held last week at Spennymoor (County Durham) on the body of Emmerson Lancaster (57), who was killed whilst working at the Weardale Steel, Coal and Coke Co.'s coke ovens, Tudhoe. William Birken, a fellow workman, said he saw deceased near a wire rope, connected with a winch. He heard Lancaster scream, and on going to his assistance, found him in a stooping position, and holding the winch rope. Deceased shouted, "Don't touch me, but go for someone else." William Robertson, in charge of the chemical works adjoining, said that the winch was used for taking down a large casting for a superheater. He could not tell how the live wire came in contact with the winch rope. William John Shand, electrician, said he went to the scene shortly after the accident, and found that the wire rope had been in contact with a live wire. He could not form any idea how the wire came in contact with the winch rope. The jury returned a verdict of "Accidental death," attributing no blame to anyone.

**Educational Notes.**—CITY AND GUILDS OF LONDON INSTITUTE.—At the Technical College, Finsbury, a special course of six advanced lectures on "Induction Motors" will be given by Mr. J. K. Catterson-Smith, M.I.E.E., on Monday evenings, commencing January 27th, at 8 o'clock.

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS.—The annual dinner and reunion of the Institution will be held at the Hotel Cecil, Strand, London, on Thursday, February 6th, 1913, under the presidency of Mr. W. Duddell, F.R.S., supported by the Council. Early application for tickets should be made; the charge is 10s. 6d. each.

INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM SECTION).—A meeting was held on Wednesday, at the University, Edmund Street, Birmingham, to hear and discuss a paper by Prof. Miles Walker, entitled "The Design of Apparatus for improving the Power Factor of Alternating-Current Systems."

**For Sale.**—The Winchester Corporation has for disposal one 200-kw. and two 50-kw. Belliss-Parker generating sets. See our advertisement pages in this issue.

**International Electrotechnical Commission.**—The meetings of the Special Committees will be held at Zürich on the following days: Symbols, January 13th and 14th; Rating, January 15th, 16th and 17th; Prime Movers in Connection with Electrical Plant, January 18th and 19th. The Committees are constituted as follows:—

Country.	Special committee on		
	Symbols.	Rating.	Prime movers.
Austria ...	—	Prf. Pichelmayr	Dr. K. Kobes
Belgium ...	Prof. E. Gerard	Prof. E. Gerard	—
France ...	Prof. Paul Janet	M. P. Boucherot	M. Ad. Bochet
Germany ...	Geh. Dr. K. Streckler	Herr Leo Schütle	Direktor H. Tonnmacher
Great Britain	Dr. R. T. Glazebrook, C.B.	Dr. Gisbert Kapp	Mr. G. Stoney, M.Inst.C.E.
Holland ...	Prof. Dr. de Haas M. G. J. Van de Well	—	—
Italy ...	Prof. M. Ascoli	Prof. E. Morelli Sig. G. Semenza	Sig. G. Semenza
Norway ...	—	—	Mr. W. Fougnez
Spain ...	Sr. L. de la Pena	Sr. L. de la Pena	Sr. L. de la Pena (to be appointed)
Sweden ...	—	Mr. J. L. la Cour	(to be appointed)
Switzerland	Prof. Dr. Wyssling	Herr Huter-Stockar	Dr. H. Zoelly
U.S.A. ...	Mr. C. O. Maillonx	Mr. C. O. Maillonx	Mr. H. G. Stott

With regard to the rating question, much of the time of the delegates will naturally be occupied in dealing with the numerous amendments to Report 17 of the I.E.C., issued by the Central Office in June, 1912, as the result of the work accomplished in Paris in May last, when, after much preliminary discussion, certain definite proposals were put forward.

The subject of international rating is undoubtedly of importance to the electrical industry of this country, with its growing foreign trade; the co-operation of the Manufacturers' Association, the B.E.A.M.A., has, therefore, been of considerable value to the Joint Committee (of the Engineering Standards Committee and the British Electrotechnical Committee), by which the Paris proposals, referred to above, have been fully discussed in detail. The representative of the makers (Mr. A. R. Everest) is to accompany Dr. Gisbert Kapp to Zürich. Although he is not going as a delegate, Mr. Everest's intimate knowledge of manufacturing details, as well as difficulties, will be of no small value to the delegate of the British Committee.

### Petrol-Electric Railway Car for Wellington, N.Z.

—Our Wellington, N.Z., correspondent states that the New Zealand Government Railways Department has placed an order with Messrs. Grapes & Riley, of Wellington, for a self-propelled car, of which the body will be built in New Zealand. The gearing is to be on the Thomas transmission system. The estimated weight, fully loaded, is 32 tons, and the car is to be capable of hauling a trailer weighing 25 tons loaded. The truck is to be built by the Leyland Motors, Ltd., and to have an engine developing 160 B.H.P. at 900 R.P.M., but capable of being worked up to 200 H.P., with two electrical machines, each rated at 50 H.P. at 500 R.P.M., for half an hour. The general design is similar to that of the car, which has been giving such good results in South Africa, and it is to maintain a speed, with trailer, of 25 miles per hour on the level, and 10 miles on a gradient of 1 in 40. It is understood that a further order is to be placed with the British Westinghouse Co. for a car on their system, and that tests will be made between them with a view to determining which type is the most suitable for the Dominion.

**'Tricity House.**—A complete and up-to-date electrical restaurant has been opened by Messrs. Modern Kitchens, Ltd., at 48, Oxford Street, W., and a demonstration of its capabilities was given on Tuesday last. The equipment consists of the well-known "Tricity" apparatus, with which the whole of the cooking is done. The promoters are to be congratulated upon their enterprise, which will undoubtedly prove highly beneficial to the electric cooking business as a whole, and to their own specialities in particular. We hope to give a description of the installation in an early issue.

**On Reading Papers.**—We have often remarked that few authors of papers are capable of reading them, and we have urged that the often painful and always time-wasting process should be discontinued. Some day that will be done, and the members of British technical societies will receive the printed papers in advance, like their more fortunate American confrères. But in the meantime we commend to the perusal of our author-readers the letter reprinted below, for which we are indebted to our American contemporary, *Science*. People take lessons in singing, in dancing, in playing musical instruments—but everyone seems to think he is a born elocutionist!—

#### IN THE INTERESTS OF BETTER SPEAKING.

To the Editor of *Science*: Would it be at all worth while, now that the innumerable scientific papers of the midwinter are about to be read, to urge their readers to take a few elementary lessons in elocution before they ascend their platforms? It is difficult to compute to what extent aesthetic pleasure, as well as facility of comprehension, would be added to if men of science understood better the art of putting their communications before the public. The main work of the professional elocutionist would be to show the prospective reader how to produce full, clear, round chest tones, instead of the thin, clouded, head tones which they too often adopt. If the dozen or so of precious hours that this would take is too much to demand, perhaps the following simple rules might be of some assistance; I am sorry that they are so very elementary, but in point of fact they are rules which are violated by fully one-half of those who read:—

1. Stand erect, with chest expanded, and not contracted.
2. Consult a physician, and see that the nasal bones do not obstruct the nasal passages.
3. If manuscript is to be read from, hold it in the hand (and hold it high). Manuscript which is stationary on a desk causes a rigidity of the body which should be avoided.
4. The length of the line of type-written manuscript must be short—not more than 7 in. This is very important. The long line of the ordinary typed manuscript is convenient for the typewriter, but it is fatal to the reader. The effort necessary to catch the right line as the eye returns to the left-hand margin of the paper consumes energy which should be devoted to securing that mysterious rapport that must be established between reader and hearer if the function is not to be a painful one. For the same reason the type must be good and black, and the lines far apart. Whatever contributes to the physical ease of the speaker conduces also to that free and undistracted state of mind which is indispensable to the securing of the desired rapport.
5. Better still—make a mental note of the *Art and Weise* of those men of science (half our number, perhaps), who, whether by instinct or by early training, know how to address an audience effectively. There is a subtle mental attitude about them, quite aside from physical details, which can, perhaps, be better caught by instinctive imitation than by conscious intention. May their tribe increase!
6. If, in addition, every individual reader would, in his own interest, see to it that there is enough oxygen in the audience-room to permit of ready comprehension on the part of his hearers, then, indeed, would the mid-winter scientific meeting become such a joy to the spirit as would brighten, in retrospect, many a coming month of solitary hard labour.

The essential matter of inspiring papers is always at hand; a little furbishing-up of method of presentation is all that is needed to make that matter far more effective, in the way of presentation, than it is, too often, at present. Of this the reader may be certain—if he insists upon beginning his paper with his voice thin, low and veiled, and directed downwards upon the floor instead of outwards towards the level of his hearers' ears, the spirits of his auditors, so far as they have any aesthetic quality at all, will also descend to their boots, and will remain there until another speaker gives them a chance of better nourishment.—X.Y.Z.

**Quietness Preferred.**—In the backblocks of New Zealand, where roads are bad and in wet weather at times almost impassable, telephonic communication on the party-line system is extensively used. Investigating a fault on a line with seven or eight subscribers recently, it was found that a lady had tired of the continual ringing in the evenings amongst her neighbours, and had adopted a method of her own to stop it. She took down the microtelephone and inserted a large cork in the transmitter mouthpiece.

**Appointments Vacant.**—Telegraph and telephone line superintendent, for the Government of Jamaica, Public Works Department (£250); laboratory assistant in the electrical engineering department of the South-Western Polytechnic. See our advertisement pages in this issue.

**Parliamentary Notes.**—**TRINIDAD WHEEL TAX.**—In Monday's Parliamentary Papers Mr. Pointer asked the Secretary of State for the Colonies whether his attention had been drawn to the Wheel Tax Ordinance recently brought before the Legislative Council of Trinidad; whether it had been passed by the Council; whether it had come within his notice that the provisions of the ordinance would not apply to the vehicles of the tramway company, who exercised their monopoly powers without any payment of any kind for the valuable monopoly held by them; and whether he was able to offer advice to the Trinidad Government, suggesting that the provisions of the ordinance should apply to the tramway company. Mr. Harcourt replied that the hon. member no doubt referred to the Port-of-Spain Carriage Licences Ordinance, 1912. That Ordinance had been passed by the Legislative Council, but had not yet been submitted to him for His Majesty's pleasure to be taken with regard to it.

**AUCKLAND PARK COLLIERY EXPLOSION.**—Sir H. Havelock Allen asked the Home Secretary whether he had yet received the report of the Inspector who investigated the explosion which took place at Auckland Park Colliery, County Durham, on October 29th last. In reply, Mr. McKenna said he had received a further report from the District Inspector, stating that the examination of the cable under the large fall showed conclusively that the cable was not the originating cause of the explosion. The origin of the explosion remained a mystery.

**Electrical Imports and Exports in 1912.**—The returns issued on Tuesday for the month of December, and for the complete year 1912, show the following figures:—

	Dec. 1912.	Dec. 1911.	Complete year 1912.	Complete year 1911.
	£	£	£	£
<b>IMPORTS.</b>				
Electrical goods and apparatus (other than machinery and telegraph and telephone wire) .. .. .	137,464	138,581	1,457,646	1,495,492
Machinery .. .. .	614,619	453,718	6,820,744	5,768,062
<b>EXPORTS.</b>				
Electrical goods and apparatus (as above) .. .. .	320,119	217,219	4,369,877	2,819,374
Machinery .. .. .	2,743,334	2,650,903	33,161,772	30,960,678

**Copper.**—A rather more cheerful tone in respect of European politics, and the prospect of better economical conditions at home, had their influence at the end of December on this as on other markets. The European visible supply (including stocks in Rotterdam and Hamburg) is shown by Messrs. Merton's statistical circular to have decreased during December from 43,281 tons to 43,241, a difference of 40 tons only. Withdrawals from English ports during the month have, apparently, been small, and covered by incomings, the quantity standing to home supplies being considerably higher than that for the end of November. Rotterdam has brought up its stocks (which were low) to 1,000 tons, while Hamburg registers 1,882 tons, a decrease of 333 tons during the month. In detailed supplies European arrivals from America are on the average, the quantity from Spain and Portugal to England and France is rather low, but the amount is compensated by increase in supplies from other countries. Chile shipments are well up, and Australian high (4,400, against an average of 3,750). Deliveries are brisk at 42,817 tons. American stocks (American Copper Producers' Association figures) increased during November 4,205 tons. The world's supply for the same date (November 30th, 1912) was 81,747 tons, an increase over the return for October 31st of 1,145 tons. The large withdrawals from stock last year in the United States were during January, according to figures.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—We are pleased to learn that Mr. W. J. U. SOWTER has now sufficiently recovered from the effects of his serious accident of July last to enable him to resume charge of the Bray U.D.C. electricity undertaking. All communications should, therefore, now be addressed to him. We understand that Mr. McDONNELL, assistant engineer, has now left the service of the Council, and Mr. V. DEMPSEY, of the Galway Electric Supply Co., has been appointed to succeed him, at a commencing salary of £104 per annum.

Mr. DUNDAS FOX, manager of the Penrith Electric Supply Co. has resigned his connection with the company, and will shortly proceed to Calgary, Alberta, Canada, accompanied by Mr. J. W. BLEANDALE, his assistant engineer at Penrith, where they will commence business as consulting engineers. The directors of the company, at a recent meeting in Manchester, accepted Mr. Fox's resignation with regret. Mr. Fox is to be succeeded at Penrith by Mr. SPEIGHT, of St. Anne's, the company's consulting engineer.

The Burnley T.C. has increased the salary of Mr. JAMES E. STARKIE, electrical engineer, from £100 to £500 per annum, as from January 1st.

The Electricity Committee of the Manchester Corporation has recommended to the City Council, that an agreement with Mr. H. LAMB be prepared, appointing him resident engineer at the Stuart Street generating station, at a commencing salary of £350.

The Nelson (Lancs.) T.C. last week decided to increase the salary of Mr. G. F. NAYLER, chief assistant electrical engineer, from £110 to £156 per annum.

**Tramway Officials.**—The employees of the Southport Tramways Co., Ltd., have presented a framed photograph of themselves to the general manager, Mr. J. LLOYD, as a token of esteem.

**General.**—Mr. H. R. KEMPE, M.Inst.C.E., M.I.Mech.E., M.I.E.E., and late Electrician to the Post Office, who has commenced work as a consulting engineer, notifies that his temporary address is 4, Ludgate Hill, London, E.C.

Mr. C. D. FALCKE, who recently resigned the position of resident engineer to the Stratford-on-Avon Electric Supply Co., Ltd., has opened an office as consulting electrical and mechanical engineer at 410, Mansion House Chambers, Queen Victoria Street, London, E.C. Mr. Falcke went to Stratford-on-Avon six years ago to lay down the electricity works, and he subsequently acted as resident engineer. On his resigning that position, the directors appointed him to be their consulting engineer. We understand that he is now occupied with an interesting patent.

Mr. H. W. POWER, engineering publicity expert, has removed from 180, Eswyn Road, London, S.W., to 31, Queen Victoria Street, E.C., where his telephone number is "City 8590."

Mr. S. L. LORD, of the staff of Messrs. Crompton & Co., electrical engineers, of Chelmsford, who has been married to Miss K. M. Gaffney, daughter of Mr. J. N. Gaffney, of Broadstairs, has been presented by his colleagues at the Arc Works with a barometer.

At St. Guthbert's Church, Darlington, on January 2nd, the marriage took place of Mr. RUPERT STANLEY ALLEN, fifth son of Mr. W. H. Allen, J.P., D.L., of Bromham House, Beds., and of Messrs. W. H. Allen, Sons & Co., Ltd., electrical engineers, Queen's Engineering Works, Bedford, and Miss Gladys Marion Hill, elder daughter of Dr. Eustace Hill, of Birchfield, Darlington. The presents included a large silver salver from the staff of the Queen's Engineering Works.

Mr. F. J. TEAGO, B.Sc., lecturer in electrical machinery and assistant lecturer and demonstrator in electrical engineering at Liverpool University, was married at Newcastle on January 2nd to Miss Annie Middlemiss, of Morpeth.

Mr. WILLIAM WHITTLE, the chief accountant of the Metropolitan District Railway, has just retired, after 42 years in the service of the railway. The directors and officers presented him with a service of silver plate, and the staff, together with friends, gave an illuminated address and a gold watch. A farewell dinner was held at the Café Royal, with Lord George Hamilton, chairman of the company, presiding.

Mr. HERBERT J. G. WEBB has been appointed manager of the apparatus department with the Electrical Co., his position as representative engineer in Yorkshire and the North of England for the same firm being taken by Mr. HERBERT FOSTER, late with the York Corporation.

Messrs. Jaeger Bros., of 18, Christopher Street, London, E.C., announce that Mr. H. STEINBACH has resigned the position of London manager to the firm, and Mr. ERNEST JAEGER is taking up that appointment.

The COMTE DE BAILLEHACHE has been appointed director of our Paris contemporary, *La Lumière Electrique*, dating from January 1st.

Mr. LEE MURRAY has been appointed to the seat on the board of directors of Messrs. Bruce Peebles & Co., Ltd., recently vacated by Mr. Charles H. McEuen. Mr. S. E. BASTOW and Mr. J. H. BUNTING have been appointed joint managers in the place of Mr. Murray, who has retired from the position of general manager of the company.

Mr. C. H. WRIGHT is giving up his position with Messrs. Crompton & Co., Ltd., in order to take up an engagement with the National Steam Car Co., Ltd.

Mr. W. C. MOUNTAIN has opened an office at 131, West Regent Street, Glasgow, in connection with his consulting engineering practice, and Mr. J. E. MACEWAN will act there as his resident engineer in Scotland.

**Obituary.**—Mr. SYDNEY WOODFIELD.—We learn with the deepest regret of the death of Mr. Sydney Woodfield, A.M.I.E.E., which occurred on December 3rd. Mr. Woodfield was a contributor to our pages whose services were most highly appreciated by us, and we greatly deplore his untimely death, which occurred under peculiarly sad circumstances. Our readers will remember that, eight months ago, he was appointed chief engineer to the Lacroze Co.'s electric traction undertakings in Buenos Ayres. He had prepared a home there in readiness for the arrival of Mrs. Woodfield, but just before her sailing day he cabled to England that he was seriously ill and had booked his return passage. He arrived in this country on November 24th, and he lived only until December 3rd.

The deceased gentleman was at different periods of his career connected with Messrs J. G. White & Co. Ltd., the British Thomson-Houston Co., Ltd., the Glasgow Corporation Tramways Department, Leeds Corporation Tramways Department, and several of the technical institutions. We tender our sincere sympathy to his relatives.

### NEW COMPANIES REGISTERED.

**Eckstein, Hoop & Co., Ltd. (126,262).**—This company was registered on January 1st, with a capital of £50,000 in £1 shares, to take over the business of an electrical engineer and manufacturer of electrical apparatus, carried on by A. Eckstein, at Caroline Street, Broughton Lane, Salford, and at 5, Chapel Walks, Manchester, as Eckstein, Hoop & Co. The subscribers (with one share each) are:—A. Eckstein, Brantwood, Oak Drive, Fallowfield, Manchester, electrical engineer, J. Hamer, Low Croft, Bow-acre Lane, Gee Cross, Cheshire, chartered accountant; P. B. Hall, Nesfield, Marple Grove, Prestwich, near Manchester, manager; D. B. Mellis, 4, Burlington Road, Altrincham, Cheshire, manager. Private company. The number of directors is not to be less than three or more than seven; the first are A. Eckstein (chairman and governing director), J. Hamer, P. B. Hall, and D. B. Mellis; qualification of J. Hamer, £3,000 shares; of other directors, £1,000 shares; remuneration (except managing director) as fixed by the company. Solicitor, P. H. Jordan, 1, Princess Street, Manchester. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**Javal Patents, Ltd. (126,273).**—This company was registered on January 1st, with a capital of £2,000 in 1s. shares, to carry on the business of manufacturers of and dealers in hydraulic, electric and steam machinery and appliances, engineers, founders, &c., and to adopt an agreement with E. Cremon-Javal. The subscribers (with one share each) are:—F. Samuelson, 71A, Queen Victoria Street, E.C., solicitor; R. C. E. Poulter, Midland Bank Chambers, Queen Victoria Street, E.C., solicitor. Private company. The first directors are not named; qualification, £10. Registered office, 44, Basinghall Street, E.C.

### OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Harry W. Cox & Co., Ltd.**—Particulars of £1,000 debentures, created October 10th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's property, present and future. No trustees.

**United Sherardising Co., Ltd.**—Issues on December 12th, 17th and 29th, 1912, of £100, £400 and £200 debentures, parts of a series of which particulars have already been filed.

**Salford Electrical Instruments, Ltd. (112,599).**—Capital, £20,000 in £1 shares (10,000 preference); return dated May 16th (filed October 25th, 1912); 10,000 preference shares taken up; £10,000 paid. Mortgages and charges: Nil.

**Forster & Sons, Ltd.**—Particulars of £20,000 second debentures, created December 14th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £2,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Sheppey Water and Lighting Co., Ltd.**—Charge on land and hereditaments at Minster-on-Sea, Sheppey, dated December 19th, 1912, to secure all moneys due or to become due from the company to London County and Westminster Bank, Ltd., 21, Lombard Street, E.C., stamped to cover £1,500.

**Rawlings Bros., Ltd. (67,908).**—Capital, £100,000 in £1 shares (90,000 preference and 70,000 ordinary). Return dated October 22nd, 1912, 20,685 preference and 33,169 ordinary shares taken up, £58,854 paid. Mortgages and charges: £8,812.

### CITY NOTES.

#### Llandudno and Colwyn Bay Electric Railway, Ltd.

The seventh ordinary general meeting of the above company was held on January 2nd, at the offices, Basildon House, Moorgate Street, E.C., Mr. A. W. Tait presiding.

The CHAIRMAN, in moving the adoption of the report, said the profit for the year was £6,023, as compared with £5,784 for the preceding year, an increase of £239. That increase was on the top of an increase of £2,172 for 1911, as compared with 1910. The traffic receipts amounted to £16,199, as compared with £15,359 last year, an increase of £840, or over 5 per cent. That increase would have been greater but for the disappointing weather during the summer, particularly during the month of August. The traffic during the winter months showed a steady improvement, which was due to the increase in the resident population along the route and to the improvement in the time and running of the service, and because of the increased facilities they were able to give owing to the double tracking of a considerable portion of the line. Turning to the debit side of the profit and loss account, it would be observed that the power expenses were £2,271, as against £2,530 last year—a saving of £259, or approximately 10 per cent. That was particularly satisfactory when he mentioned that that economy was effected in spite of an increase in the number of car-miles run of 8,899. The saving in units was 62,272, or approximately 13 per cent. The saving was really more than it appeared, because, owing to the sliding scale in their power-supply agreement, the less electricity they took, the higher they had to pay

for it. The economies which they had effected during the last two years had been very great, and he thought they had now reached their maximum in that respect. The reductions which had been effected in the past two years amply justified the expenditure on double tracking, and credit was also due to the manager for the better inspection and lubrication of the motors and the general conduct of the service. There were small increases in the amounts charged for traffic expenses and interest, and there were small decreases in the amounts of general expenses and depreciation of equipment. The only other item calling for comment was that of repairs and maintenance. The amount this year was £1,481, as compared with £783 last year. Of that sum, approximately £657 represented expenditure upon permanent way, and approximately £656 upon cars, both of which items were in excess of the amounts charged under these heads last year. Part of that might be regarded as expenditure of a special nature. The large expenditure on the permanent way was due to some heavy repair work on the track in Colwyn Bay, where it had subsided owing to the track being laid over a green sewer trench. He was afraid that they could not expect to have any reduction of expenditure under that head for some time owing to the exceptional local conditions, and the wet summer and excessively wet autumn of last year had, of course, tended to make those conditions worse as regards the year under review. Wherever possible efforts were being made to render the condition of the track more satisfactory, and they would see that when the doubling work over Bodafon Fields was carried out a certain amount of regrading and reconstruction work was done at the same time, which had greatly improved that part of the line. They had also completed arrangements to double track the line at the top of Penrhyn Hill and from the end of Mostyn Avenue to a point beyond the North-Eastern Hotel in Llandudno. When that work was completed, the double track would extend for, approximately, four miles, which would enable them to cope more expeditiously and economically with the traffic, especially in the summer. Included under the cost of repairs, too, was the cost of repainting practically the whole of the cars and the complete overhauling of their equipments so that, at the end of the year, they were in excellent condition, and he thought they might expect to see some reduction in that item next year, because such an extensive overhaul should not be necessary. It would be observed that the company had expended during the year about £6,700 on additions of a capital nature, which he had already explained. The variations in the other assets were self-explanatory. With regard to the liabilities they had issued £3,175 additional debenture stock, and they owed to sundry creditors and on bills payable, approximately, £1,800 more. It would be necessary in order to pay the dividend which the directors recommended, and for other purposes, to issue a further amount of debenture stock. The order for the extension to Old Colwyn had now been confirmed by the Board of Trade, and arrangements with the Colwyn Bay Council as regards road widenings, were in progress. The terms upon which the company were willing to proceed with that extension had been clearly indicated to the Council, and he hoped that those would be accepted by them, as otherwise the construction of that extension must be held over. The balance available for distribution after adding another £1,000 to depreciation reserve account—making a total of £4,000 to date—and writing off £1,000 from discount and expenses of issue of debenture stock, amounted to £4,737, which included £714 brought in from the previous year. That sum the directors proposed should be applied in the following manner:—In payment on January 31st of a dividend at the rate of 3½ per cent. per annum (less income-tax), which would absorb £3,479, leaving £1,258 to be carried forward. He should, perhaps, point out that the sinking fund for the redemption of the debenture stock came into operation on the 1st inst., and in future the amount required for that purpose each year would appear as a debit to profit and loss account, and would take the place of the previous debits on account of depreciation reserve, because to all intents and purposes it was in substitution of that charge. He thought that the shareholders would agree that, particularly in the view of the unsettled weather, the net result for this year might be considered satisfactory, and he thought their thanks were due to Mr. Balfour and his firm, and to the manager at Llandudno for the careful supervision which had been exercised. There was one further point which he would like to mention before putting the resolution, and that was "Sunday running." He was glad to tell them that several local residents and visitors to North Wales had, during the past year, approached the company with regard to the matter, and there had also been some correspondence in the local Press. As he pointed out at the last general meeting, the restriction under which the company at present laboured did not affect the local residents, and it was for them to see that the great need for that service, which was evidently desired by many local people and by the large majority of the visitors to Colwyn Bay and Llandudno, was clearly impressed upon the local Councils.

MR. A. BALFOUR seconded the motion, and the report was adopted.

#### The A.E.G. Annual Meeting.

THE recent annual meeting of the A.E.G., as previously announced, sanctioned the proposed increase of £1,250,000 in the share capital to £7,750,000. Dr. Walter Rathenau, who presided, stated that the augmentation was materially influenced by the great pressure of new orders which could only be carried out with extreme difficulty, and it was therefore necessary to extend the workshops. In reply to questions, it was mentioned that the company did not hold a considerable portion of the shares in the Berlin Electricity Works, but the company's interest in the undertaking was exceptionally great. The real problems before the undertaking applied to the future;

It was no longer merely a lighting enterprise, but was already one for the supply of power on a larger scale, and it was submitted that the future programme would be one for the electrical incorporation of the suburbs and the province of Brandenburg, within the scope of the electricity works. The war in the Balkans had affected the A.E.G. comparatively to a much less extent than other undertakings, as the Balkans were not really an electrical hinterland for the company. The Constantinople express railway, for which a concession was expected, remained an important project, and would presumably be realised when quiet and order had been re-established. The company's business had also been but little affected by the Presidential election in the United States. The chief business was with South America, which was in favourable course of development, and had already yielded large orders. Concerning the transactions with the Victoria Falls and Transvaal Power Co., the speaker stated that the debentures taken over by the company were successfully disposed of some time ago. The sale prices for manufactures had not become worse, but rather slightly better. It was added that since the completion of the annual report, the position of orders and turnover had increased from £19,550,000 to £22,850,000, as compared with £18,100,000 at the end of September, 1911.

**Continental Electrical Companies.**

*The Fabrik Isolierter Drähte (Insulated Wire Works, late C. G. Vogel), of Berlin*, have allocated £6,500 to depreciation in 1911-12, as contrasted with £5,300 in 1910-11. It is intended to distribute 13 per cent, on the share capital, this comparing with 11 per cent. in the previous year.

*The Siemens Elektrische Betriebe A.G.*, which manages a number of electricity works, earned considerably larger gross profits in 1911-12 than in the previous year. As net profits the accounts indicate the sum of £37,700, as against £27,700 in 1910-11. It is proposed to pay a dividend of 6½ per cent. on the old share capital, as in the preceding year, whilst the new capital of £250,000 will participate to the extent of 3¼ per cent. for the year.

*The Deutsche Gasglühlicht A.G., of Berlin*, which manufactures wire lamps as well as incandescent gas lighting appliances, states that the Osram lamp department was extended during 1911-12, and the turnover increased. The foreign Osram lamp companies in London and Paris also obtained favourable results, although the profits were not included, as the balance-sheets had not yet been closed. The net profits of the Berlin company were £441,000, as contrasted with £278,000 in 1910-11, and the dividend on the ordinary shares is at the rate of 25 per cent.

*The A.G. für Elektrizitäts Anlagen (Electrical Investment Co.), of Berlin*, which owns various central stations, as well as being financially interested in others, reports gross profits of £61,000 in 1911-12, as compared with £36,000 in the previous year. Including the balance forward, the net profits are returned at £32,000, as against £32,000 in 1910-11, and a dividend of 8 per cent. has been declared on share capital of £350,000, being at the same rate as in the preceding year. During the year the extension of the company's scope of activity necessitated an increase of £150,000 in the share capital, whilst at the same time a ½ per cent. loan of £300,000 was also raised for the same purpose.

*The Elektrische Licht und Kraft-Anlagen A.G. (Light and Power Investment Co.), of Berlin*, has just declared a dividend at the rate of 7½ per cent. for 1911-12 on the ordinary share capital of £1,500,000, as contrasted with 7 per cent. in the preceding year. According to the directors' report presented at the recent general meeting, most of the undertakings in which the company is interested made further progress during the year, and a share was also taken in various new enterprises having a promising future. The gross profits reached £208,000, as against £197,000 in 1910-11. After defraying general expenses, taxes and interest charges on the loan of £1,181,000, the accounts show net profits and balance forward of £136,000, as contrasted with £124,000 in 1910-11. The payment of the dividend absorbs £112,500, the reserve fund receives £12,900, and the sum of £8,000 has been carried forward. Among the list of advances made to electrical companies appear the names of two English undertakings.

*The Telefonsfabrik A.G. vorm. G. Berliner, of Hannover*, reports that the turnover in 1911-12 experienced an increase. The Buda-Pesth Co., whose share capital is held by the Hanover Co., was satisfactorily employed during the year. Government orders also showing an advance over the previous year. A dividend of 10 per cent. was proposed by the Buda-Pesth Co., as compared with 9 per cent. in 1910-11, and that company's factory was in full operation. The branches of the Hanover Co. were well employed, and participation in foreign transactions again yielded satisfactory profits. The gross profits from sales and investments amounted to £70,000, as contrasted with £64,000 in 1910-11. After meeting general expenses and allocating £12,000 to depreciation, as against £8,800, the accounts indicate net profits and a balance forward of £24,700, as compared with £23,600 in 1910-11. It is intended to pay a dividend of 8 per cent., being at the same rate as in the previous year. The share capital is to be raised by £50,000 to £260,000.

**SIEMENS & HALSKE.**

[THE inter-relationship of the Siemens & Schuckert Companies explains the mutual references and information contained in the annual reports of the undertakings forming this group.]

The report of Siemens & Halske, A.G., for the year ended with

July 31st, 1912, states that a considerable extension of the undertakings of the company and its group took place and the number of officials and workmen employed by the company and the Siemens-Schuckert Works increased from 66,000 in 1910-11, to 77,000 in 1911-12. The growth was comparatively the greatest in connection with the German and Russian works, and the expenditure on plant correspondingly advanced. This development in association with the comprehensive technical progress rendered necessary a very fully connected and expensive organisation, whilst competition between the individual firms was very keen. An improvement in this respect was hoped for from the effect of the *Verband Deutscher Elektrotechniker*, which had already been successful in many directions. The report repudiates the idea of the establishment of any kind of monopolistic structure. As to the question of profits on financial transactions, it is stated that these play no noteworthy part in the company's scope. The latter had, of course, financially participated in individual undertakings or created such enterprises but as a rule they related to new departments which required to be opened up. The volume of orders thereby resulting to the company and also from some companies closely associated with it, only formed a comparatively small portion of the total turnover of the group. A considerable increase in the orders was obtained for all the departments at the Werner Works, and an extension of the works had become necessary. Among the orders were those for automatic and semi-automatic telephone exchanges for Dresden, Leipzig and Rome, as well as an extension for Munich; and the Imperial telegraph authorities ordered a 50-wire telephone cable on the Pupin system for laying between Berlin and Magdeburg, which was proposed to be extended later on through the industrial district to the Rhine. Two of the State cable lines had been equipped with the company's new system of high-speed telegraphy, and it was expected to be further introduced. The Wireless Telegraphy Co. (*Ges. für Drahtlose Telegraphie*) had made further progress, and had formed, in conjunction with the German-Netherlands Telegraph Co., the German South Sea Wireless Telegraph Co., which was to connect the German Colonies in the South Sea with the world's cable system. Concerning the manufacture of incandescent lamps, the report states that the glow lamp factory was abundantly provided with orders, and the new wolfram lamp had been well introduced, whilst the tantalum lamp maintained its special value. The department for railway safety appliances experienced an increased turnover in signalling installations and accessory apparatus, and, among others, the St. Petersburg branch obtained considerable orders from the Russian Government for the Siberian Railway. The first section of the elevated railway in Hamburg was set in operation on February 15th, 1912, and the whole of the circle railway, which is 10½ miles long, was inaugurated on June 29th, 1912, whilst the completion of the branch lines was being continued. The accounts show the following results for the two years:—

	1911-12.	1910-11.
Share capital ... ..	£3,150,000	£3,150,000
Loan capital ... ..	2,265,000	1,287,000
Gross profits ... ..	722,000	691,000
General expenses ... ..	75,000	53,000
Interest on loans ... ..	60,000	51,000
Depreciation ... ..	20,000	22,000
Net profits and balance forward	620,000	616,000
Dividends ... ..	378,000	378,000
„ per cent. ... ..	12	12
Carried forward ... ..	63,000	54,000

It will be seen that the loan capital has largely increased, the company having made an issue of £1,000,000 in 4½ per cent. bonds in May for the purpose of making an advance to the Siemens-Schuckert works. The sum of £100,000 has been placed to the special reserve fund, as against £110,000 in 1910-11, and £17,500 to the provident fund, as in the previous year, whilst the bonuses to officials and workmen has been raised from £40,000 in 1910-11 to £45,000 last year.

**SIEMENS-SCHUCKERT WERKE.**

THE directors state in their report for 1911-12 that the programme of extensions of works mentioned a year ago had been carried out, and the extensions in the meantime had been brought into operation. unusually large expenditure having been incurred on erection and equipment with machinery and the cost of removal. Nevertheless the arrival of orders was largely in advance of the completion of the new works, and extraordinary endeavours were therefore necessary in order to comply with the conditions of delivery. Difficulty was experienced in this respect owing to the circumstance that it was frequently impossible to obtain the requisite raw materials by the proper time. It was therefore all the more noteworthy that the German and ex-German works delivered 134,539 machines, motors and transformers, of a total of 3,737,674 H.P. The rising line of activity, which had only suffered one interruption since the formation of the company, took the same course in the past year, and this explained why the provision of additional funds in rapid succession had to receive attention. During the year a loan of £1,000,000 was obtained from the two proprietary companies, and the amount received from the latter in ordinary capital and loans was now £7,000,000. The proceeds of a new 4½ per cent. loan of £1,500,000, which was issued in the current year, were intended to further strengthen the working capital. The employment provided for the company by the development of overland central stations was very considerable as a result of the energetic enterprise which was manifested by all interested in that department. The works were well occupied on deliveries for tramways, light railways, colliery and works' railways, the elevated and under-

ground railways in Berlin and Hamburg and the various State railways proposed to be converted to electric traction. The following items are extracted from the accounts for the past two years:—

	1911-12.	1910-11.
Ordinary capital ... ..	£1,500,000	£1,500,000
Terminable loan ... ..	2,432,000	2,458,000
Non-terminable loan ... ..	2,500,000	1,500,000
Gross profits ... ..	1,048,000	913,000
General expenses ... ..	88,000	95,000
Depreciation ... ..	60,000	50,000
Net profits and balance forward ...	673,000	671,000
Reserve fund ... ..	125,000	125,000
Dividend ... ..	450,000	450,000
" per cent. ... ..	10	10
Carried forward ... ..	15,000	14,000

It will be observed that the total of ordinary and loan capital amounts to £9,432,000, and to this has since been added a new loan of £1,500,000, making an aggregate of £10,932,000. The bonus granted to officials and workmen in 1911-12 were £65,000, being the same amount as in the previous year, whilst the provident fund received an addition of £17,500 as in 1910-11. The report mentions the financial interest of £425,000 taken in the Bergmann Electricity Works Co., and states that this event is not to be considered as a step in the direction of a proposed future amalgamation.

#### ELEKTRIZITÄTS GESELLSCHAFT VOM. SCHUCKERT & CO.

The report for 1911-12, after referring to the financial requirements of the Siemens-Schuckert Works in respect of a further loan of £1,000,000, states that the company's share of £500,000 of that sum was provided by an increase in the share capital of £500,000 to £3,500,000, the premium of £155,000 realised on the issue having been placed to the reserve fund. The Austrian Siemens-Schuckert Works, of Vienna, were well employed in 1911-12, and again made a distribution of 6 per cent., although on increased share capital, whilst the Russian Schuckert Co., which was compelled to extend its plant in order to cope with the growth in orders, raised its rate from 4 per cent. in 1910 to 5 per cent. last year, and had since resolved to make a capital issue of £100,000 to £300,000. The report proceeds to deal in detail with other undertakings in which the company is interested in different countries. The accounts indicate the following results for the two years:—

	1911-12.	1910-11.
Share capital ... ..	£3,500,000	£3,000,000
Loan capital ... ..	1,785,000	1,855,000
Gross profits ... ..	428,000	362,000
General expenses ... ..	20,000	15,000
Interest on loans... ..	79,000	82,000
Depreciation ... ..	783	100
Net profits and balance forward ...	352,000	293,000
Dividend ... ..	260,000	206,000
" per cent. ... ..	8	7½
Carried forward ... ..	62,000	62,000

The sum of £15,000 has been allocated to the special reserve fund as in the previous year, and this fund now stands at £45,000, whilst the ordinary reserve fund has been raised to £485,000 by the addition of the premium realised on the new issue of shares. The central stations under the company's control represent £75,000, and other investments £1,890,000, but it has not been deemed necessary to make any provision for depreciation of the latter during the past three years.

**Mexico Tramways Co., Ltd.**—The directors have declared a dividend of 1½ per cent.

**British Coalite Co., Ltd.**—The directors' report, as quoted in the *Financier*, states that the loss entailed on the operations for the 12 months to September 30th amounts to £11,192, in comparison with £26,265 for the previous year. The greater portion of this loss is due to contracts which matured during the year, and which could not previously be cancelled.

## STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange markets were not greatly upset by the various postponements of the Peace Conference, although the ultimatum published last Saturday morning had the effect of disturbing prices for a time. The view is now taken, however, that intervention by the Great Powers is practically assured, and on this theory prices in most of the investment—as well as the speculative—departments have quietly improved.

The feature in the Home Railway market is renewed strength in Metropolitan and Districts. The quotations of both went up with a run on the reassembling of the markets after their New Year holiday, and the only reasons which dealers could find to explain the sudden jump was the old one of syndicate buying. This, no doubt, had something to do with it in the case of Districts, while in regard to Metropolitan the market for some time past has been so restricted that a little extra demand or supply has sufficed to move the price sharply. Central London and City & South

London are good, and there has been some improvement in East London Ordinary, attention being redirected to this stock on a steady rise in the price of Great Easterns. With the dividend announcements and distributions just at hand, and with the prospect of money becoming a little easier, it is not surprising that proprietors of Home Railway stocks should be chary about selling at present, and this naturally makes for strength in the market.

The Electricity Supply section waits upon fresh developments in connection with the linking-up negotiations. These, it is said, are by no means broken off; and in anticipation of some news or other becoming available before long, prices of the principal Electric Lighting shares are holding with noticeable steadiness, having regard to the probably increased costs which the next balance-sheets are likely to show in consequence of the rise in fuel and other items of expenditure. The winter so far has been a bad one from the point of view of the illumination industries, however pleasant it may have proved to those who suffer from fog. Changes on the week are unimportant, but a better tone in City Lights deserves notice, and there seems to be an idea about that speculation in these may be renewed. That, however, is a matter which only the insiders can prophesy with any attempt at accuracy.

It is a little surprising that investors should not pay more attention to the 4½ per cent. Debenture stock of the Urban Electric Supply Company, which can be bought in the market at about 86½, with dividends payable on April 1st and October 1st. The amount required every year for the service of the stock is £13,380, and the net profits have risen steadily from £26,000 in 1905 to £47,600 in 1911, while the estimates for the next three years look for further increases. The company, of course, is not popular, because of its recent unhappy history; and it is still in debt to the Edmundsons' Electricity Corporation. But for those who care for a stock that yields a steady 5½ per cent., with a chance of improving in value, Urban Debenture looks reasonably attractive.

The Latin-Canadian group shows several dramatic rises. Montreal Light, Heat and Power put on 10 points. Shawinigan Water Common has risen 6. Brazilian Traction is 4½ to the good. A good deal of strength has developed in Georgia Light and Power shares on the expectation that the first quarterly dividend—at the rate of 4 per cent. per annum—will be declared in March or April this year. A bet was made in the Stock Exchange the other day that Georgias would be 75 before the year is out, but this must not be taken as a tip to buy them.

The British Columbia Electric Railway issue was favourably received, and it had no chastening effect upon the prices of the existing securities—in fact, the company's Preferred Ordinary is up 1, and the 4½ per cent. First Mortgage Debenture stock rose 1½, the publication in the prospectus of the progress which the company has made during the past half-decade, evidently directing fresh notice to the undertaking. The Mexican group is strong, Mexican Light and Power Common being up 1½, while the Preferred and the First Mortgage Bonds are both better. Monterey Fives improved 1½. Mexico Trams and the First Bonds gained 1½ each, and similar rises have been frequent. The Anglo-Argentine Tramways group is steady. Brisbane Trams Investment Ordinary are nominally 7½ easier. Victoria Falls Preferred hardened to 19s. 6d.

Perth Electric Trams Debenture spurred 5½ on a small demand. River Plate Electricity Common shed 10 points, there being fears of reduced earnings in consequence of competition.

The Telegraph market is quiet, with comparatively few movements. Eastern Ordinary put on ½, and Great Northern Telegraphs gained a similar amount. The feature, however, is the strength of West India and Panama Telegraphs: the shares enjoyed a sharp rise on the attitude taken by President Taft on the question of the Panama Canal, and it is devoutly hoped that some arrangement more beneficial to this country than that originally proposed will be arrived at without outside intervention. The Preference shares hardened in sympathy. Western Telegraphs are a little better, and there has been a steady demand for Anglo-Americans, with the result that the Deferred stock at 26½ shows a rise of the fraction.

Marconis went ahead in lively mood upon the news that the Brazilian Government had concluded an important contract with the company. The price was run up to 57½, from which there was a slight recession, and the shares of the subsidiaries moved on lines very similar—that is to say, after being good they went back a little. National Telephone Deferred is disposed to sag, and the quotation shows a loss on the week.

In the Manufacturing division, Babcocks hardened to 37½, and the armament shares generally improved upon the official announcement of the Budget for 1913, with its provision of fifty millions sterling for the Navy. The Cable Companies' shares are better, British Insulated and Henleys both showing gains, while India-Rubber rose 10s. to 10½ middle. The Rubber share market continues to exhibit surprising strength and vitality, there being a big volume of business every day, and little present indication of its slackening.

**Mexican Light and Power Co., Ltd.**—The directors have declared a dividend of 1 per cent. for the quarter ending December 31st on the ordinary shares:

**Prospectus.**—*British Columbia Electric Railway Co., Ltd.*—This company has been inviting subscriptions for £750,000 4½ per cent. perpetual consolidated debenture stock at 98 per cent. The proceeds are to be devoted to extensions and general purposes of the company, which, as the last annual report showed, is developing at a remarkable rate. The list was to close on Wednesday.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME	Stock of Share	Dividend for	Closing Quotations Jan. 7th.	Rise or Fall	Present Yield p.c.	NAME	Stock of Share	Dividend for	Closing Quotations Jan. 7th.	Rise or Fall	Present Yield p.c.		
Bournemouth & Poole, Ord. ..	10	5 1/2	51	0A-10A	..	5 4 0	Kensington & Knightsbridge, Ord	6	9 81	74-8A	..	2 1/2 d.	
Do. 4 1/2 % Pref. ..	10	4 1/2	44	81-91	..	4 12 4	Do. 4 % Deb. ..	Stock	1	4	82-85	..	4 1 1/2
Do. Second 6 % Pref. ..	10	6	6	10-10A	..	6 11 9	Kent Elec. Power, 4 1/2 % Deb. ..	Stock	4 1/2	4 1/2	75-82	..	5 9 1/2
Do. 4 1/2 % Deb. Stock ..	Stock	4 1/2	4 1/2	56-98Axd	..	1 11 11	London Electric, Ord. ..	8	2 1/2	14-2	..	3 15	
Brompton & Kensington, Ord. ..	5	10 3/4	3 1/2	8 1/2-9 1/2	..	6 8 1	Do. 8 % Pref. ..	5	6	4 1/2-5 1/2	..	5 11 1/2	
Do. 7 % Cum. Pref. ..	5	7	7	8 1/2-9	..	3 17 9	Do. 4 % First Mort. Deb. ..	Stock	4	4	8 1/2-9 1/2	..	4 8 0
Central Electric Supply, 4 1/2 %	100	4	4	95-98	..	4 1 8	Metropolitan ..	5	4 1/2	3 1/2-4 1/2	..	5 3 3/4	
Guar. Deb. ..	100	4	4	95-98	..	4 1 8	Do. 4 1/2 % Cum. Pref. ..	5	14 1/2	1 1/2-4 1/2xd	..	5 1 1/2	
Charing Cross, West End & City	6	5	5	42-44	..	4 17 7	Do. 4 1/2 % First Mort. Deb. ..	Stock	1 1/2	1 1/2	4 1/2-10 1/2xd	..	4 10 0
Do. 4 1/2 % Cum. Pref. ..	6	4 1/2	4 1/2	42-44	..	4 17 7	Do. 8 1/2 % Mort. Deb. ..	Stock	8 1/2	8 1/2	8 1/2-86xd	..	1 1 1/2
Do. "City" Undertaking ..	6	4 1/2	4 1/2	42-44xd	..	6 2 10	Midland Electric Corporation	100	4 1/2	4 1/2	97-99xd	..	4 10 11
4 1/2 % Cum. Pref. ..	6	4 1/2	4 1/2	42-44xd	..	6 2 10	4 1/2 % First Mort. Deb. ..	100	4 1/2	4 1/2	97-99xd	..	4 10 11
Do. 4 % Deb. ..	100	4	4	92-91	..	4 5 1	Newcastle-on-Tyne 5 % Pref.,	6	5	42-44	..	5 2 7	
Do. 4 % Deb. ..	100	4	4	92-91	..	4 5 1	Non-Cum. ..	6	5	42-44	..	5 2 7	
Chelsea, Ord. ..	5	5	5	43-5	..	5 0 0	North Metropolitan Power Sup-	100	6	5	96 1/2-10 1/2	..	4 18 6
Do. 4 1/2 % Deb. ..	Stock	4 1/2	4 1/2	43-5	..	4 10 11	ply, 5 % Mortgages (Red.)	100	6	5	96 1/2-10 1/2	..	4 18 6
City of London, Ord. ..	10	8	8	12-13 1/2	..	4 3 0	Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9 1/2-10 1/2xd	..	6 11 7
Do. 6 % Cum. Pref. ..	10	6	6	12-13 1/2	..	4 3 0	Oxford ..	5	7 1/2	6 1/2-6 1/2	..	5 9 1/2	
Do. 6 % Deb. ..	Stock	6	6	116-119	..	4 3 0	Do. 8 1/2 % Deb. ..	5	10 1/2	10 1/2-10 1/2	..	4 17 7	
Do. 4 1/2 % Second Deb. ..	100	4 1/2	4 1/2	90 1/2-11 1/2	..	4 3 0	Do. 7 % Pref. ..	6	7 1/2	6 1/2-7 1/2	..	4 16 7	
Do. 8 % Pref. ..	10	6	6	11-12 1/2	..	4 19 0	Smithfield Markets, Ord. ..	6	2	10-11 1/2xd	..	4 3 6	
Do. 4 1/2 % Deb. ..	Stock	4 1/2	4 1/2	104-105xd	+	4 3 11	South London, Ord. ..	6	2	2 1/2-3 1/2	..	5 18 4	
Edmundson's, Ord. ..	23	Nil	Nil	3 1/2-4 1/2	..	Nil	Do. 5 % First Mort. Deb. ..	100	5	5	16-19xd	..	5 1 0
Do. 6 % Cum. Pref. ..	6	Nil	8	3 1/2-4 1/2	..	..	South Metropolitan, 7 % Pref. ..	1	7 1/2	1 1/2-1 1/2	..	5 9 1/2	
Do. 6 % Non-Cum. Pref. ..	5	..	..	14-12	..	..	4 1/2 % First Deb. Stock ..	100	1 1/2	1 1/2-99	..	4 11 3	
Do. 4 1/2 % First Mort. Deb. ..	100	4 1/2	4 1/2	84-87	..	5 8 6	Urban, Ord. ..	23	Nil	..	..	..	
Folkstone ..	6	6	6	42-43	..	5 17 1	Do. 6 % Cum. Pref. ..	5	2	2 1/2-3 1/2	..	..	
Do. 6 % Cum. Pref. ..	5	6	6	42-43	..	4 14 9	Do. 4 1/2 % First Mort. Deb. ..	100	4 1/2	4 1/2	8 1/2-8 1/2	..	5 2 3
Do. 4 1/2 % First Deb. ..	100	4 1/2	4 1/2	93-95	..	5 12 6	Westminster, Ord. ..	6	10 9 1/2	8 1/2-9 1/2	..	5 8 1	
Hove ..	6	9	8 1/2	7 1/2-8	..	5 12 6	Do. 4 1/2 % Cum. Pref. ..	6	4 1/2	4 1/2-4 1/2xd	..	4 7 10	

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6	6	5 1/2-5 1/2	..	5 6 8	Monterey Rly. Light & Power, 5 % 1st Mort. Deb. ..	100	5	5	18-10	+ 1 1/2	5 11 1
Calcutta, Ord. ..	5	8 1/2	7 1/2	6 1/2-7 1/2	..	5 19 4	Montreal, Lt., H. and Power ..	\$100	8	9 1/2	2 1/2-1 1/2	+ 10	3 14 5
Do. 5 % Pref. ..	5	6	6	4 1/2-5 1/2	..	4 18 5	Northern, Lt., Power and Coal, ..	\$500	5	5 1/2	25-30	..	..
Do. 5 % Cum. Pref. ..	100	5	5	92 1/2-94xd	..	5 6 10	River Plate, Ord. ..	Stock	10	..	217-227	- 8	4 6
Do. 5 % Deb. ..	100	5	5	115-119xd	+ 2	5 17 8	Do. 6 % Non-Cum. Pref. ..	Do.	6	6	106-111	..	5 6 8
Do. 7 % Pref. ..	\$100	7	7	118-122	..	5 11 9	Do. 5 % Deb. Stock ..	Do.	5	5	100-102xd	..	4 18 0
Do. 5 % Deb. ..	100	5	5	95-98	..	5 2 0	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb. ..	100	4 1/2	4 1/2	98-100	..	4 10 0
Cordoba Lt., Power and T., Ord.	100	5	5	12-9A	..	5 7 8	Shawinigan Water, Capital ..	\$100	5	5	1 1/2-1 1/2	..	3 5 7
Do. 5 % Deb. ..	100	5	5	95-98	..	5 7 8	Do. 5 % Con. 1st Mort. Bonds ..	\$500	5	5	1 1/2-1 1/2xd	..	4 13 6
Do. 5 % Deb. ..	100	5	5	95-98	..	5 7 8	Do. 4 1/2 % Per. Deb. ..	Stock	4 1/2	4 1/2	10 1/2-10 1/2	+ 4	4 10 0
Do. 5 % Deb. ..	100	5	5	95-98	..	5 7 8	Toronto Power, 4 1/2 % Deb. ..	Do.	1 1/2	1 1/2	58-100	- 3	4 10 0
Do. 5 % Deb. ..	100	5	5	95-98	..	5 7 8	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. ..	100	5	5	41-91xd	..	5 6
Do. 5 % Deb. ..	100	5	5	95-98	..	5 7 8	Victoria Falls Power, Pref. ..	1	1 1/2	7 1/2-1 1/2	+ 1 1/2	..	
Do. 5 % Deb. ..	100	5	5	95-98	..	5 7 8	West Kootenay Power and Lt., 1st Mort. 6 % Gold ..	100	6	8	103 1/2-106 1/2	..	6 13 9

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	4	4 1/2	7-7 1/2	..	6 0 0	Monte Video Telephone, Ord. ..	1	6	6 1/2	4 1/2-4 1/2	..	5 19 0
Do. 5 % Deb. Red. ..	Stock	5	5	96-98xd	..	6 2 0	Do. 5 % Pref. ..	1	6	6	..	..	6 18 6
American Telegraph & Teleg., Cep.	\$100	8	8 1/2	141 1/2-143 1/2	+ 1/2	5 11 6	National Telephone Def. ..	Stock	6	..	136-150	- 1	..
Do. Collat. Trust ..	\$1000	4	4	91 1/2-93 1/2	..	4 5 7	New York Teleg., 4 1/2 % Gen. Bds.	100	4 1/2	4 1/2	97 1/2-88 1/2	..	4 11 2
Anglo-American Telegraph ..	Stock	8	8	67-69	..	4 7 0	Oriental Teleg. and Elec. ..	1	8	6	12 1/2-15 1/2	..	4 9 10
Do. 6 % Pref. ..	Do.	6	6	111-112 1/2	..	6 5 5	Do. 6 % Cum. Pref. ..	1	6	6	12 1/2-15 1/2	..	4 18 6
Do. 6 % Deb. ..	Do.	80 1/2	..	26 1/2-26 1/2	..	4 15 5	Do. 4 % Red. Deb. ..	Stock	4	4	87-87xd	..	4 8 11
Do. 6 % Deb. ..	Do.	5	5	102-104	..	4 16 2	Pacific and European Tel., 4 % Guar. Debs. ..	Do.	4	4	98-100xd	..	4 0 0
Do. 6 % Deb. ..	Do.	5	5	7 1/2-7 1/2xd	..	5 3 3	Reuter's ..	10	10	10 1/2-10 1/2	- 1/2	9 6	
Do. 6 % Deb. ..	Do.	4	4	80-82xd	..	4 17 7	Submarine Cables Trust ..	Cert.	6	6	127-120	..	4 12
Do. 6 % Deb. ..	Do.	10	10	16-17	..	6 5 4	Telephone Co. of Egypt, 4 1/2 % Deb. Red. ..	Stock	4 1/2	4 1/2	97-99xd	..	4 10 1
Do. 6 % Deb. ..	Do.	6	6	12-13 1/2	..	5 17 8	Do. 5 % Cum. Pref. ..	5	8	7 1/2-7 1/2	..	5 4 1	
Do. 6 % Deb. ..	Do.	5	5	6 1/2-7	..	7 2 10	Do. 6 % Cum. Pref. ..	5	5	6 1/2-6 1/2xd	..	4 7 11	
Do. 6 % Deb. ..	Do.	10	10	6 1/2-7	..	6 15 7	Do. 4 % Deb. ..	2 1/2	2 1/2	1 1/2-1 1/2	..	4 0 0	
Do. 6 % Deb. ..	Do.	100	4 1/2	99-101	..	4 9 0	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. ..	100	4	4	95-98xd	..	4 1 8
Do. 6 % Deb. ..	Do.	7	7 1/2	133 1/2-136 1/2	+ 1/2	5 2 7	West India and Panama Teleg. ..	10	2 1/2	1 1/2	3 1/2-3	..	5 11 7
Do. 6 % Deb. ..	Do.	8 1/2	8 1/2	77-79	..	4 8 7	Do. 6 % Cum. 1st Pref. ..	10	5	5	10 1/2-10 1/2	+ 1/2	6 11 7
Do. 6 % Deb. ..	Do.	4	4	96 1/2-98 1/2	+ 1/2	4 1 3	Do. 8 % Cum. 2nd Pref. ..	10	6	6	9 1/2-10	..	6 0 0
Do. 6 % Deb. ..	Do.	7 1/2	7 1/2	13-13 1/2	..	6 9 8	Do. 5 % Debs. ..	100	5	5	101-103xd	..	4 17 1
Do. 6 % Deb. ..	Do.	4	4	96-98	..	4 1 8	Do. 5 % Deb. ..	10	7	7 1/2	13 1/2-13 1/2	+ 1/2	5 2 9
Do. 6 % Deb. ..	Do.	25	4	98-101	..	3 19 8	Do. 4 % Deb. ..	Stock	4	4	94-96xd	..	4 3 4
Do. 6 % Deb. ..	Do.	10	6	10 1/2-10 1/2	..	5 10 4	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	4 1/2	97 1/2-100 1/2	+ 1/2	4 10 0
Do. 6 % Deb. ..	Do.	10	6	12 1/2-12 1/2	..	4 13 2							
Do. 6 % Deb. ..	Do.	25	19	5 1/2-5 1/2	..	6 12 1							
Do. 6 % Deb. ..	Do.	100	5	5	85-88	..	5 13 8						
Do. 6 % Deb. ..	Do.	4	4	67-70	..	5 14 4							
Do. 6 % Deb. ..	Do.	1	20	..	45-55	+ 1 1/2	4 0 0						
Do. 6 % Deb. ..	Do.	1	17	..	4 1/2-4 1/2	+ 1 1/2	3 15 7						

\* Unless otherwise stated, all shares are fully paid. † Paid in deferred interest warrants. ‡ Interim Dividend. § 3s. in Funded Dividend Certs

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 7th.	Rise + or Fall	Present Yield p.o.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 7th.	Rise + or Fall	Present Yield p.o.
Bath Trams, Pref. Ord. . . . .	1	Nil	Nil		Nil	Metropolitan Railway Consol. . .	100	1 1/2	1 1/2	+1 1/2	2 18 10
Do. 5% Pref. . . . .	1	5	5		6 8 1	Do. Surplus Lands . . . . .	100	2 1/2	2 1/2		4 6 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		5 11 1	Do. 8 1/2% Deb. . . . .	100	8 1/2	8 1/2	+1	8 17 9
Brit. Elec. Trac., 5% Pref. . . . .	100	5	5		7 1/2	Do. 5% Pref. . . . .	100	5	5		4 0 6
Do. Do. Deferred . . . . .	100	5	5		7 1/2	Do. 8 1/2% Con. Pref. . . . .	100	8 1/2	8 1/2		4 1 5
Do. Do. 6% Com. Prf. . . . .	100	6	6		6 13 4	Metropolitan District Ord. . . . .	100	Nil	Nil	+2 1/2	Nil
Do. Do. 7% Non-Cum. Prf. . . . .	100	7	7		6 13 4	Do. 6% Deb. . . . .	100	6	6		4 0 6
Do. Do. 5 1/2% Perp. Deb. . . . .	100	5 1/2	5 1/2		5 4 2	Do. 4% Deb. . . . .	100	4	4		4 2 5
Do. Do. 4 1/2% 2nd Deb. . . . .	100	4 1/2	4 1/2		5 7 2	Do. 4% Prior Lien . . . . .	100	4	4		3 13 4
Central London Railway, Ord. . . . .	100	5	5		3 11 5	Do. 5% Deb. . . . .	100	5	5	+1	4 15 11
Do. Pref. . . . .	100	4	4		4 14 2	Do. 3 1/2% Gtd. . . . .	100	3 1/2	3 1/2		4 9 9
Do. Def. . . . .	100	2	2		2 7 1	Metropolitan Elec. Trams, Ord. . . . .	1	6	6 1/2		5 1 1
Do. 4% Deb. . . . .	100	4	4		4 0 0	Do. Def. . . . .	1	Nil	Nil		Nil
City & South London, Ord. . . . .	100	1 1/2	1 1/2		8 13 4	Do. 5% Pref. . . . .	1	5	5		5 14 3
Do. 5% Pref., 1891 . . . . .	100	5	5		4 10 1	Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		4 14 9
Do. Do. 1888 . . . . .	100	5	5		4 10 1	Do. 5% Deb. . . . .	100	5	5		5 3 1
Do. Do. 1901 . . . . .	100	5	5		4 10 1	Potteries, Ord. . . . .	1	3 1/2	3 1/2		5 19 0
Do. Do. 1908 . . . . .	100	5	5		4 10 1	Do. 5% Pref. . . . .	1	5	5		6 19 0
Do. 4% Deb. . . . .	100	4	4		4 0 0	Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		5 2 8
Dublin United Trams, 5% Pref. . . . .	10	5	5		4 12 4	South Metro. Trams, 5% Pref. . . . .	1	6	6		7 7 8
Great Northern & City, Prf. Ord	10	Nil	Nil		Nil	Do. 4% Deb. . . . .	100	4	4		5 14 4
Hastings Trams, 5% Pref. . . . .	100	5	5		8 6 8	Underground Elec. Railways	10	10	10		10 10 10
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		6 1 7	Do. "A" . . . . .	1/2	1/2	1/2		10 10 10
Leamington Trams, 5% Pref. . . . .	5	2 1/2	2 1/2		3 15 3	Do. 5% First Cum. Inc. Deb. . . . .	100	5	5		5 6 2
Do. 4% Deb. . . . .	100	4	4		5 0 0	Do. 4 1/2% Bonds . . . . .	100	4 1/2	4 1/2		4 10 0
Lancashire United, 5% Deb. . . . .	100	5	5		6 0 0	Do. 6% Income . . . . .	100	1 1/2	1 1/2		5 14 4
London Elec. Railways, 4% Deb. . . . .	100	4	4		4 2 6	Yorkshire (West Riding), Ord. . . . .	5	Nil	Nil		Nil
London United Trams, 5% Pref. . . . .	100	Nil	Nil		5 11 1	Do. 5% Pref. . . . .	5	5	5		4 5 9
Do. 4% Deb. . . . .	100	4	4		5 11 1	Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . . . .	5	5 1/2	5 1/2		5 10 0	La Plata Elec. Trms, Ord. . . . .	1	Nil	Nil		6 0 0
Do. 2nd Pref. . . . .	5	5 1/2	5 1/2		5 14 8	Do. Pref. . . . .	1	6	6		4 16 0
Do. 4% Deb. . . . .	100	4	4		4 5 1	Lisbon Elec. Trams, Ord. . . . .	1	6	6 1/2		4 16 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		4 10 11	Do. 5% Pref. . . . .	1	6	6		4 16 0
Do. 5% Deb. . . . .	100	5	5		5 0 0	Do. 4% Deb. . . . .	100	5	5		4 18 0
Auckland Trams, 5% Deb. . . . .	100	5	5		4 17 1	Madras Elec. Tr. (1904), Deb. . . . .	100	5	5	+2	18 0 0
Bombay Elec. R. & Trams, Pref. . . . .	10	6	6		4 18 0	Manaos Trams & L., 1st Deb. . . . .	100	5	5		5 11 1
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		4 11 10	Manila Elec. R. and Lig., Bonds	1000	5	5		4 17 7
Do. 5% 2nd Deb. . . . .	100	5	5		5 1 0	Mexico Trams Com. . . . .	100	7	7		6 2 8
Brazilian (Tram Light) and Power	5	100	100		4 11 0	Do. Gen. Con. 5% Bonds . . . . .	5	5	5		5 0 6
Brisbane Trams Inv., Ord. . . . .	5	8	8 1/2		4 5 6	Do. 6% Bonds . . . . .	100	6	6		5 17 1
Do. 5% Pref. . . . .	5	5	5		4 8 3	Paço Elec. Rly. & L., Ord. . . . .	5	10	10 1/2		5 9 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		5 11 2	Do. 5% Pref. . . . .	5	6	6		5 9 1
B. Columbia Elec. Rly, Def. . . . .	100	8	8		4 17 7	Do. 5% 1st Deb. . . . .	100	5	5		5 0 0
Do. Pref. Ord. . . . .	100	6	6		4 17 7	Perth (W.A.) Elec. Tr., Ord. . . . .	1	5	5 1/2		3 14 5
Do. 5% Pref. . . . .	100	5	5		4 10 11	Do. 6% 1st Deb. . . . .	100	5	5		4 14 4
Do. 4 1/2% 1st Mort. Deb. . . . .	40	4 1/2	4 1/2		4 11 5	Rangoon El. Tr. & Sup., Pref. . . . .	5	5	5		5 0 0
Do. 4 1/2% Vancouver Deb. . . . .	100	4 1/2	4 1/2		4 5 9	Do. 4 1/2% 1st Deb. . . . .	100	4 1/2	4 1/2		4 10 11
Do. 4 1/2% Con. Deb. . . . .	100	4 1/2	4 1/2		4 5 0	Rio de Janeiro Trams, 1st Mort. . . . .	5	5	5		4 18 0
Calcutta Trams, Ord. . . . .	5	7	7 1/2		5 12 0	Do. 5% Mort. Bonds . . . . .	100	5	5		5 1 6
Do. 5% Pref. . . . .	5	5	5		4 17 7	Sao Paulo Tram, Lt. and P. . . . .	100	5	5		4 15 8
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		4 10 0	Singapore Trams, 5% 1st Deb. . . . .	100	5	5		5 17 8
Cape Electric Trams . . . . .	1	2 1/2	2 1/2		4 8 0	Southern El. Tr. B.A., 5% Deb. . . . .	100	5	5		5 2 0
City Buenos Aires Trams (1904) . . . . .	5	5	5		5 0 0	Un. Elec. Trams Monte Video . . . . .	5	7	7		5 16 8
Do. 4% Deb. . . . .	100	5	5		5 2 1	Do. 5% Pref. . . . .	5	6	6		5 11 7
Colombo Elec. Tr. & L., 5% Deb. . . . .	100	5	5		4 17 1	Do. 5% 1st Deb. . . . .	100	5	5		4 18 0
Havana Elec. Rly., 6% Bonds	1000	5	5		6 13 8	Winnipeg Elec. Rly., 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		4 8 3
Kaigorie Elec. Trams . . . . .	1	Nil	Nil		Nil						
Do. 5% A Deb. . . . .	100	5	5		6 13 8						
Do. 6% B Deb. . . . .	100	6	6		Nil						

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	6	6		8 0 0	Crompton & Co. . . . .	8	Nil	Nil		Nil
Do. 6% Pref. . . . .	1	6	6		7 7 8	Do. Deb. . . . .	100	5	5 1/2		9 1 10
Babcock & Wilcox . . . . .	1	23	14 1/2		4 14 0	Dick, Kerr . . . . .	1	6	6		6 17 2
Do. Pref. . . . .	1	6	6		4 0 0	Do. Pref. . . . .	1	6	6		4 11 10
British Aluminium, Ord. . . . .	1	Nil	Nil		5 2 8	Do. Deb. . . . .	100	4 1/2	4 1/2		5 17 8
Do. 6% Cum. Pref. . . . .	1	Nil	Nil		5 12 4	Edison & Swan, A, £8 paid	5	5	5		5 17 1
Do. 5% Prior Lien Debts. . . . .	100	5	5		6 8 1	Do. fully paid . . . . .	5	5	5		5 17 1
Do. Deb. Bk. . . . .	100	5	5		4 14 1	Do. 4% Deb. . . . .	100	5	5		6 18 4
B.I. & Helay Cables . . . . .	5	10	8 1/2		4 6 7	Do. 5% Second Deb. . . . .	100	5	5		7 1 4
Do. Pref. . . . .	5	6	6		4 13 9	Electric Construction . . . . .	2	2 1/2	2 1/2		7 0 0
Do. Deb. . . . .	100	4 1/2	4 1/2		4 12 9	Do. Pref. . . . .	2	7	7		8 5 8
British Thomson-Houston, Deb.	100	4 1/2	4 1/2		6 11 2	Greenwood & Batley, Pref. . . . .	10	5	5		6 4 2
British Westinghouse, Pref. . . . .	1	Nil	Nil		5 16 6	Do. Deb. . . . .	100	5	5		4 4 3
Do. Deb. . . . .	1	3	3		Nil	General Electric, Pref. . . . .	10	5	5		6 8 4
Do. 6% Prior Lien . . . . .	100	6	6		Nil	Do. Deb. . . . .	100	4	4		4 7 10
Browett, Linsley, Ord. . . . .	1	1	1		Nil	Do. Deb. . . . .	100	5	5		6 14 4
Do. Pref. . . . .	1	1	1		Nil	Do. Deb. . . . .	100	4	4		4 1 8
Brush, 7% Pref. . . . .	2	Nil	Nil		5 0 0	Willans & Robinson . . . . .	1	Nil	Nil		Nil
Do. 5% Prior Lien Deb. . . . .	100	5	5		8 13 2	Do. Pref. . . . .	5	Nil	Nil		Nil
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2		14 1 4	Do. Deb. . . . .	100	4	4		6 15 7
Do. 4 1/2% Second Deb. . . . .	100	4 1/2	4 1/2		6 13 4						
Callender's Cable . . . . .	5	15	10 1/2		5 0 0						
Do. Pref. . . . .	5	5	5		4 10 0						
Do. Deb. . . . .	100	4 1/2	4 1/2		5 6 8						
Cascker-Kellner . . . . .	1	30	20		4 2 7						
Do. Deb. . . . .	100	4 1/2	4 1/2		4 2 7						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

**INVENTORY OF PLANT IN MUNICIPAL ELECTRICITY WORKS.**

By "INTERESTED."

"I WANT an inventory of all plant installed purchased from capital, together with a certificate signed by the engineer, stating that the whole is in commission and of useful service as means of profit earning." A tall order that; and there is more in it than meets the eye at first glance, too. It is one of the latest requests made by our old friend, Mr. Auditor, for a certified detailed statement of the value of plant actually in commission, and not merely of scrap value only. In reality, the request amounts to a guarantee that machinery, boilers, auxiliary apparatus, mains, switchgear, &c., are not standing idle awaiting the precise moment when their particular loan is redeemed, in order to be relegated to the scrap heap.

In most stations owned by local authorities the absence of detail records in the early period of their existence accentuates the difficulty now experienced in preparing a true statement of the whole capital expenditure in detail, and likewise that of allocating expenditure to each separate mortgage. Speaking generally, loans have ever been increasing; repayments have been made over varying periods at many different rates of interest; and occasionally here and there small loans have been redeemed, more through force of circumstances than otherwise. Some works have plant installed purchased from revenue and, perhaps, small floating balances of loans on account of plant scrapped, in order to make room for that purchased from revenue. Mr. Auditor requests all these transactions properly and clearly set out in tabulated form.

In some cases a systematic balancing-up for the purpose of preparing a detailed summary of capital account reveals the necessity for immediately writing off numerous small outstanding amounts. This procedure is caused by the fact that goods for which loans have been taken up either cannot be justly certified as useful profit-earning units, or have entirely disappeared owing to various causes.

What seems now to be imperative is a clear, lucid, up-to-date statement of capital expenditure and redemption made up from the commencement of the undertaking. Just how this should be done, and the best manner of showing the present state of affairs, is rather a vexed question. In this short article I propose illustrating one method for carrying out the work, which may prove of use to not a few readers.

The whole matter is in the form of a book printed and ruled after the fashion illustrated below. This is in actual use in a certain London station, and will, I think, with little alteration, prove suitable for many others. The pattern runs right across each opening, and a four-letter index at the front of the book serves the purpose of enabling any particular item to be found without delay. In the pattern shown a few imaginary figures are filled in for the purpose of explanation. As will be seen, entries are made and a balance shown annually, so that once the bulk of information is collated, very little time is needed to keep the record up to date. The right-hand side of the illustration is really of a revenue nature, but serves the purpose of showing the amount expended over and above depreciation, i.e., repayment of capital, so that the true value of the plant as it stands can be ascertained (see illustration No. 1).

General Description.—3,500-kw. turbo-alternator.  
Detail Description.—Turbine, by Williams & Co.  
Alternator, by Brown & Co., Ltd.  
H.T. motor-driven exciter, by Electric, Ltd.

Total value, £9,400.  
Mortgage Nos., 146 and 147.  
Period for repayment, 20 and 15 years.  
No. and marks, E20, E21.

Remarks.—Foundations included in capital value.  
Balance of £3,000 paid out of revenue.

Date.	Item No.	Capital value.	Instalment No.	Redemption.	Balance.	Revenue.	Depreciation 10%.	Balance.	Total capital and revenue.
31/3/11	1	£6,000 0	1/20	£300 0	£5,700 0	Balance paid from revenue £3,000	£300	£2,700	£8,773 12
	2	400 0	1/15	26 8	373 12				
		£6,400 0		£326 8	£6,073 12				
31/3/12	1	£5,700 0	2/20	£300 0	£5,400 0	do.	£2,700	£300	£8,147 4
	2	373 12	2/15	26 8	317 4				
		£6,073 12		£326 8	£5,747 4				

The repairs and maintenance, or revenue, side of an undertaking is one affecting the engineering staff generally, and the "Chief" in particular. He it is who frequently requests information respecting repairs executed upon the different plant units of which the whole works is composed. In order to be in a position to present such information immediately it is called for, without unnecessary delay and a hurried search through innumerable log-books, sheets, &c., a systematic entry of important breakdowns, repairs and replacements is obviously necessary: not simply a conglomeration of foolscap sheets of writing and figures arranged in no particular order, with an index noticeable by its absence, but a simple, quick and ready means of recording occurrences. Such a system

DESCRIPTION OF PLANT: No. 12 B. & W. BOILER FITTED WITH MECHANICAL STOKERS. Nos. and Marks. BR. 12 & 12A.

Date.	Work calling for attention.	S-in-C's initials	Date.	Work done.	Remarks.	Engr's Sig.
23/1/12	Left-hand furnace arch wants re-pairing.	A. P.	6 to 9/2/12	Boiler cleaned out.	Tested and found all O.K.	
4/2/12	Plug of blow-down cock leaking.	J. W.		Wire brush through tubes. B.D. cock overhauled and repacked.	5 p.m.	
				New gauge glass protectors fitted.	9/2/12.	J. R.
				Brickwork L.H. arch repaired.		

No. 2.

should be arranged so that anyone can refer thereto easily and quickly, and find there briefly described all work of much account in the nature of repairs, replacements, renewals and alterations made from time to time. Also there should be added notes of any work calling for attention at the first possible opportunity.

I do not suggest that every minute detail is or should be recorded, but merely work of sufficient size and importance, reference to which at any later time might conduce to a saving in time or material. In order to afford a clear illustration let me take a concrete example by way of explanation. A battery of say five boilers is "off" for some trivial repairs, opportunity being taken at the time to clean them internally. Whilst it is impossible thoroughly to overhaul the five boilers in such a short period, there are most likely a few points which require examination, and time and worry will be saved by reference to notes (which would be found in the below-mentioned system) in order to observe those few important details demanding attention. A casual examination will suffice generally for other points provided the annual period for thorough examination is not near at hand, for if anything worthy of attention was noticed during the time these boilers were in commission previously to being temporarily shut down, note would certainly be found in the proper place in the system. A glance at the five places in the book, i.e., one for each boiler, would reveal all that should receive attention.

The arrangement is simply a foolscap book of about five quires, with printed headings, as per illustration No. 2. One page is allotted to each unit in the works, and entries are made from time to time, whenever necessary. The last column is for the signature of the engineer or works superintendent directly the repair, alteration or replacement is

made. An index is, of course, included at the front of the book.

This simple book will be found quite adequate to meet all demands, whereas entries in a daily or weekly log book fail to show the required information at the right time. The details require summarising and analysing, and putting forward in such a way as to be observed at the right time.

In effect, this revenue plant record is a summary of the log book, with notes and instructions added, and from this book particulars are abstracted for entering on the right-hand side of the above-mentioned Plant Inventory.

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## "GENTLEMEN—WE THANK YOU!"

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HOW THE GOOD NEWS CAME TO HONG-KONG.

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BY PROF. C. A. M. SMITH, M.Sc.

"THE Mail is in!" We heard the boom of the gun about two hours ago, and even the Chinese undergraduates, who are but slightly interested in mails, looked up from their drawing boards to take a glimpse of the great liner as she slowly steamed among the junks and sampans which cover the most wonderful harbour in the world. There are 37 of these engineering undergraduates—when last I wrote, in October, there were only 25, but the score climbs steadily up. How long before we reach 500? If the present symptoms can be taken as indicative of what the Chinese mean to do, it will not be very long before Hong-Kong is as famous in China for its University as is Cambridge in England. We have 37 engineering students out of a total new entry of 55. That is as it should be. Medicine and other subjects are being, and will be, studied by the Chinese. But what the nation seeks after, as a thirsty man seeks something for his parched lips, is applied science. We offer them that in full at this University.

### THE GREAT DAY.

"The mail is in." As soon as I could, with decency, leave the drawing office, I hastened to my room. Yes, there was the familiar bundle—the good old ELECTRICAL REVIEW. Had it published my appeal? Had it backed it with the incisiveness of the pen which the Editor or some of his staff keep stowed away in a special cupboard above which must be writ large King George's watchword, "Wake up, England!"? These, and a thousand other, thoughts rushed through my brain as I tore open the wrapper, and then—

Then I knew that the spade work—the digging in the trenches—of the last few weary months had not been in vain. For I opened the blue cover and I turned to the index . . . but before I did so I saw the word "China" on the page which is sacred to the statement of editorial policy. And I knew that whoever else failed us, the great-hearted friend in Ludgate Hill was true. And a wave of feeling swept over me, such as I suppose comes to few men, for never before had it been my lot to carry anxiety single-handed, or to feel responsibility to such extent that it seemed impossible to win success. And now the message had come. After all, those at home had answered the call! Now can we go forth boldly into the struggle once again. China is hungry for knowledge—yes, but we will supply it, and the British Empire shall still lead in the teeth of twentieth-century competition.

### "DO IT NOW."

I frankly confess that there are lines—the closing line—in the leader which ought never to have been written. But I cannot find it in my heart to upbraid the REVIEW after its magnificent appeal. That clarion call has been echoed up and down the China coast, and now we who are at work for the future know that we can rely upon those at home to help us.

But there are yet readers of the REVIEW who have done nothing. Ponder over the following extract from the *Hong-Kong Daily Press* of October 28th:—"The University is already a success beyond the dreams of its most

sanguine sponsors. . . . The majority of the first-year students at the University have elected to be trained in Engineering Science. That is only what we expected. China needs above all else, at the present time, and will continue to need for very many years to come, engineers for waterworks, the development of her mines, the extension of her railways and other modes of communication, so that the trade of this great country can be effectively opened up. The need of engineers is recognised in China."

Reader, what have you done? Have you thrown aside this golden opportunity—it will never return—to advertise your goods in the Far Eastern market? Won't you strike a blow for freedom and progress? Send that cable or write that letter which will tell us in this little island by the Canton River that you recognise your responsibilities. *Do it now!*

Let me take this opportunity to pay my humble tribute to the British Engineers' Association, whose coming will be greatly welcomed in China. To it we look for substantial help, and I can now suggest that it should endow one of our chairs when it is firmly at work.

It is because I am certain that the electrical firms of Great Britain will see to it that we have an electrical equipment in the beautiful laboratories of this University, that I say with heartfelt gratitude, "Gentlemen, we thank you!" We have done our work for you out here; we are cutting through the jungle of ignorance and superstition. Under the tropical sun we are carving for you a pathway that you and your countrymen may use. If you have not already sent that cable or written the letter—please, for the love of your profession, for the love of your country, for the sacred cause of scientific progress, **DO IT NOW.** What matter your doubts, write—we will advise.

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## NATIONAL INSURANCE ACT, 1911.

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FURTHER DECISIONS OF THE UMPIRE. REFUNDMENT OF CONTRIBUTIONS. QUARTERLY STAMPING.

BY JOS. J. H. STANSFIELD, F.C.I.S.

IN the ELECTRICAL REVIEW of August 16th and October 4th last the decisions of the Umpire appointed under the provisions of the Unemployment Part of the National Insurance Act, 1911, were given, and the present article brings up the decisions to the close of 1912.

The rush of applications to the Umpire appears to be over. From May 16th to June 27th 223 decisions were advertised in the *Board of Trade Journal*, whilst the decisions given therein for the quarters ending September 30th and December 31st, 1912, were 846 and 158 respectively, bringing up the total decisions to the end of the year to 1,227.

The numbers in various sections follow on from the previous articles.

*Mechanical Engineering.*—Contributions are payable in respect of the following:—

27. Hoistmen or lift attendants (for passengers or goods) employed in factories and workshops, or in stores immediately connected therewith (but not in offices), when the aforesaid factories and workshops are engaged wholly or mainly in carrying on any of the trades set out in Schedule VI of the National Insurance Act, 1911 (A. 1,088). (Note.—Mechanical engineering is one of these trades.)

28. Labourers engaged in assisting millwrights, either in excavating foundations for the erection of engines or machinery, or in dismantling machinery or otherwise (A. 1,105).

29. Workmen and their helpers and labourers employed in factories and workshops which are engaged wholly or mainly in the manufacture of castings of aluminium for use as parts of the products of a mechanical engineering establishment (A. 1,110).

30. Workmen employed in businesses carrying on an insured trade, and engaged wholly or mainly in setting out the work in detail from the architect's or draughtsmen's

drawings on board, paper or other material, or in making working sketches from the drawings for the use of the workmen and not engaged wholly or mainly as supervising foremen (A. 1,124).

31. A workman described as a locomotive crane driver and engaged wholly or mainly in loading or unloading materials in a wharf siding forming part of a mechanical engineering establishment (A. 1,132).

32. Workmen engaged in making metal patterns for the use of iron, steel, brass or other foundries which are engaged wholly or mainly in making castings for use as parts of the products of a mechanical engineering establishment (A. 1,139).

33. Workmen employed in a mechanical engineering establishment and engaged wholly or mainly in repairing and screwing couplings and chains as part of the work of making or of repairing vehicles, cranes and machinery (A. 1,141).

34. A workman described as an inspector employed in a mechanical engineering establishment wholly or mainly in testing materials with straight-edge and other gauges (A. 1,160).

35. Tube benders engaged in a mechanical engineering establishment (A. 1,163).

36. Twiners and other machinists engaged wholly or mainly in producing ebonite or vulcanised fibre parts for use as parts of the product of a mechanical engineering establishment (A. 1,169).

37. Workmen engaged wholly or mainly in connection with insured trades and employed as sketchers and progress men (A. 1,212).

38. Workmen engaged wholly or mainly in making, finishing or fixing ferro-concrete and artificial stone in connection with any insured trade, whether on the site or in a workshop or yard (A. 1,216).

39. Workmen engaged wholly or mainly in making moulds for ferro-concrete or artificial stone mentioned in A. 1,216 (A. 1,217).

40. Workmen engaged wholly or mainly as tool setters for general brasswork on capstan lathes and machine tools (A. 1,219).

41. Workmen employed in a mechanical engineering establishment and engaged wholly or mainly in machining and assembling metal windows (A. 1,225).

42. Workmen engaged in marking out timber in connection with an insured trade (A. 1,227).

Contributions are *not* payable in respect of—

11. Workmen engaged in making metal patterns (other than cast-iron patterns) not being for the use of iron, steel, brass or other foundries, who are engaged wholly or mainly in making castings for use as parts of the products of a mechanical engineering establishment (B. 1,138).

*Electrical Engineering.*—Contributions are *not* payable in respect of—

13. Workmen engaged in making lead accumulator boxes or lead linkings for accumulator boxes (B. 1,134).

44. Workmen engaged wholly or mainly in wiring electroliers and similar electrical fittings, and not engaged in the installation or fixing of same (B. 1,150).

45. Workmen engaged wholly or mainly in making ebonite or vulcanised fibre parts of scientific instruments, telephones, or electric light fittings (B. 1,170).

*Cables, Overhead Lines, and Street Lighting.*—Contributions are payable in respect of:—(4) Workmen engaged wholly or mainly in driving or attending steam road rollers in connection with the construction of new roads, and not merely the resurfacing of existing roads (A. 1,076).

Contributions are *not* payable for:—(18) Workmen engaged wholly or mainly in making sills for lids of man-holes in streets (B. 1,089).

*Generation and Supply of Energy.*—Contributions are payable in respect of:—

7. Workmen engaged in erecting and connecting necessary wires to run and control electric time service (A. 1,115).

Contributions are *not* payable for:—

15. Chauffers employed wholly or mainly in driving and cleaning motor-cars and in doing occasional adjustments and repairs thereto (B. 1,108).

*Tramways.*—Contributions are payable in respect of:—

9. Workmen employed in a vehicle constructing or re-

pairing establishment, and engaged wholly or mainly in repairing and screwing couplings and chains as part of the work of making or of repairing vehicles, cranes and machinery (A. 1,111).

*Refundment of Contributions.*—The Unemployment Part of the Insurance Act, by Sec. 91, provides that the Board of Trade shall, on the application of any employer, made within one month after the termination of any prescribed period of 12 months, refund one-third of the contributions paid by him on his own behalf in respect of workmen who have been continuously in his service during the period and in respect of whom not less than 15 contributions have been paid during the period.

A refund of contributions paid in respect of unemployment insurance may also be claimed under Sec. 96, where any employer satisfies the Board of Trade that during any period of depression in his business his workmen have been systematically working short time and he has paid the workman's share of the insurance in addition to his own.

Sec. 100 of the Act provides that any regulations made by the Board of Trade must provide for the return to a workman who is not in an insured trade, and to his employer, of any contributions paid under the belief that the workman was in an insured trade, subject, of course, in the case of a workman, to the deduction of any unemployment benefit that may have been paid.

Forms to be signed by workmen and employers applying for the return of contributions paid in error may be obtained from Labour Exchanges.

No provision is made in the Health part of the Insurance Act for the repayment of contributions paid in error, but upon application being made to the Commissioners, forms can be obtained to claim repayment.

*Quarterly Stamping.*—A revised circular with respect to the quarterly stamping of Contribution Cards has been issued (Circular No. 105 (3)) by the English Health Commissioners. The alterations are not serious, the main one being that where there are less than 100 employes, Methods 3 and 5 (see ELECTRICAL REVIEW of November 8th, 1912) will not be approved. These methods allow for weekly cheques being sent to the Accountant-General, instead of depositing the whole quarter's contribution in advance.

## REVIEWS.

*Vapours for Heat Engines.* By W. D. ENNIS. London: Constable & Co., Ltd. 1912. Price 6s. net.

This is a very thorough investigation into the theory of what it has been customary to call the binary vapour engine. This binary engine is very tempting to the untutored engineer, who knows that certain liquids boil at a lower temperature than water, and give greater pressures at lower temperatures. But these are not the only desiderata, and when we learn that the few vapours which are, under circumstances, better than steam, are those of alcohol, chloroform, acetone, carbon bisulphide and carbon chloride, our joy in binaries, or even in the primary use of these liquids, is somewhat tempered. Was not carbon chloride the stuff, or something like the stuff, that was used by one Guittari as an economical liquid?\*

The author has worked out a series of curves, giving the pressure-temperature relations of what he terms the engineering vapours—ammonia, sulphur dioxide, ether, CS<sub>2</sub>, acetone, chloroform, carbon chloride, ethyl alcohol, and steam. Except the last two in suitable combination, they do not sound attractive to engineers, but are more reminiscent of the operating theatre. They are at least dangerous. Of all the vapours that of steam has the least pressure for a given temperature, and its best ideal efficiency at modern temperatures is at present 0.47; the best recorded efficiency is 0.25, or little over half the theoretical.

The author attacks the problem on the grounds that (1) another vapour might give a higher temperature at 250 lb. pressure (the present steam limit) without superheat; or (2) a temperature of 600° with superheat might

\* Guittari used a mixture of carbonic acid gas and ethene chloride.—EDS. ELEC. REV.

give an efficiency better than steam: or (3) at 28 in. vacuum a lower temperature might be attained.

No vapour is known that will fill the first two conditions, which demand a  $t, p$  curve crossing that of steam. Other vapours do cross, as ethyl alcohol and carbon chloride at 190° F. It is easy to meet condition (1), but not at the same time (3). Condition (3), in any case, is dependent upon a supply of cooling water at, say, 60°, and then the limit of efficiency for any vapour would be 0.51, or 8 per cent. over present steam limits.

Only four vapours fit this condition (3), namely, carbon bisulphide (poisonous and offensive), chloroform (dangerous), acetone, carbon chloride, and possibly a fifth—alcohol. The best is carbon chloride with a pressure of 88 lb. at 302° F. as compared with 69 lb. for steam, and the pressure curve may even cross that of steam at 400° F.

Between 302° and 68° steam stands first in order of merit as a first approximation, but only four of the vapours could be condensed down to 68°, and both alcohol and steam would be slightly inferior to the other four vapours. If high initial pressure is got by superheat no advantage appears to be possible with the four vapours, and steam and alcohol stand first. The author finds no advantage in the binary principle to offset its complications.

For the whole of the six vapours named there is not an enormous difference in the relative sizes of either the boiler or the condenser, but considerable differences are found in the time to get up steam. In Chapter XI the author finds with the so-called Rankine cycle that the cycle efficiency may decrease with an increase of temperature range. With three of the vapours an engine will give equal power with a steam engine of nearly and fully double the cylinder capacity, when working with four expansions.

The substitute vapours probably lose more than steam in cylinder condensation effects, and they have very heavy pressures which are balanced, it may be to some extent, by the possible use of smaller cylinders.

There appears nothing "inherently absurd" in the use of vapours other than steam, and their use, as the primary liquid, is more promising by far than their use as binary vapours heated by the exhaust from a steam engine. We regard this as a very useful book for the student who might be led away by too much enthusiasm for other vapours. There is very little that can be said on behalf of them, and when their various characteristics are taken into the balance, there does not appear to be any real balance in their favour as compared with steam.

*Studies in Radio-activity.* By W. H. BRAGG, M.A., F.R.S. London: Macmillan & Co., Ltd. Price 5s. net.

This book deals chiefly with the phenomena attending the passage of the  $\alpha$ ,  $\beta$ , and  $\gamma$  or X-rays through matter. It embodies a record of experiments carried out in this branch of radio-activity by the author, together with an account of what has been done in this particular field by other investigators. It is, therefore, not a text-book on radio-activity in a general sense, but an account of a more or less limited portion of the subject only. The author has been struck by the absence of any evidence of true secondary radiation, that is, of an ionising radiation which derives its energy from matter under the prompting of primary rays. He concludes, as a result of his investigations, that we can claim no power of causing the atoms to unlock and distribute any stores of energy they may possess. This, of course, is also the conclusion of many other experimenters, though there are some who are not quite satisfied. The author also considers it remarkable that there should be so little evidence of the influence of molecular association upon radio-active phenomena. When an atom acts upon a passing  $\alpha$  or  $\beta$  or  $\gamma$ -ray, it is unsupported by any other atom, even of those belonging to the same molecule.

Particular attention is drawn to the strong family likeness which the three types of radiation,  $\alpha$ ,  $\beta$  and X or  $\gamma$ -rays bear to each other. The  $\alpha$ -rays are positively charged, the  $\beta$ -rays negatively, the X or  $\gamma$ -rays are uninfluenced by electric or magnetic fields. But putting aside these differences and their immediate consequences, in their laws of penetration and scattering, in their actions on matter, and the reactions which they suffer themselves, the three forms of

radiation differ in degree rather than in kind. If it is assumed that the action of each form is direct and requires no assistance from any other form, it is difficult to believe at the same time, that the  $\alpha$  and  $\beta$  radiations are corpuscular, and that the X and  $\gamma$ -rays are spreading pulses in the ether. The author comes to the conclusion that the assumption is wrong, and that the X and  $\gamma$ -rays act only through the intervention of the  $\beta$ -rays. He finds that this is accomplished by means of a complete interchangeability between the X or  $\gamma$ -ray on the one hand, and the moving electron on the other, a change which may be brought about during the passage of the ray or the electron through the atom. He shows that such a change must take place with little or no loss of energy.

The somewhat original conception of the interchangeability of the two primary rays is then declared to lead to a corpuscular hypothesis of X and  $\gamma$ -rays; and this is said to be convenient, as the ether pulse idea has been for some time unproductive. It is better, therefore, to put it aside provisionally, and take the interchangeability of the X-ray and the electron as a new starting point.

From the preliminary sets of experiments the following conclusions are drawn:—

1. The  $\alpha$  particle is not appreciably scattered in passing through matter, but is "absorbed" only through the expenditure of its energy on ionisation.

2. The  $\alpha$  particle has a definite range in any given material depending upon its initial velocity.

3. Radium in a state of equilibrium contains four substances, each of which ejects a particles at the same rate, but with different initial velocities.

4. The range of the  $\alpha$  particle of radium itself is about 3.3 cm.

5. The  $\alpha$  particle produces more ionisation as its speed diminishes.

Chapter II describes the range-finding apparatus. Chapter III shows how the ionisation curve of the  $\alpha$ -ray is obtained. Chapter IV gives an interpretation of certain peculiarities of the  $\alpha$ -ray curve. Chapter V deals with the quantitative results of stopping power exhibited by matter to the rays. Chapter VI is on the ionisation produced by the  $\alpha$  particle in different gases. Chapter VII deals with initial recombination; Chapter VIII, with the  $\beta$ -ray and the law of its scattering; Chapter IX, with the loss of energy of the  $\beta$ -ray; Chapter X, with the general case of "absorption" of the  $\beta$ -ray; Chapter XI, with the general properties of X and  $\gamma$ -rays; Chapter XII, with the production of the secondary  $\beta$ -ray by the X-ray; Chapter XIII, with the corpuscular form of the X-ray; Chapter XIV, with the energy of the X-ray; Chapter XV, with the calculation of the ionisation current under given conditions; Chapter XVI, with the scattering of X and  $\gamma$ -rays; and Chapter XVII, with the nature of X and  $\gamma$ -rays.

The book is well worth study by those interested in the subject, as it is evidently the record of an able experimenter.

*Electrical Injuries.* By C. A. LAUFFER, M.D. London: Chapman & Hall. Price 2s. net.

This little book is the work of the medical director of the relief department of the Westinghouse E. & M. Co., Pittsburg, and deals with the causation, prevention and treatment of electrical injuries in a manner to be understood by electrical men. Having acquired great experience and trained 1,000 men in the methods of artificial respiration, the author is well qualified to handle this subject, which is constantly growing in importance. He deals first with flash burns, which are not necessarily very dangerous, but need very careful treatment, and the author gives full details of the proper methods. Under this head are included "flashed eyes," a condition which can be developed by exposure of the eyes to arcs even at a considerable distance, as many an inquisitive electrical neophyte has learnt by painful experience. Burns of the skin are more serious on account of the danger of bacterial infection, which is sometimes fatal. The strangely contradictory phenomena that are met with, such as death from a shock at 110 volts and recovery from one of 15,000 volts, are noted, and a case is quoted in which a lineman died of pure fright on touching a high-voltage line which was not charged at all. Full

instructions are given for the resuscitation of victims of shocks, according to the Schaefer method, which is strongly recommended. An electrician in the employ of the Westinghouse Co. has rescued six lives by this means in as many years, not losing one case. Extreme promptitude in commencing the treatment is of the utmost importance. Short sections are given on minor surgery and first aid, and on infections, and the author concludes with a much longer one on the effects of occupation on health, one of the best in the book. Every engineer in charge of electrical works or machinery ought to have a copy of this excellent manual and make himself familiar with its contents, and everyone without exception ought to be acquainted with the teachings of the last section.

*Examples in Applied Electricity.* By G. C. LAMB, M.A., B.Sc., Cambridge University Press. Price 2s. 6d. net.

This collection of examples has been compiled mainly from tests set to engineering students at Cambridge, and includes some good exercises, both numerical and graphical, on electrical machines, transformers and power distribution. Probably most engineering colleges possess as useful a set of examples in a more or less collected form, and most teachers would map out exercises on the lines of their own lectures in preference to adopting those of another school.

So far from encouraging originality and experimentation, the publication of such sets of examples would appear to tend rather to the stereotyping of engineering courses and ultimately to the stereotyping of electrical engineers. It must, however, be admitted that this particular book contains examples of a really practical type, which is perhaps a tolerably good excuse for its existence.—P.H.S.K.

PROCEEDINGS OF INSTITUTIONS.

Tramway Feeding Networks.

By J. G. CUNLIFFE, M.Sc.Tech., and R. G. CUNLIFFE, M.Sc.Tech. (Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Manchester, December 3rd, 1912.)

(Concluded from page 10.)

In order to understand the correct principles of negative feeding, it is necessary to study the effects on the flow of vagabond current of the various methods of feeding, since protection from electrolysis is the first object of the design.

With a uniformly distributed load, such as is approximately obtained with cars spaced at short intervals, the potential of the rails at any point with respect to the negative feed point is represented by a parabolic law, and if the curve of potential gradient in the rail is dropped until the two areas enclosed between it and the datum line are equal, as shown by the broken lines in fig. 5, A, the area enclosed above the rail will represent the amount of vagabond current leaving the rail, whilst the area enclosed below the rail will represent the amount of current re-entering, the curve itself then representing the absolute potential of the rail, and also the vagabond current density, at any point, the point *o* of intersection being the point at which the rail is at normal earth potential.

The broken lines shown in fig. 5, A, represent, neglecting any mutual effects, such curves of absolute potential for the two sub-sections of rail, the left-hand one of which is supposed to have (whether owing to greater length or to heavier loading is immaterial) a higher value of rail drop than the right-hand one. The point *X*, however, being common to the two sub-sections, must have a potential represented by a point on both curves which will accordingly be shifted to some positions such as those represented by the full lines, when it is evident that the two neutral points must be moved to the right and that there must be an interchange of vagabond current between the two sub-sections as shown in fig. 5, B. The higher rail drop will be reduced and the lower one increased, the tendency being to reduce their values to equality.

In considering the absolute potential conditions of any sub-section, full allowance must be made for the effects of other sections at a different absolute potential, and a sub-section may from this cause be rendered wholly negative with respect to earth, whilst safety and danger zones may be situated at totally unexpected places. Evidently then it is of importance that all sub-sections should have approximately the same value of rail drop, i.e., that all negative feed points should be at the same absolute potential. This conclusion, based on the authors' researches into vagabond current phenomena described in a previous paper, also forms one of the recommendations of the recent joint Commission which will govern future German practice.

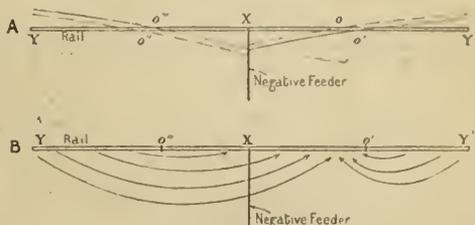
For a given rail drop the authors have previously shown the vagabond current to be proportional roughly to the square of the length of sub-section, so that it is of importance that such length should be a minimum.

The general use of negative boosters alone permits of the attainment of the two ideal conditions, viz.:

1. Uniform absolute potential at the negative feed points, and hence no interchange of vagabond current.

2. Minimum length of sub-section, and hence minimum vagabond current.

Further, full advantage is taken of the high conductivity of the track: the rail drop is easily maintained at a low value, the pressure loss in the negative feeders is no longer subtracted from the supply pressure; great potential difference between the negative bus-bar and earth is avoided, and, finally, with heavy loading

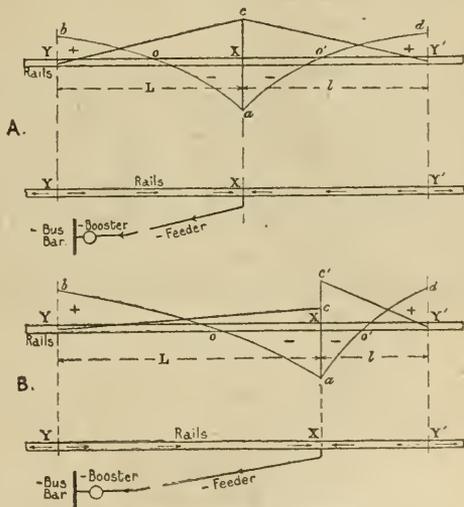


In A.—Broken line = absolute potential gradients of sections considered independently. Full line = absolute potential gradients of sections considered jointly.

FIG. 5.—UNBALANCED SECTIONS.

a very material reduction may be obtained in the amount of return copper as compared with the amount required to obtain satisfactory conditions, even if they could possibly be obtained, without boosters. The saving in cost over the installation of additional sub-stations would be very considerable.

Economy in copper, however, must on no account be allowed to influence the amount of current to be brought back by any individual booster or the number of boosters to be employed. A maximum permissible value of rail drop must be adopted, and the amount of current to be returned must be determined solely by such rail drop considered in conjunction with the maximum



A.—UNIFORM LOADING OF SUB-SECTIONS.

*X*, negative feed point; *x'*, *x''*, artificial dividing points created by negative booster suction; *o*, *o'*, neutral points; *a o b*, *a' o' d*, absolute potential gradients, and are identical; *x*, *x'*, *c*, loading at any point in the rails; *L* = *l*, length of sub-identical.

B.—UNBALANCED LOADING OF SUB-SECTIONS.

*L* > *l*; *x*, *c*, *x'*, loading of sub-sections; *y*, *b*, *y'*, *d*, absolute potentials at dividing points; *x*, *a*, common absolute potential at negative feed point.

FIG. 6.—NEGATIVE BOOSTING CONDITIONS.

intensity of loading and the specific conductivity of the track, with due allowance for increase of traffic, and it is in the determination of the booster voltage that the saving in copper may be balanced against the cost of dissipated energy.

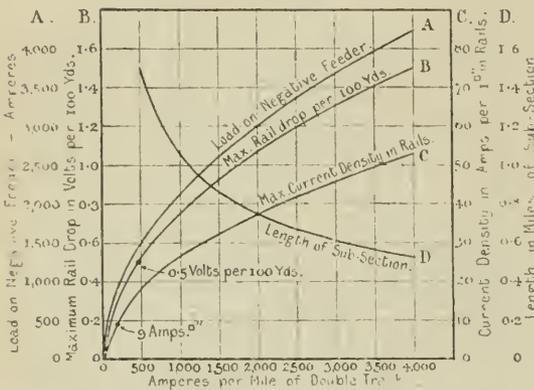
The problem is—knowing the maximum and average intensities of loading at all points along the routes—to divide each route into negative feeding sections, each of such length that its own current flowing to its selected feed point shall split it up into two sub-sections having equal rail drop opposed in direction as shown in fig. 6, A, which illustrates the absolute potential gradients, and shows by means of arrows the direction of current flow in each of the sub-sections of rails of lengths *L* and *l* respectively, the con-

ditions illustrated being applicable to sub-sections of equal lengths, equally loaded. This rail drop must have the same value on all sub-sections. Fig. 6, B, illustrates the conditions to be obtained in cases of unequal intensity of loading in the two sub-sections. The lengths  $L$  and  $l$  must each be such as to give the common rail drop, with their different conditions of loading, when there will be no interchange of varabond current. The length of each sub-section may be determined by the following considerations. Let—

- $i$  = maximum intensity of loading in amperes per mile on the respective sub-sections,  
 $R$  = specific resistance of track in ohms per mile,  
 $l, l'$  = respective lengths of sub-sections in miles,  
 $v$  = maximum permissible rail drop in volts.

Then—  $v = \frac{1}{2} i \cdot R \cdot l^2 = \frac{1}{2} i' \cdot R \cdot l'^2$   
 $\therefore l = \sqrt{2v/iR}$ , and  $l' = \sqrt{2v/i'R}$   
 hence—  $l : l' :: \sqrt{i} : \sqrt{i'}$

Typical values of the length  $L$  of sub-section and of the booster current, with two such sub-sections, are given in fig. 7 for various



NOTE.—With a limit of 9 amperes per sq. in. the limit of loading is 200 amperes per mile.  
 Contrast above limits with the value of 4000 amperes per mile taken from actual American practice, and upwards of 2,000 amperes per mile from British and Continental practice.

FIG. 7.—NEGATIVE BOOSTING.

intensities of loading with double track composed of 105-lb. rails of British standard section and corresponding to a rail drop of 7 volts. The values of current show that the boosters would be quite large enough to justify a separate one to each negative feeder with heavy loading, whilst, if a higher rail drop than 7 volts were allowed, or if rails of a heavier section were employed, both current and length of section would be larger, i.e., the size of the boosters would be increased and their number reduced. The total length of section if the sub-sections were equally loaded would be twice the value shown in fig. 7.

In practice, however, the feeders would, in the majority of cases, be run to junctions, when the values given in fig. 7 would be doubled and the number of boosters almost halved, a slight sacrifice

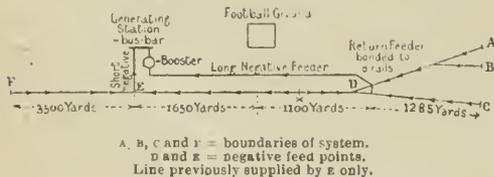


FIG. 8.—NEGATIVE BOOSTING (ALL DOUBLE TRACK.)

being made in the resulting conditions to effect this end. The ideal conditions could not in any case be perfectly obtained, owing to imperfect distribution of the load, regulation of the boosters, &c., but the conditions actually attained would be greatly superior to the best that could be obtained in any other way. Many unboosted feeders could still be retained where favourably situated. Each booster should be excited from the grouped positive feeders serving the same area.

The application of the negative booster is not likely to become sufficiently general to permit of the attainment of the ideal conditions, but the latter should be kept in mind. In the most general cases a booster is required either occasionally or continuously to operate a long negative feeder in parallel with shorter ones, and gives satisfaction provided the permissible maximum rail drop is not exceeded.

An installation of this kind, designed by the authors to deal with very heavy football traffic, is illustrated in fig. 8. The heavy loading was experienced between the football ground shown and the boundary at A, B, C, and the rail drop between these points

and the point D was found to be below 7 volts. The negative booster was so designed, that an artificial dividing point was created at x and moved with varying load distribution over a range such that it never reached the point D of attachment of the booster feeder. In this way the section was split up into three sub-sections, the direction of flow of current in each being indicated by the arrows. The rail drop in each sub-section was maintained below 6 volts, and although the total drop from p to E could not be reduced to zero—the ideal value—it was reduced to 2 volts as against 18 volts without the boosted feeder. This imperfect balance was due to the loading of the sub-section E K, which was beyond the control of the booster. In this way alone, by splitting up the section into sub-sections with their directions of flow mutually opposed under all conditions of loading, could the rail drop under such difficult conditions be maintained below 7 volts. The practice of connecting a group of long negative feeders to a single booster would not be possible with really heavy loading, nor would that of exciting the booster from a shorter negative feeder, and in any case with such methods the track sectionalisation is not definitely assured.

The authors have known cases where return current from a section fed by long feeders from one station entered another station by its negative feeder, flowed through its generators along its trolley wires, and through the equipments of its distant cars to re-enter the former station by a shorter negative feeder on another route. This would not occur if the potential at the negative feed points were uniform, and cannot be prevented by merely equalising the resistances of the negative feeders, although it can be minimised, since such equalising is correct for one value only of the load distribution. With boosters it is correct for all values.

It has been shown by the authors in their previous paper that one regulation alone is of any use in assisting in the prevention of electrolysis, viz., limitation of the maximum permissible rail drop, and other regulations are not merely useless, and often contradictory, but may impede progress. Thus, for instance, for a given rail drop, the potential difference between the rail and a pipe at any point is definitely fixed and is beyond control.

There are two regulations in particular which would effectually prevent the use of the ideal system of negative boosting, viz., the British limit of 9 amperes per square inch in current density in the rails, and the present Chicago limit of steepness of potential gradient in the rails, which must not exceed 1 volt per 1,000 ft. in the downtown sections and 1 volt per 700 ft. in other places. The latter is a reflection of the old French administrative rule of 1 volt per kilometre also adopted for suburban lines by the German Commission.

The maximum values of current density and rate of fall of potential in the rail with the ideal boosting conditions, British standard 105-lb. rails and 7-volt rail drop, are illustrated by the curves B and C given in fig. 7, whence it is obvious that the above values would be far too low. And yet the conditions in fig. 7 represent the maximum of safety. The limitation of current density in the rails has been adopted as the most practical way of limiting the local steepness of the potential gradient to a maximum of 0.5 volt per 100 yd., so that the two regulations are really identical in nature and are based on the fear that with a potential difference of, say, 1 volt per 100 yd., there would be a heavy flow of current in any metallic structure which happened to approach the rails at two points several hundred yards apart. It is clear however, from the curves shown in fig. 6 that these high values are obtained only in the neighbourhood of the negative feed points, where at no single point could current leave the rails, and the danger is purely imaginary.

It is widely believed that with very heavy loading the British limit of 7-volt rail drop would be prohibitive, but with negative boosting this would not be the case. The German Commission already referred to recommends a maximum value of 2.5 volts; but this is too low, as the 7-volt limit has proved to be a reasonable insurance against damage, which is all that should be expected. A value recently incorporated into the City ordinances at Chicago of 12 volts maximum is considered very harsh, but the pressure drop along a pipe situated within 3 ft. of the rails may easily exceed 10 per cent. of the total rail drop, and so values greatly in excess of 7 volts are not to be encouraged.

Legislation alone cannot provide complete protection against electrolysis. It must be assisted by careful construction. Metallic structures must not approach within 3 ft. of the rails (the German Commission recommends 1 metre), and in a new construction or reconstruction, care must be taken to reduce to a minimum the number of section-box frames, poles, &c., which require to be bonded to the rails as these pass down amongst the pipes beneath the footpath.

Guard wires ought to be insulated from the poles and "earthed" by means of insulated cables passing down the interior of the poles to the rails, and poles carrying gas-lamps ought to have triple insulation rather than be bonded to the track, as the latter is equivalent to bonding the pipes themselves to the track, which is bad practice.

#### DISCUSSION.

MR. B. WELBURN agreed that they should endeavour to bring the point of connection of the feeder to the rails to zero potential throughout, so that the negative feeder should be used in the most economical manner; this would make electrolysis an entirely negligible quantity. Had the authors considered the raising of the pressure on the trolley wire? If the pressure were raised they would enormously decrease the expense in feeders, both positive and negative, and would also have a great many other advantages in that the number of sub-stations would be reduced, and so on. There was no inherent difficulty in making trolley wires perfectly

safe, even if an auxiliary suspension had to be employed to prevent a broken wire from falling into the street. It was for the designer of tramway equipment to say what the limit was that tramway motors and controllers could be arranged for.

Mr. S. L. PEARCE said it would have been very interesting if they could have had some concrete figures dealing with the Manchester tramway system, showing how the increased service—the proportion of the larger to the smaller cars—had affected the question of power. A striking increase of power had been required. The authors stated that "in view of the strict limitation of the line pressure the governing factor in the feeder designs must, at some stage in the development, change from overheating to pressure drop, and that boosting must ultimately be resorted to." That was a rather sweeping statement, and he took it that it entirely referred to D.C. 600-volt systems; it would not be correct in the case of mixed systems. The authors referred to the reluctance of engineers to employ feeders much larger than 1 sq. in. in cross-section. He recently had occasion to look into that, and had come to the conclusion that where it was necessary to use a total of 1 sq. in., it was better to use two halves rather than 1 in.; it enabled the current density to be pushed up much higher with two halves than by using one 1 in., and even after allowing for the slightly increased cost of the cable, and so forth, it was still a commercial proposition. The authors stated that the amounts of current returning by the respective feeders, if of the same size, would be almost inversely proportional to their length, and they went on to say that the distribution of the return current amongst the feeders was governed by the nature of the load distribution. His experience was that the low-resistance rails would to a very great extent swamp the load distribution, and that by employing resistances in the short negative returns to a limited extent, the current did return by the respective negative feeders in inverse proportion to their lengths. If the resistance of a short negative was increased the effect was the same as reducing the resistance of a longer one, and the balance point was moved only in one direction. Frequently it would be found that it was far better to cut the bonds and allow the separate negative feeders to bring back their own currents respectively. He entirely agreed with the statement that "for a given length of track, with increasing loading, the maximum permissible rail drop is ultimately attained, when copper must be provided to carry any additional current, and as this copper is operated at a very low current density, its use is very uneconomical"; it was quite a mistake to attempt to put copper in parallel with the rails; if there was any copper to spare it should go into the negative feeders. The authors stated that by the use of negative boosters the flow of current in the rails might be controlled in a manner which was almost ideal; but was it commercial? There was a very great difference between necessary conditions and ideal conditions. There was no electrolysis in Manchester. In many cases a resistance in short negatives was used to secure all that was really necessary or desirable. The strongest point for the use of negative boosters, apart from the ease of load distribution, was the fact that pressure loss in the negative feeders was no longer subtracted from the negative section. Fig. 7 would be of very great value when tackling other problems. No one would pretend for a moment that it was possible to install the negative booster for such low capital expenditure as resistances. The authors referred to the necessity of having treble insulation when tramway standards carried gas lamps; obviously the correct thing was to move the gas lamps.

Mr. J. S. PECK said that some of his friends in America had never heard of negative boosters, and did not know what they were at all, evidently owing to their having no laws in America until recently regarding the allowable drop in rails. There was very little attention given to the matter as long as the current got back somehow in the cheapest and easiest way; but they would suffer for that in the long run. The reason why electrolysis was coming more into effect in some cities, and of the increasing advance with feeders, both positive and negative, as had been pointed out by the authors, was the general tendency to force up the schedule speed and the general increase in car weight.

Mr. H. A. RATCLIFF thought that the negative resistance was not always understood. As an energy-converting device, the resistance had precisely 100 per cent. efficiency, and a booster never approached that efficiency. The resistance had practically no maintenance charges or running cost, and no capital cost; it would not fulfil the ideal conditions, but it would fulfil the necessary conditions.

Mr. E. M. HOLLINGSWORTH said he tried running negative feeders without boosting some years ago, but they were absolutely useless. Later on, owing to the increased service, it was found that the drop was excessive, so negative boosters were put in, though they could not possibly get the ideal conditions, for the reason that Mr. Pearce had pointed out. At St. Helens they had had one or two bad cases, though, perhaps, they were rather peculiarly placed on account of chemical works at that place. Two fires had occurred owing to guard wires being pulled down and the water pipes being in contact with the gas service, which was, perhaps, 150 yards away; and on another occasion a subway caught fire, due to an electric telephone cable which was carried down one of the standards. The guard wire was again the cause of the trouble, and he agreed with the authors' remarks that guard wires should be earth-connected by means of insulated cables; this also applied to gas lamps. He had tried connecting the lead-covered cables for a tramway system to the rails, and found that they were getting electrolysis, so he disconnected them, and since that time he had not experienced any trouble.

Mr. C. C. ATCHISON said as time went on schedules were

altered, conditions of working were different, and the negative feeders, which were big enough to suit the original conditions, were at the present moment almost useless. Many of the large undertakings might have been able to straighten them out, but difficulties arose in small undertakings. He did not think radiating sub-feeders were as good as separate feeders in a busy area. If sub-feeders were supplied by one big feeder, and the big feeder was put in on a busy route, every driver on that route would be trying to start at the same time, and it was almost impossible to keep the breakers in. He had a very disrespectful opinion of guard wires as a whole. He did not approve of insulating guard wires and trying to keep the poles and pipes insulated and separate from the rails, because, after all, one wanted to protect the pipes. In towns where the municipality worked the tramways, it should be an instruction to any department that was laying pipes that they should be kept at such a distance as to be safe. Mr. Pearce had pointed out that two 0.5 cables were better than one of 1 sq. in., and from past experience he endorsed the statement entirely.

Mr. A. G. COOPER said they ought to put down heavier rails so as to minimise the rail drop, because the extra price for the rails would be cheaper than putting down copper feeders. He quite agreed that it was much better to put down two small feeders than one large one on account of the current density.

Mr. R. ROWLANDS referred to fig. 8. He had arranged to put all the feeders through the booster, and in the event of the breakers coming out, if only one feeder was coupled up, there would still be the load to be dealt with on the remaining section, as in this case there were two separate positive feeders. He had arranged for an electrical control governor to be placed on the end of the shaft, which cut out the booster before it reached a dangerous speed. They had in this case run two negative 0.8 in. feeders instead of one 1.6 in. With regard to the point of connection, fig. 8, he thought that the connection at "D" was not at the right point.

Mr. C. G. L. PREECE believed Glasgow was the first to adopt the negative booster, and had paid a great deal of attention to limiting the rail drop. At one time a very large system of potential wires was used in its system of negative feeders, and the function of these was similar to what the authors described in the paper. As far as he remembered, the positions of the negative feeders were fixed from results obtained from the system of potential wires, and on a visit to a sub-station, he was shown the drop of a great number of sub-sections in the city, and noticed that it did not exceed 2 volts in any of those sections.

Dr. E. ROSENBERG said he could not follow why resistance had 100 per cent. efficiency and the booster only 80 per cent., for after all if they wanted to generate heat, everything had 100 per cent. efficiency. The resistance drop was a dead loss, but if the dead loss was only for a few hours during the whole year the yearly annual efficiency might, of course, be better than that of a machine with 20 per cent. less efficiency.

Mr. H. E. YERBURY (in a communication) said that the deplorable state of things formerly existing in Chicago and other American cities could not have existed under B. of T. rules and regulations, and he saw no reason to fear any trouble now that overloading conditions prevailed in many of our large towns. The Sheffield Corporation Act of 1901 had a protective provision inserted by the Sheffield Gas Co., relative to possible electrolytic injury or damage to mains, pipes, &c., and although the loading and output in units had been more than trebled since that year, it had been demonstrated to the satisfaction of the company that no trouble had taken place, and that they were still able to work within the B. of T. limits. With respect to positive feeding, he thought the system of feeding with graded distributors was preferable in point of efficiency and economy to the Manchester system, as shown in fig. 2. He saw nothing new in what was called the authors' design (fig. 8). The correct principles of negative boosters and returns were dealt with by himself in an informal paper read before the Leeds Local Section of the I.E.E. on April 13th, 1905, which was published in the technical journals. With regard to present legislation, taken as a whole the results were satisfactory to all concerned. Still, he thought the limit of 9 amperes per sq. in. for the current density in the rails could be exceeded under certain conditions, without harmful results.

The AUTHORS, in reply, said that boosters were not recommended for cases where other and cheaper methods were available, but there were conditions of loading where only boosters would enable the requirements to be fulfilled. Where possible with economy, the control of return circuits by the balancing of feeders was advisable, but was limited, with extra heavy loading, by the loss of pressure in the return feeders. This loss was not obtained if negative boosters were used. With respect to Mr. Pearce's remarks on the use of two ½ sq. in. feeders in place of a 1 sq. in. feeder, they referred more particularly to heavier feeders than those, and advised multiple feeders on grounds of greater facility in handling and laying, greater reliability in operation, and greater factor of safety, with the advantage that breakdown of one component did not cut out the whole feeder. There were objections to the use of a large number of boosters in a single station, and the compound feeder was put forward to minimise the number of boosters. They again emphasised the importance of keeping pipes and metal work at least 3 ft. distant from the rails. The Chicago rails were bonded at all possible places to the elevated railway structure, and the result had not been such as to support the principle of such bonding. In addition the pipes were bonded to the rail at all parts of the system, yet the resulting damage from electrolysis was notorious. It was of greater importance to know what currents the negative feeders were carrying than was the case with positive feeders. The suggestion to use heavier rails so as to utilise steel in place of copper, presupposed the advisability of employing bare conductors

in parallel with the rail, which they had stated to be inadvisable on account of the low efficiency and heavy expense. The results indicated the correctness of the design in fig. 8.

### Earthed v. Unearthed Neutrals on Alternating-Current Systems.

[The paper on this subject, by MR. J. S. PECK, of which an abstract was given in our issue of December 6th, 1912, was read before the NEWCASTLE LOCAL SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS on December 9th, 1912.]

MR. W. C. MOUNTAIN, chairman, in opening the discussion, said for private installation work he favoured unearthed neutrals, and from a colliery engineer's point of view he thought that this system was advisable. The confusion which would result from a sudden cutting-off of all power and light would be far worse than an earth on an insulated system. He had always hesitated about putting automatic features underground, and preferred a leakage indicator.

MR. C. VERNIER (N.E.S. Co.) said that he was a firm believer in earthing everywhere, without exception. A cable generally broke down to earth first, and it was advisable to isolate it as quickly as possible, and before it had time to develop a fault to earth. On an insulated system some time was required to locate the fault, and while this was being done there was always the risk of another fault occurring on another phase. While small systems might be left unearthed, at the discretion of the engineer, he considered that those systems which were at present running satisfactorily without earthing would eventually find it advantageous to earth when they reached a certain size. Telephone disturbances were almost entirely due to electrostatic induction, and with one phase earthed the whole electrostatic balance of the system was upset. In his opinion the neutral should be earthed for distribution circuits, and he attributed the freedom from serious accidents in this country to the usual practice of earthing in such cases. The reduced cost of insulation by earthing the neutral was not worth considering for voltages up to 50,000, but above this it might be worth while, especially where corona effects were present to take care of pressure rises. He strongly disagreed with the suggestion that in order to maintain continuity of supply, high-tension lines should not necessarily be cut off in the event of a fault, as this was simply balancing the cost of a duplicate supply against the danger to life. Whatever views might be held in other countries, this was considered most important in this one, and there was already quite sufficient prejudice against overhead work without introducing any doubts regarding safety. "Split-conductor" protection, which was the latest development in protective devices, promised to be of great importance, as it operated in the most positive manner on the breakage of a conductor wire.

PROF. W. M. THORNTON (Armstrong College) mentioned that in every electrical circuit the resultant current was zero, and he could not understand why it should be considered necessary to raise this point so often. Referring to fig. 1, he asked what was the smallest earth current at which the system would operate.

MR. HUNTER said that it could be made to operate with 1 per cent. of the line current, but a delicate relay was necessary.

PROF. THORNTON (continuing) remarked that the opinion was held, especially amongst mining men, that the risk of breakdown was increased by earthing the neutral, and it was interesting to note that the author's opinion was to the contrary. Regarding the presence of surges following arcing between phases, he put forward the theory that these were due to the condenser action of the incandescent metallic vapour in conjunction with the reactance of the line, thus forming a circuit which would resonate with great violence. Instead of using resistances for earthing the neutral, he suggested the use of choke coils, on the assumption that the cost of these would not prove prohibitive.

MR. P. V. HUNTER (Merz & McLellan) said that he had had experience of unearthed neutrals in the early days of the Durham Collieries system, and had found that when one fault occurred other faults occurred simultaneously at one or more parts of the system, probably due to the free energy liberated when one phase went to earth. He had known cases where high voltages had occurred on low-voltage systems having insulated neutrals; in one case a 600-volt system fed through a transformer from 6,000 volts, sparked through a paper disk which would stand at least 1,200 volts. With regard to "potential front," he had come across one case where sparking took place over a 10-in. gap on a boosting transformer which normally could not have more than 2,000 volts across its terminals. Such sparking could only be explained by "potential front" when switching the cable and booster together.

MR. F. O. HUNT referred to a device brought out by Mr. M. B. Field, which worked on the same principle as that shown in fig. 1, but in that case the magnetic fields were balanced and not the currents. He thought that a choking coil in the earth connection might form a resonating circuit with very low resistance, in conjunction with the capacity of the cable network.

### THE JOHANNESBURG TURBINE CONTRACT.

JUDGMENT was given by Mr. Justice Ward on December 3rd in the Witwatersrand Division of the Supreme Court, in the action for libel brought by Mr. John Taylor against the *Rand Daily Mail, Ltd.*, and his decision was published in the Johannesburg newspapers.

His Lordship said: The plaintiff in this case is a solicitor, and has been since 1907 the town clerk of Johannesburg. Among other enterprises carried on by the Municipality of Johannesburg is the manufacture of electricity for the purpose of running its own tramcars, and of supplying the inhabitants with light and power. The first plant contracted for by the Council consisted of certain gas engines, which proved an absolute failure, and in April, 1907, it became necessary to install a new plant as quickly as possible. The Council then had an advisory board of expert engineers in connection with the gas engines, and, under the advice of this board, a steam plant was purchased from Messrs. Reunert & Lenz. Rapidity of delivery was essential, and the contractors tendered to deliver in eight weeks, as against the next tender of 13 weeks. In 1907 another set was purchased, and here again rapidity of delivery was essential, and the order was given to Messrs. Reunert & Lenz, who contracted to deliver in 16 weeks, as against the next tender of 36 weeks. A third order for 1,000-kw. and 500-kw. sets was considered in February, 1908; quick delivery was again an essential, and the order was again given to Messrs. Reunert & Lenz, who undertook delivery two months earlier than next tender. A fourth order was also given to Messrs. Reunert & Lenz for a 1,000-kw. set. There was no question of rapid delivery in this case. Tenders were called for a 1,000-kw. set, and the choice lay between the plant accepted for £12,695, or a 1,800-kw. Parsons turbine set for £13,450, both of which were on exhibition and ready for delivery. The latter set was recommended by the manager, as also by the Tramway Committee of the Council. The Council, however, accepted the tender of Messrs. Reunert & Lenz. The defendants, in their issue of August 4th, 1908, commended the Council for its action, on the ground that direct current turbines were still experimental so far as Johannesburg was concerned, and that the Council was consequently taking the safer course. In the case of the second set, a board of technical advisers recommended a Parsons turbine. But the Council rejected the advice, and ordered a set from Messrs. Reunert & Lenz on account of the rapidity of delivery. The plaintiff had nothing to do with any of these purchases. He was the town clerk, but as I understand the matter was decided by the Council independently of him, and in the case of the fourth order he was away in England. An engineer named Thomas was at the time these orders were placed the manager of the electrical department. In September, 1911, the Council decided to order further plant and to call for tenders for that purpose. Prof. Dobson, the manager of the electrical department, was entrusted with the duty of making out the specifications and conditions of tender. As it was desired to have the plant ready for the Christmas load of 1912, it was decided to make the period for delivery 45 weeks.

On January 31st, 1912, Prof. Dobson, the Council's manager, reported on the various tenders received, and recommended the acceptance of the tender of Messrs. Reunert & Lenz. This was reported on by the Tramway Committee on February 2nd, 1912, and sent forward to the Council. On February 13th, 1912, a letter was sent to the Council by the Chamber of Commerce, criticising Prof. Dobson's report. The matter was referred back to the Tramway Committee, with a recommendation to have the tenders reported on by a Government electrical engineer or three experts appointed by the Council. On March 11th, 1912, the Tramway Committee met the Chamber of Commerce representatives, who were, in fact, the unsuccessful tenderers, as their representatives and the representatives of the successful tenderer. Naturally, therefore, the representatives were not quite unanimous in their views. Certain letters and criticisms were then sent to the Council by these representatives. T. Dobson, the general manager, made a report in reply. On March 26th, 1912, Messrs. Rider and Tippett, the former an eminent electrical and mechanical engineer, and the latter a civil engineer who holds the position of chief engineer of the South African Railways, and has had considerable experience in contracts, were appointed as a board to report as to which was the most advantageous tender for the Council to accept, the board bearing in mind the condition of affairs at the power station; and, further, Prof. Dobson's three reports referred to in the criticisms of the Chamber of Commerce, and on those criticisms, Prof. Dobson's reply to these criticisms; to report generally on any matter at the power station which, in the opinion of the board, affected the questions submitted to it. On April 17th, 1912, Messrs. Rider and Tippett reported at considerable length. On April 19th, 1912, the Tramway Committee instructed the town clerk to report upon the engineers' report. On April 22nd, 1912, the plaintiff reported at great length on the situation and on the engineers' (i.e., Messrs. Rider and Tippett's) report. He had the assistance of two technical advisers on the town staff. Prof. Dobson was at this time ill. The plaintiff says that if this had not been so, Prof. Dobson would have been asked to report instead of himself. The engineers recommended the acceptance of the tender of Messrs. Sykes & Co. The plaintiff's report was considered by the Tramway Committee, who recommended the acceptance of the tender of Messrs. Reunert & Lenz, recommended by Prof. Dobson. This recommendation was accepted by the Council on April 23rd, 1912. On April 25th, 1912, a motion was brought before the Council to rescind this resolution, but it was lost. A great deal of excitement and comment was caused in the town, and the action of the Town Council was freely discussed. On

**Norway's Electrical Imports.**—According to the latest statistics published, Norway was an importer in 1911 of cable and insulated wire to the value of 1,919,000 kr.; of accumulators and accessories to 79,000 kr.; of electric apparatus, including telephones and telegraphic instruments to 363,000 kr.; of glow lamps, to 498,000 kr.; and arc lamps, 10,000 kr. About three-fourths of these goods were supplied by Germany.—*Elek. Zeitschrift.*

June 21st, 1912, the defendants published in their issue of that date an article taken from the ELECTRICAL REVIEW, London, which is the article complained of in this action.

The plaintiff has set forth certain passages in his declaration to which he attaches certain innuendoes, and the Court is asked to hold that the passages bear the meaning alleged, taking into consideration the whole tenor of the article and the surrounding circumstances. The surrounding circumstances relied upon are that charges of bribery and corruption were being freely made in speeches by town councillors, which were published in the defendants' paper. Thus on June 14th, 1912, a Mr. Bernberg, who appears to have at that time been the general secretary of the South African Labour Party, is reported to have said, at a meeting of a branch of that party for the purpose of expelling a Mr. Jackson from the party for his action in connection with "the turbine trouble," which I presume refers to the contract in question: "If they had any Labour principles at all, those principles were that they should be solid on all matters in which there was a reasonable suspicion of bribery and corruption." On June 27th, 1912, a leading article was published in the defendants' paper in which it was stated: "The meetings of the Council degenerate into scenes of turbulence, in which charges of jobbery and graft are hurled with distressing frequency," and suggested that new men must be sent to the Council able to transact business with dignity and in a manner not calculated to arouse suspicion. On March 24th, 1912, a Mr. Mulvey, is reported in defendants' issue of that date to have said in the Council: "He had heard of graft in America, but he thought that Johannesburg could give the average American city points." Then, after referring to Messrs. Rider and Tippet, he continues: "The time has come for a Government inquiry upon oath into the affairs of the Johannesburg Town Council." On July 2nd, 1912, a Mr. Benson, another councillor, is reported to have said: "He had never accused Prof. Dobson of taking bribes;" then, after quoting from the ELECTRICAL REVIEW (*loc. cit.*, the article complained of), to have added that his position was supported by that article. He had submitted the urgency report to judicial authorities, and they had one and all asked, "Who's getting something out of it?" On June 26th, 1912, Mr. Mulvey, again moved that, in view of the serious allegations contained in the ELECTRICAL REVIEW on May 30th *re* the management of the town of Johannesburg's business affairs and other allegations made from time to time, "we approach the Government for an independent inquiry." I have set forth these circumstances at this juncture, as it is perhaps more convenient to have collected before one the circumstances on which the plaintiff relies as proving his innuendo before dealing with the actual words. These may be divided into three classes:—(1) The defendants' own attitude as shown by the article calling attention to the matter complained of, and to the reply to the letter of demand. (2) The fact that prior to the publication of the article charges were made in public in connection with this particular contract that there was corruption somewhere. (3) The fact that the same charges were made after the publication of the article, and that speakers referred to the article as containing grave charges.

That the article contained grave charges of mismanagement was stated by Mr. Mulvey. Mr. Benson's position, which he says was justified by the article, it is rather difficult to find, but I do not see any charge of bribery made except as a deduction by certain judicial authorities from the urgency report. It was contended that the defendants are bound by a meaning attached to the words in speeches of third parties, seeing that they have reported such speeches without contradiction. But in the case of a newspaper it cannot be said that the editor is cognisant of the meaning attached to words used, although there may be a report of a speech in his paper which gives that meaning to them. This point, and the fact that one or two individuals attach a certain meaning to the words, may be considered by the Court sitting as a jury, but the jury are entitled to reject such meaning. Coming now to the article complained of, this starts by giving a history of the first four contracts, which is fairly accurate until we come to the summing-up of the situation, when we read: "Thus we see four contracts given away to one firm at prices far in excess of what need have been paid and in face of the best engineering advice procurable, which advice was not offered in an officious manner, but was solicited, and we presume paid for by this Council." This statement is not true. Only one of the contracts was given contrary to the technical advice outside the municipality's own advisers. With regard to three of the contracts, time of delivery was the most important factor. In one case, the Council refused to make an experiment by using turbines, and, in the other, they refrained from taking a 1,800-kw. set which was ready for delivery in favour of a 1,000-kw. set which was also ready. Tenders had been called for a 1,000-kw. set. The article goes on then to give an account, not inaccurate, of the history of the last tender, with some account of the board's report (*i.e.*, of the report of Messrs. Rider and Tippet). Then it goes on: "The town clerk of Johannesburg, to whom, as the executive head of the Corporation staff, the report was sent, took it upon himself to criticise it." This is not true. The plaintiff was instructed by his Committee to make a report upon the report. It is said that this does not mean criticising it, and consequently he did take it upon himself to criticise it. He was asked to make his report, and I do not see how he was to do so without criticising the report. It was his duty to give his views; his views may or may not have been inept, but it was his duty to give them. Messrs. Rider and Tippet considered that their report, being technical, would not be understood by the Council, and did not think it should be criticised; they would never have made it if they had thought it was to be criticised, so they say. And the attitude of the article is that Messrs. Rider and Tippet's report was from the nature of the case beyond criticism, especially by laymen. But after a careful

perusal of both the report and the criticism of the plaintiff in so far as the business portion of it is concerned apart from the technical portion, the observations of the plaintiff appear to me to have been quite called for and just. He is pointing out to his Committee the practice laid down previously as he was obliged to do; the question, for instance, of having a separate tender for foundations or erecting them departmentally might make a vital difference in the Council's view. There is no doubt that the correct course then was to call the board's attention to the Council's attitude on these points, so that the Council could get the benefit of its advice from that point of view. With regard to the technical point, it is impossible to judge of the merits, but, although differences may be only a matter of opinion, the Council certainly should have borne in mind that they had eminent independent technical advice on one side as opposed to that of their servants on the other. They may have paid attention to this for all I know—whether they did or not I cannot see that the plaintiff was in any way to blame for putting before them the views of their technical advisers, seeing that he was asked to report. To proceed with the article: "His criticism extends over 35 pages of typewritten matter, and for a thoroughly bumptious, consequential and extravagantly-aburd concoction, we have never seen its equal." This is said to be libellous, and the innuendo is that either the plaintiff is incompetent as a town clerk, or that he was dishonest in his criticism of the report. But I do not think the words can be made to bear that construction. The writer is entitled to express his opinion of the merits of the town clerk's report as a literary or technical production provided he does not impute dishonest or disgraceful motives. The view of the writer of the article is clearly largely influenced by the fact that a layman was exhibiting the audacity to criticise a technical report. But that does not affect the question as to whether the words are defamatory. In my opinion, they do not, as they stand, bear out the innuendo alleged. The article proceeds with the history of the breaking down of a certain turbine. The plaintiff called attention to the fact that the board had concluded, from the papers before them, that Messrs. Reunert & Lenz were entirely responsible for the breakdown, and remarks that they are not in a position to give a judgment on the point, inasmuch as Messrs. Reunert & Lenz's answer was not before them. It is not necessary to decide whether he was right or wrong in this; the view, from a legal standpoint, is not without merits, though a board of experienced technical experts doubtless thought they had sufficient to form a judgment on the matter. The article says:—"We hope these words, which we presume, express the considered opinion of the town clerk, as the legal adviser of the Corporation, will be duly noted by the manufacturers." I have been unable to find what is meant by this; no explanation was offered in argument by either side; but I take it the writer is commending to the notice of the manufacturers the fact that the town clerk's view is that a Belliss turbine should not be condemned as defective mechanically until it is established that the accident to the No. 2 turbine was caused by mechanical defects. This does not appear to me to be defamatory.

The article proceeds:—"Next we find this chologenic genius arguing over the meaning of the word dismantled. They saw No. 2 turbine dismantled, said Messrs. Rider and Tippet. The town clerk pretends to think that this might lead people to suppose that it was being taken down as useless and condemn the board's report on this account." It is said the sting in this is in the use of the word "pretends." I do not think that this is defamatory. The words "pretends to think" quite clearly are capable of meaning that the defendant falsely states that he thinks, whereas he does not, which would certainly be defamatory and bear out the innuendo that he was dishonest in his criticism. But the expression also means "professes to think," which does not mean he puts in a claim falsely. The expression is a rhetorical one, which is used to express strongly the view of the writer that an expression which has been criticised cannot bear the meaning attached to it by the critic. In my opinion, that is all that the expression means here, and is not, in my opinion, speaking as a jurymen, defamatory. The writer does not think that anyone can take the view that the words used in the report by the board were open to misconception. For my part, I must say that I think the words were quite capable of bearing the construction to a lay mind that Mr. Taylor says they bore to more than one town councillor. The expression, "We saw dismantled," is certainly open to the construction, "We saw in a dismantled state." The report is not condemned on this account, but the expression is explained for the benefit of the readers who Mr. Rider said he never expected would understand his report. But though I am satisfied there was no pretence at all in the town clerk elucidating the expression by a reference to the facts—I do not think this passage defamatory. The expression is purely rhetorical, and does not, in my opinion, convey any imputation against the plaintiff's character. The next passage set forth in the declaration, and which follows immediately in the article is this:—"He then goes on to prate of professional conduct and the fact that Prof. Dobson's reputation was in their hands. Now the board treated him with quite as much consideration as he deserved, and quite as much, to judge from our prefatory remarks on the contracts, as he was accustomed to obtain." This passage contains a very serious misstatement of fact—in that it suggests Prof. Dobson was connected with the former contracts, when, as a fact, he was not in the employ of the Council at that time—but the whole passage appears to be more an attack on Prof. Dobson than on the plaintiff; but the sentence clearly shows that the writer was not careful to inquire who was connected with the other contracts, and it may be of importance, when one comes to examine the meaning of the text of the articles as a whole.

(To be concluded.)

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**MEXICO.**—With reference to a notice which appeared in these columns recently regarding proposed increases in the rates of duty on imported goods levied under the Mexican Customs Tariff, the Board of Trade have received telegraphic information from the British Legation in Mexico to the effect that the previous Bill has not been passed, and that the Mexican Government intend to present to Congress a modified project providing for the increase of the Customs duties by 7 per cent. in addition to the increase of 5 per cent. which was previously proposed. If Congress does not pass the new Bill during the present session a special session will be called to deal with the matter.

**ROUMANIA.**—A considerable amount of trade with Roumania is carried on *via* certain European ports which possess what are known as "free zones"—i.e., sections of the open port which are in the nature of bonded districts. When goods are transhipped at these ports for final destination in Roumania, it is often difficult to determine the actual country in which they originated, and as the Roumanian tariff is divided into two parts, one the General (higher) tariff, applicable to countries not entitled to most favoured nation treatment, and the other, the Conventional (lower) tariff, applicable to countries having treaty arrangements with Roumania, the duties to be levied on the goods are open to doubt. The Customs Authorities have therefore, decided that goods arriving in Roumania from the undermentioned European ports possessing a "free zone" cannot be assessed for duty under the Roumanian "Conventional" Tariff unless they are accompanied by a certificate of origin which specifies the country of production or manufacture of the goods:—

*Austria-Hungary.*—Trieste and Fiume.

*Italy.*—Genoa, Leghona, Oneglia and Venice.

*Germany.*—Hamburg, Cuxhaven, Bremerhaven, Geestemünde, Emden, Neufahrwasser, Stettin, Altona, Bremen and Brake.

*France.*—Marseilles.

*Denmark.*—Copenhagen.

From February 1st, 1913, all goods arriving in Roumania from the foregoing ports, unaccompanied by a certificate of origin, will be assessed for duty under the Roumanian "General" Tariff.

**SWEDEN.**—The British Consul at Stockholm, in a recent report, states that he again wishes to point out that if imported goods bear the name of a place, property, industrial establishment or tradesman in Sweden, or any marking in the Swedish language to explain the nature of the goods—even consisting only of a single word—they must also bear the word "import" or the name and domicile of the foreign manufacturer, applied in a distinct and conspicuous manner, so that removal or effacement cannot be effected easily or without injury to the goods. Goods not so marked are liable to confiscation. The Customs Authorities will not permit goods to be marked *subsequent* to confiscation, and it is therefore impossible to get them restored once they have been condemned by the Court. The Consul adds that goods which are packed and imported in bulk, but can be sold singly, must themselves be properly marked so as to show their foreign origin: the fact that such marking may have been applied to the packing or covering in which the goods are imported will not of itself constitute a sufficient compliance with the Swedish regulations.

**AUSTRALIA.**—The Commonwealth Customs Authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods on importation; the rates of duty quoted are in all cases the preferential duties applicable to goods of British origin accompanied by a certificate to that effect in the proper form:—

Thermal electric baths:

Cabinet ... ..	30 % ad val.
Electric heating portion ... ..	10 "
Fittings for electric conduit:	
Plain tee and elbow inspection pieces ... ..	10 "

- 29,612. "Sanitary attachments for telephone apparatus," M. J. DE ZOLTENSBY. December 23rd. (Complete.)
- 29,620. "Electric ignition generators," B. LAWRENCE. December 23rd.
- 29,636. "Driving vehicles by means of internal-combustion engines combined with dynamos, accumulators and motors," H. PIEPER. (Divided Application on 3,281/12, February 9th. Convention date, February 20th, 1911, Germany.) December 24th. (Complete.)
- 29,639. "Manufacture of tungsten," C. GLADITZ. (Divided Application on 12,244/12, May 23rd.) December 24th.
- 29,698. "Adjustable electric lamps," H. FAIRBROTHER. (Vesta Accumulator Co., United States.) December 24th.
- 29,719. "Impulse sending mechanism," WESTERN ELECTRIC CO., LTD. (Western Electric Co., Belgium.) December 24th.
- 29,721. "Telephone systems having automatic switching apparatus connected over junction lines with a manual exchange," SIEMENS BROS. & CO., LTD., and T. PERTTIGREW. December 24th. (Complete.)
- 29,736. "Fittings for electric incandescent lamps," T. B. PICKARD. December 24th. (Complete.)
- 29,750. "Element for electrical heating," H. J. DOWSING and D. HUNTLEY. December 24th.
- 29,753. "Time meter for gas and electric fires and lights," C. B. TULLY. December 24th.
- 29,763. "Electric cooking and heating appliances," A. H. RAILING and C. C. GARHARD. December 24th.
- 29,774. "Electric cable-connecting boxes or apparatus," BRITISH INSULATED AND HEATSEY CABLES, LTD., and K. W. BLADES. December 27th.
- 29,778. "Electric locks for lift and hoist gates," C. G. MAJAO and SMITH, MAJOR & STEVENS, LTD. December 27th.
- 29,781. "Method of and apparatus for use in and in connection with electro-plateing," E. E. L. GRUNDY and G. P. M. LEE. December 27th.
- 29,783. "Electricity multicore cable dividing boxes or apparatus," BRITISH INSULATED AND HEATSEY CABLES, LTD., and K. W. BLADES. December 27th.
- 29,809. "Electric terminals," H. LUCAS and W. H. EDWARDS. December 27th.
- 29,826. "Apparatus for electro-osmosis," GEN. YER ELECTRO-OSMOSE M.R. H. and H. ILLIG. (Addition to 726,19.2.) December 27th. (Complete.)
- 29,832. "Means for electrical alarm signalling in connection with steam or other engines and machinery," T. H. HILL. December 27th.
- 29,842. "Electric switches," BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 27th.
- 29,846. "Manufacture of dry cells," J. A. E. ACHENBACH. December 27th. (Complete.)
- 29,817. "Primary galvanic cells," J. A. E. ACHENBACH. December 27th. (Complete.)
- 29,848. "Manufacture of negative electrodes or secondary alkaline cells," H. F. K. L. PORSEK and J. A. E. ACHENBACH. December 27th. (Complete.)
- 29,859. "Supports for desk telephonic instruments," D. D. CUSHMAN and DAVID MOSLEY & SONS, LTD. December 28th.
- 29,863. "Construction of electro-magnets," STEEL, PEECH & TOZER, LTD. and H. E. BOWEN. December 28th.
- 29,874. "Device for recording telephone calls in connection with the measured rate system of post office telephones," G. H. PARRY. December 28th.
- 29,879. "Detachable electric immersion heater," G. H. IDE. December 28th.
- 29,881. "Electric advertising devices or signs," E. H. BUCKLEY. December 28th. (Complete.)
- 29,905. "Automatic instantaneous switches for alternating and direct-current circuits," A. M. TAYLOR. (Addition to 7,111,1910.) December 30th.
- 29,956. "Line protective devices or the like," AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) December 30th.
- 29,988. "Magnetoelectric generators," L. JOHNSON, J. T. ROBERTS, and B. LAWRENCE. December 30th.
- 29,999. "Method of and apparatus for electric welding," R. HADDAN. (Cleveland Welding and Manufacturing Co., United States.) (Divided application on 17,749, 1912, July 31st.) December 30th. (Complete.)
- 30,024. "Electric switches and the conductor switches thereto," H. C. SHELTON. (Maschische Gruppenwechselrator G.m.b.H., Germany.) (Divided application on 3,999, 1912, February 13th.) December 31st. (Complete.)
- 30,059. "Electrically-operated mechanism," F. H. NICHOLSON. (Convention date, March 8th, 1912, United States.) December 31st. (Complete.)
- 30,060. "Electric switches," P. S. CRANER and A. E. ROBERTS. December 31st.
- 30,103. "Dynamo-electric machines," H. A. MAVOR and MAVOR & COULSON, LTD. December 31st.
- 30,105. "Electric regulating devices," BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 31st.
- 30,106. "Systems of electric distribution," BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 31st.
- 30,107. "Regulation of dynamo electric machines," BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) December 31st.
- 30,111. "Ear and mouthpiece protectors for telephones," E. DANNEBERG. December 31st. (Complete.)

## PUBLISHED SPECIFICATIONS.

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### 1911.

- ELECTRIC FURNACES. N. Testrup and T. Rigby. 19,923. September 7th.
- TYPE-PRINTING ELECTRIC TELEGRAPH SYSTEMS. W. S. BIELJES. 20,105. September 11th.
- TYPOGRAPHIC AND LINE RECEIVING INSTRUMENTS FOR ELECTRIC TELEGRAPH SYSTEMS. W. S. BIELJES. 20,107. September 11th.
- ELECTRICALLY-OPERATED TIME INDICATING DEVICES. L. J. ATON and C. E. HARTSON. 20,264. September 12th.
- APPARATUS FOR AUTOMATICALLY OPERATING GAS OR ELECTRIC LAMPS. C. R. OUYER. 23,789. October 27th. (April 23th, 1912.)
- AUTOMATIC ELECTRIC FIRE-EXTINGUISHERS. S. B. FRIESEL. 27,163. December 4th.
- MEANS FOR, AND METHODS OF, CLEARING FAULTS ON ALTERNATING-CURRENT SYSTEMS. A. M. TAYLOR. 27,660. December 4th. (Cognate applications, Nos. 11,560 and 12,609 of 1912.)
- DEVICES FOR REGULATING THE SPEED OF MACHINERY. SIEMENS BROS. DYNAMO WORKS, LTD. (SIEMENS-SCHUCKERTWERKE G.S.) 27,688. December 5th.
- PREPAYMENT ATTACHMENTS FOR ELECTRIC CURRENT LIMITING DEVICES. H. B. E. NORFIELD. 27,801. December 11th.
- ELECTRIC REGULATING OR EQUALISING APPARATUS. R. Rankin and Chloride Electrical Storage Co. 28,913. December 22nd.

## NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 29,522. "Electric machines." Soc. DITE S.T.A.R. (Systeme de Traction Auto-Regulateur.) (Convention date, December 21st, 1911, France.) December 23rd. (Complete.)
- 29,633. "Frothing or obscuring glass globes, chimneys, electric lamps and the like for use with gas, oil and electric light." W. SHARP. December 23rd.
- 29,636. "Telegraphy and telephony." H. W. SULLIVAN. December 23rd.
- 29,666. "Method of adjusting electric meters." O. T. BLATHY. (Convention date, June 20th, 1912, Hungary.) December 23rd. (Complete.)
- 29,669. "Electric heaters." L. H. MAJAO. December 23rd. (Complete.)
- 29,679. "Telephone systems and the registration of calls and messages therein." H. HAWTHORN and H. T. McNEALE. December 23rd.
- 29,681. "Magnetoelectric machines for combined ignition and illuminating purposes." F. R. SIMMS. December 23rd.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

JANUARY 17, 1913.

No. 1,834.

## ELECTRICAL REVIEW.

## THE TELEPHONE AWARD.

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The judgment of the Railway and Canal Commission was delivered on Monday morning last in the case of the National Telephone Co., Ltd., *v.* His Majesty's Postmaster-General, and thus another stage was reached in the passing of the pioneer company, to whose enterprise is due the telephone system of the country. The system itself passed into the hands of the Post Office on January 1st, 1912, so that a little over a year has been required to determine its value. In the interim has been prepared, fought, and decided, one of the largest and most complex cases ever submitted to a judicial tribunal. The taking of the "inventory" occupied a small army for many months. The material thus acquired had to be put into shape, the attack of the company to be formulated, and the defence of the Department to be organised. The hearing commenced on June 10th, 1912, and continued till July 30th, when the Court adjourned for the Long Vacation; it was resumed on October 15th, and occupied altogether 74 days.

In the earlier stages a large amount of evidence was taken on points of detail which the Tribunal considered should be the subject of agreement, and the Long Vacation was taken advantage of to reach such an agreement in the case of plant cost; but for this the case might still be proceeding.

As will be seen from the lucid judgment of Mr. Justice Lawrence, published in another column, one of the essential differences between the parties was whether the value should be assessed on a basis which could be determined by actual experience, or by the estimates embodied in "contractors' so-called 'tenders.'" Whilst unable to adopt the percentages claimed by the National Co., the Court followed their system in reaching the awarded figure, rejecting the contractors' estimates as entirely inapplicable under the circumstances of the case.

The very interesting subject of depreciation was another case in which divergent views were submitted. The company claimed that depreciation should be arrived at on a method analogous to a sinking fund. "It takes the life of the plant and then ascertains the sum which, paid into a sinking fund at compound interest, would replace the cost at the end of the life, and it is suggested that if the amount in the sinking fund in any year of the life be deducted from the cost of the plant, the remainder will give you the cost of the plant at that moment." The Post Office submitted that the straight-line method, whereby "the value is reduced in the ratio which the age bears to the life of the plant," should be adopted. The latter is more general, and was adopted by the Court, though Mr. Justice Lawrence expressed the view that the sinking-fund method is a proper one to adopt in a going concern, especially where revenue is largely used for capital purposes.

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION

In the Press.

*H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.*

The inclusion in the value of an amount representing the cost of raising capital, approved by Mr. Justice Lawrence and Mr. Gathorne Hardy, was dissented from by Sir James Woodhouse, who delivered a separate judgment mainly on this point. The question to which much of the earlier discussion was directed—the suitability of the plant for the Postmaster-General's telephonic service—was determined by the Court in a manner generally favourable to the company's contention. But whilst much of the comment in the case is of this character, the results in figures are not proportionately favourable to the company, who claimed 20 millions, and have been awarded £12,515,264.

The expectations of the Stock Exchange were higher, and on the announcement of the award the deferred stock of the company made a sensational decline. The higher price, however, was purely speculative, and the warnings of Mr. Franklin, the chairman of the company at the shareholders' meetings, may be recalled in this connection. The policy which has for so many years past added to the reserve in spite of the efforts of shareholders for increased dividends, is a further indication of the prudent management of the company. In the result, the State has acquired a most valuable system at a price which, though just, is certainly moderate.

Of the principal witnesses on either hand, it is pleasant to note the comments of the Judge that "Mr. Gill's evidence was as remarkable for the care and ability he had brought to bear on the inquiry, as it was for his fairness and candour in the witness box;" whilst "Mr. Snell did not compare unfavourably with Mr. Gill, but he had been cramped by his instructions."

The strain on the engineering, legal and administrative *personnel* of the parties to this historic case must have been severe, and the relief afforded by its cessation proportionately great.

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## HONOURS FOR ENGINEERS.

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THE Honours List, which was published in accordance with custom on January 1st, contained the names of two persons whose distinction will rejoice the hearts of those connected with the engineering world. The first is Lieutenant-Colonel Yorke, of the Board of Trade, while the second is Mr. Corbet Woodall. Each of these gentlemen is admitted to the order of knighthood; each has won a well-merited reward.

Sir Corbet Woodall has presumably been honoured in relation to the centenary of the Gas Light and Coke Co. It was on January 28th, 1807, that the first street of any city was illuminated by gas. Pall Mall was so lit on that night. A gas company, however, was not formed until 1810. Its first shareholders were pitied as idiots, and it had a formidable mass of popular prejudice to overcome. Thus it was generally assumed that the pipes conveying gas would be hot, and therefore apt to produce conflagration! The company persevered, and on the night of December 31st, 1812, Westminster Bridge was lit with the new illuminant. Exactly 100 years later a distinguished official of the Gas Light and Coke Co. is knighted. It would almost seem as if those who

are charged with the duty of advising the King as to the disposal of honours thought it right to wait for the period which, in the Roman Church, must elapse before a distinguished ecclesiastic can be made into a saint!

Having regard to the above facts, one is led to wonder when the great men who have done so much for this country in the wide domain of electrical science will be regarded as deserving of New Year or Birthday honours.

So far as public benefits are concerned, there is no applied science which has conferred greater boons on the community than that with which this paper is concerned. Every industry in the country depends to a greater or less extent on electricity in some form or another. Again, there are myriads of houses—not only the mansions of the great, but the cottages of the poor—in which its merits are appreciated day by day. Yet, ever since the time when Faraday groped, so to speak, in the dark amongst his instruments, honours have been sparingly bestowed: and such honours as have been given have generally been awarded to inventors and discoverers, not to those who have laboured to apply invention and discovery to the needs of a great manufacturing community.

The explanation of this state of things is not far to seek. It was pointed out in a leading article recently published in this REVIEW, that engineers find it difficult to take any active part in Parliamentary government. Rendering, therefore, no services which are of direct advantage to Ministers and politicians, they are out of the running when the prizes for political services come to be awarded.

The electrical engineer may design and take an active part in the erection of a huge power station, from which a supply of energy can be obtained at ridiculously low prices. In this manner, he may labour to the direct advantage of a hundred thousand voters; but he will not influence their votes. If, on the other hand, he had devoted his keen intellect to the inculcation among the voters of doctrines agreeable to the Government of the day, he might have become a knight on the King's Birthday, or at the dawn of a New Year.

Again, if he were one of those who saw that the popularity of an existing Government was on the wane, and he took active steps to hasten its defeat, the next Government might go so far as to make him a baronet or even a peer.

We have said enough to indicate our view as to the true market value of the honours which are so generously conferred upon persons who have political claims. We are far from saying that a title is never a title to fame. Many members of the learned professions, many men distinguished in art and literature are rewarded in this manner, wholly irrespective of their political services or opinions. Our complaint is that men who are distinguished in the domain of engineering are considered of so little account that they are disregarded, while the back politician whose game is "one for the party or the State and two for myself," is frequently the recipient of honours.

Nor is the complaint merely the complaint of the English electrical engineer. In the Sister Isle, which has its Lord-Lieutenant, its sham "Court" and sham "Court Circular," the same rule obtains. "Fill up the honours list with politicians, and if there is a line left in the second column insert the name of a professor." It is only when the list

runs into two pages that the engineer has any chance at all.

It may be said, and with considerable force, that the value of an honour depends very largely upon the kind of person who already enjoys it. If everyone had K.C.B. after his name, the letters would have no value. Granted, then, that there is no particular virtue in many of the orders and decorations which are so liberally conferred, it seems to us that certain titles might well be created and set specially apart for those who have acquired eminence along the difficult paths of applied science. The Order of Merit has been bestowed on men of distinction in every rank and walk of life. No taint of political bias has tarnished it up to the present time. Some kindred order might be founded which, in the course of a few years, would come to be regarded as the blue ribbon of the electrical profession. Its bestowal would excite no animosity, and would occasion no disappointment to your party hack, because he would never be qualified to receive it. Once it was established it would enable the Government of the day to recognise merit in electricity, at any rate, a little sooner than they have been able to recognise it amongst those who have done so much for the coal-gas industry.

#### The Financial Position of Aluminium.

As a substitute for copper for transmission purposes, or for conducting electricity in any other capacity, it is sufficiently accurate to reckon aluminium as having half the weight for equal conductance of copper. Thus, where a ton of copper is required, half a ton of aluminium could be substituted. It will be seen, therefore, that aluminium should be able to compete with copper at a considerably higher price than it commands at present. The reasons why the demand is not greater, and the price consequently higher, are discussed in a recent (December 31st) article in the *Times*. The writer of the article points out that, four years ago, when the price of aluminium dropped in the United States, it was predicted that the consumption would rise rapidly to something like 100,000 tons, and goes on to show that, actually, the consumption at the present time probably does not reach the half of that quantity. When the relation of the price of aluminium to that of tin is considered, it seems surprising that more processes have not been evolved in which the one could be replaced by the other.

According to the *Times* article, the only important sphere in which the metal is predominant at the moment would appear to be the manufacture of military equipments on the Continent of Europe. Considering what a great recommendation is the lightness of this metal for bulk in this application, it would appear that this field must be capable of considerable extension. Against this, it is noted that the leading producing companies have not, on the whole, realised much from their enterprise. The great American company does not show a higher average return than  $4\frac{1}{2}$  per cent. on its capital, and the corresponding British company was unable to make sufficient profit to render it worth while to continue trading, and accordingly was wound up, and reconstructed; although considerable sums have since been spent on works, it has not yet been successful in paying a dividend, interest on preferential shares being reckoned as interest merely. The hope for the producing concerns appears at present to lie in their output of by-products, such as sulphate of ammonia.

A reason for the comparatively unimportant position of the metal is suggested by the writer as being the natural distrust that exists towards a new metal as a container or conveyor of foodstuffs and drinking-water, until it has been proved by exhaustive experiment that no injurious compounds will result. Also, the fact that mankind has for many centuries been educating itself in the art of working in tougher and heavier metals, but is not thoroughly used to this one is yet.

The production of aluminium at present is given as 50,000 tons, of which the United States and Canadian factories turn out 14,000 tons, France 12,000, England 7,000, and the remainder is provided by Switzerland, Germany, Austria, Italy and Scandinavia. During the first year of the present century only 7,000 tons were available. Taking it by volume, the quantity would be much greater. As it might be used for piping, if compared with lead on this basis, 50,000 tons would go as far as 212,000 of the heavy metal. In very large-sized pipes, if the substitution were satisfactory, the advantages in handling would be considerable. With so small a production, and so many advantages, it is curious that the price has been down so long.

#### Telephone Wires and Tramways.

DURING the recent storms much damage has been done to overhead telephone and telegraph wires; unfortunately some of the former have fallen on trolley wires, with serious results. At Sheffield, for example, two cab horses were struck by the broken wires and instantly killed, the drivers also receiving shocks, as well as those who went to their assistance. It was, indeed, a wonder that no person was killed, for two men received severe burns. The accident recalls to mind the terrible occurrence at Liverpool in 1901, when two persons were killed and a large number were injured under somewhat similar circumstances.

Such incidents revive the old question of telephone wires crossing tramways. At Sheffield the National Telephone Co. by arrangement agreed to take measures of precaution, but the transfer of the telephone system to the State has brought into force the arbitrary powers of the Postmaster-General; he requires the tramway authorities to provide the necessary protection or to bear the cost of putting the wires underground, and this they refuse to do. We see no reason whatever why the Postmaster-General in this connection should be in a more privileged position than a private concern; he has taken charge of a commercial undertaking, practically by force, and seeks to impose his arbitrary will, not only upon private owners of tramway systems, but also upon public bodies. Where the telephone wires precede the trolley wires, the latter may not unreasonably be called upon to pay for the work necessitated by their presence, but if the tramway is the first in the field, it seems but fair that any later arrival should look after himself.

Guard wires, it is well known, are the greatest nuisance that tramway managers have to put up with; moreover, they are by far the most unsightly part of the overhead construction, and are costly to erect and maintain. Automatic devices to cut off the connections of fallen telephone wires suffer from the drawbacks of all automatic appliances, and act only after the fall. On the principle that prevention is better than cure, it appears to us that all telephone wires which cross the route of a tramway either should be put out of harm's way (underground), or ought to be erected in such a fashion that falling on the trolley wires is impossible. Either of these alternatives is practicable, and both are preferable to the use of guard wires, which afford a poor and unsatisfactory solution to the problem.

## THE CENSUS OF PRODUCTION.

In our issue of January 28th, 1910, we published the preliminary table relating to electrical engineering, which summarised the results of the returns received under the Census of Production Act, 1906. This Act provided for the taking of a census in the year 1908 of the production for the calendar year 1907, or the business year most closely corresponding thereto of the firms reporting.

The preliminary tables have since been carefully revised, and are issued, with a final report of the census, as a Blue Book (Cd. 6,320), price 7s. 6d.

The completed tables for general engineering show an output of £89,055,000, instead of £87,817,000 given in the preliminary tables.

The table relating to electrical engineering we give in full below:—

## ELECTRICAL ENGINEERING.

Electrical machinery and parts:—		
Direct and alternating current generators ... ..	£815,000	
Direct and alternating current motors ... ..	1,729,000	
Motor-generators, converters and transformers ... ..	421,000	
Switches, rheostats ... ..	502,000	
Switchboards ... ..	697,000	
Other descriptions ... ..	50,000	
<b>Total—Electrical machinery ... ..</b>	<b>£4,214,000</b>	
Electrical instruments of all kinds (meters, measuring instruments, &c.) ... ..		£520,000
Primary batteries ... ..	109,000	
Secondary batteries ... ..	440,000	
Lamps and parts (except carbons):—		
Glow lamps ... ..	236,000	
Arc lamps and searchlights ... ..	229,000	
<b>Total—Lamps ... ..</b>	<b>£465,000</b>	
Telegraph and telephone cables:—		
Submarine ... ..	£1,102,000	
Land ... ..	809,000	
<b>Total—Telegraph and telephone cables ... ..</b>	<b>£1,911,000</b>	
Electrical power and lighting cables:—		
Paper and bitumen insulation ... ..	£1,322,000	
Rubber insulation ... ..	1,300,000	
Other and unclassified insulation ... ..	729,000	
<b>Total—Electrical power and lighting cables ... ..</b>	<b>£3,351,000</b>	
Transmission apparatus and plant (including insulators, conduits, poles, &c.) ... ..		£539,000
Electrical accessories ... ..	374,000	
Telegraph and telephone accessories ... ..	315,000	
Contract work in United Kingdom (generally exclusive of materials made by the firm):—		
Telegraphic or telephonic lines or works ... ..	45,000	
Electric power or lighting works ... ..	1,277,000	
Repairs and maintenance work for customers ... ..	337,000	
<b>Total—Electrical engineering ... ..</b>	<b>£13,897,000</b>	

To this table should be added the statement (page 130) that the gross value of the products of the electrical engineering trades returned on all schedules is £14,098,000. Making allowances for work given out and for duplication, "the value of the output of the electrical engineering trade, taken as a whole, may be taken at about £14,400,000."

The preliminary total was £13,782,000, so that it will be seen but little adjustment has been found necessary in the returns of electrical manufacturers, but cable makers are to be credited with returns of such accuracy that no variation exists between the preliminary and the completed figures.

The total figure for general and electrical engineering combined is £102,952,000.

In cost of materials used there is a slight increase to £48,535,000, as also in the amount paid to other firms for work given out, £3,922,000.

The value of output is £102,952,000, and the value of output less cost of materials and work given out, £50,495,000. These figures, we may remark, as in our first report, relate to the engineering industries as a whole, no separate figures being given for electrical engineering.

The number of persons employed in engineering industries is corrected to 461,703, instead of 455,561.

In the General Report will be found (p. 93) a valuable table summarising certain particulars, which, for engineering trades (including electrical engineering), are as follows:—

## Gross output—

Selling value or value of work done ... ..	£102,952,000
Materials used, cost ... ..	£48,535,000

## Work given out—

Amount paid to other firms ... ..	£3,922,000
Net output ... ..	£50,495,000
Persons employed except outworkers... ..	461,703
Net output per person employed ... ..	£109
Horse-power of engines at factories ... ..	331,251

The average numbers of persons employed in factories and workshops in engineering trades are classified as follows (p. 94):—

## WAGE EARNERS.

Males under 18 years of age... ..	59,515
" over " ... ..	348,875
Females under " ... ..	4,593
" over " ... ..	9,444

## SALARIED PERSONS.

Males under 18 years of age... ..	4,839
" over " ... ..	31,571
Females under " ... ..	488
" over " ... ..	2,378

All firms owning factories were asked to make a voluntary statement respecting the quantity of fuel consumed by them. Replies were received from engineering firms whose net output was £32,632,000, 64.6 per cent, of the total, and their fuel consumption was—coal 1,400,171 tons, and coke 468,503 tons.

In order to obtain a measure of the cable industry, manufacturers were requested to state voluntarily the quantity of copper used by them. Firms whose output of cables was valued at £3,794,000, or 7.2 per cent, of the value of the total output of cables of all kinds, stated that they used about 14,900 tons of copper in making cables; the remaining firms did not supply the desired information.

The horse-power of engines at factories, mines, &c., so far as they relate to the industries dealt with in the Census of Production Office, was 10,755,009 (page III), and about one-quarter of this total was required for driving dynamos for the production of electricity for power and lighting purposes.

The total amount of electricity purchased was returned as 444,473,000 Board of Trade units. Of this 125,000,000 units were used by railway and tramway companies for traction purposes.

The total quantity of electricity produced by electricity supply undertakings was returned as (page 16) 1,432,101,000 Board of Trade units, of which 240,138,000 units were known to have been sold in 1907 for power purposes, excluding traction.

In the section relating to public utility services, it is stated (page 831) that the gross output—selling value or value of work done by gas undertakings—was: Companies £20,844,000, and public authorities £10,767,000; for electricity undertakings: Companies £3,182,000, and public authorities £5,731,000. The horse-power of engines owned by electricity undertakings was:—Companies, 569,405 H.P.; public authorities, 990,669 H.P.

The fuel consumed by electricity undertakings was as follows:—

Companies' coal 797,023 tons. Coke 2,191 tons.
Public authorities' coal 1,973,066 tons. Coke 26,762 tons.

The net output of gas undertakings (page 837) was £11,557,000, and of electricity undertakings (page 845) £5,588,000.

The average number of persons employed by gas undertakings was 54,866, and by electricity undertakings 22,618.

His Majesty's Post Office returned an output of the total value of £2,872,639, and the National Telephone Co. £1,503,784.

The whole report will be carefully studied by those interested, and we must, for considerations of space, refer our readers to it for much additional information which it contains on electrical industries.

Comparisons cannot yet be made, since the 1907 census was the first of its kind, but this is a drawback which will, before very long, be remedied. Arrangements for the 1912 census are well forward, and the schedules will shortly be issued. The organisation of the Department having been developed by the experience of the first census, there is no doubt that the results of the second will be more promptly issued and their value proportionately increased.

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

## Village Lighting.

Your article dealing with village lighting in this week's ELECTRICAL REVIEW was both interesting and instructive; but no mention was made of the numerous small undertakings in successful operation in the neighbourhood of Exmoor and Dartmoor. All of these are good examples of their kind, and show that such small undertakings are sound financial propositions.

Probably one of the smallest public services is in the pocket edition of a hamlet called Bridgetown, between Dunster and Dulverton. Here an enterprising wheelwright supplies himself and his neighbours—i.e., practically every cottage in the hamlet. His power plant—a small dynamo and set of accumulators—is driven by the oil engine used for his workshops: the battery charging is done when the engine would otherwise be working with light load. He regards the plant as a good investment, and it is a great convenience to his neighbours. Among the other villages supplied by local companies, we can mention Porlock, Dulverton, Braunton, Dunster in the Exmoor district, and Chagford, Bovey Tracey, Bradninch and other places in the Dartmoor district. All of these have taken on well, and the plant, although small, is in all cases ample for present requirements.

Another successful undertaking is that of Lynton and Lynmouth, one of the old pioneer concerns, having been at work 23 years: in its early days its road to success was both rough and thorny, but it went ahead, and now has an exceptionally heavy output for the population. According to the ELECTRICAL REVIEW list of electricity works, it has an output of 170,000 units. The total connections are 199 K.W., and the resident population is less than 1,900.

There is another supply at Okehampton (a town small enough to be rated as a village) worked in connection with a sawmill. This also is an old concern, having been at work something like 24 years. The mill turbines drive the plant as long as they can; but water power is not sufficient, and the make-up power is a steam engine, the boiler being fired chiefly with the sawmill refuse, and the two attendants being sawmill mechanics.

Knowing that there is generally a sawmill in most villages, often combined with a wheelwright's shop, when reading your recent article on the sawmills at Maldon, and their producer plant for wood gas, it occurred to me that a similar, but smaller, arrangement would be a good proposition for many small towns and villages.

Devonian.

## Lifting Magnets.

Can any reader tell me where I can procure a book or paper dealing with the design and construction of lifting magnets?

Enquirer.

[A long article on this subject recently appeared in the *Elektrotechnische Zeitschrift*.—Eds. E.R.]

## Operations of Electric Railways.

Could any of your readers inform me the usual rate of acceleration and retardation which obtains on the District and Tube trains?

J. F. C.

## The Case of the Sub-Man.

Having read with some interest, and a great deal of amusement, the letters of "Motor-Generator" and "Booster" in last week's REVIEW, I should like to point out a few obvious misstatements, made, I trust, in ignorance, by both these gentlemen.

There is no need to make any remarks with reference to the inherent snobbery of the shabby genteel, everyone

knows that that is, unfortunately, a very real factor in human affairs.

"Motor-Generator" cannot see why he should be compared to a "common wireman"—neither can I, but for quite a different reason.

Has he ever realised, I wonder, that the average wireman can take over shift duties with very little preparation other than a good look round, while the average sub-man, asked to find a small but troublesome earth on an apparently sound installation, would be very badly lost? Then, no doubt, he would find his extensive knowledge of the difference between the volt and the ampere a source of great mental comfort, if little practical assistance.

A few years ago I was honoured by the friendship of a sub-man—how highly honoured I had not fully realised until to-day—and I should like to give an example of the way he carried out his high calling. First, however, I must not forget to add, for the benefit of "Motor-Generator," that he had received a college education, together with the usual cramming associated with the majority of technical institutes. After starting up his machine, it was his practice to wedge his switch in position; then he would foregather around the corner with certain females of his acquaintance, whose intellect, it is to be hoped, was of the same high order as his own.

Being of an inquiring disposition, I naturally wanted to know why he indulged in what appeared to my weak intelligence to be a particularly foolish practice, and I was told that if the switch came out, and he was not there to replace it, there would be trouble, but if, owing to the switch failing to act, the machine burned, well—could he, on his salary (22s.), be expected to know of, and prepare for, such a contingency? Surely not!

An isolated instance? Maybe, but not, I think, more so than that of the thirsty wireman quoted by "Motor-Generator."

One other remark of "Motor-Generator's" calls for comment, and it is this. "They (the wiremen) attend the technical schools, not to learn anything, but to increase their kit of tools at the expense of the workshop." That, my dear sir, savours of the insolent, and, no doubt, any of the "common wiremen" who are honoured by receiving instructions from you, would have great pleasure in convincing you of it, to his entire satisfaction—if not to yours.

When "Booster's" salary has reached the level of the average wireman's "wages," he will, no doubt, be a great deal older, and, I trust, wiser, but until then, I should advise him to cultivate the acquaintance of a few of his social inferiors, the common wiremen, and then I expect that he will stagger at the amount of electrical information they, of their charity, will give him.

A Wireman.

In reply to "Motor-Generator's" letter, the writer does not agree with him in justifying shiftmen being snobs. He does not seem to realise that the age in which we live is a democratic one. Accident of birth does not count. A shiftman receives his salary in exchange for what he accomplishes or should accomplish. As regards shiftmen being gentlemen, there are gentlemen in all walks of life.

Let "Motor-Generator" look back to the infancy of engineering development. He will find that Geordie Stephenson, Edison, Clifton Robinson, and many others were men of lowly birth, and it is probably due to those men's discoveries and developments that "Motor-Generator" obtains his livelihood to-day. In his justification of shiftmen being snobs, I note "Motor-Generator" states that snobbishness is born in a man, but with a man of "Motor-Generator's" refinement, one would expect to find all traces eliminated. If "Motor-Generator" and his colleagues wish to advertise the fact that they are gentlemen, let them adopt the principles of such. Putting on a superior air, boasting of their University education, and the amount of money their deluded parents have spent on the same, are items which they should keep in the background, for, in the writer's opinion, a man with University and shops' experience should be able to obtain a healthier and more lucrative position than that of shiftman. Of course, it is admitted that nowadays a man with no private means must keep up appearances.

Probably the gentlemen referred to by "Motor-Generator" are some of those who bring their cold mutton sandwiches to the station in a dispatch case, but, in the writer's opinion, it does not make them one whit more an engineer than it made a young lady whom the writer used to see at South Kensington taking home potatoes in a mandolin case a musician. As regards the slur cast on wiremen by "Motor-Generator," and his doleful tale of the candles and beer, I suppose he has never heard the tale of the shiftman who used to stop the battery discharge meter and pump the battery dry to get a low coal consumption on his shift, leaving nothing for the next man on, or of the sub-station attendant who burnt out the transformer by taking the shift on the seat of his pants instead of the soles of his feet. Alas! there are fallen brothers in all professions. I agree with him that wiremen are made up from the lower and middle classes. And so are shiftmen. I knew one wireman, a doctor's son, who used to come to work in a cab. Another was a clergyman's son, who, in addition, was a fluent linguist; also two who had been 150-guinea premium pupils to a pioneer firm of electrical engineers, and were working under a foreman who had been yard boy in the days of their pupilage, so that "Motor-Generator" will see that, like shiftmen, wiremen are sometimes quite well connected.

It appears to the writer it is quite time the Government compelled men in charge of electrical and mechanical machinery to pass an examination similar to that of the marine engineer, so that none could take charge without a certificate proving their theoretical and practical knowledge. This would eliminate the caste question, and also weed out the purely University-trained men who will take a job at any price to gain experience, and are mostly as much good on a breakdown in a station as the son from College of  $2\pi r$  fame, in Harry Tate's notoring sketch, is in repairing the car.

We should then have common-sense men and have no more grumbling than there is among marine engineers.

G. F. Sullivan.

Birkenhead, January 13th, 1913.

I have read with great interest the correspondence respecting the case of the sub-man, which has been appearing in your columns during the past few weeks. A year or two ago I was a sub-man myself, and so can heartily endorse the strong remarks made by other correspondents, ament totally unqualified men running, or attempting to run, expensive plant. Considering, too, that every boy starting with a wiring contractor can graduate finally into a full-blown wireman, it does not seem fair of Mr. Potter to place such men on a level of efficiency with men in sub-stations, who have been through an engineering college, and probably served their time in the shops as well. Qualifications should count for something (although chief engineers of supply undertakings consistently refuse to pay living wages for them), and apparently the sole idea of the Electrical Trades Union is to grind all down to a common level of efficiency, or rather inefficiency.

At the same time, however, I must register a mild protest against your correspondents who seem to have a horror of being thought "tradesmen." Surely to be a tradesman is nothing to be ashamed of, but rather something to be desired. No higher praise can be given to a man than to say that he is a good tradesman, whether he be draughtsman, fitter or sub-station attendant. Each to his own trade is a good motto.

Where I am at present employed there are engine fitters who are Inter.Sc.'s of the University of London, and others who have taken first-class honours in the Board of Education and City and Guilds Examinations. These men can well be compared with the excellent men "Motor-Generator" mentions.

Let us give Mr. Potter and his magnificent offer a wide berth—we can afford to do without it. Surely, however, an engineer should be broadminded enough to keep clear of the unpleasant classifications of "gentleman," "middle class," and "lower class" mentioned by "Motor-Generator." If a man has the blood of a hundred Kings in his veins, he

will not be a better engineer for it, and when he has achieved any position at all in the profession, his birth and upbringing become matters of secondary importance. It is *what* a man is, not *who* a man is, which counts in engineering nowadays.

Switchboard.

[We are pleased to publish this letter, the tone of which is very different from that of some recent communications on this subject. In fact, the correspondence was degenerating into an irrelevant discussion of social position not unmixed with personalities verging upon abuse, and we must ask our correspondents to endeavour to keep it on the higher plane marked by this letter.—Eds. E.R.]

#### Screw Caps for Radiator Lamps.

I have recently experienced a lot of trouble with radiator lamps and lampholders, which are of the ordinary bayonet type, owing to the spring in the lampholder getting tired after the continuous application of heat and allowing the bayonet point to fall away from the lamp cap, which sets up arcing and spoils both lamp and lampholder.

I would suggest to manufacturers that this trouble would be very much reduced by using the Edison screw and cap and lampholder; the contact would be firmer, there would be greater contact area and the lamp would be better supported from the cap, making it almost unnecessary to put in a further support about the middle.

The metal-filament lamp manufacturers recommend screw caps for their high-candle-power lamps: surely there is as much necessity for a radiator lamp to be so fitted.

W. H. Allen,

Engineer and Manager.

Electricity Department, Loughborough,  
January 13th, 1913.

#### The Salford Fire.

In your issue of January 10th, under the heading "Fire Risk," you referred to the recent fire at Salford as a "switchboard fire." We have no exception to take to the general tenor of your remarks, but in describing the fire as a "Switchboard Fire," an impression is produced which is incorrect and damaging.

The switchboard was totally destroyed by a fire which originated in the basement and spread upwards through two floors, and destroyed the switchroom and its contents, which are on the first floor. The fire did not in any respect originate upon the switchboard itself. The switchboard was, in actual fact, of extremely modern construction, and has been designed with special reference to safety, and the elimination of any such risks as those which you deprecate.

Bertram Thomas.

Manchester, January 11th, 1913.

#### High-Tension Direct Current in Mines.

To reply briefly to the two points referred to by Mr. Walker:—

*Liability to Short.*—I fully realised the conditions as stated by Mr. Walker, but my point was that the probability of a short occurring through mechanical damage was not in the ratio stated. If cable-faulting were in the experimental stage, and shorts due to faulty manufacture likely to occur, I would put the ratio at less than three to one, but this point is not worth labouring, since these shorts need never occur, provided, as I stated previously, that "cheap" (?) cables are "taboo."

*Joint Boxes.*—I take it Mr. Walker refers to a "straight-through" box for, say, a three-core 0.35 sq. in. wire-armoured cable for 500 volts or so. The boxes would be about 16 in. long × 8 in. wide × 5 in. deep, and would include provision for efficiently bonding the armouring at each end, the conductivity of boxes and bonds being greater than that required under the new mining rules. Weight complete, about 15 lb.

Similar boxes (hundreds of which have been installed on contracts under my supervision) give complete satisfaction—attention to details in laying cable and boxes, with particular regard to local conditions, being all that is necessary.

May I point out as relevant to this question the unsuitability of lead-sheathed cables as a general rule in mining work—vulcanised bitumen sheaths being generally preferable, the dielectric being either bitumenised fibre or paper.

I shall be much interested in Mr. Walker's forthcoming paper, though I may not be able to attend the discussion.

L. C. Trevor-Roper.

Nottingham, January 11th, 1913.

#### British Laboratories for Electrical Goods.

Having read the report by Mr. C. Hamilton Wickes, H.M. Trade Commissioner for Canada and Newfoundland, in the *ELECTRICAL REVIEW* of January 3rd, it has occurred to me that there is a lot to be said in favour of a standard laboratory for electrical goods to prevent fire risk. Judging from his remarks, it is quite clear that America is creating a protective policy for her own goods in Canada, and a similar laboratory which would be recognised by the insurance companies here would prevent a very large quantity of cheap foreign accessories and fittings being used in this country. From the writer's experience the accessories used generally in this country and manufactured in this country would have no difficulty in passing such a laboratory, the requirements of our own consulting engineers being far more stringent than the American practice. Of course, there are difficulties to be overcome which are not met with by American manufacturers, seeing that factories in America specialise more on certain articles than is the case with manufacturers here. One has only to refer to an American catalogue to appreciate this. For instance, items like knife switches are catalogued in cases containing, say, 25, 50 or 100. The English buyer is not accustomed to ordering in these quantities and usually purchases one or two at a time. Should such a laboratory be formed, it is the writer's opinion that it should be run under the guidance of the State. It is well-known that bribery is resorted to in many instances where goods have to be passed in a country like America, and if a laboratory is formed in this country, it should be based on a reputation which, as Mr. Wickes suggests, should be recognised not only here and in America, but throughout the whole of the British Empire.

With regard to the inspection of installations, the writer is of the opinion that this should be dealt with by the fire insurance companies themselves, and should not be connected in any way with the testing laboratory for electrical apparatus. From a fire prevention standpoint, it is a national duty to see that only such apparatus is used as will reduce the possibilities of fire to a minimum, and the writer is quite sure that we should hear very little about fires being caused by defective electrical goods if such a laboratory were brought into existence. It would be most unfair to the electrical contractor if there was a possibility of competition taking place owing to some contractors using approved material and others not using approved material where the fire insurance company was not directly concerned, and that is the reason why the writer urges that it should be imperative by law to use only such material as has received the approval of the laboratory.

V. Delebecque.

Walsall, January 13th, 1913.

#### THE TRICITY HOUSE.

It is with considerable pleasure that we record the inauguration of the first public restaurant in London in which the whole of the cooking, as well as the lighting and heating, is done by electricity. We say "first" advisedly, for we are sure it will not be the last; and we feel that this younger branch of the industry is greatly indebted to the enterprise of Messrs. Modern Kitchens, Ltd., who have adopted this effective method of bringing home to the general public the advantages and capabilities of electricity in its domestic applications. As our readers are aware, the promoters of this new venture have been indefatigable in demonstrating the merits of electric cooking, and of the "Tricity" cooking appliances in particular, both in London and in the Provinces, and their expert demonstrator, Mr. F. S. Grogan, who combines with a thorough training in electrical engineering a remarkable aptitude for the culinary art, and a natural gift of lucid exposition, has earned a well-merited reputation as an electrical chef throughout the country. In more than a score of towns, we understand, the "Tricity" cookers can now be obtained on hire from the supply authorities, and electricity for cooking can be had for 1d. a unit, or even less, in over 50 districts. A campaign has now been opened in the Metropolis, which has not yet been generally enlightened upon the subject of electric cooking, and we wish it all success.

The new restaurant is situated at 48, Oxford Street, between Tottenham Court Road and Oxford Circus, and is marked by an electric sign, which is visible as far as the Circus. The equipment comprises ovens, grills and boiling hot-plates capable of dealing with the whole of the cooking, but occupying a remarkably small space—only 15 × 12 ft.—which implies a very considerable saving in rent as compared with the older systems of cooking. Beginning in a modest way, at present only luncheons and teas are served, but later on it is intended to provide dinners and suppers. Meals are served on three floors, which are tastefully decorated in various styles and comfortably furnished. Each floor is in communication with the kitchen (which is on the top floor) by a service lift, and on each floor there is a service counter, provided with electric cookers for making tea, coffee, toast, &c., the kitchen being reserved for the heavier work. A considerable amount of the cooking is thus performed in view of the customers, who are thereby enabled to observe the perfect cleanliness of the system and the absence of unpleasant fumes and odours.

The employment of so many appliances in the restaurant rendered it advisable to install indicators to show when each cooker was on high or low heat, or off. The indicator measures 12 × 3 in., and projects about 4 in. from the wall. A plug socket is attached horizontally to the projecting base, and on the front are mounted a fuse, main switch, and indicating lamp. The lamp is connected in parallel with a compound resistance element, which is in series with the main current, and consists of a spiral of wire ending in two clips, between which a small stick of carbon is connected; when the full current is on, the carbon heats and its resistance falls, while with the low current the resistance of the carbon is greater. The result is that the lamp glows on either heat, but its brilliancy is so varied that the cook can tell at a glance which heat is in use.

All is now ready; we need only recall the well-worn adage about the proof of the pudding, and recommend our readers to go and try it for themselves—and send their doubting clients also.

**Sentences.**—The 16 young employes of the London Electric Railway Co. who, as already reported, were recently before the Court charged with irregularities in connection with unpunched tickets, were before the Common Serjeant on 10th inst. Eleven of them were bound over to come up for sentence if called upon, and the others were sentenced to periods of imprisonment varying from three months' hard labour, to one month in the second division.

**Australian Tariffs.**—The Australian Customs authorities have recently given a decision, to the effect that "Electrical appliances, conduit electric fittings for—plain tee and elbow inspection pieces" are to be classified under No. 178 (D) of the tariff, the duty being 17½ per cent. *ad valorem* on foreign manufacturers and 10 per cent. on British goods.

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"INQUIRER" asks:—"I shall be glad if you could refer me to any judgment that has been given in the course of law on the following question:—

"A consumer's meter stops between the dates of reading, and in rendering the account a fair average is made on the assumption that current has been consumed during the period the meter has ceased to read. The consumer states that he had used no current over the period covered by two meter readings, although the meter read for a portion of the time."

"The Electric Lighting Clauses Act, 1899, contains no provision which expressly covers the point suggested in this query. Assuming that the consumer was able to prove absolutely that he had had no current during the period mentioned, it is difficult to see how he could be made legally liable to pay for a supply, either as by the ordinary law, or by an arbitrator acting pursuant to the Schedule to the above Act, Clause 57. It is there provided that if any difference arises between any consumer and the undertakers as to whether any meter, whereby the value of the supply is ascertained (whether belonging to the consumer or to the undertakers), is or is not in proper order for correctly registering that value, or as to whether the value has been correctly registered in any case by any meter, that difference shall be determined upon the application of either party by an electrical inspector, or, where the local authority are the consumers, by an inspector to be appointed by the Board of Trade, and the inspector shall also order by which of the parties the costs, and incidental to, the proceedings before him shall be paid, and the decision of the inspector shall be final and binding on all parties. If an inspector were to arbitrate under this section, and had power to award an amount (the question whether he has such power appearing to be somewhat doubtful) it would appear that he would be entitled to consider emphatic evidence to the effect that no current was supplied.

PROCEEDINGS OF INSTITUTIONS.

The Change of Energy Loss with Speed in Direct-Current Machines.

By W. M. THORNTON, D.Sc., D.Eng.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Newcastle, November 11th, 1912.)

THE present note deals with measurements for the purpose of examining the dependence of loss on speed made upon a 7½-h.p. Westinghouse D.C. four-pole motor, running at a normal speed of 1,500 R.P.M. The windage tests are novel, in that they were made by running the machine in air and *in vacuo*.

A large cast-iron tank specially made for the tests, which could be exhausted to a pressure of a few millimetres of mercury, was fitted to contain the tested machine. The latter was driven from an external motor by a 1-in. steel shaft passing through a stuffing box. The efficiency of the motor at the power and speed used was determined with great accuracy, and the power supplied to it during the tests measured by standard instruments. After each change in speed four to five hours were allowed to elapse before taking a reading, in order that bearing temperatures might become steady and that the temperature of the driving motor might also adjust itself to the change of load upon it.

The loss caused by bearing friction and windage together is most usually taken to obey a law of the form  $W = a n^2$ , where  $x$  has been found to be nearly 1.5. Neither of the components, however, obeys a simple law. Arnold gives for bearing friction the relation  $w = 9.8 k l d r/T$ , in which  $r$  is the velocity of rubbing in metres per second,  $l$  the length and  $d$  the diameter of the bearing in centimetres,  $T$  the temperature in degrees C., and  $k$  a coefficient, numerically about 2, depending on the oil. At lower velocities, from 0.5 to 4 metres a second,  $w = 9.8 k l d r^{1.5}/T$ .

There is, therefore, a period of transition from one law to the other.

The power required to drive air through a large machine is not negligible. All that design can do is to remove the loss by wind eddies, where these have no cooling influence, and to direct the air to where it can be most usefully applied as a cooling agent. The laws of gaseous eddies would lead to an expression in which the resistance to movement varies as the square of the velocity, or the power as its cube, and all windage loss is generally taken to follow this law. There is, however, in the present experiments, evidence of loss corresponding to a lower index.

The variation of loss with speed derived from the figures cannot be made to fit exactly any expression of the form  $w = a n^x$ .

Following the usage of the Kapp-Hausmann diagram and plotting  $W/n$  against speed, the curve of fig. 1 is obtained, which, intercepting the vertical axis above zero, confirms the existence in these experiments of a term proportional to the first power of the speed. Perhaps the most interesting feature of this curve is that it is straight over a long range of speed, and that there is a remarkable increase in the value of  $W/n$ , beginning in this case at about 1,100 R.P.M. This long straight portion, which corresponds to a

term in the power of the form  $b n^2$ , may explain the straightness of the line usually found in the running-light method of testing losses. Windage would then fall in with eddy-current loss over this range of speed. The fact that this line is sometimes curved from the base is explained later in the consideration of eddy-current loss, and that it is more often bent upwards at high speeds is to be expected from the prominence of the higher power windage loss only developing at some critical speed, peculiar, no doubt, to each machine or type of design. The mean index corresponding to the rising part of fig. 1 is, however, nearly 2 from 1,200 to 2,000 R.P.M. The complete expression for the power absorbed would then appear to be here of the form  $W = a n + b n^2 + c n^3$ , in which the first term corresponds to a resistance of constant amount, the second to one proportional to the speed, and the third to the square of the speed.

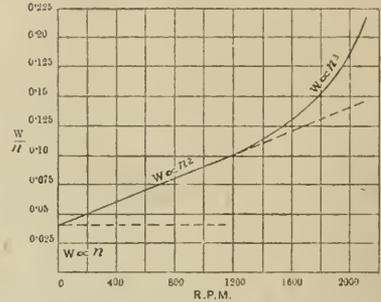


FIG. 1.—WIND RESISTANCE INDEX AND SPEED.

As a first and rough approximation the curve can be represented by  $w = 5.5 \cdot 10^{-9} n^2$ , though with this the values are at first low, and at intermediate speeds high.

This is the law generally taken to represent windage loss, and is always characteristic of loss of power by turbulent motion, in which the resistance is proportional to the square of the speed. Any resistance proportional to the speed can only be caused by opposing forces of the nature of skin friction, in which the energy is communicated to the surrounding medium through disturbances of the nature of collisions rather than eddies. The existence of a constant resistance is, so far as I know, a new feature in wind resistance experiments, and should, therefore, only be received after further experimental evidence.

The conclusion from the present experiments is that there are at least two terms in the wind resistance of electrical machines, one corresponding to the formation of eddies, the other to a skin friction. For modern types of covered armature, the former only becomes important at high speeds, whilst, for smooth covered surfaces, the latter is not negligible at low speeds.

The same machine removed from the vacuum tank and driven by the same motor was tested by the measured-power and running-down method under three conditions: with solid poles, with solid poles and

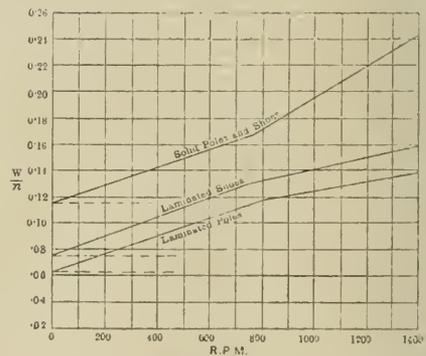


FIG. 2.—CHANGE OF COEFFICIENT OF EDDY-CURRENT LOSS WITH SPEED.

laminated pole-shoes, and with poles laminated throughout. In each case the friction plus windage loss was separately measured, and since there was no change other than the removal of end bearings to permit the armature to be drawn and the poles interchanged, the mechanical conditions should have been the same in each case. It was, however, found that the three winding and friction lines did not coincide. This illustrates the effect on bearing friction which may arise in practice from exceedingly small changes in alignment.

The figures, as far as they go, show that the shaft friction index does perceptibly change with speed, between  $w = b n^1.5$  at low speeds and  $w = b n$  at high.

These tests were repeated with the fields magnetised to give a gap flux density of 5,800 lines per sq. cm., and taking as before the ratio  $W/n$  as ordinate, a further set of curves (fig. 2) was obtained which are of interest. Each consists of two distinct parts, and the

point of flexure is in each case at a speed of 830. Below this the curves are parallel; above it they diverge in order of lamination. The intercepts on the vertical axis correspond to the hysteresis loss in each case or one proportional to the speed. If the hysteresis loss in laminated poles can be neglected in comparison with that in the armature, we have the result that even with laminated shoes and solid poles there is an increase of 20 per cent. in the total first power loss, and with solid poles and shoes 87 per cent. increase, as distinct from second power loss. The ratio of slot opening to air-gap is 3.5, the large value of which might be expected to give rise to larger than usual pulsations in the pole flux.

Since the lines of Fig. 2 are straight the eddy current index derived from them is in each case 2, both for speeds above and below the point of flexure. Apart from eddy-current loss in the armature, which is known to follow the square law, this shows that there is "turbulent" magnetic movement in the poles rather than symmetrical pulsation in the solid yoke. But though the speed index is the same for each curve, the coefficients are not. The cause of the change in the eddy-current coefficient at, in this case, 830 R.P.M., is to be sought either in the amplitude or in the type of magnetic oscillation in the poles.

The conclusion from these tests is that they agree very fairly well with those *in vacuo* as regards windage, and that the bearing friction loss is relatively higher at low speeds than at high, the index decreasing with rise of speed. Pole lamination has apparently an effect upon hysteresis as well as upon eddy-current loss. The index of the latter is in all cases 2, but the coefficients change at some critical speed, being the same in all cases at low speeds.

#### DISCUSSION.

MR. A. H. LAW remarked upon the important bearing which windage loss had upon the design of high-speed machinery, and mentioned that in some cases, where the windage had been found to be excessive, it had been possible to reduce greatly the ventilation without appreciably increasing the temperature rise, on account of the reduction of the losses caused by the air eddies. In alternators designed for very low temperature rises it had been found advantageous to put the ventilating fan at the outlet in order to avoid heating up the air before it reached the windings. Surface speed was also an important factor, as it had been found that shortening a given carcass for a smaller output did not result in a proportional decrease in the windage loss.

MR. C. H. DAVIDSON regretted that Dr. Thornton's experiments had been made on such a small machine. He had windage-loss curves for plants of various sizes, but in no case could he find a simple expression to agree with any of them, some varying approximately as the square and others as the cube of the speed. This meant that a formula worked out for one machine could not be applied to another having different proportions of length to diameter, different surface speed and different construction, and the matter was further complicated by such items as the shape of the slots and air passages. A curve giving windage plus bearing losses was obtained from a 250-kw. D.C. armature, and by assuming that the bearing losses varied directly as the speed it was found that the windage loss varied very nearly as the speed squared. This armature was smooth and covered with binding wire and centrifugal fan action would be almost entirely absent. Of course it was not correct to assume that the bearing loss went up directly as the speed, because it really went up faster than in strict proportion, and so the true windage loss would show the existence of the  $an$  term as well as the  $b n^2$  term. On these high-speed armatures there was always a skin of air being carried round and round by the armature, which seemed to stick to it, and he suggested that Dr. Thornton might be able to trace in this the origin of the  $an$  term. In some cases, this skin of air could be got rid of by fitting scrapers when the pole-pieces did not have this effect themselves. In another case, that of an old 250-kw. armature specially built for single-phase work and having an "H" type revolving field, it was found that the windage loss varied very nearly as the cube of the speed. In that case the rotor had an enormous centrifugal effect, which would account for the largeness of the third power term in the equation. In high-speed turbine plants the accurate determination of the windage losses was of the utmost importance, as they formed such a large proportion of the total losses. In some cases, the windage losses in direct-current machines, where the speed was high and resort had to be made to powerful ventilation for carrying away the heat, amounted to as much as 40 per cent. of the total losses. In the case of alternators the percentage was considerably lower, but where the speed was high, the windage loss often amounted to as much as 25 per cent. to 30 per cent. of the total losses. Windage losses were greater in machines which depended for their ventilation upon fans mounted upon the rotor, as it was difficult to design such fans to have anything approaching a really high efficiency. One of the 5,000-kw. alternators at Carville had a windage loss as low as 26 kw. = 16 per cent. of the total losses, but in this case the ventilation was produced by externally-driven fans which consumed approximately 17 kw., so that the total ventilation and windage loss amounted to about 27 per cent. of the total losses of the machine. In another case a 500-kw. single-phase alternator was found to have a windage loss amounting to almost 50 per cent. of the total losses, while at the same time the temperature rises were quite moderate. The quantity of air passing through the rotor was reduced with the result that the windage loss was halved, and the temperature rise was practically the same as before.

MR. C. TURNBULL said that even small losses in central stations were of importance. A 20-kw. loss in a generator might not seem large, but nevertheless it equalled 160,000 units in a year of 8,000 running hours.

MR. T. CARTER said that in low-speed machines the exact windage coefficient was not of great importance; the windage and friction losses might amount to only 2 per cent. or 3 per cent. of the output, so that an error of, say, 10 per cent., in estimating these losses was quite negligible. He mentioned a case of a motor-generator, in which it was found that there was an extra loss, on overload, which seem to depend upon the load of the machine. The loss varied as the square of the speed, and he suggested that some experiments to find out exactly what it was might form a useful continuation of the present record.

MR. F. O. HUNT said that previously he had not felt that anything like the truth had been arrived at in accounting for the upward curve found at the top end of the Kapp-Hausmann diagram.

MR. W. BAXTER asked if precautions had been taken to get rid of all residual field, as otherwise the results could not be accurate. With regard to trapped air, he did not think that any reasonably good designer would be likely to leave "pockets" in which air could be imprisoned, as one of the chief points in design was to ensure that air circulated through every part of the windings. The curves showed that there was not a great deal to be gained by carrying the laminations beyond the pole faces, at least with a ratio of slot opening to air-gap of 3.5 to 1. That ratio was not very excessive, as a ratio of 5 to 1 was often found in small crane motors. He felt certain that the loss mentioned by Mr. Carter was due to brush losses. As an example of the magnitude to which these losses due to commutation currents in the brushes might attain, he mentioned the great variations which were observed in the no-load current of a D.C. motor when the brushes were moved away from the neutral position.

DR. W. M. THORNTON, in reply, said that the remarks of the first speakers were interesting, as showing the real gain which could be effected by shrouding end-connectors wherever possible. Some tests were under way which seemed to show that great variations in bearing losses were possible with even small changes in the dimensions. He agreed that Mr. Carter's overload loss might be a commutation effect. Some years ago Prof. Threlfall had shown that in alternators there was an increase of 7 per cent. in the iron loss as the load came on. A suggestion by Mr. Hunt regarding quasi-rigidity should, he thought, be further considered. If the effect was a real one and not derived from some undetected change in the mechanical friction, it was difficult to see a better explanation than that it might be due to the shearing of the air blast entering the armature axially.

#### DISCUSSION AT MIDDLESBROUGH ON NOVEMBER 8TH, 1912.

MR. LONGMAN suggested that the large windage losses in high-speed machines might lead to other means being adopted to get rid of the heat, such as water or oil cooling of the stator. Referring to bearing friction, the machine in the first case was run unexcited, and no pull due to want of magnetic balance would be experienced, but with many machines, especially high-speed ones, bearing troubles occurred under load due to this cause and to circulating currents in the shafts and bearings.

MR. CHRISTIANSON said that, so long as iron and copper losses took place in machines, the windage loss could be looked upon as a useful loss, with the exception of the wind-eddy component.

MR. MARSHALL closed the discussion with a few remarks, and DR. THORNTON briefly replied to the various speakers.

#### Röntgen Society.

AT the meeting of the Röntgen Society on January 7th, PROF. A. W. PORTER delivered an address on the subject of electric discharges at high gas pressures, as recorded photographically. The spark photographs were obtained in the usual manner by connecting the terminals of an induction coil to two electrodes, one of which was placed on each side of a photographic plate, and an arrangement made by which a single spark was passed, the plate being subsequently developed. The negative spark—that is, the spark obtained when the negative terminal was in contact with the sensitive side of the plate—in air at ordinary pressure had as its characteristic feature certain fan-like expansions, like the blades of a palm leaf; but at higher pressures some fine filaments developed, and the appearance then resembled that of the fronds of a fern. These little filaments changed again at still higher pressures, and at a pressure of 14 atmospheres they were represented simply by a fluffy appearance all along the main lines of the discharge. The fan-like expansions characteristic of the negative spark seemed to be dependent upon the presence of free nitrogen in the gas through which the discharge was taking place. Oxygen and carbon dioxide gave no trace of the fans. Oxygen also differed from nitrogen in the fact that, while in the case of the latter the negative discharge would scarcely pass if the pressure were increased a little, in the case of oxygen at similar pressures the effect was as conspicuous as ever. The discharge in hydrogen was always very small, though he was not certain whether this was due to the electrical properties of hydrogen, or to its high thermal conductivity. The positive discharges seemed to be less worthy of note than the negative, because the differences in different gases were comparatively small, so far as general appearances went. He hazarded the conjecture that these fan-like expansions obtainable with the negative discharge represented in some sense or another what might be called an explosion or a disintegration set up in the surrounding gas by the discharge. Then each of the points from which the filaments of the fan emanated would be the centre of the explosion, and the different blades of the fan would represent the paths of ions or of ion aggregates.

In the discussion which followed, Mr. A. A. CAMPBELL SWINTON remarked that the negative discharges generally seemed to go in straight lines or in long, sweeping curves, such as one would expect from projectiles which were having a free course, which the very small negative electrons might be supposed to have. The positive figures resembled rather the wriggling path of larger bodies which had a tendency to be sucked in. That more or less fitted in with the modern electron theory, namely, that the negative electrons were very small, and the positive carriers very much larger.

Mr. W. DUBDELL said that, supposing the discharge really did pass through the gas, the method seemed to furnish a new means of analysing gases, and an insight into the molecular structure of gases might possibly be forthcoming by means of the fine detail visible in the discharges.

In his reply, Prof. PORTER dealt at some length with the influence of the magnetic field on these effects. There were difficulties, he said, in getting a sufficiently strong field in such cumbersome apparatus as one was compelled to use for the high pressures, but at ordinary pressures it was found that the magnetic field had no sensible influence whatever on the main figure that was obtained. He thought the results indicated that the negative discharge was not carried by free electrons, but by loaded electrons. If it were carried by free electrons one would get the same deflection for the magnetic field as one got with the cathodic stream.

Faraday Society.

At the December meeting of the Society, Dr. A. P. LAURIE, Principal of the Heriot-Watt College, Edinburgh, delivered a lecture on "Concentration Cells," embodying his researches of the last few years on the particular type of cell in which the same salt is dissolved in two different solvents.

If a salt is shaken up with two different liquids which do not mix, the salt is shared between the two solvents in a definite proportion, which is constant for dilute solution, and known as the partition coefficient. If after so shaking up, the liquids are allowed to separate, and a similar electrode introduced into each, there will be no E.M.F. between the electrodes. If a different concentration of salt be taken, at the boundary the concentrations will be such as to fall under the relation of the partition coefficient, and each cell can therefore be regarded as an ordinary concentration cell. If instead of two liquids which do not mix, one selects liquids which do mix, the problem becomes much more complicated, but the study of it is simplified by imagining the liquids separated by a third solvent which mixes with neither of the others.

Dr. Laurie's experiments on such cells were carried out by using little stoppered vessels inverted and plunged in the solution, and a Dolezalek electrometer. The stoppers not being greased, there was sufficient contact between the liquids outside and inside the bottles to give electrical connection, and yet there was no mixing. The combinations used were potassium iodide and iodine dissolved in water and nitrobenzene, with platinum electrodes; potassium iodide and iodine dissolved in water and ethyl alcohol, with platinum electrodes; and potassium iodide in water and ethyl alcohol, with silver-silver iodide electrodes.

The first experiments described with these cells were on the effect of temperature on E.M.F. In ordinary concentration cells, if the concentration on one side is kept constant and that on the other side varied, and the concentration E.M.F. curve plotted, this will be found to cut the zero E.M.F. line at the same point at whatever temperature the experiments are made, and with the reversal of the E.M.F. the temperature co-efficient is reversed, the cells being always endothermic. The peculiarity of the present cells is that the concentration E.M.F. curves at different temperatures do not meet on the zero E.M.F. line, and with the reversal of the E.M.F. the temperature co-efficient is not reversed, the cells becoming exothermic, giving out heat as well as producing current. For example, in the case of potassium iodide in water and alcohol, the cell is exothermic when the current is in the direction of transferring potassium iodide from water to alcohol, the ratio of about 1 to 20 being the concentration at zero E.M.F. If a cell which has no E.M.F. at some particular temperature  $T_1$  is heated to a temperature  $T_2$ , a current will flow so as to transfer potassium iodide from alcohol to water, and the cell will be endothermic. On cooling again to  $T_1$ , the current is reversed, the cell becomes exothermic, and potassium iodide is transferred back from water to alcohol. Thus the cell forms a very interesting reversible heat engine.

The conditions which make the cells endothermic or exothermic are easily stated.

Define unit current as that required to transfer a molecule of potassium iodide from one solution to the other. If then  $\lambda$  is the latent heat of solution of 1 gramme molecule of potassium iodide in water (calling heat absorbed positive), and  $\lambda'$  the latent heat of solution of an equal quantity in alcohol, then when the salt is transferred from alcohol to water—

$$E = \lambda' - \lambda + T \frac{d\lambda}{dT} \dots \dots \dots (1)$$

As heat is absorbed when potassium iodide is dissolved, then if  $\lambda'$  is greater than  $\lambda$ , heat is absorbed in the cell during the change, and the cell is endothermic. If, however, the concentrations are so arranged as to transfer the salt from water to alcohol, then the equation becomes—

$$E = \lambda - \lambda' + T \frac{d\lambda}{dT} \dots \dots \dots (2)$$

and the cell is exothermic.

For equation (1)  $T \frac{d\lambda}{dT}$  has a positive value, the E.M.F. rising with increase of temperature, and for equation (2)  $T \frac{d\lambda}{dT}$  is negative.

If the transfer number of the ions is known, enabling what is here called unit current to be defined, these equations enable us to measure the difference between the latent heats of solution in very dilute solutions of a salt in two different solvents.

The above results suppose that alcohol behaves like a solvent that does not mix with water. The case of water-alcohol-potassium iodide cells with silver-silver iodide electrodes was therefore studied, and a modified definition of the partition coefficient was arrived at for liquids which inter-diffuse and one of which is able partly to precipitate salt out of the other (alcohol partially precipitates potassium iodide from a strong solution of the latter in water). Two such solutions are in partition equilibrium when the ratio of the strength of solution is such that when the weaker solvent is saturated, the stronger solution is sufficiently diluted to prevent any preventary precipitation of salt by inter-diffusion.

Dr. Laurie suggests that the source of energy in such a cell when the salt is saturated on both sides, and yet the cell is exothermic, is to be looked for in the heat set free by the ionic mixing of water and alcohol, due to the carriage of water and alcohol across the boundaries combined with the respective ions.

LEGAL.

THE TELEPHONE ARBITRATION.—JUDGMENT.

THE Railway and Canal Commission, composed of Mr. Justice Lawrence, Mr. A. E. Gaythorne Hardy, and Sir James Woodhouse, delivered its judgment on Monday in respect of the application by the National Telephone Co., asking the Court to determine what amount should be paid by the Postmaster-General for the whole of the company's plant and undertaking which has been acquired by the State.

The arbitration proceedings, which have been reported week by week in our columns, lasted, in all, over 70 days, the hearing of the case having commenced in June last, the last sitting concluding shortly before the Christmas adjournment.

MR. JUSTICE A. T. LAWRENCE, in delivering the award of the Court, said he had to determine the value of the property of the National Telephone Co. upon its transfer to the Postmaster-General at the expiration of the company's licence on December 31st, 1911. The company was the pioneer in the introduction of the telephone into this country, and had a system which, at the time of the transfer, was serving 561,356 stations. The total amount claimed was £20,924,700. At the outset the parties agreed to deal first with the plant of the undertaking. The governing clause of the purchase agreement was in these words:—"The value on the 31st day of December, 1911, of all plant, land, buildings, stores and furniture purchased by the Postmaster-General in pursuance of the provisions hereof, shall be the then value (exclusive of any allowance for past or future profits of the undertaking, or any compensation for compulsory sale or other consideration whatever) of such plant, land, buildings, stores and furniture, having regard to its suitability for the purpose of the Postmaster-General's telephonic service, and in determining the value of any plant, no advantage arising from the construction of such plant by leave of the Postmaster-General upon any railway or canal over which the Postmaster-General possesses exclusive rights of way for telegraphic lines shall be taken into account." The method adopted of presenting the matter to the Court was to divide the plant into classes such as "underground" and "overhead," to divide each class into sub-divisions, and to value a unit of each sub-division, viz., a mile of conduit, a mile of bare wire, or a pole. The value of the unit, when ascertained, could be multiplied by the number of such units in the inventory. The valuation of the unit proceeded as follows:—It assessed first the price of the material, then the cost of the labour of placing it in position, up to, and including the "gang foremen"; this was called the plant cost, and to this was added, by means of percentages, the cost of every additional item of expense to which it was alleged a constructor of the system would be put to in the matter. The company based its case on its own experience. For materials they took the average price paid for a period of 12 years, and for labour the average cost for six years. After some time it became apparent that the chief conflict between the parties would turn on the percentages to be added to the plant cost, and the parties came to an agreement, the result of which was to relieve the Court from the necessity of determining the plant cost of this property *in situ*. The agreed sum, together with an agreed item for casualty insurance, became the "fundamental cost." It amounted to £10,313,765. It left over for the consideration of the Court the highly controversial questions of percentages, which should be properly added to this sum, and the depreciation to which the whole cost of construction when ascertained should be subjected. It was agreed that in cases of this character, the true method of ascertaining value was to consider what it would cost to construct and establish plant in position, if it did not exist, and then to depreciate such cost, according to the age of its respective parts. This was assessing value on what was called tramway terms. It could, he thought, be demonstrated that this was the only possible way of arriving at the fair value in cases where the present owner had no further right to work it. It was unnecessary for him to further illustrate this, because the House of Lords had clearly laid down the method to be adopted in such cases. The Tramway Act contained the words "having regard to its suitability for the purposes of the

Postmaster-General's telephonic service." Each side relied upon those words in support of certain of its arguments; but neither contended that it had the effect of changing the method of valuation to which he had referred. In applying this method, it was clear that every expense which it was necessary to incur in order to establish the plant in position formed an item in the calculation which was to result in finding its value. Both parties agreed that some percentage addition must be made to the agreed fundamental cost, and they further agreed that nothing had been included in that sum for ordering and storing material other than certain temporary storage, obtaining wayleaves, local engineering supervision, head office administration, contractors' profits as distinguished from manufacturers' profits, rent of premises, for erection of exchange equipment, wayleave payments, maintenance and endurance of plant, contingencies, interest during construction and cost of raising capital. A further head of claim—viz., "obtaining subscribers' agreements"—was not mentioned in the document. But the Postmaster-General did not by the agreement admit as a fact that anything was due in respect of any of the above heads; he merely admitted that nothing had been included in the fundamental in respect of either of those matters. Here the agreement of the parties terminated, and a wide divergence of view was presented. It was unfortunate that this agreement was not come to until after the 36th day of the hearing, for the evidence during that period had been largely concentrated on cost of materials, cost of freights, tools and labour. Evidence on these topics now became, to a large extent, immaterial, and the crucial points had to be picked out from the mass of evidence. However, the Court must be thankful that the case had, to some extent, been shortened by the agreement. The percentage additions appeared to him to be entirely questions of fact and not of law. In each case the questions had to be asked, "Is this alleged item of expense a necessary step in the construction and establishment of this piece of plant?" "If so, what is the true amount to be added in respect thereof?" These were pure questions of fact, and they had in no case added anything without having first asked themselves and answered these questions. The second question was, from the nature of the case, largely one of business experience. The computation had, in each case, to be made with due regard to the allowance made for other items in the calculation, that probably no two minds would independently arrive by identical routes at exactly the same figure. The company's case upon the percentages was shaped in this way: They professed to take their own actual experience of what it had cost them to perform the services, and asked the Court to infer that, as they had been well and economically managed, that it would cost the Postmaster-General or anyone else at least as much. The Postmaster-General, on the other hand, asked the Court to accept the view that a contractor would do the work for a percentage of 20 per cent. on the cost of labour alone, plus a profit of 10 per cent., to which he added 5 per cent. for the services of the engineer. The company purported to get at what it had cost them by taking a period of time alleged to be typical and by investigating this period and distributing their total expenses for the particular service during this period between maintenance and construction in proportion to the time devoted to each by their employes. This gave the ratio which the cost of the service bore to the construction work executed during the period in the form of a percentage, and this percentage they sought to add to each class of plant. The Solicitor-General contested each point in the process, and some of his criticisms were certainly very cogent. It was plain that the percentage of cost of any service obtained in this way was open to many errors, no matter how well intentioned the conduct of the investigation might have been. The investigation was made under the direction and superintendence of Mr. Gill, the engineer-in-chief of the company. His evidence was as remarkable for the skill and ability he had brought to bear on the inquiry as for his fairness and candour in the witness box. Notwithstanding this, his results were not completely satisfactory. This was chiefly due to the fact that the typical period was one during which construction was less than it had been in previous years, for the company was then beginning to approach the termination of its licence, whereas the staff was not materially diminished. This tended to increase the ratio which general charges bore to construction. Again the allotment of time to maintenance and construction respectively was made by Mr. Gill's subordinates from their memories and what had happened in preceding months—a method manifestly open to error. This method involved a comparison of construction by the company with the construction by a hypothetical constructor, and that was comparing piecemeal construction with continuous construction. This was a favourite subject of attack by the Solicitor-General, but he placed too much weight on it. In the two matters of preparing the estimates and "ordering" it did undoubtedly increase the expense, and in other respects it afforded an opportunity for possible error in the apportionment of time between construction and maintenance. This objection to the company's experience was incapable of exact measurement, and in that respect it resembled a claim put forward by the company to an additional allowance called separate establishment charge. He had come to the conclusion that any increased cost by reason of piecemeal construction, might well be set against the claim for separate establishment allowances. In regard to the cost of "storage," his Lordship thought that the gentlemen who had prepared the returns had, through not fathoming the true meaning of the instructions, unduly increased the expense of storage. Mr. Gill had again introduced his percentage additions into the calculations at different stages, and this the Postmaster-General had named a "snowball fallacy." It was clear that in this way any error that might have crept into an earlier percentage would have been magnified by subsequent percentages based on

such error. He would have felt greater confidence in the calculations of both parties if the cost of all services had been taken at the ratio which their cost bore to labour and materials or plant cost. He felt that Mr. Gill's percentages must be reduced. His method when they were properly reduced was satisfactory, in that it was based on actual experience, but the Postmaster-General's evidence was not so satisfactory. It was true that his leading witness, Mr. Snell, did not compare unfavourably with Mr. Gill, but he had been cramped by his instructions, and instead of being supplied with a firm foothold of experience, of which the Post Office authorities had ample, he was supplied with contractors' so-called "tenders." The method of approaching this question by asking what would a contractor do the work for, was perfectly sound if they had contractors of experience in executing similar contracts. To provide the telephonic plant of this company would be a perfectly unique experience, and no contractor called before the Court had had any experience extending beyond mere fragments of similar work. Most of them objected to producing the figures resulting from the carrying out of any contract executed by them, basing their objections on the wish not to disclose their business. The percentage which the contractors to the Post Office spoke to was one of about 20 per cent. on labour alone, which it was said would cover any charge, and leave to be added only 10 per cent. for contractors' profits and 5 per cent. for engineering, or, as it was subsequently called, "employers' burden." This 20 per cent. appeared to him to have been deduced from an investigation in the North Wales district during 11 months of 1907-8, but he did not think an investigation of that character, and in that district, was at all a safe guide to apply to the company's whole system, much of which was in London and other populous places. He was unable to adopt the percentages put forward by the Post Office, and he was driven in these circumstances to frame other percentages. He had tried in doing so to give due weight to, and be guided by, the evidence given. The amount of the percentages was essentially a question of fact in which one had to be guided by experience and a sense of business touch. Before he stated the amount he had determined to be due, he wished to deal with the heads of claim in respect to which the Postmaster-General said no percentage allowances should be made. The cost of obtaining subscribers' agreements was an item which had been disputed by the Postmaster-General as to amount, and as to its being an admissible element of cost. He confessed he was surprised at this, not only because it seemed to him to be within the principle of the case allowing the expenses of obtaining Parliamentary powers for a tramway, but also because it was plain that the Postmaster-General had elected to treat the transfer of the company's system as having the effect of an assignment, by operation of law of these very agreements. So he had taken up these inconsistent positions; as between himself and the company's subscribers he took all the benefits conferred by the agreements on the company; but as between himself and the company, he said: "I claim to be entitled to refuse to pay you anything in respect of the expense to which you have been put in obtaining and entering into these agreements." That did not seem to be right, and it would follow that an instrument in a house vacant at midnight on December 31st, 1911, was as valuable and as suitable to the service of the Postmaster-General, as one in a house the agreement for which continued and poured its tariff or rent into his coffers without interruption. He could not see how the bare cost of getting the agreements could be excluded. The instruments and their connections would constitute trespasses, but for the fact that they were erected pursuant to these agreements. The consent of the subscriber embodied in the agreement was as necessary in order to make the erection of the instrument a lawful act, as the Parliamentary powers were in order to legalise the breaking up of the surface of the highway for the purpose of a tramway. He was not now dealing with the quantum of cost. The evidence on that was scanty, but he thought it was to be inferred that other expenses had been included in the claim beyond those that could be properly attributed to the obtaining of the agreements in force for the instruments *in situ* at the date of the transfer. Sir A. Cripps had felt this, and suggested that one half of the amount claimed should be allowed. They must reduce this claim, and the amount they allowed, after depreciation, stood in round figures at £150,000. Next it was said that the cost of raising capital necessary to construct the plant was not an item to be taken into account in finding the cost of its construction. This meant the cost to which anyone must be put who attempted to construct this plant. The method prescribed by the House of Lords for ascertaining value was to consider what it would cost to construct the plant—that was, what it would, as a fact, cost. Would it, in fact, cost anything to provide the necessary capital? The company had given evidence, by way of example, that it cost them £41 per cent. to raise 5½ millions of pounds. No one had given evidence that it would not cost anything, nor had that proposition been put forward even in argument. He knew of no commodity and no service that could be procured as a right for nothing, and he was clear that as a fact money could not be procured for nothing. They had nothing to do with the cost of raising any capital other than the amount which would be necessary in order to construct. But it was said that it could not be an element adding to the value of the plant. The thing transferred—here was the plant *in situ*, and the cost of construction, less depreciation, was the method by which the value had to be ascertained. It, therefore, followed that every expense necessary to construct was an element to be considered, and it had to be considered because it was necessary in the process of construction. The thing to be transferred, say, a pole, must be procured, transported, and erected each of these steps was necessary to the existence of the po

*in situ*; each of these steps cost money, and the raising of this money was in itself an expense, and was one as necessary to the existence of the pole as any of the other steps. This was clear even in the case of a pole, but when the money required amounted to millions, it became clearer, for no one had millions of pounds in his pockets, or even on current accounts with his bankers. The result of this was that the cost stood out, and was seen clearly. The price of all things in which there was competition was governed by the market price. It was not true to say that this involved a proposition that the value of the plant varied with the credit of the constructor. The cost to be considered was the cost to the hypothetical constructor, who was a person of good credit; or, in other words, what it must cost any constructor, even the Postmaster-General, who had the credit of the State on which to raise the necessary capital. Nor did it involve the conclusion that the cost of raising capital should be added to the price. That it must be included was apparent if it were tested in a case in which the sale took place immediately upon the completion of the construction. Assuming the plant to cost £10,000,000 to construct, out of which £300,000 had been properly spent in raising the capital required to pay for its construction, if the contractor were to receive the cost, less the £300,000, he would receive £9,700,000 and would lose £300,000 on the transaction. Whoever raised the money necessary to pay for materials, labour, plant, &c., was put to the expense of raising that money, and, if necessary, the cost must appear in the value, otherwise no sane person would ever knowingly contract. He had come to the conclusion that a reasonable amount must be allowed under this head of the claim. He had cut the item down to a low figure, and the amount stood after depreciation at £247,189. Coming to the question of depreciation, it was admitted that the figure for construction cost had to be depreciated in view of the fact that the plant was not new at the moment of transfer. Two methods of depreciation had been put before the Court—the sinking fund method put forward by the company, and the straight-line method put forward by the Postmaster-General. He had come to the conclusion that the Postmaster-General's method of depreciation was the method which should be applied in this case. By this method the value was reduced in the ratio which age bore to the life of the plant. The next point in dispute was as to the mode of computing the life of the plant. The company adopted the physical life, but the Postmaster-General had adopted a life which in the course of the case had received a great variety of names, but which had a shorter life than the physical life. What was the service of the Postmaster-General when he took this plant? It was the affording of means of telephonic communication between the then subscribers to the combined system. It was quite possible that some of the then existing plant might have varying degrees of suitability to that service, and the evidence which showed that must receive due consideration. The Court found themselves in this position. The general evidence by the company of the good condition of the plant was met by instances of defects in particular classes of plant. They were satisfied that defects existed, but they had no evidence gauging the effect which ought to be given to those defects. The Post Office witnesses had not discriminated between the effect of their several causes for shortening physical life; they had lumped them together. They gave no evidence from which it could be reasonably inferred that their estimate of growth of business was correct. They took the growth of the company in the past as their measure. No ground was given for this. There must be a limit to the capacity of every community to provide subscribers. He was not satisfied that there would be any large expansion of the combined systems unless the rates were lowered or the service improved. In that event the increase might become enormous. He did not consider that a ground for depreciating the value of the existing plant. He had been driven to reduce somewhat the physical life he would otherwise have given to several classes of plant. He had made certain allowances and depreciated the value according to the straight-line method, by reference to the physical life so reduced. The result he arrived at was that the construction value of the plant under headings one to four inclusive in the particulars of claim was £13,457,016.

MR. GATHORNE HARDY concurred.

SIR J. WOODHOUSE said that on the cost of issuing capital for plant construction he differed from his colleagues. The company included in their claim the sum of £757,657 under that head, and his learned colleagues had awarded the company £247,189. He did not see his way to regard that item as one which they could rightly include in the value to be ascertained. If he were wrong he had no objection to the amount of £247,189, which his colleagues had allowed. The final judgment of the Court was that the sum of £12,515,264 should be paid by the Postmaster-General to the company.

The ATTORNEY-GENERAL said it was necessary that the decision of the Court should be entered in a particular form. According to the purchase agreement, the money would be payable as to not more than one-fourth in cash. There were other stipulations, which he would not trouble the Court with. He suggested the decision of the Court should be in the form of a declaration that the amount to be paid should be the sum suggested by the Court.

HIS LORDSHIP said he had not mentioned anything about the payment of the money. He meant an order should be drawn up for the amount of the award which would be included in the order in accordance with the usual practice of the Court. He did not mean that money should be paid as distinguished from some other agreed security.

SIR A. CRIPPS said that under the Telegraph Arbitration Act, 1909, the cost of the proceedings before the Commission should

be at the discretion of the Commission. Therefore, the company were clearly entitled to the costs of the inquiry.

The ATTORNEY-GENERAL said his submission was that the proper order would be that neither party should have costs. The total claim by the company was £20,900,000, and the decision of the Court was that they were only entitled to £12,515,264.

HIS LORDSHIP said that in the opinion of the Court, the company were entitled to the amount awarded, and that the costs would follow the event.

The ATTORNEY-GENERAL, on behalf of the Crown, expressed indebtedness to the Court for the promptness with which the decision had been given. He knew what stupendous labours must have been involved, and he was afraid the vacation had been devoted to work instead of to recreation.

SIR A. CRIPPS said he echoed the sentiments of the Attorney-General. All parties were most grateful for the attention which had been given to the case by the Court and for the promptitude with which the decision had been given.

## AN INTERESTING COLONIAL TELEPHONE PROBLEM.

FOR some years there has been an interesting dispute in progress between the municipal Corporation of Port Louis in the island of Mauritius and the Oriental Telephone and Electric Co., Ltd., which owns the telephone system in the city.

As far back as 1883 the Telephone Co. asked and obtained permission from the Municipality to erect poles and carry wires for the purpose of establishing a telephone exchange. The exchange was established, and for 22 years, that is, until 1905, carried on without any interference. At that date the Corporation decided to erect an electric lighting system using overhead wires, and on November 27th, 1905, this information was given to the company in a letter from the Mayor, who advised them to take whatever steps were necessary to guard against accident or troubles arising from induction. At the same time the company were asked to keep their wires as far as possible in the side and more private streets, as requested in the original permission granted by the Corporation. The company took no notice of this letter.

In March, 1907, a notice as required by the Electric Lighting Ordinance of 1902 was published in the Government Gazette, intimating that it was the intention of the Municipality to undertake the electric lighting of the town, and stating that the system of distribution would be by overhead wires generally and by underground where necessary for safety against contact with aerial wires of other systems.

Shortly after this the Corporation commenced to erect the lighting wires, and moved the Supreme Court for an injunction ordering the Telephone Co. to at once remove all the dead wires which crossed the streets and rested on municipal buildings, to lower their wires where they crossed the lighting distributors and to take all necessary precautions to prevent trouble from induction.

The Telephone Co. then brought an action to determine who was to pay for this work, claiming that the Corporation were responsible. The Corporation denied liability, but insisted that the work should be put in hand. Both parties agreed to an interim decree by the Court that, pending the trial of the action, the Telephone Co. should, within six weeks, remove all dead wires, and, within nine months, lower and alter the position of the wires interfering with the run of the lighting-wires, and establish a double-wire circuit throughout their entire system, to prevent any induction trouble.

The Corporation, during this period of nine months, undertook not to run their generating plant between the hours of 6.30 a.m. and 5.30 p.m. The Telephone Co. were to keep separate the cost of the work they had to carry out, and this sum was to form the claim at the trial of the action. This work was carried out by the Telephone Co. at a cost of £1,031 (15,462 rs. 39 cts.), which sum they claimed from the Corporation.

At the trial which took place last year, the Telephone Co. argued that the Corporation had no special privileges in regard to powers for putting up or taking down electrical wires, but were in the position of ordinary undertakers,

amenable, like other people, to the provisions of the Electric Lighting Ordinance of 1902. Article 6 of this Ordinance was very clear as it bound all undertakers to take all reasonable precautions in constructing electrical lines, so as not to injuriously affect, whether by induction or otherwise, the working of any wire or line from time to time used for the purpose, among other things, of telephonic or telegraphic communication, or the currents of such lines.

The Corporation maintained that they were not bound by the provisions of this clause, inasmuch as the powers under which the Telephone Co. operated were obtained from them and could be revoked by their instructing the Telephone Co. to remove them altogether. If the company wanted to override the Corporation's powers they would have to obtain a licence from the Government, which licence would not be granted to such an antiquated, old-fashioned and obsolete system as the one used by the company, but only to such a metallic return system, which was all that was now required by the ordinance.

The case came before the Court and was fully argued, a number of witnesses appearing on each side.

The Judge, in giving judgment against the Corporation, stated that, in his view, the Corporation were undertakers under the ordinance, and as such were bound by the very stringent provisions of Article 6. This article demanded that they should take all reasonable precautions to prevent interference or induction with existing telephone or telegraph lines. The lighting wires might have been placed underground, but if carried overhead the provision of a metallic return to the telephone system was essential. He, therefore, held that the Corporation were responsible, and decided they should pay the Telephone Co. £1,000 (Rs. 15,000), the remaining £31, being, in his opinion, for unnecessary work. Had it not been for the explicit wording of Article 6 of the ordinance, he felt that the fact the Telephone Co. would, under normal circumstances, have had to modernise their plant, would have had an important bearing on the case.

As it was, the Corporation were fully aware of the risk they ran in erecting the lighting overhead wires. This was proved by the minutes of a Council meeting and the publication of a letter on the subject written them in October, 1905, by their electrician.

This is a most interesting case, for while at first sight it does not seem equitable that a new electric light undertaking should be saddled with the cost of bringing up to date an old-fashioned existing telephone exchange, yet a perusal of the circumstances in this particular case points to the justice of the decision. The ordinance under which the lighting undertaking was established was explicit in its wording; it was open to the Corporation to avoid trouble by using an underground system of mains, and the Telephone Co. had been in existence for 22 years without serious complaint; all these points told heavily against the Corporation. As a result the Telephone Co. were able to modernise their plant and turn what might have caused them a good deal of trouble into a means of establishing their business on up-to-date lines. It is not at all surprising to find that they have now applied for, and obtained, a Government licence to continue the working of their modernised metallic return telephone system.

## SMOKE AND DUST PRECIPITATION.

IN spite of the vast improvements in fire-grate construction and the regulation of industrial coal combustion in recent years, factory chimneys still belch forth volumes of black smoke, and even with the widespread use of electric power our manufacturing towns are but little freer from soot than they were a decade ago. In addition to detracting from the appearance and health of our towns, this deposition of soot on the roadways and housetops marks a sad waste of fuel, and should be of equal or greater interest to the works engineer as to the health officer or the local inspector of nuisances.

In this connection an investigation of "The Electrical

Precipitation of Suspended Matter in Gases,"\* by Prof. W. W. Strong, of Pittsburg University, is of considerable interest. The purpose of the investigation was to study the electrical properties of gases containing solid and liquid matter in suspension (especially smoke from soft coal), and to ascertain the manner by means of which an electrostatic or an electromagnetic field will cause a separation of the suspended solid or liquid matter from a gas.

This article reviews Prof. Strong's experiments, and some of the more important conclusions to be drawn from his research.

The precipitation of suspended matter from gases by means of electrical discharges was suggested by Hohlfeld in 1824 and by Guillard in 1850. Lodge and Clark were the first investigators to go into the problem extensively. Lodge states that the discharge from points kept charged to a high potential by means of an electrostatic machine produced a clearance of the suspended matter in the neighbourhood of the points. This clearance seemed to be independent of the nature of the suspended material and of the sign of electrification at the point. Walker patented the above "process for separating and collecting particles of metals or metallic compounds, applicable for condensing fumes from smelting furnaces and for other purposes." According to Walker's arrangement, one electrode of the electrostatic machine was earthed, while the other was connected to an electrode covered with metallic points, against which the fumes made contact. This is the "active" electrode.

Apparatus of the above type was installed in the Dee Bank Lead Works, but on account of the unreliability of the source of electricity—Wimshurst electrostatic machines—the method was apparently a failure. Thwaita took out a patent in 1899, in which a barbed wire was used as the active electrode. In the description this is mentioned as being positively charged.

It is to F. G. Cottrell and his co-workers that we owe the recent commercial development of electrical precipitation. In his 1908 patent he claimed the following conditions to be favourable to successful operation: First, the current should be unidirectional, or, at least, the time occupied by its reversal should be large compared with the time of deposition of the individual suspended particles; second, the particles should be charged at or near the electrode about which the brush discharge appears (the "active" electrode); fourth, the suspended particles in the gas should be subjected to as uniform treatment as possible. High-voltage alternating current was made unidirectional by the use of a synchronously driven rotating commutator. In order to make the brush or glow discharge as great as possible, the active electrode was wound with asbestos threads, strips of mica, &c. The surface of the asbestos is usually moist enough to act as a conductor, so that the exposed fibres give point discharges into the gas. Such electrodes Cottrell calls "pubescent." The patent includes claims to the maintenance of the insulation of the pubescent electrodes by means of currents of clean gas and by heating. Howard took out a patent on the use of horizontal plate electrodes for precipitating fumes. Nothing is stated concerning the electrical conditions necessary.

In a patent taken out by Dion the action of the electrical current is that of aggregating the fume particles and then allowing them to settle. It is stated that under the same conditions metallic particles of different kinds are precipitated to a different degree, and this fact is stated as affording a means of separating the various fume materials. Metallic plate electrodes are described, the electrodes being of a composition determined by the kind of fumes to be precipitated.

Strong's experimental apparatus was constructed for the purpose of applying the various electrical precipitation methods to the smoke from soft coal, and consisted of a small furnace which, "on account of its construction, proved to be a most efficient smoke producer." An underground pipe served to convey the smoke along various paths which could be regulated by dampers, and the flow was assisted by a small fan run by an a.c. motor. One smoke circuit was through a series of pipes (which could be either insulated or earthed)

\* Communicated to the *Journal* of the Franklin Institute, September, 1912.

in which an active wire electrode was suspended. The electrification of this electrode was effected in various ways, the apparatus used in these experiments including a Wimshurst electrostatic machine, a pneumatic influence machine capable of giving an 11-in. spark, a Fessenden induction coil, a Westinghouse transformer rated at 60,000 volts and other smaller transformers. Another smoke circuit contained an adjustable spark gap and was used for experiments on flue gases at different temperatures, velocities and smoke-content, the variations being produced by altering the condition of the furnace combustion, speed of the fan or the dimensions of the pipe.

Suspended solid and liquid particles in gases may be acted upon in various ways by an electric field, so that some or all of the particles are drawn from the gas to the electrodes. (1) If the particles are conducting, the effect of the electric field is to polarise the particles, inducing a positive charge on one side and a negative charge on the other side. This action of the field probably plays an important rôle in producing aggregates of fine particles that are close to each other. (2) If the suspended particles are non-conductors their dielectric constant will be greater than that of the gas, and in an electric field that is not uniform the particles will move into the more intense part of the field. (3) Gaseous ions may be present in the gas, and some of these will combine with the suspended particles. Such charged particles are the large ions, and these move very slowly in the weaker fields. Large ions are always gaining and losing charges, and this process may aid in aggregating together the smaller particles. (4) The above processes, by means of which suspended particles can be removed from a gas, apply only to cases where the gases move very slowly between the electrodes. When there is intense ionisation and an intense electric field, streams of ions will be created between the electrodes. Under these conditions, the streams of ions carry the suspended particles in the gas with them to the electrodes, to which they give up their charge. Streams of ions are produced in the various point, brush, and corona discharges.

The relative importance of these effects in removing suspended particles is difficult to estimate, especially as some distinction must be drawn between mere aggregation and final precipitation on the electrodes. The effects numbered (1) and (3) probably function chiefly as aggregators, while the ionic streams produced in the high-tension discharges (probably by collision or secondary ionisation in stronger parts of the field) undoubtedly sweep the suspended particles, whether aggregated or not, to the electrodes. But it has been found that the precipitation due to the formation of an electrical "wind," or ionic stream, is accompanied by more or less aggregation and a settling of the larger particles.

The causes of aggregation are not well known, but there is no doubt that the sound waves radiating from the discharge have some effect. The sound waves act in a similar manner to the phenomena in the ordinary Kundt's tube, used in measuring the wave length of sound waves.

Some writers claim that electromagnetic waves produce an aggregating effect upon the small water drops in fogs and mists for comparatively long distances from the source of the waves. M. Dibos claims that he has succeeded in clearing fog for distances of 50 or 60 yards by means of high potential discharges from points (140,000 volts) and Lodge is said to have made clearances by means of electromagnetic waves.

The action of electromagnetic waves upon suspended particles in gases may be of the same nature as the action on the Branly and other coherers made of carbon or metallic filings. Sound waves cause the particles of smoke or fume to be set into motion. Moving particles that are near each other experience an attraction or a repulsion, depending upon their relative motion. An effect of this kind is shown in Kundt's tube, where particles of lycopodium, or any kind of dust, are caused to collect together when stationary waves are produced in the tubes. It has been suggested by Dr. Speyers that a scheme might be devised to clean gases of suspended particles by producing a stationary wave in the gas and providing outlets for the gas between the regions where the particles were caused to collect by the Kundt's tube effect.

What rôle electromagnetic and sound waves, and the

polarising action of an electrical field, play in the electrical precipitation of smoke is not known, but these effects are probably subsidiary.

Having considered the probable ways in which particles may be acted upon by an electrical field, Prof. Strong proceeded to test the capabilities of electrification of fine particles of carbon and sprays from various liquids. To do this he connected the spray nozzle to one pole of a 45,000-volt machine, and earthed the other pole. The earthed pole, was perforated to allow the spray to be blown through it on to the electrode of an electroscope. He found that various kinds of dust were electrified with varying degrees of ease, calcium-oxide dust being most easily electrified, followed in order by carbon dust, alcohol, ether, and toluol.

The actual effects of electrical fields in promoting precipitation of particles having been demonstrated, it remains to investigate the best experimental conditions, both as regards type of electrification and physical condition of the dust-laden gases. The kind of discharge used may be of two types, a point discharge producing an electrical "wind," or a stream of ions produced by the secondary ionisation of a corona discharge from a wire carrying a high-voltage current. The former of these is used in the Cottrell method, one of the essential features of which is the use of wire electrodes interwoven with asbestos or mica.

Fine threads of asbestos or the sharp edges of the mica cause the production of secondary ionisation at lower voltages than could be obtained from the wire electrodes themselves. For this reason it is not necessary to have such accurate spacing of the electrodes to prevent the formation of sparks and arcs. There is usually sufficient moisture or other conducting deposits on the asbestos or the mica to make the surface a fairly good conductor at high potentials. At high temperatures it is difficult to keep the surfaces conducting, and this trouble was experienced in the plant set up by the Balaklala Copper Co., at Coram, California.

In the Coram plant the active electrodes consisted of two No. 10 iron wires twisted on mica strips about a centimetre wide and with serrated edges. A treating unit consisted of eight rows of these electrodes, 24 electrodes being in a row. The units were 30 ft. in length, 10 ft. wide and 10 ft. high. The grounded electrodes were made of No. 10 sheet-iron, 6 in. wide and 10 ft. high, and were connected directly to the frames of the units themselves. The active electrodes were kept stretched by springs between a system of bus-bars supported outside the precipitating chamber on wooden insulators; in order to prevent a deposit from short-circuiting the insulators, a current of air could be passed over the insulators into the precipitation chamber, thus preventing any of the fumes from coming in contact with the insulators. The cleaning of the electrodes was done by mechanical shaking.

At the Coram plant three units were kept charged by a single rectifier using from 0.3 to 0.4 ampere. Each unit treated about 10,000 cu. ft. of fumes per minute, the fumes passing through about 30 ft. of the electrical field with a velocity of about 5 ft. per second. The suspended matter remains about 6 seconds in the electrical field. About 30 lb. of fumes were precipitated per hour per unit.

The corona discharge is not greatly affected by the presence of dirt (an important consideration in the practical application of precipitation), and is independent of the air velocity and of humidity.

An example of the use of the corona type of discharge is the application of electrical precipitation to the cement dust from the kilns of the Riverside Portland Cement Works at Riverside, Calif., U.S.A. In this plant the gases to be treated are at temperatures of about 150° C. The cement dust is non-conducting, so that no conducting surface would be formed over the mica or asbestos. The use of the corona discharge requires higher voltages than those used in the point discharge. These voltages range in the neighbourhood of 40,000, according to Cottrell. The clearance of dust is in general from 95 to 98 per cent. The construction of the treating units at Riverside is almost identical to those used at Coram.

Some of the most important results of the investigations, particularly on coal smoke precipitation, are given in Prof. Strong's own words as follows:—

1. "Very little difference was obtained in the precipitation

of dense coal smoke in cylindrical pipes, between an alternating current and unidirectional current, when a similar corona form of discharge was used. The precipitation seemed to be comparatively greater for a dense smoke than for a light smoke. From this it would follow that dilution of the fume, or smoke-laden gases, should be prevented as much as possible.

2. "Clearances of 90 and 95 per cent. have been obtained by passing extremely dense smoke through a corona discharge less than 2 ft. in length. These experiments indicate that the greatest efficiency of precipitation can be obtained by keeping the suspended matter from being diluted and by exposing it as much as possible to the streams of ions flowing from the corona by passing the gases through a uniform discharge. Shadows can be obtained from objects placed near the collecting electrodes, indicating that the matter being deposited moves in straight lines.

3. "Some kinds of smoke show selective precipitation, a thin cloud of white or bluish particles coming out from the corona discharge. Part of this is water vapour which may have condensed after the carbon and tarry matter had been precipitated. Whether this selective action is due to a difference in the size of the suspended particles, or due to a difference in their composition, has not yet been determined, although the former view is the more probable.

4. "Experiments would indicate that temperature does not play much of a rôle in electrical precipitation. On the other hand, the state of ionisation of the gases probably does play a very important part.

5. "The application of electrical precipitation to the smoke problem has not as yet been tried on a commercial scale. Laboratory experiments indicate that the problem is essentially the same as that of the precipitation of fumes and dust. While the brush form of discharge from points is only a good precipitation agent when the current of gas is small, the corona discharge is effective for much greater velocities of the gas containing the suspended particles. Under these conditions the suspended particles need remain but a short time in the region where the corona discharge is taking place, so that the size of the precipitation chamber can be greatly reduced. The mechanical difficulties of keeping the electrodes properly adjusted and cleaned, are probably as great as the electrical part of the problem."

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## CAN A LIGHTING AUTHORITY SURRENDER ITS POWERS ?

[FROM A LEGAL CONTRIBUTOR.]

IN view of the fact that the supply of electricity for lighting purposes is not always a complete success from the financial point of view, those responsible for such undertakings may sometimes have to consider whether the burden of supplying current can be transferred to other shoulders.

The law on this subject has recently undergone a certain amount of modification to which it may be convenient to advert. By Sec. 11 of the Electric Lighting Act, 1882, it was provided that: "Any local authority who have obtained a licence, order, or special Act for the supply of electricity, may contract with any company or person for the execution and maintenance of any works needed for the purposes of such supply or for the supply of electricity within any area mentioned in such licence, order, or special Act, or in any part of such area; but no local authority, company, or person shall by any contract or assignment transfer to any other company or person or divest themselves of any legal powers given to them, or any legal liabilities imposed upon them by this Act, or by any licence, order, or special Act, without the consent of the Board of Trade."

The italics are ours. It will be seen that the first part of the section confers certain rights upon local authorities. They might, e.g., sub-contract for the execution and maintenance of works, or even for the supply, of electricity

within an area; these being rights which apparently could not be exercised by a company supplying electricity pursuant to the terms of a provisional order. As to the second half of the section, which we have printed in italics, this is now repealed and replaced by Sec. 14 (1) of the Electric Lighting Act, 1909, which provides as follows:—

A local authority, company, or person who have obtained a licence, order, or special Act for the supply of electricity shall not, by transfer or otherwise, divest themselves of any of the powers, rights, or obligations conferred or imposed upon them by the Electric Lighting Acts, or by any licence, order, or special Act otherwise than under and in accordance with a provision contained in a licence, order, or special Act authorising such divestiture.

It will be seen that the effect of the amendment is to prevent all classes of undertakers from transferring any of the legal powers conferred upon them without the authority of a licence, order, or special Act. The Board of Trade no longer has power to grant any leave.

These limiting clauses do not, of course, mean that undertakers may not employ contractors for the purpose of, e.g., building a generating station. Again, the laying of the necessary mains in a street is clearly a duty which undertakers must hand over to the care of an independent contractor, and is quite lawful. It should be observed, however, that by handing over the performance of work to a contractor, undertakers cannot get rid of any statutory duty which the execution of that work imposes upon them. For instance, the laying of mains in a street may involve risk to passers-by. That is a risk necessarily incident to the laying of mains, and to lay mains is a duty cast upon the undertakers who are to supply electricity. In one case which is a leading authority on the subject (*Hardaker v. Idle District Council* (1896) 1 Q.B. 335), it appeared that the defendant local authority entered into an agreement with a contractor to lay a sewer. In carrying out the work he failed to give proper support to a gas pipe, which became fractured. The gas escaped into a house, and the consequent explosion wrecked the furniture and injured the plaintiff's wife. In an action against the District Council it was held that that body was liable, although it had apparently delegated its duty. The principle applied by the Court of Appeal was that laid down by Lord Blackburn in *Dalton v. Angus* (1881), 6 A.C. 740—e.g., "Ever since *Quarman v. Burnett* (6 M. & W. 499) it has been considered settled law that one employing another is not liable for his collateral negligence, unless the relation of master and servant existed between them. So that a person employing a contractor to do work is not liable for the negligence of that contractor or his servants. On the other hand, a person causing something to be done, the doing of which casts upon him a duty, cannot escape from the responsibility attaching on him of seeing that duty performed by delegating it to a contractor. He may bargain with the contractor that he shall perform the duty, and stipulate for an indemnity from him if it is not performed; but he cannot thereby relieve himself from liability to those injured by the failure to perform it." Lord Lindley then defined the position of the local authority thus:—"Their duty in sewerage the street was not performed by the constructing a proper sewer. Their duty was not only to do that, but also to take care not to break any gas pipes which they cut under; this involved supporting them. This duty was not performed." In the words of Lord Justice Rigby, "I consider it has always been, on the balance of authority, and is now clearly recognised as the law, that no one can get rid of such a duty by imposing it upon an independent contractor." It was accordingly held that the defendants were liable to the plaintiff.

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**West Ham Electricity Supply.**—A letter has been received from the Barking U.D.C., inquiring whether the Corporation would be prepared to give it a supply of electricity in bulk, and, if so, upon what terms, or alternatively, whether it would be prepared to consider the question of the transfer to West Ham of the Barking Council's electric lighting order, and the work, executed thereunder, upon terms. Having regard to the fact that the East Ham Council has under consideration the desirability of giving a bulk supply to Barking, it has been decided to defer the consideration of the matter until a definite decision has been arrived at by that Council.

## BUSINESS NOTES.

**Consular Notes.—Japan.**—The American Consul at Nagasaki reports that in connection with the coal mines at Mike, in the Nagasaki district, and the erection of patent coke ovens, it is proposed to operate with a part of the gas produced, a large electric power plant, driven by powerful gas engines made by the Nuremberg Gas Engine Works, of Nuremberg, Bavaria. These engines are capable of developing over 7,000 h.p., and with the duplicate set to be installed, if the first set proves satisfactory, this plant will have almost 15,000 h.p., and will be capable of supplying light and power for the mines, machine shops, shiploading conveyors, and cranes of the company, and for the electric lighting of the towns of Omuta and Miike.

**Russian Far East.**—The American Consul at Vladivostok reports that the erection of wireless stations in Okhotsk, Naihau, and Novo-Marijnsk has been much handicapped by difficult conditions of navigation in these seas, especially in the Okhotsk, where several sections of the heliograph towers were lost overboard, and their recovery will cause a great deal of delay in completing the stations. A Far-Eastern rumour is to the effect that the six new steamers of the Russian Volunteer Fleet for the Vladivostok-Okhotsk-Kamchatka line are to be supplied with a new system of wireless telegraphy, which will enable them to communicate in plain language without the use of a code.

**Arabia.**—The American Consul at Muscat reports that the installation of a 500 lamp electric lighting plant in the palace of the Sultan of Oman has recently been completed by N. S. Bayanker, formerly with the Deccan Electric Co., of Hyderabad, India. This is the first instance of the operation of any kind of electrical machinery in the country. Mr. Bayanker has also received permission to operate a commercial lighting and power plant, and will proceed to erect the same at once, his intention being to use two 30-kw. dynamos capable of supplying current for 6,000 lamps. One set of machines will be run at night and the other in the day, principally for the purpose of driving fans, which, on account of the great heat and the difficulty of securing energetic punkah-pullers, are much needed. Power will be furnished by oil engines and direct current will be used. All equipment will probably be of German manufacture, partly owing to the desire of having the system in operation before the close of the hot weather.

One of the recent purchases made at Cairo, Egypt, by the Sultan of Lahej is a dynamo for supplying light in His Highness's palace at Labej, an Arabian town 18 miles north-west of Aden. A large number of electric lamps, wires, and other fittings, have also been bought. An electrical engineer has been specially engaged to look after the plant.

**Manchuria.**—The American Consul at Dalny reports that the electric power station of the South Manchuria Railway department of electricity has now under installation a fourth generator of 1,500 kw., ordered from the United States. At present the power station has three generators, of three phase, 25 cycles, each of 1,000 kw., in addition to two exciter sets of 75 kw. each. Two 1,000-kw. generators are used in the daytime for the supply of motor power to the different plants and the tramway service. These are supplemented by the remaining generator at night to answer the wants for lighting purposes. The Manchuria Electricity Co., a private concern, with head office at Dairen, being organised, has had nearly all the required shares subscribed, and has applied for a franchise; when it is granted, the first quarter of the capital is to be paid and work will be started before winter, first at Kungchuling.

**Sicily.**—The American Consul at Catania (Sicily) reports that the most important innovation in the way of public utilities in that district during 1911 was the completion of two large water power electric generating plants and the power transmission and transformer installations of the Societa Electrica, per Sicilia Orientale. The plants are located at Alacantha, in the Province of Messina, and at Cassibile, in the Province of Syracuse. The former has a generating power of 5,000 h.p., and the latter of 7,000 h.p. The new company has already supplanted the older local companies in supplying energy in the cities of Catania, Syracuse, and Messina besides supplying initial electric power to the small towns and agricultural districts of Eastern Sicily.

Two concessions have been let to Belgian companies to construct electric railways, one to La Galatea for a railway between Catania and Acireale, and the other to Les Chemins de fer Electrique, for an additional double track system in the city of Catania.

Later in his report the Consul states that opportunities for the extension of American trade appear to lie in the direction of electrical supplies, small motor and man-power machines for wood and metal working, &c. The business at Messina in building and construction material and appliances might also be increased. These lines are now principally drawn from northern Italy, Germany and England. However, the introduction of new goods and the establishing of business relations can be accomplished only through personal canvass by well-equipped salesmen who speak Italian. The utility of sending catalogues and descriptive matter to a country in a language foreign to it has been adequately set forth in Consular reports. The conditions in this district in that respect are not unlike others.

**Serbia.** The Austrian Consul at Belgrade reports that the several electrical stations in Belgrade and elsewhere in Serbia are working satisfactorily. New lighting plants have been installed at Gradiste and Paracin. When it has been found possible to raise new capital for the works in Ovacr Kablar in order to bring the station to completion, it is anticipated that new industries will soon

spring up, as the works will be capable of supplying 2,000 h.p. The electrical works in Nisch, which are run by the municipality, have developed on right lines, and now form an important factor in the production of revenue for the town. They have not yet reached full capacity, however. The electrical works in Leskovac, a private undertaking, were able to show a not inconsiderable profit in 1911. There are excellent opportunities for the erection of electrical plants in the district of Nisch, as some of the townships, such as Alexinac, Prokuplje and Sokobanja, are favourably disposed towards such works.

Later in his report the Consul points out that the imports into Servia of machinery, apparatus, electrical appliances, &c., in 1911 were valued at 11,860,746 dinars (25 dinars = £1) as compared with a value of only 5,973,383 dinars in 1910. There was thus an increase last year of nearly 6,000,000 dinars. This large increase is due for the most part to the rapid development of Servian industries and the increasing tendency to erect new works and extend existing plant. The imports of steam boilers were valued at 542,075 dinars, as compared with 107,433 dinars in 1910. The imports from the United Kingdom have decreased; the other chief suppliers are Germany, Austria and Belgium. The imports of stationary and non-stationary steam engines, locomobiles, turbines, &c., were valued at 2,103,183 dinars, as compared with 1,103,575 dinars in 1910. Of the 1911 imports, Germany supplied about half, Austria about one-quarter, and Great Britain and America almost all the remaining quarter. Imports of oil motors consist chiefly of 1 to 2-h.p. motors, Sweden is the largest supplier. The imports of electrical apparatus, dynamos, and motors, and accessories were valued at 317,847 dinars, as compared with 213,851 dinars in 1910; Germany and Austria are the largest suppliers, and Switzerland, France and Belgium do a fair trade. In transformers, condensers, accumulators, &c., the imports were valued at 68,585 dinars, as compared with 51,854 dinars in 1910, Austria practically monopolising the trade. Cables and other transmission material were imported to a value of 68,761 dinars, as compared with 74,237 dinars in 1910, and in this line also Austria took practically the whole of the trade, having usurped the position held by Germany in the previous year. Telegraph and telephone apparatus, bells, rheostats, &c., were imported to a value of 295,460 dinars, as compared with 116,390 dinars in 1910. Austria and Germany took the greater part of the trade, though France and Belgium also supplied a certain quantity. Arc lamps were imported to a value of 8,148 dinars, and other electric lamps to a value of 134,122 dinars, as compared with 5,502 dinars and 109,719 dinars respectively in 1910; Austria and Germany are the largest suppliers. Accessories for lighting insulators, &c., accounted for 126,729 dinars, as compared with 62,234 dinars in 1910. The demand for dynamos and motors is not very great, as at the Belgrade station favourable arrangements for the use of such machines do not exist, and in the interior, where electric controls are run with cheap water-power, this branch of the business has not been sufficiently developed. Nisch is however, taking steps in this direction.

**1912.**—The *Yorkshire Observer* in an annual trade review for the year 1912, contains a vast quantity of information respecting textile industries, iron and steel trades, engineering and other subjects. Mr. P. J. Pybus, M.I.E.E., has an illustrated article on "Electric Driving in Textile Factories," the Bradford Corporation electricity department has an effective two-page advertisement including a picture of Valley Road power station, and a progress diagram showing supply to textile mills, factories, &c., from 1903 onwards.

MESSRS. S. DIXON & SON, LTD., of Swingate, Leeds, report having had a satisfactory year in their electrical department. Amongst the different installations carried out, and still in hand, are the following:—

Beckett's Park Training College.—Seven hostels and five houses, 4,000 lights.  
Bingley Training College.—Five hostels, 2,000 lights, Stabbos.  
New residence at Aysgarth, for Mr. H. Tunstall.—150 lights, petrol engine and dynamo.  
New Georgian residence, for Mr. Sam Ambler.—150 lights, gas engine, dynamo and accumulators.  
Ashkham Richard Hall, for Mr. Wallis-Fairbairn.—200 lights.

They report a total of 11,000 lights installed or orders in hand during the 12 months.

**Condensing Plant Contracts.**—Among the orders recently received by the MIRRLEES WATSON CO., LTD., for independent steam condensing plant are the following:—

Barometric Jet Plant.—Umhloti Valley, Natal, and Messrs. S. Lister, Ltd., Bradford, per Messrs. Greenwood & Batley, Leeds.  
Surface Plant.—Torquay Corporation, per British Thomson-Houston Co., Ltd.; Messrs. Alex. Henderson, Dundee, per Messrs. James Howden & Co.; the Tharsis Sulphur and Copper Co., Spanish Mines.

The above are fitted with reciprocating air pumps.

The following are for plants fitted with Mirrlees-Leblanc rotary air pumps:—

Surface Plant.—Bolekow, Vaughan, Southbank, 11th set; Smith & McLean, Ltd., Gartosh Ironworks; Tullis Russell & Co., Markinch, per Christy Bros., Chelmsford; Mexborough U.D.C., per Messrs. Jas. Howden.  
Mirrlees-Leblanc Multi-Jet Plant.—Vears, Ltd., Erith, per Fraser and Chalmers; Sutton Heath and Lea Green Collieries, per Jas. Howden & Co.; Parkside Mining Co., per the A.E.G. Electric Co., Newcastle; J. S. White and Co., East Cowes; Fraser & Chalmers, Ltd., London. Also repeat orders for low level jet plant for the Dalton Main Colliery Co., Ltd., per the British Thomson-Houston Co.

**Liquidations.**—NEW SUPERHEATER CO., LTD.—This company is winding up voluntarily, with Mr. S. G. Bruff, 155, Salisbury House, London, E.C., as liquidator. A meeting of creditors is called for January 21st. Particulars of debts, &c., must be sent to Mr. Bruff by February 25th.

MR. P. F. BRITAIN, of the Langdon-Davies Motor Co., 110, Cannon Street, London, E.C., writes to point out that the Langdon-Davies Motor Co., Ltd., which we announced as holding a meeting of creditors at the offices of Mr. Cape, at Coleman Street, E.C., to hear an account of the winding up, is, of course, the old Langdon-Davies Motor Co., which went into liquidation some two years ago. Our readers are aware that the present firm acquired the assets, &c., from the liquidator as a going concern, and are carrying on the business, as heretofore, at their new works at Lowisham. They report that they are turning out more motors now than at any time in the history of the old company.

**Book Notices.**—“Elementary Manual on Applied Mechanics.” By Prof. Andrew Jamieson. Tenth edition. 1912. London: Charles Griffin & Co., Ltd. Price 3s. 6d.

“Foundations and Machinery Fixing.” By Francis H. Davies. London: Constable & Co., Ltd. Price 2s. 2s.

“The Russian Year-Book, 1913.” By H. P. Kennard. London: Eye & Spottiswoode, Ltd. Price 10s. 6d. net.

“An Elementary Course of Magnetism and Electricity.” By Charles H. Draper. London: Blackie & Son, Ltd. Price 2s.

“Science Abstracts.” Vol. 15, part 12. December 31st, 1912. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

“The First Railway in London.” By A. R. Bennett. London: The Locomotive Publishing Co., Ltd. Price 3s. 6d. net.

“Advice on Country House Lighting.” London: Simplex Conduits, Ltd. Price 1s. net.

“Proceedings of the American Institute of Electrical Engineers.” Vol. XXXII, No. 1. January, 1913. New York: The Institute. Price \$1.

“Journal of the Röntgen Society.” Vol. IX, No. 34. January, 1913. London: Smith & Ebbis, Ltd. Price 4s. net.

“Journal of the American Society of Mechanical Engineers.” Vol. XXXV, No. 1. January, 1913. New York: The Society. Price 35 cents.

“Proceedings of the American Society of Civil Engineers.” Vol. XXXVIII, No. 10. December, 1912. New York: The Society.

“Transactions of the Illuminating Engineering Society.” Vol. VII, No. 8. November, 1912. New York: The Society. Price 7s. 6d.

“Transactions of the Institution of Engineers and Shipbuilders in Scotland.” Part III, 1912-13. Glasgow: The Institution.

“Atti della Associazione Elettrotecnica Italiana.” December 31st, 1912. Milan: Stucchi, Ceretti & C.

**Calendars.**—The *Chemical Trade Journal* has issued a wall calendar for 1913 with large monthly tear-off sheets.

From the FOSTER ENGINEERING CO., LTD., of Wimbledon, London, we have received a wall card with calendar for the whole year. The design and style are excellent, the ten items of Foster manufactures being so embodied in the scheme as to be essential parts of it, and by no means obtrusive.

A pamphlet entitled “The Past Year and Prospects for 1913” has been issued by MESSRS. JOHN BIRCH & CO., LTD., 2, London Wall Buildings, E.C., discussing in turn the coal strike, the trade boom, the prospect, the “coming motor” (the Diesel), the London agent, and the value of having personal travelling agents abroad.

**Catalogues and Lists.**—From MESSRS. VICKERS, LTD., of Vickers House, Broadway, Westminster, we have received a handsome brochure—“The Vickers’ Book”—in which there are some 64 pages of excellent half-tone prints on art paper showing warships, floating docks, turbine steamships and dredgers built and fitted out by them, gun mountings and gun-mounting shops, turbines, finished guns, guns firing, motor-cars and motor-car parts, 1,000-KW. D.C. turbo-generators, 5,000-KW. three-phase generators for Winnipeg, automatic reversing gear for planers, motor-driven tools, monoplanes, electric control pillars, motors from  $\frac{1}{4}$  to 50 H.P., the Vickers train-lighting system, roller bearings, Duralumin and other features of their multifarious operations carried on at Barrow, Sheffield and Birmingham. A number of pictures show interior and exterior views of the works and other premises of this gigantic concern.

MESSRS. OZONAIR, LTD., 96, Victoria Street, Westminster, London, S.W.—Eight-page pamphlet (No. 8) giving useful information relating to the Ozonair system of food preservation, and its application to the purification of water in ice factories. A list of installations coming under these classes, testimonials, and diagrammatic explanations of the arrangement of the system, are included.

THE WESTINGHOUSE COOPER-HEWITT CO., LTD., 80, York Road, King’s Cross, London, N.—Four-page list, No. 24, giving illustrated particulars of their mercury vapour converters for cinematograph projection arc lamp work, with prices, and notes on maintenance expenses. Similar converters are in extensive use for telegraph and telephone exchanges, and for charging commercial batteries. The list is specially prepared for electricians in charge of cinematograph plant.

MESSRS. ISARIA, LTD., 208, Tower Bridge Road, London, S.E.—Two four-page lists containing brief descriptions, with tabulated particulars and prices, of small C.C. dynamos and polishing motors.

THE METALLIC SEAMLESS TUBE CO., LTD., Corporation Street, Birmingham.—Postal card giving prices and brief particulars of “Swingback” fuseboards.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., 109-111, New Oxford Street, London, W.C.—List CB 1, containing tabulated particulars and prices of different qualities and types of carbon brushes manufactured by Dr. Albert Lessing, for whom the firm are sole selling agents for Great Britain and the Colonies.

MESSRS. DONOVAN & CO., Cornwall Street, Birmingham—New catalogue containing particulars of a very wide range of electrical supplies and material, including standard lines in conduit, cables, insulators, motor starting switches, fan regulators, shunt regulators, switchgear, Board of Trade fuses and hand lamps, ironclad switchgear and fuses, accessories, bell and telephone material, electric fittings, &c. We understand we have not counted that prices are given of about 10,000 articles, and there is an abundance of illustrations. The copy received by us is of the special export edition on thin art paper, and copies will be forwarded to any reader abroad who is interested. The edition for home use is on a thicker paper. Every effort has been made to facilitate reference by providing a full index in addition to a finger index to sections.

MESSRS. SCHOLEY & CO., LTD., 151, Queen Victoria Street, London, E.C.—Twenty-four page catalogue containing a full descriptive account of the Graham electric lifts (concerning which some particulars were recently given in these pages) admirably illustrated on a good art paper. Full technical notes with detailed diagrams are also given.

**Trade Announcements.**—It is stated in the *Standard* that the BRITISH THOMSON-HOUSTON CO. propose to transfer the switchboard department of their factory from Rugby to Willesden. “Recently the firm built a factory there, in order to cope with the increased demand for Mazda lamps, at the same time retaining their lamp factory at Rugby. The removal of the switchboard department to Willesden is not difficult to understand. Whilst extensive building operations have been carried out during the past six years in Rugby, they have been nothing like sufficient to meet the greatly increased population, which is to a large extent accounted for by extensions at the B.T.H. In fact, the local Council is being urged to put up municipal dwellings with all speed. The preliminary arrangements for the transfer of the switchboard department to Willesden are to be pushed forward with all speed, and it is expected that the men will be installed in North London by Easter.”

MESSRS. HASLAM & SCHONTHEIL, 11, Windsor Place, Cardiff, have been appointed by Messrs. Callender’s Cable and Construction Co., Ltd., to be their sales agents for South Wales, Monmouthshire, and the Bristol district. Callender’s rubber cables will be stocked.

MESSRS. HERMANN STEINBACH and MAX HOHN (who were for many years with Messrs. Jaeger Bros.) have commenced business as suppliers of electrical accessories at 669, Mansion House Chambers, Bucklersbury, London, E.C., under the style of Steinbach and Hohn.

MESSRS. MATHER & PLATT, LTD., announce the removal of their registered office and publicity department to Park Works, Newton Heath, Manchester.

“A. FATTORI & CO.” is the title of a firm recently registered at 104, Via Tomacelli, Rome, to act as agents for the sale of electrical material.

**Bankruptcy Proceedings.**—A. F. MANDER, electrical engineer and cycle dealer, Victoria Road, Aston, Birmingham.—First and final dividend, 2s. 3d. in the £. payable January 20th, at Official Receiver’s office, 191, Corporation Street, Birmingham.

THEODORE HENRY MEAKIN, electrical fitter, Quarry View, Four Mile Bridge, Valley, Anglesey.—First meeting, January 18th at Chester: public examination, February 6th, at Bangor.

**For Sale.**—The Secretary of State for War is offering for sale a quantity of electric lighting and steam pumping machinery and accessories at Bordon Camp, Hampshire. The Belfast Corporation has for disposal a quantity of Hopkinson steam valve and flanged steam pipes. See our advertisement pages in this issue.

**New Zealand.**—H.M. Trade Commissioner reports that an Auckland firm seek the representation of British manufacturers of wire and cable, and also of electrical heating apparatus. *Board of Trade Journal*.

**Ignition Magnetos.**—MESSRS. DUNCAN WATSON and Co., of 62, Berners Street, London, W., have acquired the British concession in a new ignition magneto, known as the “Mafan” made by MESSRS. HARTMANN & BRAUN, of Frankfort-am-Main.

## LIGHTING AND POWER NOTES.

**Altrincham.**—At a meeting of the District Council last week, it was stated that the plans for the proposed electric street lighting were now in the hands of the manager of the Altrincham Electric Supply Co., who was giving the matter attention.

**Argentina.**—Messrs. Gambarini & Co. have applied to the San Luis Government for a concession for an electric tramway in the city of Mercedes. The concession is to be for 60 years.

The chief of the Public Works Department of the Rosario Municipality has presented to the mayor his report on the various tenders received for public electric lighting of that city. He is of the opinion that the concession should be for 20 years, and terminates his report by recommending that the tender of the Rosario Electricity Co. be accepted as, in his opinion, it is the most advantageous to the

city, if the company eliminated from its offer that clause of obliging the municipality to pay in ten years the costs of all the installation. He calculates that this tender would be a saving to the Corporation during the 20 years of the concession of the sum of \$554,729.70. The report has now been sent to the City Council.—*Review of the River Plate.*

**Australia.**—According to the *Mining and Engineering Review*, a scheme has been outlined, and a preliminary report furnished by Mr. Wm. Corin, electrical engineer, of the Public Works Department, for the supply of electric power by the Government to the more populous areas of the State, to cover existing and future needs, including a supply of light, heat and power for all public and private purposes; the establishment in Australia of larger electro-thermic and electrolytic industries, such as the manufacture of calcium carbide and cyanamide; and, eventually, for a complete electrification of the State Railways. The scheme provides for the utilisation of the State coal and water-power resources by the establishment of power stations in each of the important coalfields, and on those rivers which may be depended upon to provide power in sufficiently large quantities to make their development commercially feasible. In the report it is suggested that a beginning might be made by the establishment of a large power station at some convenient point on the southern coalfield, and that this should eventually be linked with stations at Burrinjuck, on the Shoalhaven River, and in other coalfields. Transmission lines would supply power to all the towns along their route, or within a reasonable distance of them. A comprehensive scheme on such lines, it is stated, would enable power to be provided at a very low price, ranging, according to the character of the load, from  $\frac{1}{2}$ d. to  $\frac{1}{4}$ d. per unit.

The North Sydney Council has agreed to adopt the first report of Mr. G. A. Julius in regard to providing electricity and erecting a refuse destructor, the scheme being that of the Northern Suburbs E.L. and P.S. Corporation. The Mayor's recommendation was, however, only carried by his own casting vote, and the matter has been reopened in Council, as it is understood to be the opinion of the expert that the offers of the Sydney Council and Public Works Department are well worth greater consideration.

Last year the Melbourne City Council reduced its charges for electric supply, and estimated a revenue reduction on lighting of £12,500, and on power of £3,000. The difference has, however, amounted to £22,500, in spite of the fact that a great increase in supply took place, which has led the Electricity Committee to consider still further reductions in the price of power.

**Blackburn.**—An accident at Messrs. Baynes' extensive Cioely Bridge Mills, Blackburn, led to the firm deciding to install special electric motors to enable an early start to be made. It will be several months before the defective engine is repaired.

**Blackpool.**—At the T.C. on January 9th, a letter was read from owners of property adjoining the electricity works complaining about the noise caused by the machinery which, they understood, had been newly installed. A property owner said he must look after his tenants, and if the nuisance was not abated, he would have no option but to take such steps as would abate it. Ald. Brodie said the electricity works had been established 20 years, and the property of Mr. Alex. Moore (the person to complain) had been occupied 12 months.

**Blackrock.**—A special meeting of the Urban Council was held to consider what action should be taken as to a petition to the B. of T. embodying the Council's objections to the Dublin Southern Electric Lighting Order, promoted by the Dublin and Southern District Electric Supply Co. The town clerk said the object of the proposed order was to give the company power to light Dalkey, Kingstown and Blackrock with electricity. He suggested that the first thing to be done was to employ an expert electrical engineer to report upon the scheme of the company as it concerned Blackrock. It was mentioned that Blackrock had an Electric Lighting Order covering certain areas. The intention was to use that order to the best advantage of the ratepayers. This company wanted the Council to waive its powers and give them the Electric Lighting Order. The area the company marked did not touch more than half what was scheduled in the Council's Order. The town clerk said the company's area covered about the same mileage. After further discussion, it was decided to employ Mr. Price as an expert to report on the company's scheme for lighting Blackrock.

**Bognor.**—The U.D.C. is considering the advisability of adopting electricity for driving the new pumps at the sewage outfall works. The gas company has offered to supply current at  $\frac{1}{2}$ d. per unit.

**Bolton.**—The Corporation has arranged terms with Messrs. Joseph Crook & Co. for giving a supply of electricity for power purposes to Eagle Mill, and with Messrs. Greenhalgh and Shaw for giving a supply of electricity to their Halliwell mills.

**Bournemouth.**—At the last meeting of the Council the question of the lighting of the Undercliff Drive and West Promenade was discussed at great length, there being a wordy conflict as to whether gas or electricity should be used. The Lighting Committee recommended that the tender of the Bournemouth and Poole Electricity Supply Co., Ltd., at £5 2s. 10d. per lamp per annum for a term of five years be accepted, but the question was referred back. In the course of the discussion the borough engineer stated that he had been in communication with other towns on the subject, and he had received replies from Brighton, Clacton-on-Sea, Eastbourne, Folkestone, Great Yarmouth, Hastings, Lowestoft,

Margate, Ramsgate, Scarborough, Southend-on-Sea, Southport, Torquay and Weymouth. Eleven of these used electric lamps on the sea front, three used gas, and five both gas and electricity.

**Brighton.**—The Lighting Committee of the T.C., on the advice of the town clerk, recommends opposition to the Bill of the Hove T.C. as regards the supply of current outside the borough of Hove, as it is considered that such powers will prejudicially affect the rights and powers of Brighton. The parishes mentioned in the proposed extended area of supply are Portslade, Preston Rural, West Blatchington and Hangleton.

**Caerphilly.**—At a meeting of residents recently a resolution was passed requesting the U.D.C. to petition against the granting of a prov. order for electric light to a private company. It was stated that the Council proposed to support the application.

**Chalfont St. Peter.**—The Amersham R.D.C. has consented to the electric lighting mains being extended to Chalfont St. Peter in connection with the promotion of a prov. order by a company.

**China.**—A steadily increasing demand for electric lighting equipment and electric fans is reported from Swatow in China.

**Continental Notes.**—**BELGIUM.**—La Société des Centrales Electriques des Flandres has secured the concession for the electric lighting of 17 villages in the neighbourhood of Ghent. Work is well in hand on the establishment of the company's central station, which will, primarily, have a capacity of 4,000 kW., and is situated at Langerbrugge, on the banks of the Ghent Maritime Canal.

**FRANCE.**—The Government engineers are now engaged in making investigations in connection with the alternative schemes of dams suggested with a view to the electric utilisation of the water power of the Upper Rhone. The schemes put forward are a single large dam at Génissiat, or two dams, one at Malpertuis and the other at Perte du Rhone, on the frontier.

The Havre Chamber of Commerce has approved a scheme for the disbursement of 4,200,000 fr. for the installation of 15 electric cranes and the construction of an electric line for the service of the cranes and the lighting of a warehouse; 50,000 fr. additional is also approved for the installation of 16 electric winches on the Colbert Quay.—*La Lumière Electrique.*

**GERMANY.**—Work is approaching completion of the new water-utilisation plant of the Glambocksee Kraftwerke Gesellschaft, at Stolp, Pomerania. Altogether six 850-h.p. turbines and generators are to be installed, three of which, as also an exciting set, are to be supplied by Messrs. Briegleb, Hanson & Co., of Gotha.

**SPAIN.**—A new undertaking, with a capital of £50,000, and the title La Sociedad Co-operativa Electrica Donostiarra, has lately been formed in San Sebastian to undertake the supply of electrical energy for lighting purposes in the district.

**Coventry.**—A meeting of parochial electors has been held, when resolutions were passed approving of the insertion in the proposed Corporation Bill of clauses providing for, among other things, the supply of gas and electricity to several villages.

**Douglas (Isle of Man).**—In connection with the new kursaal, which is nearing completion, in the Public Gardens, it has been decided to install electric lighting at a cost of £3,000.

**Dover.**—The T.C. has decided to apply to the L.G.B. for a loan of £300 for transformers.

Barton Road Schools are to be wired for the electric light in the coming summer.

**Dungarvan.**—The T.C. of this Irish town has decided to light it with electricity if the necessary funds can be raised, in lieu of the present gas lighting system. Permission is to be asked for a loan of £2,000 to float the scheme.

**Eccles.**—Replying to a question at the T.C. meeting last week, Ald. Pearson said his Committee was in favour of supplying electrical fittings. Councillor Ogden expressed the hope that the Committee would not, without taking the Council into its confidence, embark on anything which would lead to municipal trading in electrical fittings in opposition to private enterprise, and he was assured that before anything of the sort could be done the Council would have an opportunity of saying what it thought on the matter.

**Edinburgh.**—A Corporation Committee has instructed the Town Clerk to prepare a report on the general question of supplying electricity to suburban districts, and to have a conference with the military authorities on the subject of supplying electric power to Redford Barracks.

**Felixstowe.**—According to the *East Anglian Daily Times*, a Dr. C. H. Liebrand has a scheme on foot for the acquisition of the Suffolk E.S. Co., which supplies the town. The scheme apparently contemplates a central station (on the German plan) for supplying the agricultural townships scattered round Ipswich, and, of course, including Felixstowe.

**Gravesend.**—The T.C. has received from the L.G.B. sanction to loans of £4,500 for E.L. mains, £1,200 for house services, £500 for a coal store at the electricity works, and £300 for an automatic stoker.

**Hayward's Heath (Sussex).**—The U.D.C. on Monday consented to waive the statutory notice of the application for a

prov. order for electricity supply by the Mid-Sussex Electric Light and Power Co., Ltd., on condition that a satisfactory purchase clause is inserted in the Order.

**Hove.**—At a special meeting of the T.C. on January 10th, the recent decision to promote a Bill for the acquisition of the undertaking of the Hove E.L. Co., Ltd., was confirmed by 28 votes to 4.

**Kendal.**—A Sub-Committee has been appointed to make arrangements for the electric lighting, in lieu of gas, of the court room and magistrate's room at the Town Hall.

**Knighton (Badnorshire).**—The U.D.C. has had an application from, and an interview with, Mr. L. J. Simons, electrical engineer, in reference to the granting of permission by the Council to open the streets for the laying of a cable for the proposed electric lighting scheme. Prior to the Council meeting, a public meeting had been held at the Norton Arms, when it was suggested that the Council should carry out the scheme, or, failing this, that a private company should do so. It was decided to hold a special meeting, followed by a public meeting, to ascertain the views of the ratepayers on the subject.

**Lincoln.**—The T.C. has decided, owing to the great increase in the price of oil, not to install an oil engine at the electricity works, but to purchase a steam turbine plant.

**Llanfairfechan.**—A communication has been received from Mr. W. R. Walton, the consulting engineer, in connection with the electric lighting scheme, stating that the original expenditure at Llangollen was £2,220, including legal expenses, and suggesting the holding of an electrical exhibition, with a view to ascertaining whether there is any real demand for electricity in the town. The U.D.C. has decided to provide a building free for a week's exhibition.

**London.**—**MARYLEBONE.**—At the last meeting of the Council, the Electricity Committee brought up a report with regard to the supply for next winter. In this connection, Mr. J. F. C. Snell, as consulting engineer, prepared a preliminary report in which he stated that he was certain that the load would grow beyond the economical transmission by 600-volt continuous current. After careful consideration of the various load curves, he agreed that a 3,000-kw. turbo-alternator was the convenient size of machine to install. He approved the pressure proposed, namely, 6,600 volts, and the speed of 3,000 R.P.M. As the tender of the Oerlikon Co. was so extraordinarily low, he was of opinion that it would be sounder policy to accept their tender and install a second set practically at once. The Council would then have a complete stand-by to its three-phase plant, which he thought advisable. On this report, the Electricity Committee stated that the question of the period of delivery of any turbine-alternators which it might be decided to order was the most pressing part of the problem, and it had authorised the general manager and Mr. Snell to give a prov. order for one such apparatus, if they came to the conclusion that such a course was advisable, such order to be subject to confirmation by the Council. This was duly done, the order being given to the Oerlikon Co., but as the installation of a second set as a complete stand-by was recommended, they had extended that authority to cover a prov. order for two sets, which would provide 6,000 additional kW. The Committee accordingly recommended the Council to confirm their action, and that a contract be entered into for the purchase of two turbo-alternators, each of 3,750 K.V.A., at a total cost of £8,600. In the discussion on this recommendation, Alderman Hopkins said that the position was that the load was increasing at a very rapid rate, and that it was necessary that steps should be taken to provide for the next winter so that there might be no difficulty in supplying the current. It had been found that existing arrangements were not economical, and would not meet requirements. The recommendation was eventually adopted.

**ST. PANCRAS.**—Sanction has been received from the L.C.C. to the borrowing of £13,176, made up as follows:—£5,329 for mains; £5,310 for generating plant; £2,006 for house services, and £621 for meters. This sum is to be invested out of the Electricity Reserve Fund account, repayment of principal being annually upon the instalment system and interest at the rate of 3½ per cent. per annum. In connection with the putting in of new feeding mains from the King's Road Electricity Station to the Camden Broadway, mains are to be laid for street lighting by incandescent electric lamps in the thoroughfares concerned, at an estimated cost of £93.

**ISLINGTON.**—At a meeting of the Guardians last week, the question of introducing electric light and power (as mentioned in our issue of December 20th) came up for discussion. Various proposals with a view to adhering to gas lighting were considered, the Gas Co. having offered to fix inverted burners throughout for £725, and to replace all old gas piping. In the end the electric lighting scheme was adopted by 14 votes to 8, but a clause providing for a minimum payment of £1,000 per annum for the supply, was rejected on an amendment.

**Maidenhead.**—The T.C. has applied to the L.G.B. for a loan of £1,700 for new buildings and plant at the electric light works, and for £2,000 for mains.

**Northumberland.**—By a serious fire at Ashington Colliery on the 12th inst., haulage machinery, electric plant, &c., of the value of £3,000, was destroyed. Only one seam was affected, and there were only two men at work at the time. Some 80 ponies were killed. Ashington Colliery is the largest in the county.

**Oldham.**—The T.C. has confirmed the recommendation of the Electricity Committee, to apply to the L.G.B. for sanction to borrow £30,000 to cover the cost of additional plant, &c.

**Rhyl.**—Mr. Wright, the electrical engineer to the U.D.C., has recommended to the Council the desirability of encouraging the use of electricity for heating and cooking purposes in the district. An additional output of 50,000 units at 1½d. would mean an additional revenue of £300, and would add practically nothing to the working expenses, which had been decreasing for the last two years. The working costs of the Diesel engine set, by which this load would be supplied, are ½d. per unit generated, or 1½d. unit including all the charges except line charges. It would be necessary to have a new form of tariff, and the rateable value scale would be the best for Rhyl: say a fixed charge of 15 per cent. on the rateable value of the house, and 1½d. per unit used. A consumer willing to install separate wiring could, of course, be charged by an additional meter at 1½d., but in that case it would be advisable to fix a minimum consumption per quarter of, say, 250 units.

**Rushden.**—The U.D.C. on January 8th passed plans of electricity works which are to be erected in the town.

**Salford.**—The T.C. has expressed warm appreciation of the assistance of neighbouring authorities at the time of the recent disastrous fire at the electricity works. The disaster, said Councillor Billington, was a lesson not only to Salford, but to electrical undertakings generally, not to have their eggs all in one basket. The Corporation had received an order from the fire insurance people for £3,100 for a new switchboard, which would be placed in hand at once. The cause of the occurrence would be investigated as soon as possible.

The T.C. on January 8th decided to apply for a loan of £750 for installing electric light in the extensions to the town hall buildings.

**Scarborough.**—The T.C. has appointed a special sub-committee to consider the question of the Council's right to purchase the undertaking of the electric supply company.

**Shrewsbury.**—The Lighting Committee contemplates that extensions will need to be made at the electricity works in the near future.

**South Africa.**—According to *African Engineering*, in five years the output of the Electric Department of the Johannesburg municipality has risen from nearly 8½ million units to upwards of 18½ million units. The cost per unit sold to-day is 2'566d. In 1907-8 the working expenses of the Tramways Department for almost 2 million car-miles came to £217,495, or 27'02d. per car-mile; last year the expenses totalled £285,706, but the mileage had increased by a million, making the cost per car-mile 23'08d.

When the extension of the Cape Town electricity supply to Green Point and Sea Point was decided upon, it was estimated that the consumers would require about 5,580 16-c.p. lamps. The demand has, however, already amounted to over 7,000 lamps.

**Southampton.**—Application is to be made to the L.G.B. for sanction to borrow £3,000 for mains. Tenders are to be invited for the provision of a balancer.

**Stirling.**—Owing to the Parliamentary regulation restricting it from supplying current outside the burgh boundaries, the Corporation electricity undertaking is losing one of its best customers, viz. Messrs. Robert Walls & Sons, Springkerse. The T.C.'s loss, however, is the Scottish Central Co.'s gain, and as it is now supplying the Forthbank Carpet Works, it is able to supply the Kersemills Works which are within its area.

**Stretford.**—During the past eight months a total of 1,395,779 units have been sold. This is an increase of 129,448, compared with an increase of 65,300 during the previous year's working.

**Tollesbury.**—An electric light scheme for the town was explained at a meeting of residents on January 6th by Mr. H. P. Girling, M.I.E.E., of Malden, who estimated the cost of plant, dynamo, accumulators, street lamps, &c., with the necessary working capital, at £1,500. The matter is to be fully gone into at the annual parish meeting in March.

**Tunbridge Wells.**—Last week a series of electrical cooking demonstrations was held at the Town Hall, the lectures being given by Mr. Norman Miller, on the "Eclipse" stoves, manufactured by the Electrical and Ordnance Accessories Co., Ltd. The opening ceremony was performed by the Mayoress (Mrs. Silcock), and the lectures and demonstrations throughout the week were extremely well patronised. Artistically furnished dining and bedrooms, erected at the end of the Town Hall by Messrs. Waymarks, Ltd., were wired throughout with "Stannos" by the Electrical Installation Co. (Mr. J. P. Strange), and they attracted thousands of visitors. Mr. H. A. Stonham gave practical demonstrations with the "Imperial" vacuum cleaner. At the close of the demonstrations, on Friday night, a dinner, which was entirely cooked by electricity in the "Eclipse" stove, was served to a dozen or so members of the Corporation electricity works staff, who had been in attendance at the hall during the week. In the absence of Mr. R. N. Torpy (the borough electrical engineer), Mr. J. Bemrose occupied the chair, and was supported by Mr. W. H. Hayden and Mr. Norman Miller. A hint was given that it was quite probable that further reductions would be made in the heating and cooking charges, which were lowered only a short time ago.

**Venezuela.**—The Harbour of Caracas is to be the object of extensive improvements, among other works the construction of 7 km. of quays being planned. These are to be lit by electricity, which will also supply the motive power for numerous cranes which are to be installed there. A generating station is also to be constructed. The works are to be carried out by the municipality. —*Elek. u. Masch.*

**West Hartlepool.**—The costs connected with the recent inquiries into the proposed extension of the electricity undertaking totalled £1,963, and for this sum the L.G.B. has sanctioned a loan.

**Whitehaven.**—The T.C. has decided to apply to the L.G.B. for a loan of £1,565 for electricity purposes.

**York.**—The City Council has passed a resolution confirming the promotion of the Bill under which the Corporation proposes to acquire the undertaking of the York Gas Co., and to acquire lands for the electricity undertaking and for other purposes.

## TRAMWAY and RAILWAY NOTES.

**Australia.**—The Victorian Railways Standing Committee has reported favourably on electric tramway extensions in South Melbourne, Richmond, Camberwell, Hawthorn, &c., and recommends that the required authority to carry out the work should be vested in a trust representing these Councils.

**Birmingham.**—The City Tramways Committee contemplates making at an early date a junction between Villa Road and the main Handsworth line. When this is completed, passengers will be able to ride by car from the New Luns or West Bromwich, along Villa Road to Aston, without going into the city.

**Canary Islands.**—Work is shortly to be commenced at Las Palmas in the Canary Isles, on the new electric tramway in the San Jose quarter of that town, to join up the San Francisco road, the Verduga bridge and the Obispo Codina.

**Colne.**—The T.C. last week formally confirmed the promotion of the Colne Corporation Bill, which includes provision for the taking over of the Colne and Trawden Light Railway undertaking, and the extension of the electric lighting area.

**Continental Notes.**—**AUSTRIA.**—According to a recent utterance of the Minister of Railways, the delay in the electrification of the Vienna municipal railway and in the building of the underground express line is owing, firstly, to the time needed for the preparation of the plans; secondly, the condition of the money market and the political situation have been causes of some delay. The plans have now, however, been completed, and the improvement in the financial and political situations gives ground for believing that the two groups who have the schemes in hand will shortly proceed to their realisation. —*Zeit. des Oest. Ing. und A.V.*

**BOSNIA.**—Plans are being prepared in respect of a projected electric tramway between Sarajevo and Ilidze.

**ITALY.**—The municipal authorities of Milan, following the example of great cities in other parts of the world, are contemplating the introduction of an electric underground railway which they propose to achieve by means of a building and working concession for a term of years. The narrowness of the streets in the inner parts of the city prevents, it seems, the establishment of an ordinary tramway, while the congestion of population and traffic render additional means of locomotion a necessity. The nature of the sub-soil of the city does not lend itself so well as elsewhere to the construction of an underground line on which account construction by stages is favoured. Contractors contemplating submitting schemes must do so during the month of March, and additional particulars may be obtained from the Ufficio Technico di Municipio di Milan.

**SPAIN.**—La Sociedad de Tranvias Electricos de Granada has applied for a concession for a projected electric tramway between Granada and Santa Fé.

**East Ham.**—A communication has been received from the Postmaster-General stating that he was prepared to erect insulated wires wherever the wires of his department crossed the Council's trolley wires, thereby relieving the Council of the necessity to erect guard wires, providing it would agree to pay half the cost. A reply is to be sent that the Council cannot comply with this request.

**Glasgow.**—Since the beginning of the Tramway Department's financial year on June 1st there have been 181,413,000 passengers, against 156,907,760 in the corresponding period of 1911-12, an increase of 24,505,220, while the drawings have been £592,372, as compared with £596,875, a decrease of £4,503.

**Huddersfield.**—The financial statement of the borough treasurer respecting the Corporation tramways for the nine months ended December 31st, 1912, states that the capital outlay to date is £416,985. The miles run were 1,780,522, compared with 1,687,596 for the corresponding period of the previous year. The income amounted to £82,443, or 11'11d. per car-mile, compared with £80,253, or 11'41d. The total working expenditure was £49,056, or 6'01d., compared with £44,311, or 6'30d. Interest on capital

absorbs £9,873, and redemption of debt, £7,620, leaving a surplus of £15,894, or 2'14d., compared with £18,476, or 2'62d. After provision is made for depreciation at 3 per cent, there is a net surplus of £6,512, or '87d. compared with £9,191, or 1'30d. The balance brought forward on the reserve or renewal account was £13,253, and interest on investments amounted to £262, while the transfer for the nine months (depreciation) amounted to £9,382, making a total of £22,897. The payments totalled £8,034, leaving the fund at £14,863.

**Hull.**—The Tramways Committee has had under consideration a report from the city engineer regarding new tramways in the neighbourhood of the Paragon station, and has agreed to recommend the carrying out of certain work in connection with the proposal, with the consent of the B. of T. and N.E. Railway Co.

**Leeds.**—The attitude of several of the local authorities affected by the proposed tramway extensions of the Corporation has been under consideration. Objections were raised to the introduction of railless traction in Wharfedale. After a meeting between the representatives of the Drighlington R.D.C. and the Tramways Committee, terms were suggested which it is believed will be acceptable to the various Councils and the Leeds Corporation. The Committee recommends that the Parliamentary Committee should abandon the application for powers to extend the system to Ilkley (beyond Burley) and to Calverley and Farsley.

**Liverpool.**—On the proceedings of the Tramways and Electricity Committee at the Council meeting on January 8th, Councillor Miller moved that application be made to the B. of T. for a provisional order authorising the construction of a tramway line connecting Aigburth Road with Princes Road, *via* Belvidere Road and Devonshire Road. Pursuant to standing orders, this motion was formally referred without debate to the Committee for consideration and report.

**London.**—**HAMMERSMITH.**—Petitions are to be presented against the London Electric Railway Bill and the Central London Railway Bill for the preservation and protection of the interests of the borough. Both Bills seek power to acquire and interfere with property belonging to the Council, while in the former Bill the rateable value of the property in the borough which the company seeks to acquire is £10,754, of which £7,631 represents property which will necessarily be disturbed along the line of the proposed railway. A deputation is to wait upon the L.C.C. to urge the necessity for arrangements being made for the early reconstruction of the tramway track in King Street and Goldhawk Road.

**LEWISHAM.**—With the view of saving, as far as possible, expense in the matter of opposition, the L.C.C. is to be asked to take the necessary steps for withdrawing its proposals to run railless trolley vehicles on certain routes in the borough, from the Bill to be considered in the next session of Parliament.

**Mexborough.**—The Mexborough and Swinton Tramways Co. has deposited a Bill for introduction into Parliament next session for powers to provide and work railless trolley vehicles in connection with its existing tramway system. The five routes proposed to be authorised will pass into or through Conisboro' and the rural district of Doncaster.

**Sheffield.**—During the severe snowstorms of the week end, a telephone wire over one of the tramway routes broke and fell across the trolley wires and into the road. Two cab horses which came into contact with the wire, were instantly killed, while the drivers jumping on to the snow, received severe shocks, owing apparently to the immediate area being electrically alive. Two men who went to assist, shared the same fate, and were badly burned, but all were eventually rescued by two other men, who adopted the expedient of walking on a coat layed on the snow in the danger zone. At Blackpool a somewhat similar occurrence took place, but with less serious consequences, two men receiving shocks, while at Blaydon a displaced overhead wire (not used for traction purposes) caused the death of a horse, and shock to its rider.

**Shoreham-by-Sea.**—At a meeting of the U.D.C. on January 7th, a letter was read from the B.E.T. Co. suggesting that the Council should acquire the tramway powers in the district. It was decided to take no action in the matter.

**South Lancashire.**—At a meeting of the employees of the South Lancashire Tramways Co. held last week, it was unanimously decided to tender notices to cease work in order to secure higher pay and improved working conditions. The terms offered by the company were considered unsatisfactory, and were rejected. An application has been placed before the Executive Council of the Tramwaymen's Association for leave to cease work on the 24th inst. pending a settlement of the men's grievances.

**Stockport.**—At a meeting of the T.C. last week, Ald. Sharples said the Tramways Committee had not yet been able to get delivery of the trackless cars required. One which had been received had required alteration as to height to make it suitable for the route. The cars would probably be running, however, before the end of the present month.

**Torquay.**—The figures of last year's tramway traffic show large increases compared with those for 1911. The comparative totals of the passengers carried were as follows:—1912, 4,207,619; 1911, 3,594,317, an increase of 613,302. Receipts: 1912, £28,111; 1911, £22,634; increase, £5,477. Car-miles: 1912, 627,479; 1911, 494,468; increase, 133,011. The cars cover eight different routes.

## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—The litigation between the Marconi Co. and the Commonwealth Government proceeds by slow stages. Some time ago the company renewed its application to the Courts for an order for inspection of the wireless plant installed by the Federal Government, without success. On the other hand, the Government recently asked the Court to direct that further particulars of the alleged infringements should be supplied by the company, and this application was also refused. The actual hearing of the case has not yet appeared in the Australian papers received in this country.

The Commonwealth lighthouse expert, Commander Brewin, says the *Australian Mining Standard*, has advised the Minister of Customs to install wireless telegraphy in all lighthouses that are not provided with telephone communication.

**German Wireless Patent Rights.**—In the nullity suit against one of the chief patents owned by the C. Lorenz Aktien-Gesellschaft, of Berlin, relating to the creation of undamped electric oscillations by means of an arc burning in a hydrogen atmosphere, the Court of First Instance declared the patent void in all but what relates to a sub-claim. The Imperial Court, however, in its verdict of November 9th last, upheld the essential portions of the patent, and only declared one claim void, because the claimant, V. Poulsen, had obtained a Danish patent only a few days before Germany entered the International Patent Union. The voided claim related to the arrangement of the arc in a hydrogen atmosphere. The arrangement of the arc in a closed chamber, the cooling of the electrodes, and the use of rotation and a magnetic field, were upheld to the fullest extent by the Imperial Court.—*E.T.Z.*

**The Imperial Wireless System.**—On January 6th, the Select Committee of the House of Commons resumed the inquiry into the Marconi agreement, continuing the examination of Mr. Gandil, who stated that he sent in the tender of January 11th, 1912, to the Postmaster-General entirely on his own responsibility. On June 7th, he applied for permission for the Poulsen Co. to be represented at the International Radio-Telegraph Conference, Signor Marconi having been permitted to attend, but it was refused. It would have been of great importance to his company for him to meet the foreign delegates. In January, 1912, there was no British company or capital for working the Poulsen patents. He did not agree that he could not have got financial assistance to put up trial stations, unless he got a conditional contract with the Government. He admitted that a delay of 12 months would probably have been incurred in erecting the trial stations. The Marconi Co., he said, had not yet communicated 2,000 miles overland.

Mr. R. H. Eggar, solicitor to the owners of the Poulsen system, stated that the Poulsen patent rights for the United States remained vested in the inventors; those for the British Empire were owned by the Amalgamated Radio-Telegraph Co., Ltd., which also had the right to all improvements made by the owners at any time of the United States patents. The rights for all other countries belonged to the Continental Syndicate, but the Amalgamated Co. had the right to oversea communication with and between all foreign countries other than the German Empire. In 1911, Mr. Gandil was forming a British company, but was unable to obtain an assurance from the Postmaster-General that his company would be allowed to tender for the contract; if Canada had taken part in the contract, it would have been impossible to obtain a licence for a trans-Atlantic service competing with the Imperial system. The licences held by the company expired in 1909, and the Postmaster-General would not grant others until a British company was formed, but this was found to be impracticable. It had been shown in the evidence that Capt. Loring was anxious that the Marconi Co. should purchase the Poulsen patents, and therefore witness suggested that, when the Postmaster-General endeavoured to buy these patents for the whole world, he was acting on behalf of the Marconi Co., with a view to the Government having the benefit of them without extra payment. The Poulsen Co. believed that any information given to the British Government got into the hands of the Marconi Co. He was informed by Capt. Loring that the Department would not give the business to a foreign company; he must first form a British company. He suggested that Clause 3 was inserted, giving the Marconi Co. a five-year monopoly, in order to make the Poulsen patents worthless, so that they could be bought up cheaply.

On the 8th inst., Mr. Eggar's examination was resumed. He said that the owners of the Poulsen patents were preparing copies of their agreements with the American Co. for circulation to the Committee. The German purchasers of the Poulsen rights were, like the American, compelled by agreement to give the Danish inventors the benefit of any improvements they might make, but the English company were under no such obligation. Mr. Beach Thomson came over to acquire the Poulsen rights for the whole world, but was too late—the English syndicate had purchased them; Mr. Thomson was wrong when he said that the English company was not entitled to the American improvements. If the British Government had entered into an agreement with the Poulsen Co., they could not have used the system for communicating with Germany or the United States.

On the 9th inst., Mr. Eggar was further examined. He said the Post Office purchased the Cullercoats station because the licence having expired, the owner (Mr. Hage) had no use for it. In May, 1909, the Amalgamated Radio-Telegraph Co. went into liquidation, and Mr. Hage bought the station. The Poulsen Co. had been trying

to get a licence for trans-Atlantic communication since December, 1909, but the Post Office required them first to form a British company, and as the Post Office would not specify the terms of the licence, it was impossible to form the company. The Post Office did not give them a chance.

Sir G. C. Marks, M.P., recalled, stated that eight articles in the apparatus covered by the agreement with the Marconi Co. were proper to the system, but 15 were not, and the latter need not have been made the subject of a contract. Out of the £60,000 to be paid for each station, £50,000 was for things not properly belonging to the Marconi system. There were two main Marconi patents, one of which would expire in 14 months. This was practically a master patent. The contract was an extraordinary example of wrong-headedness on the part of the advisers of the Government, as the agreement of September, 1909, gave the Postmaster-General the right to use the Marconi inventions. The contract would close the door to independent invention. There were plenty of experts outside the company who could do the work. He objected to the ratification of the agreement. The foreign patents of the Marconi Co. would not interfere with the erection of any of the six stations. A royalty on profits was the proper course to take.

On Monday the Committee considered a draft interim report, and the Postmaster-General was invited to attend. The chairman (Sir Albert Spicer) stated that the Committee had been impressed with the great urgency of the matter and with the difficulties connected with the technical questions; as regarded the hearing of scientific evidence, it felt itself hardly competent to deal with that side of the question. The interim report was to the effect that it was a matter of urgency that a chain of Imperial wireless stations should be established as proposed in the agreement:

"They therefore recommend that steps should be at once taken for the purchase of sites for wireless stations large enough for Marconi installations in the countries or places mentioned.

"They further think that, with respect to the construction and installation of such wireless stations, one of two solutions must be adopted—either a particular company must be selected, and their system accepted, or else the Government must leave themselves free to adopt or reject from time to time any system. . . .

"Whichever solution is ultimately recommended by the Committee, it will be necessary either for the Committee or the Government to come to a conclusion as to the technical and scientific merits of the various systems. For this purpose, the Committee believe that the best result could be reached by the immediate appointment of a highly qualified technical committee, similar in character to the Explosives Committee."

Mr. Samuel, asked for his opinion on the draft report, said the Government would at once act on the suggestion that steps should be taken to select the sites; but as the contracting company would have to bear the whole of the risk of failure in the working of the stations, and would therefore have to be given a voice in the choice of sites, all that could be done was to secure options on suitable sites, and to defer the actual purchase until a company had secured the contract—if there was to be a contract. Suitable sites on Crown land had been selected in England. He would at once send out the Commission to Egypt, and two months ought to suffice for the selection of the sites in England and Egypt for the first two stations, which ought not to be delayed pending the choice of the more distant stations. The Admiralty were more disinclined than ever to undertake the erection of the stations, and informed him that they now considered themselves not in a position to do so at all. The Post Office staff was not qualified to undertake the work. There was a danger that a technical committee, unless limited in point of time in the making of a report, would increase the delay. It would not be proper to postpone a decision on this matter until the foundations were completed and the masts erected, as had been suggested. The experts would want to make tests, and on the point of arriving at a decision, would probably find some other system for which superiority was claimed, and therefore they should be asked to report by a fixed date, lest the investigation should be indefinitely prolonged. He suggested that Parliament would not be justified in sanctioning a contract with any company whose system had not been submitted to practical long-distance tests. The question was, therefore, what systems were in a position to undergo adequate tests within a short period. All other systems must be ruled out, whatever their theoretical merits. He did not think the technical committee would go in person to San Francisco to investigate the Poulsen system—they would send representatives, and those tests could quite well be made without a technical committee. Technical matters were not the only considerations to be taken into account. Would it be in the interests of the State to place the contract for these primarily strategic stations in the hands of a foreign company? The matter could not be disposed of by reference to a technical committee—but this fact was not pointed out in the draft report. The Government attached importance to three points—to getting the stations soon, to having stations that would work day and night, and to having complete freedom to change the system for a better one. The efficiency of the system and the price of the stations were of less importance. He foresaw the greatest difficulties in selecting for the technical committee persons who were independent both of the Government and of the various wireless systems, but who nevertheless were really experts in wireless telegraphy.

Sir G. C. Marks was then further examined, and criticised the terms of the contract, alleging that the price was extraordinarily unreasonable.

On Tuesday the Committee revised the interim report, and submitted it to the House of Commons, expressing the desire that it should be endorsed by the House, pending which the sittings were suspended. The report followed the lines of the draft, recommend-

ing that a highly qualified committee of eminent scientific experts should be appointed to report within three months on the merits of the respective systems. On Wednesday, in the House of Commons, the P.M.G. stated that the Government would immediately give effect to the Committee's recommendations.

In reply to a question in the House of Commons, the Postmaster-General stated that Messrs. Siemens Bros. & Co. did not tender for long-distance stations on the Telefunken system, but in answer to an inquiry they stated that the cost would be £23,000 for the equipment of a single simplex station in England, without duplicate plant and without automatic reception. It was not on a basis comparable with that adopted for the stations of the Imperial system.

**Mexico.**—The construction and equipment of the wireless station at Chapultepec has now been completed. The plant was supplied by the Compagnie Générale Radiotélégraphique, and is wholly of French manufacture.—*Revue Pratique de l'Electricité*.

**Norway.**—The investigations of the Select Committee appointed by the House of Commons into the English Marconi contract have placed the bargain of the Norwegian Government in a new light, and the Director-General of the Norwegian State Telegraphs announces that, in the near future, he will put before the Storting all the particulars regarding the Norwegian Marconi contract.

**Peru.**—Congress is considering the question of setting aside a credit for £17,750 for the installation of two wireless telegraph stations. One is to be situated on the north coast and the other on the south.

**The Recent Storms.**—Numerous interruptions and delays in telegraphic and telephonic communication were caused by the storms of snow and wind which raged last week end, especially in the North.

**Telephone Call Offices.**—In reply to a question, the Postmaster-General stated that the number of automatic telephone call boxes in London at the end of March, 1912, was 2,867. The cash collected from the boxes for the year ending March, 1912, was £79,032. The difference between the cash collected and the number of calls registered was slight.

**Underground Telegraph Cables.**—In reply to a deputation from cities in the North of Scotland, the Postmaster-General recently stated that he could not agree to the extension of the underground cable system to Aberdeen and Dundee, but he had in contemplation the use of phantom circuits over the trunk telephone wires, and the adoption of wireless telegraphy to prevent interruption of communication.

**United States.**—The six naval wireless telegraph stations in Alaska—at St. Paul, Dutch Harbour, Unalga, Kodiak, Cordova and Sitka—were to be opened for commercial business on Wednesday last.

**Wireless on Board ship.**—The U.S. prosecution against the captains of the *Numidian* and *Winifredian*, who were charged with violation of the law concerning the wireless equipment of vessels, has been withdrawn. The companies pleaded that they were unable to comply with the regulations, owing to the delay of the contractors in completing the orders for the equipment. The Government has, therefore, given them further time to make the installation.

## CONTRACTS OPEN and CLOSED.

### OPEN

**Atherton.**—January 29th. One E.H.T. switchboard and one H.T. switchboard for the U.D.C. See "Official Notices" December 27th

**Australia.**—VICTORIA.—February 21st. Four 1,500-kw. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

WESTERN AUSTRALIA.—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" January 10th.

SYDNEY.—March 17th. Motors for the City Corporation.

**Belgium.**—LIERRE.—February 28th. Tenders are invited for a concession to install and work an electric lighting service. Particulars, Hôtel de Ville, Lierre.

**Birmingham.**—January 27th. Stores for a year for the Corporation Tramways. Mr. A. Baker, manager.

**Bispham-with-Norbreck.**—January 18th. One oil or gas engine direct coupled to a 100-kw. dynamo, for the U.D.C. See "Official Notices" January 3rd.

**Canada.**—January 24th. The Winnipeg Board of Control requires three 2,700-kw. step-down transformers. Plans, &c., Civic Light and Power Department, Winnipeg. Tenders endorsed "Tender for step-down transformers."

February 13th.—Machines, motors, cranes, &c., for Transcona Railway shops. Specifications, forms of tender, Mr. W. J. Press, engineer Ottawa

February 10th.—One 1,500-kw. steam turbine and generator for the City of Moose Jaw, Sask. See "Official Notices" January 10th.

**Chile.**—September 10th. Tenders are invited for the establishment of a central electric station and the distribution of electrical energy at the port of Valparaiso. Inquire at the offices of the Chilean Legation, 48, Grosvenor Square, W.

**China.**—January 30th. High and low-tension underground cable, for the Shanghai Municipal Council. See "Official Notices" to-day.

**Clacton-on-Sea.**—January 29th. One 250-kw. Diesel oil engine, generator, switchboard, &c., for the U.D.C. See "Official Notices" January 10th.

**Eccles.**—The Electricity Supply Committee has invited tenders for the erection of an extension to the present boiler house at the electricity works, Cawdor Street, Patricroft.

**Edinburgh.**—January 20th. Electric light, power, telephone and bell installation at Boroughmuir New School. Plans, &c., at office of Messrs. Crawford & Cummins, consulting engineers, 41, George Street, Edinburgh.

**France.**—PARIS.—Tenders will shortly be invited by the Chemins-de-fer de l'Etat for 260 electric automobiles. Particulars from the Bureau de l'Administration, Paris.

**Glasgow.**—January 21st. Two 6,000-kw. turbo-alternators, with condensing plant and accessories, and water-tube boilers, for the Corporation. See "Official Notices" January 3rd.

**Hoyleake and West Kirby.**—January 31st. High-tension single-phase switchgear (eight panels) and one 50-k.v.a. single-phase transformer, for the U.D.C. See "Official Notices" to-day.

**India.**—January 24th. Bombay, Baroda and Central India Railway invites tenders for rotary converter plant. See "Official Notices" January 10th.

The intention of the Government of Mysore to establish an electric tramway system in Bangalore will involve the placing of orders for the necessary material. Further particulars from the Chief Electrical Engineer to the Mysore Government, Bangalore, or the Indian States and Eastern Agency, 25, Victoria Street, S.W.

**Llanely.**—January 20th. Electric light installation at Moriah Church. Messrs. J. & B. E. Evans, architects, 47, Stepney Street, Llanely.

**London.**—HAMMERSMITH.—The Electricity Committee is to buy new cables for drawing into ducts to be laid from Scrubbs Lane to Hythe Road (£700); and is also to invite tenders for annual contracts for electrical stores.

CAMBERWELL.—January 20th. The B.C. is inviting tenders for (h) maintenance of private telephones at the Town Hall and Grove Vale dépôt; and (s) electric lamps for a period of one or three years, at option. Specifications and forms of tender from Mr. W. Oxtoby, borough engineer, Town Hall, Camberwell, S.E.

February 4th.—The Metropolitan Water Board is inviting tenders for Sec. 25, electric lamps and accessories, for one year. Specifications and forms of tender from the Clerk of the Board, Savoy Court, Strand, W.C.

L.C.C.—January 20th. Electrical installations at Camberwell School of Arts (with fire-alarm bells and wiring for power and electrical clocks), and at Vauxhall Street Elementary School. See "Official Notices" January 10th.

January 29th.—Electrical installation at Cook's Ground Elementary School, Chelsea, S.W. See "Official Notices" to-day.

**Nelson.**—February 3rd. One traction battery, one automatic reversible booster and switchgear, one D.C. motor-generator and switchgear, for the Electricity and Tramways Committee. See "Official Notices" January 10th.

**New Zealand.**—Announcements of the following open contracts appear in *Tenders (Mining and Engineering Review)*:—

February 6th.—Wellington Electric Tramways. Supply of Weir pump, steam piping, &c.

February 18th.—Auckland Harbour Board. Supply of switchboards, &c., for wharf lighting and power.

**Nuneaton.**—January 21st. One water-tube boiler, with valves, fittings, &c., for the Corporation Electricity Department. See "Official Notices" January 10th.

**Panama.**—The Acting British Consul at Colon intimates that tenders will shortly be called for the towers and equipment for a transmission line across the isthmus. Owing to the unfavourable prices in the States, British manufacturers are invited to compete. Particulars, Commercial Intelligence Branch, B. of T.

**Plymouth.**—January 23rd. Stores for a year, for the Corporation Electricity and Street Lighting Departments. See "Official Notices" January 3rd.

**Servia.**—BELGRADE.—Orders will be shortly given out for the electric light and power plant, electric cranes and other equipment required for the new port projected near Prohova.

**Sheffield.**—January 23rd. General stores for the City Tramways Department. See "Official Notices" January 3rd.

February 5th.—General stores for two years, for the City Electricity Supply Department. See "Official Notices" to-day.

**South Africa.**—February 3rd. Cables, trolley wire, fittings, poles, converters, switchgear, &c., for the Germiston municipal trackless trolley scheme. Specification, &c., can be seen at the Board of Trade Commercial Intelligence Department in London.—*Board of Trade Journal.*

**Spain.**—January 30th. The municipal authorities of Cullerbaça (province of Granada) are inviting tenders for the concession for the electric lighting of the town during a period of six years.

Tenders have lately been invited by the municipal authorities of San Pedro de Torello (province of Barcelona) for the concession for the electric lighting of the town during a period of 10 years.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C. I. Department in London.

**West Ham.**—January 24th. Engine-room stores, chemicals and A.C. house-service wattmeters, for the Council's electricity department. See "Official Notices" January 10th.

### CLOSED.

**Ashton-under-Lyne.**—The Tramways Committee has accepted the following tenders:—

United Electric Car Co., Ltd.—Two double-deck cars, with top covers and trucks.

Siemens Bros.—Two complete car equipments and spare parts.

**Australia.**—According to the *Australian Mining Standard*, the following contracts have been placed:—

MELBOURNE.—P.M.G.'s Department:—

100,000 porcelain insulators, at 2½d. each.—I.R., G.P. and T. Works.  
222,500, at 2½d. each, and 135,000, at 5½d. each.—Dalgety & Co., Ltd.

According to *Tenders (Mining and Engineering Review)*, the following orders have been given out:—

NEW PLYMOUTH (N.Z.).—Borough Council:—

Supply of turbo-generator set, £1,251.—Turnbull & Jones.

VICTORIA.—City of Brunswick:—

Erection of main station and three sub-stations, £373 and £198 respectively.—Thomas Coates.

12 s.p. transformers, £791.—Noyes Bros.  
Three c.c. transformers, £391.—Australian General Electric Co.  
Switchgear, £538; wires and cables, certain rates.—Noyes Bros.  
Lamps, £84.—Australian General Electric Co.  
Street fittings, £565.—Warburton, Franki, Ltd.  
200 meters, £285.—Australian Metal Co.

*Tenders* also gives the following list of accepted tenders for the Jamestown Municipality (South Australia):—

Semi-Diesel oil engine and 30-kw. Phoenix generator, £721; spares for generator, £52; booster, £21; consumers' meters, £96; street brackets, £21; section of whole plant, £428.—Warburton, Franki, Ltd.  
Tudor storage battery, size V5, £576; aluminium wire and cable, £260.—Wm. McLean & Co.

Switchboard equipment, comprising switches, £34; fuses, £1 7s. 6d.; switchboard instruments, £16 12s. 6d.; service fuses, £12; insulators and bolts, £20 15s. 8d.; testing instruments, £59 15s.—Noyes Bros. Pty., Ltd.  
Supply of poles, £237.—H. Hyatt & Sons.

An Australian exchange states that the Woods-Gilbert Rail Co., Ltd., Melbourne, has secured a contract to treat the corrugations and worn joints throughout the Sydney electric tramway system. The work will take about 12 months.

**Bradford.**—The T.C. has accepted the tender of Ferranti, Ltd., at £305, for the supply and delivery of switchgear and accessories required in connection with the new 1,500-kw. rotary converter about to be erected at the Valley Road works.

**Brighton.**—The B. of G. has accepted the tender of Messrs. George Virgo & Sons, for the installation of an electric fire alarm with call points and bells, and of a private telephone service at the Warren Farm Schools, at £70.

**Douglas (Isle of Man).**—The T.C., on January 8th, accepted the tender of Mr. Hanson Perry for the electric light installation at the Villa Marina, at £543; and that of the General Electric Co., Ltd., for generating plant, at £1,411.

**Dover.**—The T.C. has accepted the tender of Messrs. J. Wright & Son, of Dover, for electric wiring at St. Martin's School, at £42. Mr. Pinto tendered at £43 10s.

**Glasgow.**—Messrs. John Bennie & Co. have secured the contract for supplying and erecting an electric hoist at Tradeston Gas Works, at a cost of £262.

**Keighley.**—In connection with the extensions of the Corporation electricity works, the tender has been accepted of Messrs. Willans & Robinson, Ltd., at £5,827, for a 2,000-kw. turbo-alternator, with exciter and surface condenser (the alternator to be made by Messrs. Dick, Kerr & Co., Ltd.).

**Musselburgh.**—Messrs. Venner & Co. have received an order to equip the Musselburgh cars with Chamberlain & Hookham motors.

**Nuneaton.**—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., Ltd., for a 17-h.p. motor and accessories, at £17.

**Ramsbottom.**—The U.D.C., on January 9th, decided to accept the tender of the Railless Electric Traction Co., Ltd., for the supply of four cars, and that of Messrs. Clough, Smith & Co. of London, for the overhead electrical equipment. It is proposed to run the cars from Holcombe Brook to Edenfield, a distance of about four miles, and it is hoped to have the cars running in about four months.

**Ramsgate.**—The T.C. has sealed a contract with Messrs. Vitty & Hopper, Ltd., for the supply and maintenance of fire-call bells.

**Sunderland.**—The T.C. last week approved of the following contracts on behalf of the Electricity and Lighting Committee:—

Dick, Kerr & Co., Ltd.—Alternator slip rings.

Electrical Co.—F.H.T. fuses.

R. O. Heslop & Son.—Block tin.

W. G. Farrow & Co.—Box frames and covers.

H. Tomkinson & Sons.—Cast-iron boiler fittings.

Babcock & Wilcox.—Babcock fittings.

British Insulated & Helsby Cables, Ltd.—House service boxes, fuse boxes.

**Wakefield.**—The tender of the Victoria Coal and Coke Co., Ltd., for the supply of coal to the electricity and destructor works for 1913, has been accepted by the Corporation.

**Walsall.**—The tenders of Callender's Co., Ltd., and the British Thomson-Houston Co., Ltd., have been accepted by the T.C. for providing and laying high-tension mains required in connection with the extension to the Caldmore district, and for sub-station switchgear, respectively.

**West Bromwich.**—The T.C. has accepted the tender of the Electric Construction Co., Ltd., for a dynamo, and that of the National Gas Engine Co., Ltd., for a gas engine.

**Wolverhampton.**—The Electricity Committee of the Corporation has purchased three coal-measuring drums from Messrs. Babcock & Wilcox, Ltd., at a cost of £105.

**Worcester.**—The City Council has accepted the following tenders:—

British Thomson-Houston Co., Ltd.—One 1,500-kw. steam turbo-alternator, exciter and Worthington condenser for two-phase supply, £5,261; regulator and water recorder, £172, for the Hylton Road station.  
British Insulated and Helsby Cables, Ltd.—Three years' supply of paper cables, at same prices as hitherto.

### FORTHCOMING EVENTS.

**Institution of Mechanical Engineers.** Friday, January 17th. At 8 p.m. Paper on "Indicators," by Mr. J. G. Stewart.

**Association of Mining Electrical Engineers (West of Scotland Branch).**—Saturday, January 18th. Meeting at 4.30 p.m. At the Royal Technical College, Glasgow.

**Salford Technical and Engineering Association.**—Saturday, January 18th' At 7 p.m. At the Royal Technical Institute, Salford. Presidential address by Mr. J. Morris. Musical social evening.

**Institution of Electrical Engineers (Newcastle Section).**—Monday, January 20th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Electric Resistance Welding," by Mr. P. Bucher.

Tuesday, January 21st. At 7.30 p.m. At the Lit. and Phil., Middlesbrough. The above paper will be read.

(Manchester Students' Section).—Tuesday, January 21st. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Street Photography," by Mr. S. E. W. Taylor.

(London).—Thursday, January 23rd. At 8 p.m. Paper on "The Use of a Large Lighting Battery in Connection with Central Station Supply," by Mr. F. H. Whysall.

**Royal Society of Arts.**—Monday, January 20th. At 8 p.m. Cantor lectures on "Liquid Fuel," by Prof. V. B. Lewes. (Lecture I.)

**Institution of Civil Engineers.**—Tuesday, January 21st. At 8 p.m. At the Institution of Mechanical Engineers. Paper on "The London and South-Western and Metropolitan District Railways' Widening between Acton Lane and Galena Road," by Mr. E. A. Ogilvie.

**British Electrical and Allied Manufacturers' Association.** Friday, January 21st. At 7 for 7.30 p.m. At the Savoy Hotel. Dinner.

**Royal Institution.**—Friday, January 21st. At 9 p.m. Discourse on "Recent Advances in Scientific Steel Metallurgy," by Prof. J. O. Arnold.

**Physical Society.**—Friday, January 21st. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "The Electrical Conductivity and Fluidity of Strong Solutions," by Mr. W. S. Tucker; "The Resistance of Electrolytes," by Messrs. S. W. J. Smith and H. Moss; and "The Recalescence of Iron Carbide," by Messrs. S. W. J. Smith and J. Guild.

**Junior Institution of Engineers.**—Saturday, January 25th. At 11 a.m. Visit to the Houses of Parliament for inspection of heating, ventilation, &c.

**Will.**—It is stated in the *Times* that the late Mr. Edward Tyer, inventor of electric appliances for railway signalling, whose death was recently announced, left estate valued at £20,400 gross, with net personality £15,759.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, January 20th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.  
 Tuesday, January 21st.—"B" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.  
 Thursday, January 23rd.—"C" Company. Company training, 7 to 10 p.m.  
 Friday, January 24th.—"D" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.  
 Saturday, January 25th.—"A" Company. Week-end run at Fort Coalhouse. Dress:—Service dress, putties and greatcoats. No arms or equipment will be taken. Parade at Fenchurch Street Station, Midland, London and Tibury section, at 5 p.m., for Low Street Station.

Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,  
For Officer commanding L.E.E.

### NOTES.

#### Melbourne Railway Electrification Contracts.—

We understand that contracts have been placed with the following firms in connection with the Melbourne Railways electrification:—  
 Boilers and buildings: Babcock & Wilcox, Ltd.  
 Turbo-alternators: C. A. Parsons & Co.  
 Electrical equipment of rolling stock: British Thomson-Houston Co., Ltd.  
 Sub-station machinery: Siemens Bros.

**Appointments Vacant.**—Assistant electrical and mechanical engineer, for an English electricity supply undertaking in China; charge engineer, for the City Electricity Department, York (£91); junior assistant engineers, for the Newcastle-upon-Tyne Electric Supply Co., Ltd. (10s.). See our advertisement pages in this issue.

**Educational Notes.**—CITY AND GUILDS TECHNICAL COLLEGE, FINSBURY, E.C.—A course of six advanced lectures on "Induction Motors" will be given by Mr. J. K. Catterson-Smith, on Mondays, commencing on January 27th. See our advertisement pages in this issue.

**Blackburn Extensions.**—On Friday next, January 24th, the new generating plant at the Corporation electricity works, Jubilee Street, will be started up by the Mayor.

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS (NEWCASTLE LOCAL SECTION).—The preliminary programme of this Section shows the following as the subjects for the next few months:—

February 10th.—"The Need for an Authority to test and certify Electrical Apparatus and Materials," by C. Turnbull.  
 March 10th.—"Electrical Equipment of a foreign-built Battleship," by G. G. Mallinson.  
 March 21st.—"Telephonic Development," by J. R. Andrews.  
 April 21st.—"Notes on Gas Engines," by A. P. Pyne.

On Monday, 27th inst., the Students' Section will meet in the Armstrong College to hear a paper by Mr. S. I. Ellis, on "The Application of Electricity to the Lighting of Residences, Business Premises and Factories."

**SALFORD TECHNICAL AND ENGINEERING ASSOCIATION.**—We have received a copy of the 1913 syllabus of this Association, whose meetings are held monthly at the Royal Technical Institute, Peel Park, at 7 p.m. To-morrow night Mr. John Morris will deliver his presidential address, and later arrangements include "Wireless Telegraphy," by Mr. J. McKeever, on March 1st; "Modern Gas Engines," by Mr. K. Cox, on April 5th; and a visit to the works of Messrs. E. Green & Son, Ltd., at Wakefield, on May 3rd. Whitsun week will be spent in touring Wales, and visits to works have been arranged for the summer months. Mr. A. H. L. Lucas, 9, Ellastone Road, Pendleton, is hon. secretary to the Association.

**JUNIOR INSTITUTION OF ENGINEERS.**—At a recent meeting, Capt. H. Riall Sankey gave the hon. member's lecture, taking for his subject the "Hot-Panel and Hot-Floor-Board System of Heating," in which the dominant feature is the use of radiant heat rather than the heating of the air.

**THE CONCRETE INSTITUTE.**—The total membership of the Institute is now 955. When the membership reaches 1,000, an entrance fee, which at present is not required, will be imposed.

**INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).**—A meeting of the Section was held on Tuesday, when a paper was read by Mr. F. C. Aldous on "Starting and Speed Control of Induction Motors." A discussion followed, and was replied to by the author.

**INSTITUTION OF ELECTRICAL ENGINEERS (YORKSHIRE SECTION).**—A lecture was given by Mr. W. A. Dexter on "Comparative Notes on Independent Steam Condensing Plants" on Wednesday last, and was followed by a discussion.

**INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS (LONDON CENTRE).**—On January 13th a paper was read on "The Electrophone Service," by Mr. J. H. Patman, A.M.I.E.E.

**The British Government and British firms.**—A correspondent in Shanghai writes protesting vigorously against the treatment accorded to British firms by the Office of Works in connection with the heating and electric lighting of the Peking Legation. In the first instance, it was stated that only British firms were to be allowed to tender for the work; but on the outbreak of the recent disturbances in China all those who had made offers were informed that the work could not be proceeded with. Shortly afterwards our correspondent returned to London, and called at the Office of Works, when the chief engineer definitely stated that fresh tenders were to be called for later on. The end of the matter was that no fresh tenders were invited, and the work was given to a German firm trading under an English name in Shanghai. Our correspondent ironically states that this will give us an idea how the British Government assists its nationals and upholds British prestige in China.

**East London Railway Electrification.**—Messrs. Johnson & Phillips inform us that they are carrying out certain cable work in connection with the above line. These cables are being laid between the existing Whitechapel sub-station on the District Railway and a new sub-station at Deptford; they are made for 11,000 volts working pressure, three-phase, and are paper-insulated, lead-covered and double-wire armoured. The wire armoring is



specially protected against corrosion by being passed through a bath of compound, and then covered with a substantial compound impregnated tape. Two cables are being laid on hangers, one on each side of the tunnel, and this work is being carried out at night, as illustrated herewith, so as not to interfere with the normal working of the trains. The cables are to be tested at 20,000 volts when laid and jointed.

**English-made Motor Spirit.**—The current issue of *The Motor* points out that while an excellent Diesel-type engine fuel and a high-grade motor spirit are now being made as commercial propositions in this country, the all-important question is whether a process can be found which will enable the production of internal-combustion engine fuel to be carried on successfully on a really large scale in this country, so rendering us independent of imported fuel. Through the instrumentality of *The Motor*, the three great motor organisations have co-operated to constitute a Committee of Inquiry into the possibilities of benzol production for motor spirit in this country. There will be three delegates from each of the organisations, and £1,000 is provided to pay a secretary and start the work of collating data. The work is to be undertaken without delay.

**Business Announcements.**—Since our "Business Notice" pages went to press, we have received the following:—The Phoenix Electric Heating Co., 17, Morwell Street, Tottenham Court Road, W.C. have acquired the goodwill, stock and plant of Messrs. Plumstead & Co., brass finishers and electrical fittings manufacturers, together with the services of Mr. F. Plumstead, whose experience extends over a period of more than 30 years. Telephone number "Gerrard 8933."

The Stearn Electric Lamp Co., Ltd., 47, Victoria Street, London, S.W., have issued some new illustrated price lists of their Lepocmium metal-filament lamps. These lamps are now made and sold under licence from the Osram Lamp Works, Ltd., the Stearn Co. having joined the ring.

The Electric and Ordnance Accessories Co., Ltd., of Aston Birmingham, advise us that their agency agreement with Messrs. Baxter & Caunter, Ltd., of 219, Tottenham Court Road, W.C., terminated on December 31st, 1912, and that as from January 1st, 1913, all business in the company's electrical manufactures in the London district will be handled at the London Office Electrical Department, at Vickers House, Broadway, Westminster, S.W., to which address all inquiries and other communications should be addressed. Mr. C. S. Thomson, M.Sc., M.I.E.E., is in charge of the Electrical Department at Vickers House, and has a staff of qualified engineers under him. His telephone number is 10110 Gerrard (10 lines).

**Fatalities.**—**WEDNESBURY.**—On Monday, Mr. G. C. Lewis, coroner, held an inquiry at the Town Hall, Wednesbury, on the body of Thomas James Brownell (38), 53, Upper Darlington Street, King's Hill, Wednesbury, who it is supposed was electrically killed on the previous Thursday at the Old Park Works of the Patent Shaft and Axle Tree Co., Ltd., Wednesbury. Harry Bates, a driller, employed at the Old Park Works, stated that deceased's occupation was that of a general oiler of the machinery. Between 6.10 and 7 p.m. on the 9th inst., deceased was oiling witness's machine, which he left for a minute, and upon hearing Brownell groan, he turned and saw him hanging on a switch with his left hand. Witness went for assistance, and when he came back he found a man named Hawkes there, who had attended to deceased. Questioned by the Factory Inspector (Mr. H. T. Thomas), witness said that the plug was covered up to a fortnight ago, and he reported the fact that the cover was missing to the night charge hand. In reply to Mr. Hosgood, solicitor, who represented the company, witness said he was told by the charge hand to tell the electrician that the cover of the plug was missing, but he failed to find him, and the matter went clean out of his mind the next day. He admitted that he should have reported it. William Charles Hawkes, night charge-man of the drilling machines, stated that he heard a commotion, and thought there had been an accident, so he immediately switched off the motive power. He saw deceased lying on his back in a belt, and as he was still breathing, witness slapped his face to try and bring him round, but without success. He was told by Bates that the cover was missing from the plug, and he thought the electrician would attend to it. He did not learn until later that Bates had failed to find the electrician. Dr. Garman said that when he was called at 7.30 p.m. the man was dead, although artificial respiration had been tried for fully an hour. He found that the man died from shock, and the absence of any marks on the hand might be accounted for by the thickness of the skin and the rapidity of death.

Wm. Boffey, Brunswick Park Road, Wednesbury, the electrical engineer, was questioned by the Factory Inspector, and said he and his assistants went round the works and examined the protection of the wires about every week. They did not have periodical examinations of small things to see if the safeguards were in working order. He admitted that the cover of this particular switch had not been maintained as required by the regulations. Answering Mr. Hosgood, witness said it was the rule for the men on the machines to report such things, and notices were posted in the works to this effect.

Replying to Mr. F. A. Platt, solicitor, who represented the widow, witness said that an inspection of all the switches had since been made.

The Coroner: You rely on broken reeds apparently. This switch has been broken a fortnight and not attended to. If the system is not efficient, it is for you to find some system that is more efficient.

A notice similar to those posted in the works was produced, and stated that if any workman experienced a shock, however slight, he should at once report the fact to his foreman or the timekeeper. Witness said that it was the duty of an employé to inform the charge hand if there was anything wrong, and he in turn should report the matter to his (witness's) department. The Coroner said that this fact was only implied in the notice; he thought it would be as well if an amended notice were put up, so as to make it more clear. The jury returned a verdict of "Accidental Death." Mr. Hosgood expressed the sympathy of the company with the widow, and promised that the Coroner's suggestion should be attended to.

**Mexican Lamp Factory.**—Mexico will shortly possess a glow lamp factory, a concession having been applied for by a Mr. Ignacio Galvan, who anticipates being able to sell his products at 50 per cent. below the price of the imported articles.—*La Revue Pratique de l'Electricité.*

**Annual Taxes on Electric Motor Vehicles.**—Hitherto electric motor vehicles, for the purpose of the annual licences of motor-cars, have been regarded as being of from 12 to 15 H.P., the annual tax being £4 4s. Under the revised rules, which came into force on the 1st inst., a concession has been made to electric vehicles, which are now regarded as being of from 6½ to 12 H.P., the annual tax being thus reduced to £3 3s.

**The B.E.A.M.A. Dinner.**—The dinner of the British Electrical and Allied Manufacturers' Association (Inc.) will take place at the Savoy Hotel, W.C. (new Banqueting Hall), on Friday next week, January 21th, at 7 o'clock for 7.30.

**Electrical Trades Union.**—On Tuesday next, January 21st, at 9 p.m., a lecture will be delivered at the North-West branch of the Electrical Trades Union, Princess of Wales Hotel, corner of Belsize Road and Abbey Road, Hampstead, on "Transformation of Alternating Current to Direct Current." There will be questions and discussion—time permitting. We are asked to say that all electrical workers are invited.

**Another New Battery?**—A local correspondent states that the Halifax Market is shortly to be supplied with a new electric storage battery by Messrs. Worsnop & Co. of Halifax. The battery is known as the "Alklum." Messrs. Worsnop have already received orders for the supply of the battery to various English and Continental railways, and a European power has given an order for one to be supplied for a submarine. The British Government are now engaged in experiments with the new battery.

**Inquiries.**—The makers of an electrical machine for manufacturing ice cream (not a refrigerating apparatus) are asked for.

**Shocks for Snakes.**—The following communication was recently received by one of our readers in Australia:—"I have had some very narrow squeaks with snakes lately, and to avoid being bitten I should like to have some device that would let me have a bit of safety, the place where I live on the Western Line being infested with various kinds of snakes.

"If you have a small battery, with a wire about 7 ft. long, so that I could fix the wire on to a long thin pointed stick or bamboo and place same on the snake, then turn the current on and so electrocute, or at least make him insensible, I think that that would be the best way to fix him up; a shot gun being too heavy to carry with you, as you are not always going shooting and you have to be a good shot with a revolver to hit him, while at the same time it is too dangerous, as he might spring on to you before the smoke cleared away; and you cannot always get a good stick to finish him if you have neither of these articles.

"If you have the battery, and think it would be strong enough while at the same time fitting into a big pocket, I would take it as a favour if you would send me a catalogue with the price at your earliest convenience. The battery would not have to be too dangerous, as the children would have to use it if it was a success."

This interesting letter throws a new light on the conditions of living in some parts of the Commonwealth. The remedy for snakes seems to savour somewhat of the salt-on-the-bird-tail idea, and one wonders what the snake would be doing while one was trying to tickle him with the electric wire; the completion of the lethal circuit also presents difficulties. But if these details can be arranged, it is possible that quite a small induction coil and battery would kill a snake, for the lower animals are very sensitive to electric shocks. Personally, we should prefer to do the shocking by deputy.

**Electrically Operated Motor-Tire Inflators.**—The Ingersoll Rand Co., Ltd., of 165, Queen Victoria Street, London, E.C., have lately brought out an electrically operated motor-tire inflator for garage or private motor-house use. The arrangement is made in two models, and has been designed with the object of enabling tires to be pumped up quickly and with a minimum of trouble. The outfit comprises a small electric motor coupled to an air compressor and mounted on a small hand truck, complete with connections, pressure gauge, switch, &c. The motor is designed to work off either direct or alternating-current circuits, at 110 or 220 volts, the connection being made to the lighting installation by a wall plug. In the larger model, instead of the motor driving the compressor direct, a short belt drive is introduced.

**Electricity and Cotton Growing.**—At a representative meeting of members of the Textile Managers' Association held in Manchester on Saturday, Mr. W. Bleakley, dealing with the question of bad spinning, contended that there ought to be no bad cotton grown or delivered. The application of electricity to the soil should be extended, and the quality of the cotton would be improved.

**University College.—Students' Dinner.**—The 18th annual dinner of Past and Present Students of the Engineering Department, University College, London, will take place on February 7th next at the Imperial Restaurant, Regent Street. Sir Alexander B. W. Kennedy, LL.D., F.R.S., Emeritus Professor of Engineering, U.C.L., has kindly consented to take the chair. Old students who have not yet received advice of this are requested to communicate with Mr. R. A. Bell, Past Students' Secretary, 166, Worple Road, Wimbledon, or with the Secretary, Engineering Society, U.C.L., Gower Street. An attempt is being made to compile a complete register of Past Engineering Students, and the secretary will be pleased to receive any information as to the whereabouts of any U.C.L. Engineering Students.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—On Saturday, January 4th, two pleasing and informal gatherings took place in honour of Mr. F. J. DELVES, who has for the past three years held the position of constructional superintendent in the Sales Department of the West Ham Corporation electric undertaking, which he has just resigned on being appointed electrical engineer to the United Malaysian Rubber Co., Ltd., Singapore. Previously to looking after the constructional work at West Ham, he was one of the assistant engineers at the generating station, Canning Town. The first of the gatherings was held at the headquarters of the Department, 84, Romford Road, Stratford, where, in the presence of large numbers of the staff employed in various departments, Mr. J. W. Beauchamp, engineer and manager, wished good luck and God-speed to Mr. Delves, and presented him on behalf of the staff with a pair of binocular field glasses, wherewith, among other purposes, he might locate the position of any distant tiger that might be moving in his direction whilst he was out supervising the laying of mains or similar work in his tropical area. The second gathering took place in the evening, when Mr. Delves was well feasted and feté by a number of his late colleagues at the Connaught Rooms, Great Queen Street, W.C., under the presidency of Mr. F. Farnon, sales manager of the West Ham Electricity Department, who proposed the health of their guest; Mr. Delves responded in brief

but feeling tones to this toast, thanking Mr. Farndon and the late engineer and manager, Mr. H. H. Couzens, for the very great assistance they had always given him in his work. Mr. Couzens proposed the toast of "The Prosperity of the West Ham Corporation Electric Supply undertaking," and said he felt sure that, although they had done big things already, there were still greater things to be achieved by them in the near future, and he emphasised the necessity, which every man placed in the enviable or unenviable position of chief engineer of an electricity undertaking felt, of having an absolutely loyal staff around him, such as he had had whilst at West Ham. Mr. Delves, sen., engineer-in-charge at the West Ham Corporation's pumping station, and father of the guest of the evening, then proposed the health of Mr. Farndon, the chairman. A short concert of an impromptu character followed. Mr. W. F. Edgerton carried out the duties of hon. sec.

The Islington Electricity Department staff held their annual dinner last Saturday evening at the Cock Hotel, Highbury, Mr. A. P. MacAlister, chief assistant electrical engineer, presiding, in the absence, through indisposition, of Mr. A. Gay. Mr. T. A. G. Margary, superintendent of the distribution department, occupied the vice-chair. Some 60 members of different departments sat down, and after dinner had been served, a very acceptable programme of music and song was rendered, members of the staff contributing. The vice-chairman, during the interval, proposed "Success to the Department," and in doing so referred with regret to the absence of Mr. Gay, and to the absence through death of two of their members, Mr. Cummings and Mr. Barley. He also mentioned that the Islington Electricity Department weathered the colliers' strike without once being short of coal, and referred to the fire which occurred at the station last September, adding that if water had not been splashed about, running would have been resumed in a few minutes instead of in an hour or two.

Mr. W. JONES has resigned, owing to ill-health, the position of superintendent of the Bradford Corporation electricity works. MR. JAMES FAIRBAIRN deputy works superintendent, has been appointed to succeed him, whilst Mr. C. R. BROWN, generating engineer, takes the position vacated by Mr. Fairbairn.

MR. LLOYD LEWIS, of Newport, has been appointed a charge engineer at the Cheltenham Electricity Works in place of Mr. SPENCER, who has received a position at Devonport.

MR. F. HURST has resigned his position as shift engineer with the Mersey Power Co., to take up the post of engineer-in-charge at the Stoke-on-Trent Electricity Works.

MR. T. C. PARSONS, M.I.E.E., who has had 22 years' central station experience, and for the last 9½ years was burgh electrical engineer of Govan, retired from that office in November, 1912, as, owing to the annexation of Govan by Glasgow, his post was abolished. For the last completed year of working the works costs were 474d., and the total costs 686d. per unit. He has had experience with D.C. and A.C., one and three-phase tramways, and a considerable amount of power work, and is at present open to accept an engagement.

The Port Elizabeth Council has granted Mr. H. J. HOLDER, its electrical engineer, leave of absence for four months from March 1st, in order that he may visit England, Germany, and perhaps the U.S., to enable him to inquire at first hand into the economy, behaviour, cost of maintenance, &c., of plant such as will be found the most suitable to recommend for the town.

MR. K. K. BENSON, who has been mains superintendent in the Swansea Corporation Electricity Department for about 9½ years, has resigned his position for the purpose of starting as an electrical engineer on his own account, and at the last meeting of the Electric Lighting and Tramways Committee, Col. A. Sinclair, the chairman, said they could only accept the resignation with regret. Mr. Benson had held a very responsible position, and he had given the Committee and Mr. Prussmann, the borough electrical engineer, complete satisfaction. They could not speak too highly of him. It was resolved to put on record the Committee's great appreciation of the excellent services rendered by Mr. Benson, their regret at losing him, and their wishes for success and prosperity in his new undertaking. A slight rearrangement of the staff was also agreed to, and it was further decided to advertise for a new mains superintendent.

MR. J. P. BOWEN, of the Llandrindod Wells Electric Light and Power Co., Ltd., has resigned his position of resident engineer, and Mr. T. WILLIAMS, who has been Mr. Bowen's chief assistant for several years, is the present engineer.

MR. J. W. MCINNES, manager of the light railways at Colwyn Bay, has resigned, and will be succeeded by Mr. A. G. BALFOUR.

The salary of MR. V. J. ALLAN, engineer-in-charge, Corporation electricity works, Southampton, has been increased by £13 per annum.

**General.**—We understand that MR. R. BORLASE MATTHEWS, Wh. Ex., M.I.E.E., Assoc. M. Inst. C.E., has resigned his position with the General Electric Co., Ltd., to accept a directorship with his father's old-established firm of Létricheux & David, Ltd., Swansea and Cardiff, together with a seat on the boards of several allied shipping companies.

MR. A. J. ROBINSON, of the outside contract department of Messrs. Christy Bros. & Co., Ltd., of Chelmsford, who was recently married, has been presented by his colleagues with a case of cutlery.

According to the *Australian Mining Standard*, MR. J. T. FAHY, chief electrician of the New Zealand railways, recently arrived in Sydney on a tour of inspection of the railway systems of the Commonwealth.

**Obituary.**—MR. R. T. PRESTON.—The death has occurred, at his residence, Hayes Court, Kent, of Mr. Reuben Thomas Preston, senior director of the firm of J. Stone & Co., Ltd.,

electrical and general engineers, of Deptford, S.E. The deceased gentleman, who had been ill for over 18 months, was 66 years of age, and had been associated with the firm for upwards of 40 years.

MR. JAMES PATTERSON, secretary of the Newcastle and District Electric Lighting Co., died at his residence at Newcastle-on-Tyne on the 12th inst. The deceased gentleman, who was 52 years of age, was a native of the city, and commenced his business career in the offices of Messrs. J. P. Scott, colliery owners at Newcastle. Subsequently he went to Messrs. Clarke, Chapman & Gurney, electrical engineers, Gateshead, where he held a responsible position in the commercial department for about six years. When the Newcastle and District Electric Lighting Co. was formed in 1889, he was appointed secretary.

## NEW COMPANIES REGISTERED.

**Credenda Conduits Co., Ltd. (126,340).**—Registered January 6th, by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C. Capital, £50,000 in £1 shares. Objects: To take over the business of manufacturers of and dealers in conduit tubes and fittings and other electric lighting and power apparatus carried on in Birmingham, as a branch of the business of Tubes, Ltd., as the "Credenda Conduits Co." Tubes, Ltd., guarantee 8 per cent. profit on the paid-up capital (not exceeding £20,000) until April, 1916, and so long as they discharge this obligation they may have two of their directors or managers on the board. The signatories are:—J. Chamberlain, Beechcroft, Edgbaston, director, Tubes, Ltd., 1 share; J. H. Aston, Drayton House, Erdington, director, Tubes, Ltd., 1 share; E. A. Edwards, Penns Lane, Erdington, manager, Credenda Conduit Co., 100 shares; J. W. Barratt, Central House, 75, New Street, Birmingham, chartered accountant, 1 share; C. E. Cope, 2, Florence Road, Chester Road, Erdington, secretary, Tubes, Ltd., 1 share; C. H. Bankers, 8, Cregoe Street, Birmingham, clerk, 1 share; A. E. Kirk, 29, Redditch Road, King's Norton, Birmingham, manager, 1 share. Minimum cash subscription 7 shares: the first directors (to number not less than two or more than five) are J. Chamberlain, J. H. Aston and E. A. Edwards (managing director); the two first named are nominees of Tubes, Ltd.: the qualification, 500 shares, provided (a) that so long as Tubes, Ltd., hold 10,000 shares, any director or manager of that company may, until the ordinary general meeting in 1916, be appointed as a director of this company without qualification, and (b) that the qualification of a managing director shall be 100 shares only.

**H. L. Morton & Partner, Ltd. (126,437).**—This company was registered on January 10th, with a capital of £1,000 in £1 shares, to take over the business of repoussé art metal, electric and other sign designers and workers, art craftsmen, colour schemists, poster and showcard designers, &c., carried on at the Empire Sign Works, 23, Union Street, Sheffield. The subscribers (with one share each) are:—H. L. Morton, 18, Clarke Street, Sheffield, manager; J. B. Taylor, 19, Gainsborough Road, Sheffield, manager; H. Ramsden, 18, Clarke Street, Sheffield, manager; J. H. Freereborough, 25, Figtree Lane, Sheffield, incorporated accountant. Private company. The number of directors is not to be less than two or more than five; the first are to be appointed by the company or by subscribers; qualification, £30; remuneration as fixed by the company. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

**Compania Constructora del Pacifico, Ltd. (126,415).**—This company was registered on January 9th, with a capital of £25,000 in £1 shares, to carry on the business of a construction company in Ecuador or elsewhere, in relation to railways, tramways, docks, harbours, piers, wharves, canals, irrigation, sewage, water, gas, electric light, telegraphs, telephones and other works or conveniences of public utility or otherwise. The subscribers (with one share each) are:—J. Davis, 123, Pall Mall, S.W., contractor; G. Lorette, 1-2, Great Winchester Street, E.C., company director; L. Chabot, 6, bis de Chateaudun, Paris, financial agent; W. Warren, 4, Lloyd's Avenue, E.C., consulting, mining and metallurgical engineer; R. E. Moore, 5, St. Margaret's Road, Tottenham, N., clerk; A. Babin, 28, St. Dunstan's House, Stoney, E., clerk; H. E. King, 13, St. John's Road, Richmond, S.W., gentleman. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than 10; the first are G. Lorette, L. Chabot and W. Warren; qualification, one share; remuneration of chairman, £100 per annum; of others, £20 each per annum. Registered office, 6, Lichbury, E.C.

**B. & C. Foil Syndicate, Ltd. (126,383).**—This company was registered on January 8th, with a capital of £100 in 1s. shares, to acquire (1) a sub-agent of the benefit of certain secret processes for the United Kingdom and the British Dominions (except Canada); (2) sub-licence under Patent No. 2,446, of 1906, for the manufacture of aluminium foil or sheet; and (3) sub-licence to use rolling mills in accordance with the British Patent No. 18,821, of 1909, for the purpose of rolling aluminium foil or sheet. The subscribers (with one share each) are:—R. Petherbridge, Crooms Hill House, S.E., secretary of a public company; J. M. Banks, 75, Edith Road, West Kensington, W., secretary. Private company. The number of directors is not to be less than two or more than ten; the subscribers are to appoint the first. Registered by Warren & Warren, 4, Broad Street Place, E.C.

**J. W. Smith, Ltd. (126,438).**—This company was registered on January 10th, with a capital of £1,000 in £1 shares, to carry on the business of electricians, plumbers, gas engineers, manufacturers and workers of and dealers in electric, motive power and light, &c. The subscribers (with one share each) are:—W. Langley, 7, St. Ann's Hill Road, Nottingham, retired civil servant; J. S. Smith, 534, Mansfield Road, Sherwood, Nottingham, tobacconist. Private company. The number of directors is not to be more than three; the first are W. Langley and J. S. Smith (both permanent, subject to holding £50 shares each). Solicitors, Beck & Beck, 2, King's Walk, Nottingham. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C.

**Oswald Stott, Ltd. (126,348).**—This company was registered on January 6th with a capital of £2,000 in £1 shares (1,000 preference), to carry on the business of designers, manufacturers and vendors of fans and ventilating appliances, electrical and general engineers, &c. The subscribers are:—O. Stott, 79, Grantham Road, Sparkbrook, Birmingham, engineer, one ordinary share; E. R. Jones, Hanbury House, Stourbridge, engineer, one ordinary share; J. H. Jones, Hanbury House, Stourbridge, engineer, one ordinary share. Private company. The first directors are O. Stott and E. R. Jones, each of whom may retain office while holding one share; qualification of other directors £25; remuneration as fixed by the company. Registered by Waterlow Bros. & Layton, Ltd., Birchin Lane, E.C. Solicitors, Harwards and Evans, Stourbridge.

**C. Goodman & Co., Ltd. (126,397).**—This company was registered on January 8th with a capital of £2,400 in £1 shares, to carry on the business of tool makers, mechanical and electrical engineers, manufacturers of machinery, tool makers, metal workers, &c., and to adopt an agreement with C. W. Bailey and A. Weir. The subscribers (with one share each) are:—A. Weir, 110, Wansley Park Avenue, Manor Park, E.C., electrical engineer; A. Weir, 110, Wansley Park Avenue, Manor Park, E.C., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are C. W. Bailey and A. Weir. Registered by A. W. Osmond, 6, South Square, Gray's Inn, W.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Willans & Robinson, Ltd.

**Asuncion Tramway, Light and Power Co., Ltd.** (126,196).—Particulars of £300,000 first mortgage debenture stock, created January 3rd, 1912, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including unincorporated and immovable property (tramways system, and buildings). Trustees: Union of London and Smith's Bank, Ltd.

**British Columbia Electric Railway Co., Ltd.** (51,953).—Issue on December 31st, 1912, of £750,000 4 per cent. perpetual consolidated debenture stock, part of a series of which particulars have already been filed.

**James Keith & Blackman Co., Ltd.**—Issue on January 6th, 1913, of £1,700 debentures, part of a series of which particulars have already been filed.

**Hunt & Moscrop, Ltd.**—Particulars of £4,000 debentures, created December 30th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £900. Property charged: The company's undertaking and property, present and future, including unincorporated capital. No trustees.

**X.I. Electric Co., Ltd.**—Debenture dated January 6th, 1913, secure £1,000, charged on the company's undertaking and present property, including unincorporated capital (subject to prior charges). Holder: Capt. C. Wicnor, well Castle, Ewell, Surrey.

**Brecknell, Munro & Rogers, Ltd.**—Third mortgage debenture, dated December 5th, 1912, to secure £500, charged on the general assets. Holders: Mrs. F. Rogers, A. E. Rogers and Dr. K. Rogers.

**South Staffordshire Tramways (Lessee) Co., Ltd.**—Particulars of £100,000 debentures, created by resolutions, August 3rd, 1904, and December 11th, 1912, and secured by trust deeds dated November 1st, 1904, and December 11th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £45,300. Property charged: Company's leasehold interest in the South Staffordshire tramways: certain rights, powers and privileges with respect to the working of the said tramways: interest in an indenture dated April 25th, 1900; certain and, buildings, fixed plant and machinery at Wednesbury, Walsall and Dudley; preference shares and ordinary stock in South Staffordshire Tramways Co., and company's undertaking and general assets, present and future. Trustees: Law Guarantee Trust and Accident Society, Ltd. (in liquidation), 4, Chancery Lane, W.C.

**Venezuela Telephone and Electrical Appliances Co., Ltd.** (11,305).—Capital, £85,000 in 70,000 ord. shares of £1 each and 1,500 pref. shares of £10 each. Return dated December 6th, 1912; 70,000 ord. and 860 pref. shares taken up; £1 per share called up on 13,494 ord. and 1 £10 per share on 860 pref.; £22,094 paid; £56,506 considered as paid on 56,506 ord. Mortgages and charges: £120,000.

**United Electric Car Co., Ltd.** (57,082).—Capital, £300,000 in 50,000 ord. and 150,000 6 per cent. pref. shares of £1 each. Return dated October 2nd, 1912 (filed December 18th); 150,000 ord. and 100,000 pref. shares taken up; £250,000 paid. Mortgages and charges: £15,657.

**Bullers, Ltd.** (62,020).—Capital £40,000 in 20,000 ord. and 2,000 pref. shares of £10 each. Return dated December 25th, 1912; 16,000 ord. and 15,000 ord. shares taken up; £10 per share called up on ord. and 5,000 pref.; £150,070 paid; £149,930 considered as paid on 14,993 ord. Mortgages and charges: Nil.

**Carlton Engineering Co., Ltd.** (111,781).—Capital £6,000 in 60,000 shares. Return dated December 9th, 1912; 5,153 shares taken up; £2,153 paid; £3,000 considered as paid. Mortgages and charges: Nil.

## CITY NOTES.

**Direct United States Cable Co., Ltd.**—An interim dividend of 2s. per share, less income-tax, being at the rate of 4 per cent. per annum for the quarter ending December 31st, 1912, is payable on and after 31st inst.

**Stock Exchange Notice.**—Application has been made to the Committee to appoint a special settling day in—

Cesara Tramway, Light and Power Co., Ltd.—85,007 ordinary shares of £1 each fully paid, Nos. 200,001 to 285,007; and scrip fully paid for £125,000 5 per cent. first debenture stock.

**Central London Railway Co.**—It is officially announced that the holders of over 75 per cent. in the aggregate of the ordinary, preferred ordinary, and deferred ordinary stock of the Central London Railway Co. have agreed to transfer their holdings pursuant to the proposals recently made by the Underground Electric Railways Co. of London, and the scheme has therefore become operative.—*The Times*.

**"Harper" Electric Piano Co., Ltd.**—The directors have declared an interim dividend at the rate of 4 per cent. per annum on the participating ordinary shares for the half-year ended December 1st.

**Suffolk Electricity Supply Co.**—At a meeting of shareholders held at Ipswich last Friday, a resolution was passed granting to Dr. C. H. Liebbrand an option to purchase the undertaking on certain terms.

**Kaministiquia Power Co.**—The directors have declared a dividend at the rate of 5 per cent. per annum for the quarter ending January 31st.

We are informed that the ordinary general meeting of this company was held at Cannon Street Hotel, E.C., on 9th inst. We understand that the meeting was treated as a private one, but the report and accounts for the year ending June last were adopted. The directors report indicated that towards the close of 1911 necessity arose for exercising the borrowing powers given in 1910, to meet heavy payments incurred over the Queen's Ferry lawsuit, and to finance the increasing volume of work. The loss shown on the year's trading to June last continues to reflect the low level of prices in the electrical industry and insolvency of work. Larger contracts under better conditions, and at somewhat better prices, have been secured during the year, and the company's shops are now well supplied with work. More working capital is, however, required. The Queen's Ferry Works are under the consideration of one or two parties, but the figure at which they stand in the balance-sheet is unlikely to be realised. In view of negotiations which vitally concerned the company's future, it was found advisable to dispense with the customary half-yearly meeting in April. These negotiations have now been concluded. The proposals are as follows:—The 4 per cent. and 5 per cent. mortgage debentures to remain at the present total of £248,828. Issue of £30,000 new preference stock 6 per cent. cumulative (Class A), with option to subscribers to take up one ls. ordinary share with each £5 allotted (this new stock to be offered, in the first instance, to the existing shareholders). Issue of Class B preference stock 4 per cent. cumulative to be allotted to existing shareholders in exchange for present shares as follows:—Preference shares, £2 stock for every share of £5 nominal value; ordinary shares, 2s. 6d. stock for every share of £1 nominal value. This means the writing down of £333,330 preference shares and £66,666 ordinary shares, making a total of £399,996, to a total of £141,665. There will be an issue of 30,000 new ordinary ls. shares, 6,000 of which are to be reserved for subscribers of Class A and 24,000 will be subscribed by incoming parties, whom it is proposed shall be associated with the company. The revised capital will, therefore, be £421,993, as against the present capital of £618,824. At a subsequent extraordinary general meeting, resolutions were passed agreeing to the proposed rearrangement of share capital.

## STOCKS AND SHARES.

Tuesday Evening.

THE great event in the Stock Exchange this week has been the announcement of the award of the Railway and Canal Commissioners in the case of the National Telephone Company. The declaration that the Company would receive £12,515,264 took the market by surprise, and was followed by a slant in the price of the stock such as the Stock Exchange has not seen for years past. The price fell from 140 to 106 in a day, with hardly a check in between, and the market was the scene of wild excitement.

As the price gave way, so more and more stock was forced out, until it became evident that at least part of the selling was on account of holders who had pledged stock with their bankers and saw themselves faced with the necessity for paying out large extra sums in the way of cover this week. The prophets who not long ago were talking airily of 180 as the probable price that would be paid by the Government for the Deferred stock, have now revised their estimates, and talk as pessimistically as before they had been hopeful. It is more than probable that, before Friday, when this paper appears, more definite information will be available as to the amount which the Deferred stockholders are likely to receive; but, writing on Tuesday, the utmost confusion and perplexity exist. Cautious calculation puts the ultimate figure between 105 and 115. Nominally, the stock on the week shows a fall of 33½ points, but on the morning of the announcement one buyer gave 140 for it, and it was not long ago, of course, that the price was run up above 160. The perplexity and confusion are underlined with considerable indignation, while rumour was busy with further estimates as to how many members of the Stock Exchange would be hammered on the pay-day—that is, Thursday—as the direct outcome of this slump.

Other markets are distinguished by no special features. The political situation abroad has been worsened by the break up of the Peace Conference and the departure of the delegates, though it is felt that all the loopholes are not yet closed to peace, and that even at the eleventh hour some way can be found out of the deadlock, whereby the Allies could be satisfied and Turkey could feel that she was not giving away too much.

The Home Railway market felt the influence of the political clouds as much as any of the other departments, and speculators sold stock in disgust at the turn which events had taken. Districts and Metropolitans both fell back, though neither stock lost all the substantial rise gathered during the previous week. City and South London rose a point, and Central London Ordinary at 84 hardened into line with the quotations for the company's Preferred and Deferred stocks upon the confirmation of the stockholders' agreement to the terms of purchase made by the Underground Electric group. Later, however, the rise was lost, and the Deferred went back to 83 at the same time.

Underground Electric shares continue in demand. The price at one time rose to 5, easing off later to 4½, at which it shows a rise of ½ on the week; while the 6 per cent. Income bonds, after dipping

to 94½, rose to 95½, thus marking an improvement of a point. British Electric Traction gave way slightly, and Yorkshire West Riding Preference shares are ¼ down, there being few quotable changes beyond this. Business has sprung up in the £10 shares of the London Electric Railways Company, and a fair number changed hands on the basis of £3. The shares are still a long way from the dividend point, but the buyers contend that there is plenty of scope for improvement, and those who are content to wait for some period have been picking up shares to put away.

In the lighting market, Monday's severe fog in the City cheered up some of the principal prices. Chelseas, Charing Cross Preference, and Westminster Ordinary and Preference rose ¼ to ½. City of London Second Debenture gained ½, the Company's Ordinary shares remaining about 17. The market as a whole, however, is described as somewhat heavy, and there is not much trade doing in the shares. One large holder of Electric Lighting issues announced that nothing short of a week's fog would make him really happy, but he was careful not to mention this except to those whom he knew to be interested in the same market as himself. The National Telephone award has given rise to some heart-searching in the electricity supply department, though it had no effect upon quotations.

The market for Latin-Canadian securities was a little upset by the general depression caused by foreign politics. Brazilian Traction shares, in which there is a lot of business doing, fell from 100 to 97½, regaining a point of the fall afterwards, so that on balance they have only shed ½ out of the 4½ points gained last week. Georgia Light and Power jumped to 51, and came back to 48½. Mexican Light and Power and Mexico Trams are both easier, disquieting reports reaching this side as to warnings having been issued by some of the mining companies in Mexico that it would be safer for women and children to be removed into less troublous districts. Monterey Debenture, however, at 90 is a point to the good. Montreal Common stock retains its rise of 10, and Shawinigan, after their big jump, are no more than a point off.

Buyers have come along for several of the Debenture stocks in this section. Cordoba Light and Power Debenture, Cochabamba bonds, Ontario bonds, and Toronto Debentures are all higher. Canadian General Electrics show rises in the Ordinary and Preference. On the other hand, Madras Ordinary fell ½. Melbourne Debenture is another of those in request, and the price has risen to 102½, while the Electric supply of Victoria Debentures are 2 up. The Anglo-Argentine Tramways group improved. United Electric Trams of Monte Video and Para Electric Ordinary are both higher, and the only change in the British Columbia sextet is a rise of ½ in the Preferred stock. Inquiries are being made for Pacific shares, several influential firms having taken substantial lines of the bonds for account of trust companies and other clients; and it may be surmised that before long a market will be started in the Common stock of the company.

Marconi shares have been flat. It was reported that a failure had occurred in Dublin, which would mean the liquidation of a large line of Marconis, but to this ostensible cause of the depression not much importance was attached. What is more troubling the market and Marconi shareholders is the evidence given before the Commission, from which it would appear that there is at least the possibility of a second commission being formed to deal with the question of the agreement between the Government and the Company. If the agreement with the Government should be upset, probably Marconis would fall still further, and it has to be remembered that there are yet many people left who paid fanciful prices for their Marconis when the boom was proceeding so merrily.

Indo-Europeans are ½ higher, and Reuters rose ¼. Cuba Telegraphs are 10s. easier. Investment demand is responsible for further improvement in the price of Anglo-American Telegraph Preferred, and there has been another small rise in American Telephone and Telegraph Capital stock. The Eastern group is steady, and no changes of consequence have occurred in the Trust Companies issues.

Of the Manufacturing shares, Callender's Ordinary and Preference and Henley's Ordinary are better, while Castner-Kellners hardened to 3½. Armament shares are advancing by reason of the 50 millions sterling budgeted for naval requirements this year. The Rubber share market gave way on a little scattered selling before the settlement, though the price of the raw material keeps very steady, and some of the firms interested in this department have to deal this week with one of the heaviest settlements since the boom of three years ago. The amount of the raw material offered at the Mincing Lane auctions this week was 1,130 tons, the largest on record for these fortnightly sales.

**Dublin United Tramways Co., Ltd.**—The directors have declared a dividend for the half-year ended December 31st at the rate of 6 per cent. per annum, less income-tax, on both the preference and ordinary shares, after setting aside £10,000 towards renewal of rails, £2,000 to accident insurance reserve, £5,000 to reserve and renewals fund. £11,257 is carried forward.

**Continental.**—FRANCE.—The report of the Société Industrielle des Téléphones. of Paris, for the last financial year shows a net profit of £64,194, as compared with £61,375 in the preceding 12 months.

RUSSIA.—La Société de l'Usine Electrolitique de Moscou is the name of a new company which has just been formed with a capital of 1,200,000 roubles to establish works near Moscow for the electrolytical production of copper and other metals.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, January 15th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
■ Acid, Hydrochloric .. .. per cwt.	8/-	..
■ " Nitric .. .. .. per lb.	29½	..
■ " Oxalic .. .. .. per lb.	23d.	..
■ " Sulphuric .. .. .. per cwt.	5/6	..
■ Ammoniac Sal .. .. ..	42/-	..
■ Ammonia, Muriate (large crystal) per ton	£29 10	..
■ Bleaching powder .. .. ..	£5 10	..
■ Bisulphide of Carbon .. .. ..	£13	..
■ Borax .. .. ..	£16 10	..
■ Copper Sulphate .. .. ..	£25 10	..
■ Lead, Nitrate .. .. ..	£29 10	..
■ " White Sugar .. .. ..	£27 10	£2 inc.
■ " Peroxide .. .. ..	£33	..
■ Methylated Spirit .. .. .. per gal.	2/6	..
■ Potassium, Bichromate, in casks .. per lb.	8½d.	..
■ Potash, Caustic (88/90 %) .. per ton	£22 10	..
■ " Chlorate .. .. .. per lb.	8½d.	..
■ " Perchlorate .. .. ..	4½d.	..
■ Potassium, Cyanide (98/100 %) ..	7½d.	..
(for mining purposes only)		
■ Shellac .. .. .. per cwt.	72/6	..
■ Sulphate of Magnesia .. .. .. per ton	£4 10	..
■ Sulphur, Sublimed Flowers .. ..	£6 10	..
■ " Recovered .. .. ..	£6 10	..
■ " Lamp .. .. ..	£5	..
■ Soda, Caustic (white 70/75 %) ..	£10 5	..
■ " Chlorate .. .. .. per lb.	8½d.	..
■ " Crystals .. .. .. per ton	£8 5	..
■ Sodium Bichromate, casks .. per lb.	8d.	..
METALS, &c.		
■ Aluminium Ingots, in ton lots .. per ton	£95	..
■ " Wire, in ton lots .. ..	£112	..
■ " Sheet, in ton lots .. ..	£120	..
■ Babbitt's metal ingots .. ..	£38 to £145	..
■ Brass (rolled metal 27 to 12" basis) .. per lb.	9½d.	½d. inc.
■ " Tube (brazed) .. .. ..	10½d.	½d. dec.
■ " " (solid drawn) .. .. ..	8½d.	½d. dec.
■ " Wire, basis .. .. ..	8½d.	½d. dec.
■ Copper Tubes (brazed) .. .. ..	1/0½d.	..
■ " " (solid drawn) .. .. ..	11½d.	..
■ Bars (best selected) .. .. .. per ton	£52	..
■ Sheet .. .. ..	£22	..
■ Rod .. .. ..	£22	..
■ " (Electrolytic) Bars .. .. ..	£20	£2 dec.
■ " Sheets .. .. ..	£27	£2 dec.
■ " Rods .. .. ..	£25	£2 dec.
■ " H.C. Wire .. .. ..	10½d.	½d. dec.
■ Ebonite Rod .. .. ..	5/8	..
■ Sheet .. .. ..	4/9	..
■ German Silver Wire .. .. ..	1/10	..
■ Gutta-percha, fine .. .. ..	7/- to 8/-	..
■ India-rubber, Para fine .. .. ..	4/6	..
■ Iron Pig (Cleveland warrants) .. per ton	66/0½	¾d. dec.
■ Wire, galv. No. 8, P.O. qual. ..	£14	1/4d. inc.
■ Lead, English Pig .. .. ..	£18 6 to £18 10	..
■ Manganin Wire No. 28 .. .. .. per lb.	6/6	..
■ Mercury .. .. .. per bot.	£7 8 6	..
■ Mica (in original cases) small .. per lb.	6d. to 8s.	..
■ " " " medium .. .. ..	8/6 to 9/-	..
■ " " " large .. .. ..	7/6 to 11/-	..
■ Phosphor Bronze, Plain castings ..	1/2 to 1/4	..
■ " " rolled bars & rods .. ..	1/2	..
■ " " rolled strip & sheet .. ..	1/2½	..
■ Platinum .. .. .. per oz.	185/-	..
■ Silicon Bronze Wire .. .. .. per lb.	11½d.	..
■ Steel, Magnet, in bars .. .. .. per ton	£55	..
■ Tin, Block (English) .. .. ..	£231 10 to £232 10	..
■ Wire, Nos. 1 to 18 .. .. .. per lb.	2/9	..
■ White Anti-friction Metals .. per ton	£45 to £230	..
■ Zinc, 8½" (Vielles Montagne bnd.)	£81 12 8	..

Quotations supplied by—

- a G. Door & Co.
- b The British Aluminium Co., Ltd.
- c Thos. Bolton & Sons, Ltd.
- d Frederick Smith & Co.
- e E. Wiggins & Sons.
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- h Edward Tull & Co.
- i Bolling & Lowe.
- k Morris Ashby, Ltd.
- l Richard Johnson & Nephew, Ltd.
- m W. T. Glover & Co., Ltd.
- n P. Ormiston & Sons
- o Johnson, Matthey & Co., Ltd
- p W. F. Dennis & Co.

**Anglo-American Telegraph Co., Ltd.**—The directors have resolved to pay the following dividends to the close of the year 1912, viz.: A balance dividend of £1 10s. per cent. upon the ordinary consolidated stock for the year; a balance dividend of £1 10s. per cent. upon the preferred stock for the year; a first and final dividend of £1 10s. per cent. upon the deferred stock for the year—all payable on February 1st next, less income-tax. The above dividends, together with those already paid, will amount to £3 15s. per cent. on the ordinary consolidated stock, 6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock.

**Japan.**—The Yokohama Electric Railway Co., which has just declared a dividend at the rate of 8 per cent. per annum for the last half-year, is increasing its capital from £300,000 to £600,000.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME	Stock or Share.	Dividends for	Closing Quotations Jan. 14th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 14th.	Rise + or Fall	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	1011. 56	94-104	..	2 s. d. 6 3/4	Kensington & Knightsbridge, Ord	5	9 81	74- 84	..	2 s. d. 5 10 9
Do. 4 1/2 % Pref. ..	10	44 44	81- 93	..	4 12 4	Do. 4 % Deb. ..	Stock	4 4	92- 95	..	4 4 8
Do. Second 8 % Pref. ..	10	6 6	10- 10 1/2	..	5 14 8	Ken Elec. Power, 4 1/2 % Deb. ..	Stock	4 4	79- 82	..	5 9 9
Do. 4 1/2 % Deb. Stock. ..	Stock	44 44	89- 98 xd	..	4 11 10	London Electric, Ord. ..	8	24	14- 2	..	3 15 5
Brompton & Kensington, Ord. ..	6	10 91	81- 91	..	5 8 1	Do. 6 % Pref. ..	5	6 6	43- 54	..	5 14
Do. 7 % Cum. Pref. ..	6	7 7	84- 94	..	3 17 9	Do. 4 % First Mort. Deb. ..	Stock	4 4	84- 91	..	4 8 0
Central Electric Supply, 4 %	100	4 4	95- 98	..	4 1 8	Metropolitan ..	5	4 41	84- 84	..	5 8 3
Charing Cross, West End & City	5	5 51	48- 54	..	4 17 7	Do. 4 1/2 % Cum. Pref. ..	5	4 44	100- 100 xd	..	5 1 6
Do. 4 1/2 % Cum. Pref. ..	5	4 43	48- 54	..	4 10 0	Do. 4 1/2 % First Mort. Deb. ..	Stock	4 4	87- 110 xd	..	4 10 0
Do. City Undertaking 1 1/2	5	4 44	82- 48 xd	..	5 2 10	Do. 5 1/2 % Mort. Deb. ..	Stock	5 5	81- 86 xd	..	4 1 5
Do. 4 1/2 % Cum. Pref. ..	5	4 44	82- 48 xd	..	5 2 10	Midland Electric Corporation	100	4 43	47- 03 xd	..	4 10 11
Do. 4 % Deb. ..	100	4 4	92- 94	..	4 5 1	4 1/2 % First Mort. Deb. }					
Chelsea, Ord. ..	5	5 41	42- 54	..	4 17 7	Newcastle-on-Tyne 5 % Pref.,	5	5 5	47- 44	..	5 2 7
Do. 4 1/2 % Deb. ..	Stock	5 44	96- 98 xd	..	4 10 11	Non-Cum. ..	5	5 5	104- 102 1/2	+ 1	4 17 7
Do. 7 % Pref. ..	10	8 6	12- 13 1/2	..	4 9 0	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	6 5	99 1/2- 102 1/2	+ 1	4 17 7
Do. 8 % Cum. Pref. ..	10	8 6	12- 13 1/2	..	4 9 0	Notting Hill, 6 % Non-Cum. Pref. }					
Do. 5 % Deb. ..	Stock	6 5	116- 120	..	4 8 4	Oxford ..	5	7 1/2	64- 68	..	5 9 6
Do. 4 1/2 % Second Deb. ..	100	4 44	100- 102	..	4 8 8	St. James' and Pall Mall, Ord.	5	10 101	94- 101	..	4 17 7
County of London, Ord. ..	10	6 44	114- 12	..	5 0 0	Do. 7 % Pref. ..	6	7 7	64- 74	..	4 18 7
Do. 6 % Pref. ..	10	6 44	114- 12	..	5 0 0	Do. 8 1/2 % Deb. ..	100	6 3	81- 87 1/2	..	4 9 6
Do. 4 1/2 % Deb. ..	Stock	4 44	104- 103 xd	..	4 4 11	Smithfield Markets, Ord. ..	5	2	14- 14	..	5 10 3
Do. 4 1/2 % Second Deb. ..	Stock	4 44	98- 101	..	4 8 8	South London, Ord. ..	4	6	24- 24	..	5 18 4
Edmundson's, Ord. ..	£3	Nil	..	..	Nil	Do. 5 % First Mort. Deb. ..	100	6 5	97- 100 xd	+ 1	5 0 0
Do. 6 % Cum. Pref. ..	5	Nil	..	..	..	South Metropolitan, 7 % Pref. ..	1	7 7	1 1/2- 1 1/2	..	5 9 5
Do. 8 % Non-Cum. Pref. ..	5	..	..	..	..	Do. 4 1/2 % First Deb. Stock ..	100	4 4	96- 99	..	4 11 3
Do. 7 % Pref. ..	10	4 44	84- 87	..	5 8 6	Urban, Ord. ..	23	Nil	..	..	..
Folkestone ..	5	5 5	92- 94	..	5 17 1	Do. 5 % Cum. Pref. ..	5	2	24- 24	..	..
Do. 5 % Cum. Pref. ..	5	5 5	42- 54	..	4 17 7	Do. 4 1/2 % First Mort. Deb. ..	100	4 4	85- 88	..	5 2 3
Do. 4 1/2 % First Deb. ..	100	4 44	92- 95	..	4 14 9	Westminster, Ord. ..	5	10 91	84- 9	+ 1	5 6 8
Hove ..	5	9 81	74- 8	..	5 12 6	Do. 4 1/2 % Cum. Pref. ..	5	4 4	44- 54 xd	+ 1	5 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ..	5	6 8	54- 52	..	5 6 8	Monterey Rly. Light & Power, }	100	5 5	83- 91	+ 1	5 10 0
Calcutta, Ord. ..	5	5 5 1/2	63- 7 1/2	..	5 19 4	Do. 5 % 1st Mort. Deb. }					
Do. 5 % Pref. ..	5	5 5	43- 5 1/2	..	4 16 5	Montreal, Lt., H. and Power ..	£100	8 9 1/2	237- 242	..	3 14 5
Canary Power, 1st Mort. Bds. ..	100	6 6	92- 94 xd	- 3	5 6 6	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds }					
Canadian Gen. El. Com. ..	\$100	7 7	116- 120 xd	+ 1	5 16 8	River Plate, Ord. ..	Stock	10	217- 227	..	4 8
Do. 7 % Pref. ..	\$100	7 7	120- 124	+ 2	5 13 0	Do. 6 % Non-Cum. Pref. ..	Do.	6	106- 111	..	5 6 8
Cordoba Lt., Power and T., Ord.	1	8 5	123- 13	..	5 6 8	Do. 5 % Deb. Stock ..	Do.	5	100- 102 xd	..	4 18 0
Do. 5 % Deb. ..	100	5 5	96- 99	+ 1	5 1 9	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb. }					
Elec. Lt. and P. of Cochin-China	100	6 6	93- 95	+ 1	6 6 4	Shawinigan Water, Capital ..	£100	5 5	148- 152	- 1	3 5 9
Elec. Supply Victoria, 5 % 1st Mort. Deb. ..	100	5 5	90- 93	+ 2	5 7 6	Do. 5 % Con. 1st Mort. Bonds	Stock	5	165 1/2- 167 1/2	+ 1/2	4 13 0
Eleo. Dev. Ontario, 5 % 1st Mort. Bonds ..	\$500	5 5	95 1/2- 97 1/2	+ 1/2	5 2 7	Do. 4 1/2 % Per. Deb. ..	Stock	4 4	106 1/2- 102 1/2	+ 1/2	4 7 10
Kelsoville Elec. P. and Lt., Ord.	10/	Nil	..	..	Nil	Toronto Power, 4 1/2 % Deb. ..	Do.	4 4	98 1/2- 100 1/2	+ 1/2	4 9 7
Do. 6 % Pref. ..	1	6 6	112- 11 1/2	..	8 14 6	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. }					
Kaministiquia Power, 5 % G. Ba. Madras, Ord. ..	\$500	6 6	162- 104 xd	..	4 16 2	Victoria Falls Power, Pref. ..	1	14 1/2	172 1/2	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5 5	101- 104 xd	+ 1	4 16 2	West Kootenay Power and Lt., 1st Mort. 6 % Gold }					
Mexican El. Lt., 5 % 1st M. Bds.	100	5 5	85- 87 xd	..	5 15 0		100	6 6	103 1/2- 106 1/2	..	5 13 9
Mexican Lt. & Power, Common	\$100	4 4	84- 87	..	4 12 6						
Do. 7 % Cum. Pref. ..	\$100	4 4	106- 110	..	5 13 8						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	96 1/2- 98 1/2	+ 1/2	5 1 6						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	4 4 1/2	7- 7 1/2	..	6 0 0	Monte Video Telephone, Ord. ..	1	6 6 1/2	48- 1 1/2	..	5 13 0	
Do. 5 % Deb. Red. ..	Stock	6 6	96- 98 xd	..	5 2 0	Do. 5 % Pref. ..	1	5 5	..	..	5 15 6	
American Telep. & Teleg., Cap.	\$100	8 8 1/2	142- 144 xd	+ 1/2	5 11 1	National Telephone Def. ..	Stock	8 8	103- 105 1/2	- 3 1/2	..	
Do. Collat. Trust ..	\$100	4 4	91 1/2- 93 1/2	..	4 5 7	New York Telep., 4 1/2 % Gen. Bnds.	100	4 4	97 1/2- 98 1/2	..	4 11 2	
Anglo-American Telegraph ..	Stock	8 8	67- 69	..	4 7 0	Oriental Telep. and Elec. ..	1	8 6 1/2	124- 125	..	4 9 10	
Do. 6 % Pref. ..	Do.	6 6	112- 113	+ 1/2	6 2 0	Do. 6 % Cum. Pref. ..	1	8 8	1 1/2- 1 1/2	..	4 12 6	
Do. Def. ..	Do.	50/-	26 1/2- 26 1/2	..	6 15 5	Do. 4 % Red. Deb. ..	Stock	4 4	87 1/2- 89 1/2	+ 1/2	4 8 6	
Anglo-Portuguese Tel., 5 % Mort. Deb. ..	100	5 5	102- 104	..	4 16 2	Pacific and European Tel., 4 % Guar. Debs. }						
Chili Telephone ..	5	7 8	74- 77 xd	..	5 9 3	Reuter's ..	10	10 10 1/2	11- 11 1/2	+ 1/2	8 13 10	
Commercial Cable, Stig. 4 1/2 % Deb.	Stock	4 4	80- 82 xd	..	4 17 7	Submarine Cables Trust ..	Cert.	6 6	127- 180	..	4 12 4	
Cuba Telegraph ..	10	6 6 1/2	8- 9	- 1/2	6 13 4	Telephone Co. of Egypt, 4 1/2 % Deb. Red. }						
Do. 10 % Pref. ..	10	10 10	16- 17	..	5 17 8	United River Plate Telephone ..	5	8 8	7 1/2- 7 1/2	..	5 4 1	
Direct Spanish Telegraph, Ord.	5	4 4 1/2	84- 84	..	5 6 8	Do. 6 % Cum. Pref. ..	5	5 5	5 1/2- 5 1/2 xd	..	4 7 11	
Do. 10 % Cum. Pref. ..	5	10 10	64- 7	..	7 2 10	West Coast of America ..	23	2 1/2	1 1/2- 1 1/2	..	4 0 0	
Direct United States Cable ..	10	6 4	62- 72	..	6 15 7	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel. }						
Direct W. India Cable, 4 1/2 % Reg. Deb. ..	100	4 4	99- 101	..	4 9 0	West India and Panama Telep. ..	10	2 1/2	3 1/2- 3 1/2	..	5 15 5	
Eastern Telegraph, Ord. Stock	Stock	7 7 1/2	133 1/2- 136 1/2	..	6 2 7	Do. 6 % Cum. 1st Pref. ..	10	6 6	10- 10 1/2	- 1/2	6 0 0	
Do. 8 1/2 % Pref. Stock ..	Do.	5 5 1/2	78- 80	+ 1	4 7 6	Do. 6 % Cum. 2nd Pref. ..	10	6 6	94- 10	..	6 0 0	
Do. 4 % Mort. Deb. ..	10	4 4	96- 98	- 1/2	4 1 8	Do. 6 % Debs. ..	100	6 5	101- 103 xd	..	4 17 1	
Eastern Extension ..	10	7 7 1/2	13- 13 1/2	..	5 9 8	Do. 6 % Debs., Ltd. ..	10	7 7 1/2	138- 138	..	5 2 9	
Do. 4 % Deb. ..	Stock	4 4	96- 98	- 1/2	4 1 8	Do. 4 % Deb. ..	Stock	4 4	94- 96 xd	..	4 3 4	
East and S. Africa Tel., 4 % Mt. Db. Mauritius Sub. }		25	4 4	98- 101	..	9 19 8	Western Union 4 1/2 % Fdg. Bonds	\$100	4 4	97 1/2- 100 1/2	..	4 10 0
Globe Telegraph and Trust ..	10	6 6 1/2	10 1/2- 10 1/2	..	5 10 4							
Do. 12 % Pref. ..	10	6 6	12- 12 1/2	..	4 13 2							
Great Northern Telegraph ..	10	18 18	28- 30	..	6 0 0							
Indo-European Telegraph ..	25	13 5 1/2	56 1/2- 68 1/2	+ 1/2	6 11 1							
Mackay Companies Common ..	\$100	5 5	85- 88	..	5 13 8							
Do. 4 % Cum. Pref. ..	\$100	4 4	68- 72	+ 1 1/2	6 11 1							
Marconi's Wireless Telegraph	1	20	4 1/2- 4 1/2	..	4 8 11							
Do. 7 % Cum. Partic. Pref.	1	17	3 1/2- 4	..	4 5 0							

\* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ Ss. in Futed Dividend Certs

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical companies in the Home section, including Bath Trams, Brit. Elec. Trac., Central London Railway, and Metropolitan Railway. Columns include Name, Stock or Share, Dividends for, Closing Quotations, Rise or Fall, Present Yield p.c., and Name, Stock or Share, Dividends for, Closing Quotations, Rise or Fall, Present Yield p.c.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical companies in the Colonial and Foreign section, including Anglo-Arg. Trams, Bombay Elec. S. & Trams, La Plata Elec. Trms, and Singapore Trams. Columns include Name, Stock or Share, Dividends for, Closing Quotations, Rise or Fall, Present Yield p.c., and Name, Stock or Share, Dividends for, Closing Quotations, Rise or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table listing manufacturing companies, including Aron, Babcock & Wilcox, British Aluminium, and Crompton & Co. Columns include Name, Stock or Share, Dividends for, Closing Quotations, Rise or Fall, Present Yield p.c., and Name, Stock or Share, Dividends for, Closing Quotations, Rise or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

## WIRELESS TELEGRAPHY WITHOUT SPARKS.

THAT emission of Hertzian waves on which wireless telegraphy depends is obtained by the setting up of suitable oscillations in a conducting antenna. Corresponding to the industrial frequency of 50 cycles per sec., is a wave length of 6,000 km. and, since the maximum wave length which can yet be obtained from an aerial is about 10 times the length of the wires employed, a 600-km. antenna would be required to utilise 50-cycle current. An aerial 0.6 km. (600 yd.), in length corresponds to exciting frequency of 50 kilocycles per sec. Currents of such frequency are easily obtained by employing the oscillatory discharge from condensers, but numerous endeavours have been made to construct machines which should generate currents of sufficiently high frequency (say, 50 key.) for direct excitation of the aerial without intermediate condensers. Another line of research has been directed towards the designing of a form of aerial, which should occupy very small space, but yield a very long wave (say, 30-60 km., corresponding to an exciting frequency of 10-5 key., for which dynamo-electric machines can now be easily constructed).

American endeavour has been concentrated on the evolution of high-frequency generators. Alexanderson has built machines providing 200 key. frequency (corresponding to antennæ with 1,500 m. wave). Unfortunately, such a machine runs at 20 kilorevs. per min., and presents mechanical features which prevent its general use. Finally, its efficiency is less than 5 per cent. A number of German engineers, starting from the assumption that the length of ground occupied by the aerial should not exceed 1 km., and the area, 20 hectares, have endeavoured to design satisfactory 50-key. alternators. Count Arco's machine, recently exhibited in London, actually realised 10 per cent. efficiency (though the Telefunken Co. claim 24 per cent. efficiency under favourable circumstances). The constructional details of this machine are secret up to the present, but better results have already been obtained with other machines. The Goldschmidt alternator (ELECTRICAL REVIEW, November 24th, 1911, page 880) realises 50 per cent. efficiency, but its arrangement is hardly adapted for continued use in an ordinary radio-telegraph station.

Our contemporary, *Génie Civil*, announces results which have been obtained by M. J. Béthénod, who has sought to obtain economically a very long wave, thus making possible the use of low-frequency alternators, which have the important practical advantages of low cost and high efficiency and reliability.

The velocity of propagation of Hertzian waves = 300,000 km. per sec. =  $\lambda \times F$  = wave length  $\times$  frequency. American and German investigators have endeavoured to reduce  $\lambda$  by increasing  $F$ , whereas M. Béthénod has endeavoured to increase  $\lambda$  as far as possible (while retaining a small aerial structure), thus securing a more reasonable value for  $F$ .

The Blondel sheet antenna (1903) makes possible wave lengths 10 times as great as are obtainable from a single wire. Slaby endeavoured to increase the wave length of radiations by introducing capacity and inductance in the aerial (1905), but was not able to obtain satisfactory results. In 1908, Athearn (New York) proposed a sheet aerial in which the conductors were arranged as a zig-zag grid; long waves were obtained, but such a confusion of wave lengths was generated that the aerial was of no practical value.

The difficulty in increasing the capacity and inductance of an aerial arises from the formation of nodes at the points where high inductance is inserted; the wave length generated then corresponds to part only of the aerial, and may actually be shorter than that of the original simple antenna. Although full particulars cannot yet be disclosed, owing to patent negotiations, M. Béthénod claims to have designed a type of aerial providing about 10 times as great a wave length as can be obtained from an ordinary sheet aerial of similar size. Preliminary tests show that the method adopted for adding capacity and inductance provides an increase in wave length corresponding exactly to the theoretical

results obtained by summing convergent series, the terms of which represent the elementary capacities and inductances.

To obtain a 60-km. wave requires about 1 km. of aerial under the Béthénod system as compared with 10 km. under the Marconi, Telefunken and Goldschmidt-Lorenz systems. In large stations, the aerial towers must be about 100 m. in height; and whereas six or eight are required for a Béthénod aerial yielding a 60-km. wave, 30 would be required for an ordinary aerial providing the same wave length. Other things being equal, the antenna for a 6,000-m. wave would require 10 towers and a strip of ground 1 km. in length using present types of aeriæ, as compared with four towers under the Béthénod system. It appears unnecessary to use towers higher than 80 m. in the latter system, whereas, to reduce the number of towers where ordinary aeriæ are used, the umbrella type of antenna, carried by a central tower of enormous height (250 m. in the new Naiten station), has been adopted.

If the inventor's hopes are realised, 10 key. per sec. alternators will suffice for the direct excitation of Béthénod aeriæ. Such alternators can be of reasonable mechanical and electrical design and of high efficiency: probably poly-phase machines will be used with advantage. The use of two-phase current in important stations has hitherto been prevented by the necessity for two aeriæ set at right-angles, but M. Béthénod claims to have evolved a method of connection enabling efficient inversion of one phase, so that a two-phase alternator can be directly connected to a single aerial.

In the absence of those details which will determine the success or failure of the new system, we can at least say that France appears to have come nearest to a practical system of sparkless wireless telegraphy. In spite of all syntonic precautions, a pure wave cannot be practically obtained from a spark system of wireless telegraphy: by the direct excitation of the aerial from an alternator, however, a sustained and practically pure train of waves can be emitted, thus improving syntonic reception, increasing the distance of transmission and avoiding interference between stations. Multiplex working should be a possibility, the problems of wireless telephony would be greatly simplified, and it is probable that new phenomena and laws would be discovered in the generation and application of the long Béthénod waves. If these hopes are realised, there is no reason why speeds up to 200 words per min. (ten times the speed of simple trans-Atlantic cable working and six times the speed of duplex cable transmission) should not be reached. In short, the scope and utilisation of wireless telegraphy would be literally revolutionised. A tremendous amount of labour has been expended in seeking a solution to the problem of practical and efficient aerial excitation, and it is to be hoped that this has now been found.

## REVIEWS.

*Electricity made Plain.* By G. R. PEERS. Manchester: J. Heywood, Ltd. Price 1s. net.

The author's object is to explain the various uses of "practical electricity" in a general way intelligible to the average reader without scientific knowledge. The ambitious scope of the work naturally condemns many most important applications of electrical energy to a very cursory treatment, thus, electricity on ships and electricity in newspaper offices are each treated in less than one page. Electric welding, the lighting of small houses, electricity in agriculture and horticulture, and other important applications are dismissed even more briefly. In contrast to this, 40 pages are devoted to medical applications of electricity. Undoubtedly the latter are very important, but in a work intended to present the non-technical reader with a well-balanced review of present day uses of electricity, it is, to say the least, unjust to dismiss each of a number of applications, involving a vast capital expenditure and revolutionising so many phases of industry, in about one-fiftieth of the space devoted to medical electricity. The information given in the various sections should certainly be intelligible and interesting to the layman, but it will be obvious that under the above space limita-

tions the merest skeleton outline has had to suffice in the treatment of many important branches. Within the space limitations imposed, the industrial sections are, with few exceptions, excellent.

The arrangement of the work is open to criticism. Chapter III mentions arc lamps and arc furnaces, and abruptly terminates by a statement of the capital invested in electrical undertakings in the United Kingdom. Then, after dealing with electric traction in Chapter IV, the generation of electricity is considered in Chapter V, instead of following immediately after the paragraphs on galvanic electricity, as had better have been the case. That any historical basis has been adopted in the arrangement cannot be maintained, since telegraphs are dealt with in Chapter VII—after the notes on electric lighting, traction, generation, public supply, heating, cooking and ice-making. Railless traction and the uses of electricity on railways are mentioned in Chapter XIV, and are immediately followed by sections dealing with the electrical transmission of photographs, writing and time signals. The chapter on wireless telegraphy is very good, but it is not clear why a section on the storage of electricity should be tacked on to the end of it. Also, why are heating pads, electric saucepans, irons, vacuum cleaners and ovens mentioned without pause or dissociation in the section entitled, "The electric light bath"? Further mention of agricultural electroculture is made in the section on medical electricity, and the information there given should certainly be transferred to the special section on electricity in agriculture.

The opening paragraph of Chapter III describes the arc lamp as the most efficient form of artificial illuminant, but only claims for it an efficiency of 1 watt per c.p. The author speaks of a consumption of 500 watts *per hour*, and an efficiency of 1 watt per c.p. *per hour*. Both these expressions are utterly meaningless. We are strongly of the opinion that more space should have been devoted to electric lighting—encouraging the use of the latter, and explaining the choice and application of various types of lamps. Similarly, we do not agree with the dismissal of electric heating and cooking in a couple of dozen lines.

Considering the short space occupied, the notes on the generation of electricity are excellent, but we do not think that the mistake of assuming generation, for lighting and power purposes, to be by atmospheric collection or frictional generation, is as prevalent as the author supposes.

The statement that the human voice is the vehicle of transmission of messages in the telephone is distinctly misleading, and the risk of misunderstanding is aggravated by the phrase "The human voice could be transmitted . . . through a wire" (Chapter IX); in later paragraphs, however, the true action is clearly explained.

The author states that the whole human system must be brought under electrical influence to attain "full effects," supporting this argument by the fact that the effects of quinine, strychnine, and other drugs penetrate to every part of the body. He at once vitiates his reasoning, however, by remarking that if these drugs "could be localised in a single limb, only that limb would be directly influenced by them." Electrical treatment can be thus localised, and its success in connection with cases of partial paralysis, &c., depends on the correct local application of current with regard to nerve centres. With the exception of the rather too positive tone adopted in asserting the beneficial effects of various electrical treatments, the medical section of the book is very good.

The grammatical style adopted is careless in many places, and the selection of wording is at times bad. Instances of lax construction are as follows:—"The simplest method of producing electricity which can be put to practical uses is that obtained by the action of certain chemicals upon metal." "This is analogous to the steam pressure in a boiler in order to obtain a certain amount of work or power out of the steam engine." ". . . The expert . . . would be able to advise the customer of the advantages taking place in the efficient means of illumination. . . ." ". . . If this is correct, it is to be hoped that, in view of the important results already obtained, there are strong grounds for believing that, in many cases, valuable improvements can be effected in the yield of agricultural crops." "The following list of diseases treated by Wesley with electricity, with

beneficial results, is given below, which seems to cover a large range. . . ."

The volume concludes with a useful glossary of electrical terms and a detachable inquiry form for use by readers. The latter is a valuable innovation, but one which is likely to commit the author to an enormous amount of additional labour. We trust that the author's willingness to supply explanations and additional information will not be abused.

Any handbook attempting to treat the whole field of electrical engineering in a popular manner is bound to be open to considerable criticism; but a purchaser of the present volume will certainly get excellent value for his money, and a good popular groundwork from which to commence a more precise and detailed study.

*Life Understood: from a scientific and religious point of view, and the practical method of destroying sin, disease, and death.* By F. L. RAWSON. London: The Crystal Press, Ltd. 1912. Price 7s. 6d. net.

Without doubt this is the most extraordinary production that has ever appeared from the pen of a practical man. It is indescribable, in the sense that it is such a mixture of mystery, imagination, quotation, and reference, that one scarcely knows where to begin with it. In a pamphlet sent out by the publishers, "Life Understood" is called an "epoch-making" book, and "its interest is not lessened by the curious fact that it does not reach the world as the work of a dreamy, abstract philosopher, but through a business man of wide and varied activities, one of the most successful engineers of the day, whose previous training has eminently suited him for the present task."

The main practical points elucidated are said to be as follows:—

1. The mysteries of birth and death are explained, and sin, disease, and death shown to be merely crude mistakes, resulting from ignorance of real laws.
2. God is one ever living, ever active and unalterable Principle, the Principle of good, the omnipotence of which can be instantly utilised at any moment for any good purpose, by ceasing wrong thinking, and thinking rightly.
3. Man's possibilities are limitless.
4. Each reader is shown how he himself can at once put into practice, in some degree, the scientific, and, therefore, infallible and instantaneous method of obtaining revolutionary results, ultimating in deliverance from every kind of difficulty, including sin, disease and death.
5. The overcoming of limitations of all kinds is proved to be merely a matter of proportionate obedience to well-defined laws.
6. Freedom from all worries and troubles and perfect peace of mind can be rapidly and permanently gained.
7. No tortuous, difficult process is necessary to obtain such results. The method is simplicity itself, merely that of right thinking.

After perusing this startling pronouncement, we settled down in our arm-chair, and with the comfortable thought that we had at last unearthed the eighth wonder of the world, prepared to enjoy ourselves thoroughly. Our author had evidently written "finis" to age-long speculations, had solved the problem so long held to be unsolvable, had explained in a mere six hundred pages or so the mystery of the Universe. We started therefore at Chapter I, and soon came across many interesting things. The main point, however, seemed elusive. The chapters grew and grew, and the vital secret seemed to us as far off as ever; and at the end of the 600 pages the matter was, to our mind, no nearer solution. Sixty words will probably suffice for an adequate explanation of life when the secret is really known.

To the man of scientific training who critically reads through the work, the whole thing must seem stupefying. The author is delving in unearthly regions. He is making acquaintance with things metaphysical. Sir Ray Lankester likens this self-contained Universe with its known and unbreakable laws to a quantity within brackets; there may or may not be a factor outside. Our author appears to be working with this factor, and to be manipulating it by something akin to the laws of algebra; a factor which, if it exists

at all, has hitherto only been seen in the dim shadows. It belongs to the realm of things that, as Mr. Soddy says, cannot be "conserved."

The author has certainly written a book that is unique. He deals with a vast array of subjects, but not always with the pen of a specialist. For instance, hypnotism, according to his idea, is everything that is bad and useless. He does not seem to be aware of the wonderful mental cures that are being effected every day by means of this truly extraordinary science; a science which is undergoing investigation by medical men throughout the civilised world. Far from being a terror to mankind, all the omens point to its becoming one of the greatest blessings lent by Providence to humanity.

The author's treatment of spiritualism is also somewhat general. The whole of the phenomena connected with it are luminously explained as follows:—"The sub-conscious mind or basic false 'mentality' of the material man is always in etheral touch with every thought in the material world, past, present, and future, and a mixed medley of etheral thoughts of every kind and description, with and without any logical sequence or benefit to mankind, are intensified on the so-called 'mind' of the medium until they are manifested more materially in the form of what are called the spirits or the flowers or other things that these spirits are supposed to bring or produce. Thoughts are also similarly intensified so that you may hear what sounds like the voice of a human being, or see visions of the past or future."

We don't know whether there is any truth in spiritualism or not, but at any rate, we would lay odds against this as the correct explanation of the phenomena.

Throughout the book weird terms, such as "no-mind," "false mentality," &c., flit about like butterflies in a tropical foliage. We become confused and lose the thread of the argument. Perhaps our scientific training is against an unprejudiced understanding.

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## THE TRADE BOOM.

[COMMUNICATED.]

In spite of gloomy and superstitious prognostications, the trade boom is continuing to develop, even though we have entered the thirteenth year of the twentieth century. We hear from all quarters of scarcity of materials and labour; of works choked with orders, of high wages and big dividends. A record budget both as regards receipts and expenditure is forecast.

In the case of the British Empire, a profound peace coincides with the heaviest warlike preparations in its history.

A strong public opinion is supporting the strenuous efforts of Sir Edward Grey and the ambassadors of the Great Powers to restore the blessings of peace to Europe, and it is to be hoped that those efforts will be successful.

It would seem as if even the armaments men were beginning to perceive that the Dove of Peace is a better customer, and has more money to spend than the Vulture of War, which is, after all, a lean and savage bird.

It may be that the disturbed state of public feeling in Austria and Russia, and, to a lesser degree, in Germany, is diverting trade to us. But making allowance for that, there appears to be every probability of the continuance of the boom.

The outlook for manufacturers in the engineering trade is, however, not without keen anxiety. As usual at such times, the coal and ironmasters are grabbing more than their share; and the rapid advances in the price of fuel and raw materials, coupled with outrageous delays in delivery, are putting many manufacturing engineers into a most difficult position. There are only too many big firms in the hands of receivers, or almost there, in spite of the boom. In very few cases have the prices of the finished article been put up proportionately. That always takes longer to come about than a rise in price of iron, coal and steel, because of the lack of combination among engineers. The coal and iron producers always get their heads together in good time.

Labour is still somewhat sullen and threatening, on account of the great increase in the cost of living, and the widespread conviction that labour is not even yet getting its due. It is said that: "Prices go up in the elevator, while wages creep up the stairs."

The increased cost of living, however, hits no one harder than that great class of salary earners who originate, design, and carry through the whole business. Salaries do not rise; and the supply of young men, able and ambitious and well educated, constantly increases, and tends rather to reduce them. In times like the present these salaried men are working all hours without any payment for overtime, and in many cases actually taking home less money than the workmen they direct.

The difficulty of organising brain workers is well exemplified in the case of the doctors, who certainly had a better chance of working on Trade Union lines than any other profession.

The law is equally well protected, but it is at present suffering from the fact that the trades are much too busy to quarrel. There seems to be a pause in the race of improvement and invention, as capitalists and banks can get out all their money on every-day business, and they resolutely turn a deaf ear to the suggestions of genius, so that the inventors' garrets are rather more overcrowded than usual.

The high price of coal and oil, and the fact that fear of "corners" prevents anyone from relying on any given cost for oil for more than a few months ahead, are factors handicapping power producers very seriously.

Fear of motor-buses checks tramway enterprise. With abundant traffic, and labour in a less threatening attitude, the railways are not making many new departures. In the great questions of power production and distribution, little headway is being made. The Government is far too busy with politics of another kind, to tackle such a problem, and yet its very magnitude necessitates legislation on a bold scale. This great boon of cheap power might do more for the prosperity of the country than even a restoration of the canals, which seems to be as far off as ever.

It appears as if Parliament would never have time for practical affairs, nor a party leader arise to adopt such a policy as his main plank.

The times are strenuous, the pressure severe, and there seems to be less leisure than ever for engineers to cultivate what the Scots called "the amenities."

Literature and art and even science may suffer from a prolonged trade boom, and perhaps the epitaph of this generation may prove to be simply: "It made money."

Would that it might be added: "It distributed the money fairly; it encouraged genius and industry, and discouraged the wastrel. It curbed usury, stopped waste, saved and developed its sources of power; it promoted health and strengthened the race; it lived simply, thought clearly, provided wisely for its successors, and made the world a better cradle for the human race."

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## GRAPHS IN A CABLE-SHIP DRUM-ROOM: NOTES FOR JUNIOR ASSISTANTS.

By EDWARD RAYMOND-BARKER.

1. HITHERTO, in the treatment of graphs as applied to practical problems in submarine telegraphy, the writer has confined himself to the electrical side of cable work: that is to say, to what, during his past professional life, has been his own side.

2. Having been chief electrician on various cable-laying expeditions, the writer naturally has had the advantage of working in close association with colleagues responsible for the effective carrying out of other branches of cable-ship routine. Cable-laying viewed in its entirety affords a striking instance of well-organised division of important duties, all sections of the staff and ship's personnel co-operating in carrying out a general plan in a manner con-

ducing to eventual success in what often proves to be—owing to climatic drawbacks and adverse weather conditions—an arduous enterprise.

3. In view of this recognition of indebtedness to association with colleagues responsible for departments of work other than his own, the writer is sure that none other than a cordial reception will be extended to certain tentative suggestions on his part in the direction of graphic methods applicable to "Drum-Room" or "Paying-Out Office" routine work. In any case, graphic methods afford a fascinating illustration of concrete data as a rule confined to tabular compilations of dry figures.

4. Graphic treatment will be applied, first of all, to the variation in cable-drum constants, with different types of cable, and later on, to questions relating to the percentage of slack paid out, in the course of cable-laying operations, at any given moment, or for any given period of time.

5. A new form of transparent disc calculator also will be described in these notes, a device for instantaneous confirmation of cable-slack data, and for many other purposes.

6. True it is that mechanical contrivances have been devised—such, e.g., as that described on page 310 of Com-mendatore Dr. Itallo Brunelli's notable work on telegraph construction\*—for indicating automatically the percentage of cable-slack in course of being paid out; nevertheless, the graph methods, and the new transparent disc calculator suggested by the writer, will not be without their uses.

7. It will be well, first of all, here to examine the mechanical means commonly used for measuring the length of a telegraph cable, whether the said measurements be carried out for days and weeks during the laying of a cable across an ocean, or whether it be question, merely, of transferring cable, say, from a factory tank into a ship's tank. In the latter case, not only has the correct cable length to be verified, but on important occasions—e.g., the first shipment of a new cable—the positions of joint marks and mile marks put on the cable in course of manufacture, have to be verified, and entered up in "tank books," with particulars as to the whereabouts of each one in any given "turn" of any given "flake" of cable coiled into a ship's tank.

8. It will be well, also, that accurate measurement of the cable in motion necessarily affords data for computing speed rate; for instance, so many miles of cable paid out, or shipped—as the case may be—per hour. It stands to reason, therefore, that, in any of the afore-mentioned operations, cable-length measurements must be carried out with great exactitude.

9. Many useful data relating to these and cognate matters may be found by the young assistant in such well-known books as Bright's "Submarine Telegraphs"; Clark and Sabine's "Tables and Formule"; Munro and Jamieson's "Pocket Book"; and Wilkinson's new and revised edition of "Submarine Cable Laying and Repairing," pages 228-230, and 235-246, in the last-mentioned work being especially useful.

10. The following notes, however, will be found to be off the beaten track of the text-books to an extent not without advantage to the young reader, whose work with the books, therefore, will be supplemented by a parallel series of exercises, so to speak, and, later on in this series, by concrete cases developed by graph methods, in a manner both useful and novel.

11. The length of cable paid out during laying, or picked up during repair operations—likewise the rate of paying out or of picking up—all this is accurately measured "by drum indicator."

12. The cable whether paid out or picked up, for greater security and avoidance of slip, is caused to make not only one, but three or four turns round a large iron wheel or drum with a wide periphery, and about 18 ft. in circumference.

13. This cable drum may be put in or out of gear with a steam engine. A common practice on big ships is to have one drum astern for paying out, and two drums "for'ard," port and starboard, for picking up.

14. A cable drum is controlled by powerful brakes under

easy manual control, and, in the case of the paying-out drum, capable of nice adjustment by addition or subtraction of movable weights.

15. One revolution of the drum may be said to be the primary unit of length in cable measurement. A counter, or train of wheels contained in a neat brass box, is attached and tooth-wheel-gearred on to the drum shafting. This device goes by the name of the drum indicator.

16. The train of wheels inside the brass box actuate five sets of figures on brass counters. These figures are severally displayed at five small apertures or windows in the face of the brass box. These figures are in terms of drum revolutions, and, at the five apertures, show—from right to left—units, tens, hundreds, thousands and tens of thousands.

At each complete turn of the drum the "units" indicator advances 1. On the completion of 10 turns the "tens" indicator goes forward 1, and so on.

17. Thus, in fig. 1 here shown, the drum indicator reading is seen to be 14,208 revolutions.

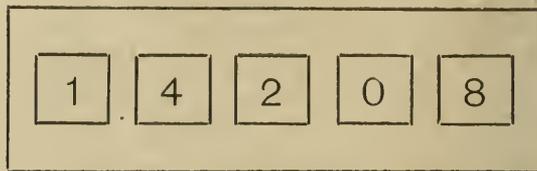


FIG. 1.

18. The reading following on 99999 will be five "noughts," which, in this instance, signify 100,000 revolutions. Thus the train of wheels, after going through all the figures, automatically pass to zero, and start a fresh series, so that, in the foregoing case, the subsequent reading 00001 would signify 100,001 drum-revs.

19. In a certain concrete example, the mean of several careful tape measurements round a drum periphery, gave 17 ft. 8 1/2 in. = 17.688 ft. = 212.24 in.

20. Fig. 2 shows three end-on views of one and the same cable drum with exaggerated sectional representations of three different sizes or types of cable encircling the drum, and demonstrates the fact that the cable length equivalent of a drum revolution must vary according to the sectional dimensions of the cable.

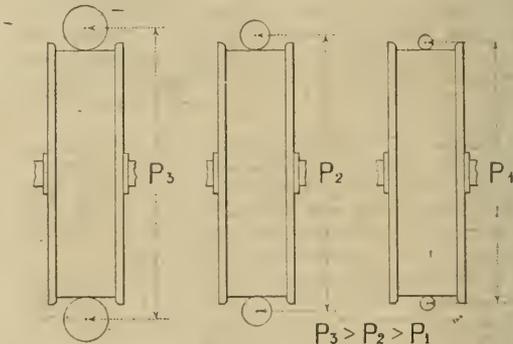


FIG. 2.

Clearly, therefore, the greater the diameter of a cable, the greater becomes the distance across the drum between cable centres, and, consequently, the greater the length of cable carried over by one complete revolution of the drum.

21. Distance between cable centres is seen to be—

$$\begin{aligned} &\text{Drum dia.} + \text{twice } \frac{1}{2} \text{ dia. of cable, or} \\ &\text{Drum dia.} + \text{cable dia.} \end{aligned}$$

The sum of these two values  $\times \pi$  (that is, 3.1416) would give the true circumference of one complete turn or encirclement of this particular type of cable.

22. It is more simple, however, and easier in execution, to arrive at a similar result by dealing with circumferences straight away from the beginning. So drum circumference + cable circumference, expressed in convenient units of length—say, inches and decimals of an inch—may be

\* "La Costruzione delle Linee Elettiche Aeree . . . Con una Appendice sui cavi . . . sottomarini." Dott. Ing. Itallo Brunelli, Ispettore Generale dei Telegrafi, Roma. Stabilimento cromo-tip di Carlo Colombo, 1912.

taken as giving the true cable-drum circumference, corrected for that particular dimension or type of cable. Example :—

23. Drum circumference has been seen to be 212.24 in.  
Circumference of cable say type D<sub>1</sub> ... 2.60 in.

Total drum circumference, corrected for } = 214.84 in.  
cable, type D<sub>1</sub>.  
73,044 in. go to the nautical mile (N.M.),

		Logs.
73,044 in.	=	4.86358
214.84 in.	=	2.33212
		-----
		2.53146 = 339.99 drum-revs. per N.M.,

this being the *drum constant* for this particular type of cable. Supposing the drum indicator to register 4,234 revs., this reading is equivalent to—

		Logs.
4,234	=	3.62675
339.99	=	2.53146
		-----
		1.09529 = 12.454 N.M. of cable, type D <sub>1</sub> .

In short, drum constant divided into drum-indicator revs. gives length in N.M. of cable passed over drum.

24. Sometimes—especially in slide-rule work—it is convenient to multiply instead of dividing. Then a result similar to the above may be obtained by multiplying drum-indicator revs. by the *reciprocal* of the *drum constant*, viz. :—

		Logs.
1	=	0.00000
339.99	=	2.53146
		-----
		3.46854 = 0.0029413 N.M. per drum rev.

Then, supposing the drum indicator to register, as before, 4,234 revs.—

		Logs.
4,234 × 0.0029413	=	3.62675
		3.46854
		-----
		1.09529 = 12.454 N.M., type D <sub>1</sub> .

25. Naturally, the drum circumference corrected for any given type of cable, divided by 12 in., gives the equivalent of one drum rev. in terms of feet—a useful figure to have.

26. N.B. :—6 ft. = 1 fathom, the generally accepted unit for short lengths of cable or core cut off for splices, damaged ends, or what not. In three-figure decimals 1 fathom = 0.001 N.M.

27. The exact circumference of any particular type of cable is obtained from the mean of several measurements. In practice, a dozen slips of white paper may be prepared. Siphon-recorder slip is excellent for the purpose. Each slip is folded tightly at right angles with, and round, the cable, at some given position. A pencil mark is made across two overlapping edges of the slip. Thus, two marks appear on the slip when it is laid out straight. The distance between the marks is measured with compass and rule, and the mean of a dozen such measurements made at different points along the cable is taken as the true circumference of that particular type of cable. Measurements may have to be made with an ordinary tape or rule giving eighths, sixteenths, thirty-seconds of an inch, but matters will be simplified if all such fractions be converted to decimals.

28. On the occasion of each cable-laying expedition, a table may be prepared for each one of the two or three cable drums in use on the ship, giving the drum constants, and various other values, not only for all the different types of cable on board, but also for the different sizes of grappling and buoy ropes. All these various data for each cable drum may be tabulated in columns under the following headings :—

- (1) Type.
- (2) Factory No.
- (3) Circumference (inches).—See 27.
- (4) Length of 1 revolution (ft.).—See 25.
- (5) Drum revolutions per N.M.—See 23.
- (6) Logarithm of same.—See 23.

(7) Reciprocal of 5, viz., N.M. per drum revolution.—See 24.

(8) Logarithm of same.—See 24.

30. The following two examples give an idea of the difference made by the drum-circumference correction for various types of cable. In a certain cable, type "E" (circumference 4.68 in.) equivalent inches to 9,150 revs. of the drum already mentioned (circumference 212.24 in.) was laid. Taking correction into account :—(See 21 and 22).

Drum-constant =  $\frac{73,044 \text{ in.}}{212.24 + 4.68} = 336.72 \text{ revs. per N.M.}$

Type "E" paid out =  $9,150/336.72 = 27.175 \text{ N.M.}$

Without correction, drum-constant =  $73,044/212.24 = 344.15 \text{ revs. per N.M.}$

Type "E" paid out =  $9,150/344.15 = 26.588 \text{ N.M.}$ ,  
or 0.587 N.M.; that is, 2.21 per cent. too little.

In the same cable, type "B" (circumference 3.564 in.) to the extent of 184,710 drum-revs., was laid.

With drum corrected, type "B" paid out =  $545.75 \text{ N.M.}$   
Without correction, " " " " =  $536.72 \text{ "}$   
or 9.03 N.M.; that is, 1.68 per cent. too low.

31. Fig. 3—with *uncorrected* drum circumference, and zero percentage of increase as bases of comparison—shows graphically the relationship between (*abscissæ*) drum-constants in terms of revs. per N.M. corrected for any given type of

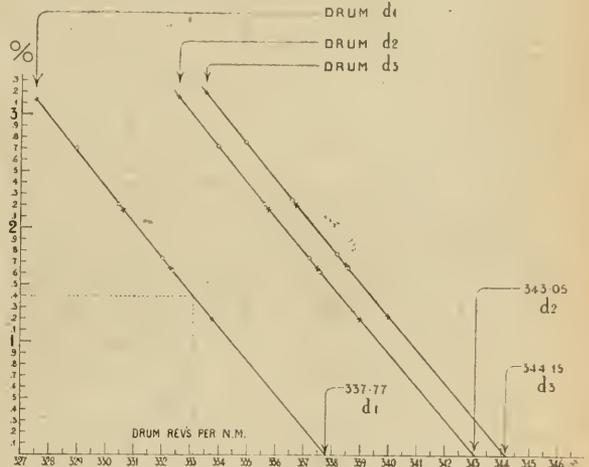


FIG. 3.

cable, and (*ordinates*) increase per cent. of cable-length per drum-rev., due to increase of drum + cable working circumference consequent on the addition of the cable. *d*<sub>1</sub>, *d*<sub>2</sub> and *d*<sub>3</sub> are curves pertaining to three cable drums on a certain ship. *Cross and circle* plottings respectively indicate *corrected* drum constants of various cable types from tabular records of *two* different expeditions. Curves *d*<sub>1</sub>, *d*<sub>2</sub>, *d*<sub>3</sub> cut the line of *abscissæ* at the three several *uncorrected* drum constants.

Examples.—Drum *d*<sub>1</sub> with a certain type of cable has a corrected constant of 333.1 R.P.N.M. This is shown by dotted line co-ordinates in fig. 3 to be equivalent to 1.4 per cent. increase due to the addition of cable to the drum.

(To be continued.)

**Bradford Tramways.**—It has been decided to fit 100 tram-cars with side life-guards of the pattern supplied by the National Railway and Tramway Appliances Co., Ltd. A portion of Queen's Road is to be equipped for railless trolley vehicle traffic, in order to experiment with the Mercedes-Stoll railless trolley vehicle which is about to be delivered. The Electricity Committee has decided to agree to undertake the lighting of Tong Street, at the same annual cost (about £160 per annum) as is now entailed in the lighting of the street with gas, and the Tramways Committee is to be asked to give permission to fix the necessary lamps to tramway poles or standards. The Committee is also to be asked to grant the use of tramway poles or standards for the like purposes, in all cases where the Committee undertakes the lighting of thoroughfares in the city.

## THE JOHANNESBURG TURBINE CONTRACT.

(Concluded from page 79.)

THE article proceeds:—"Then the town clerk deals with technical matters. Words fail us to deal satisfactorily with such crass stupidity. Rushing in 'where angels fear to tread,' he discusses vacuum, steam consumption and other engineering details, and remarks: 'I am more than astonished that Messrs. Rider and Tippett have fallen into these blunders.'" This is not, to my mind, defamatory; it is an unfair statement, because the writer fails to point out that the town clerk stated that he had had technical assistance. This probably would not alter the writer's view, but it might the reader's. To quote again: "The contract went to Messrs. Reunert & Lenz at the price of £12,469. We are not surprised to hear that the feeling out there is so strong that the Government is being asked to intervene. If there is the equivalent of our Local Government Board out there, we shall soon have some lively proceedings." It is clear from this passage that the plaintiff is being implicated in the giving of the contract to Messrs. Reunert and Lenz, and that it has been given to that firm under such circumstances that the Local Government Board would intervene, if it had happened in England. No evidence was led before me to show in what circumstances the Local Government Board would intervene, nor do I know. The article proceeds then with the words which were in the main complained of, and about which there was a considerable amount of argument during the course of the case.

"The impudence—there is no other word—of the town clerk and the laymen on the Council, who asked for expert advice (on five occasions) and then deliberately flouted it, is almost beyond belief, and such conduct on the part of the so-called representatives of the public interest is absolutely iniquitous. We have always endeavoured, so far as lay in our power, to assist in keeping clean and free from suspicion of evil practices the municipal government of this country. We have often had to express criticism of this or that action, when possibly the tendency to specialise in the goods of one firm was becoming too pronounced. But the effect of healthy publicity has made short work of such tendencies over here. In the interests of sound government, we are glad of the opportunity, though more sorry for the necessity, of laying this matter before our readers, and, through them, before the public of Great Britain. If the Corporation of Johannesburg cares at all for its good name; if the town clerk and the engineer care for their good names; if they have any regard for the welfare of the public for whom they are the trustees; if they wish to avoid suspicion of having been tempted into undue favouritism they will reconsider this matter, and attend to the recommendations of the eminent men who have not shrunk from facing obloquy and derision to do their best for the public of Johannesburg. The result of it all is that the wisdom of the remark about the displaying of precious stones before an unappreciative audience is borne out once more. They 'turn again and rend you.' Well, the only consolation is that it was the same sort of audience that 'ran violently down a steep place and were choked.' It is this rushing that we want to stop, and we cordially hope that the government of the Colony will bring the erring municipality to a right feeling."

The innuendoes alleged are:—(1) The plaintiff, contrary to his duty as town clerk and without any regard for his good name and the welfare of the public, deliberately flouted the advice of the experts, appointed by the Council, not only in respect of the acceptance of the tender of Messrs. Reunert & Lenz for the said engine and electricity generating plant, but also on four other occasions when dealing with tenders before the Council when Messrs. Reunert and Lenz were tenderers. (2) That the plaintiff was dishonest in his criticism of Messrs. Rider and Tippett's report. (3) That in his conduct in dealing with the report of Messrs. Rider and Tippett and with the acceptance of the tender of Messrs. Reunert & Lenz, he was actuated by improper and unworthy motives, and that his conduct was not free from the suspicion of evil practices and was disgraceful. (4) That the plaintiff repeatedly and unduly and dishonestly favoured the acceptance of the tender of Messrs. Reunert and Lenz in preference to other more advantageous tenders. (5) That the plaintiff was incompetent in his profession or office of town clerk. Now, the decision as to whether these innuendoes have been proved is divided into two parts: First, Are the words capable of bearing a defamatory meaning, which I must decide as a judge? secondly, Do they bear that meaning? Now, in my opinion, the words are capable of a defamatory meaning, and this is essentially a case in which the jury must decide whether the words are defamatory or not. Sitting as a juror, I have to decide what the readers of the *Rand Daily Mail* understood by the words, assuming them to be persons of ordinary intelligence, who gave the words their ordinary meaning except in so far as they have been proved to bear a different meaning. In arriving at a conclusion on this point, I have to take the article as a whole and the words as a whole. Doing this to the best of my ability I have come to the conclusion that the article attacks the Town Council for deliberately flouting—i.e., treating with contempt—the advice of experts appointed to give it advice on several occasions, and without any regard for its good name or the interests of the citizens of the town, unduly favouring the tenders of Messrs. Reunert & Lenz. This, I think, fairly summarises the attack on the Town Council. The question then arises: what was the attack on the town clerk? Was it in any way different from the attack on the Town Council? I must say that I think not. It was argued that the words "who asked for expert advice and then deliberately flouted it," referred only to the Town Council. Gram-

matically, there is great force in this argument. But I do not find that there is any differentiation of the Town Council and the town clerk in the matter. It is the town clerk as well as the Town Council who is called upon to reconsider this matter; it is the town clerk as well as the Town Council who is asked to regard his good name; and it is the town clerk as well as the Town Council who is alleged to have no appreciation of the pearls of wisdom, and whom the writer of the article wishes to protect from the fate of the Gadarene swine. I am therefore of opinion that the words accuse the town clerk with conduct which is unworthy of him in his position of town clerk. A person who deliberately flouts the opinion of the Council's experts, and who uses his position to unduly favour the tenders of one firm in disregard of his own good name and the interests of the ratepayers, is not fit to be town clerk, and the words are an attack not only upon his character but upon him in his position of town clerk.

In arriving at this conclusion, I have not taken into account the vague charges of bribery being made against undefined persons at the time the article was published, nor the meanings alleged to have been assigned by various persons in the Council and at political meetings in the town. I do not think the former would influence an ordinary reader in arriving at the meaning of an article, and I do not see that the defendant could in any way be bound by the latter. Some importance might be attached to the letter of Mr. Ward Jackson, of July 5th, 1912, as to what meaning he attached to the article in question, in that he considers the plaintiff's action in regard to the incident referred to in the article such as might cause him damage. The statement is, I think, too vague to be of any use in arriving at the meaning of the article itself. Coming now to the contention that the article, if defamatory, does not exceed the limits of fair comment. The plea says the words complained of, so far as they contain allegations of fact, are true in substance and in fact, and so far as they contain expressions of opinion are fair comment made in good faith and without malice on the said facts, being matters of public interest. The facts alleged are: That the Town Council asked Messrs. Rider and Tippett to report for them on the matters above referred to. That the plaintiff took it upon himself to criticise it. That he, being a layman, dealt with technical matters. That he and the laymen on the Council who asked for expert advice on five occasions deliberately flouted it. If these facts were true, in my opinion the article ought not to be considered as being beyond the limits of fair criticism. If the facts so stated were true, I think the defendants would have been quite within the limits of fair criticism in saying that the town clerk did not have sufficient regard for his own character, and that he laid himself open to suspicion of unfair dealing. But the facts are not true. In the first place, the town clerk was asked to report. In the second place, he had the assistance of technical advice in framing his report on technical matters. In the third place, he had nothing whatsoever to do with the previous orders for turbines, and I do not think it can be said that he flouted the expert advice. And I think that this want of accuracy in the allegations of fact in the article is fatal to the plea of fair comment. In the case of *Peter Walker & Son, Ltd., v. Hodgson* (1909; 1, K.B., at page 257), Lord Justice Vaughan Williams says, quoting from *M. R. Collins* in the case of *Digby v. Financial News*: "Comments, in order to be fair, must be based upon the facts; and if a defendant cannot show that his comments contain no misstatements of facts, he cannot prove a defence of fair comment. If the defendant makes a misstatement of any of the facts upon which he comments, it at once negatives the possibility of the comment being fair." Lord Justice Moulton, in *Hunt v. Star Newspaper Co., Ltd.* (1908; K.K., at page 319), says: "In the first place comment, in order to be justifiable as fair comment, must appear as comment, and must not be so mixed up with the facts that the reader cannot distinguish between what is report and what is comment. . . . Any matter, therefore, which does not indicate with a reasonable clearness that it purports to be comment, and not statement of fact, cannot be protected by the plea of fair comment. In the next place, in order to give room for the plea of fair comment, the facts must be truly stated." In the present case, as I have said, the facts are not truly stated, and consequently a reader of the article is not in a proper position to judge whether the inferences drawn from those facts are proper inferences to be drawn or not. In my opinion, therefore, their plea fails."

We next come to the difficult question of damages. The matter was no doubt one of the highest public importance. The fact that the Town Council, after obtaining the advice of two men of high position, then disregarded the advice was certainly matter for comment, and there is no doubt that the report of the plaintiff to some extent caused the Council to adopt that course. Some portion of the plaintiff's report was devoted to a defence of Mr. Dobson against a statement made by the Board, which, if meant in the sense in which it was taken by the plaintiff, was an attack upon the probity of Mr. Dobson, and was outside the terms of reference to the Board. I refer to the statement that Mr. Dobson appears to be straining points on several matters in order to be able to recommend the tender of Messrs. Reunert & Lenz. I do not think that the Board meant to accuse Mr. Dobson of intentionally straining matters for the purpose of obtaining the contract for Messrs. Reunert & Lenz. Such a finding is, as I have stated, outside the scope of the reference, and should not have been arrived at without giving Mr. Dobson a hearing. But I think it was only intended to say that there was a straining of points which resulted in the recommendation of the tender of Messrs. Reunert & Lenz, which recommendation could not have been made except for such straining. That was clearly within the reference. For the purpose of brevity, the Board, in their report, used, perhaps, an unfortunate phrase, and the plaintiff, in consequence, reported on some matters at greater length, and

more vehemently, probably, in order, as he says, to defend Mr. Dobson, who was ill. The fact remains that the Board's report, instead of being sent back to them for revision, if necessary, after having the policy of the Council on certain matters pointed out to them, was rejected—a course which inevitably led to considerable criticism. It is clear that no actual pecuniary harm has been inflicted upon the plaintiff by the article. He stands no lower in the esteem of his employers than before. At the same time, the letter of the editor of the defendants' paper did nothing to soothe or allay the natural irritation caused by the article, nor was anything done by the defendant to mitigate the damages. I think, on the whole, damages should be assessed at £150, which sum the defendants will be ordered to pay, with costs.

—JOHN TAYLOR v. JOHN HALL RIDER.

His Lordship, in delivering judgment in this action, said that the same libel was complained of as in the last case, and publication was admitted. It was only necessary, therefore, to consider the plea of privilege which had been set up. The defendant sent a copy of the ELECTRICAL REVIEW containing the article complained of to Mr. Hofmeyr, and he said that this publication was made *bona fide* and without malice, and in circumstances which made the communication and the occasion thereof a privileged one, in that more particularly the said Hofmeyr was a member of the Council which employed the defendant (with Tippet) to report; that Hofmeyr took a prominent part in securing the defendant's services for the purpose of the report; that the article complained of was a comment, *inter alia*, upon the respective merits of the defendants' report on the one hand, and upon the plaintiff's report thereon on the other; that Hofmeyr as a member of the employing Council, and the defendant as an employe, had a common interest in the subject matter of the article, and the defendant had a duty to make known the contents thereof to his employer, and it was in pursuance thereof that he delivered the article. His Lordship said an occasion was privileged where the person who made a communication had an interest or a duty (legal, moral or social, of perfect or imperfect obligation) to make it to the person to whom he does make it, and the person to whom he does make it had a corresponding interest or duty to receive it. He had been unable to discover any duty, either social or moral, and certainly not legal, cast upon the defendant to make the communication in this case. This defence, therefore, failed, and he could not see that in this case any damage had been sustained, and he thought a verdict for £5 was sufficient, with Resident Magistrates' Court costs. No doubt the defendant did at one time feel sore at the report being made on his own report, which he understood was to have been final; and when the article appeared, it was not unnatural that he should forward it to Hofmeyr as in a measure an apologia for, or defence of, his report, and his Lordship did not think he was actuated by ill-feeling.

At the request of Prof. J. H. Dobson, the general manager of the Johannesburg Gas, Electric Supply and Tramways Department, we reprint the following editorial from the issue of the *Rand Daily Mail* for December 9th:—

#### "THE LIBEL ACTION.

"Judgment having been given in the case in which the Town Clerk of Johannesburg sued the *Rand Daily Mail* for libel in connection with the reprinting of an article which appeared in the ELECTRICAL REVIEW, we are now able to allude to the matter. We opposed the attitude taken up by the Town Council on the Rider and Tippet report, and we still think that the wrong policy was pursued. But we never cast the slightest imputation upon the character or the honesty of the Town Clerk, or the electrical engineer, or any member of the Town Council, and we regret that it has been held that the criticism reproduced from a London technical journal was in one respect of a slanderous character as far as the Town Clerk was concerned. We dissociate ourselves entirely from the expressions of opinions which gave rise to irritation, and apologise frankly for circulating the statement through the medium of our columns. From time to time we have deemed it necessary in the public interest to disagree with several schemes proposed in the Town Council—notably the turbine purchase, the asphalt proposal, and the location site scheme. But it has never been our wish to reflect in any way upon the motives either of the Town Clerk or Prof. Dobson, or any individual member of the Town Council. Although disagreeing with a number of Councillors and officials, we felt that they on their side believed they were doing their best for the town, and were actuated throughout by the best motives, and we sincerely regret the publication of the passage in the ELECTRICAL REVIEW article which has been held to be slanderous, and unreservedly withdraw the imputation Mr. Justice Ward has found to be contained in it. Mr. John Taylor and Prof.

Dobson stand high in the esteem of the ratepayers, and we have often had pleasure in calling attention to the splendid work they have done for the town. When we disagreed with them on one point, it was certainly not our wish to reflect in any way upon their personal or professional character, and no one is more sorry than we that the article we reprinted was held to be of an objectionable nature in one particular. In closing the controversy, therefore, we wish to dissociate ourselves from, and express regret for the publication of, any imputation of wrong motives which may have been read into the ELECTRICAL REVIEW article on the lines laid down by Mr. Justice Ward."

#### TRADE STATISTICS OF BRITISH INDIA.

The following figures, showing the imports of electrical and similar materials into India during the year ended March 31st, 1912, are taken from the recently issued official trade statistics; the details for the year ended March 31st, 1911, are added for purposes of comparison, and notes of any increases or decreases are given. Values are now given in pounds sterling, and not in rupees as formerly. It should also be noted that imports are now credited to countries of original consignment, and not to countries from which they were last shipped to India. This has largely affected the appearance of the trade of Belgium, Holland, Germany and Austria-Hungary in particular, by decreasing the amounts credited to the two former countries and increasing those credited to the two latter.

	1910-11.	1911-12.	Inc. or dec.
	£	£	£
<i>Lampware.—</i>			
From Great Britain ...	70,000	90,000	+ 20,000
" Germany ...	59,000	66,000	+ 7,000
" Austria ...	45,000	41,000	— 4,000
" United States ...	37,000	57,000	+ 20,000
" Other countries ...	16,000	14,000	— 2,000
Total ...	227,000	268,000	+ 41,000
<i>Other hardware, except enamelled ware.—</i>			
From Great Britain ...	880,000	940,000	+ 60,000
" Germany ...	275,000	274,000	— 1,000
" Belgium ...	33,000	33,000	—
" Austria ...	26,000	29,000	+ 3,000
" United States ...	69,000	67,000	— 2,000
" Other countries ...	67,000	75,000	+ 8,000
Total ...	1,350,000	1,418,000	+ 68,000
<i>Brass, wrought.—</i>			
From Great Britain ...	39,000	37,000	— 2,000
" Germany ...	10,000	7,000	— 3,000
" Austria ...	4,000	3,000	— 1,000
" Other countries ...	16,000	18,000	+ 2,000
Total ...	69,000	65,000	— 4,000
<i>Copper and copper ware.—</i>			
From Great Britain ...	1,392,000	1,025,000	— 367,000
" Germany ...	640,000	552,000	— 88,000
" Belgium ...	22,000	16,000	— 6,000
" France ...	113,000	114,000	+ 1,000
" Austria ...	10,000	11,000	+ 1,000
" Japan ...	287,000	125,000	— 162,000
" Other countries ...	9,000	10,000	+ 1,000
Total ...	2,473,000	1,853,000	— 620,000
<i>Iron wire.—</i>			
From Great Britain ...	10,000	8,000	— 2,000
" Germany ...	17,000	22,000	+ 5,000
" Belgium ...	16,000	23,000	+ 7,000
" Other countries ...	14,000	16,000	+ 2,000
Total ...	57,000	69,000	+ 12,000
<i>Steel plates and sheets.—</i>			
From Great Britain ...	622,000	624,000	+ 2,000
" Germany ...	169,000	227,000	+ 58,000
" Belgium ...	63,000	84,000	+ 21,000
" United States ...	—	94,000	+ 94,000
" Other countries ...	10,000	4,000	— 6,000
Total ...	864,000	1,033,000	+ 169,000
<i>Steam engines (except locomotives).—</i>			
From Great Britain ...	464,000	402,000	— 62,000
" Germany ...	16,000	22,000	+ 6,000
" United States ...	15,000	9,000	— 6,000
" Other countries ...	10,000	5,000	— 5,000
Total ...	505,000	438,000	— 67,000

	1910-11.	1911-12.	Inc. or dec.		1910-11.	1911-12.	Inc. or dec.
	£	£	£		£	£	£
<i>Electrical machinery.—</i>				<i>Iron wire.—</i>			
From Great Britain ...	182,000	193,000	+ 11,000	From Great Britain ...	24,000	14,000	— 10,000
„ Germany ...	50,000	30,000	— 20,000	<i>Steel plates and sheets.—</i>			
„ Belgium ...	2,000	2,000	—	From Great Britain ...	42,000	28,000	— 14,000
„ Italy ...	11,000	13,000	+ 2,000	<i>Railway carriages.—</i>			
„ United States ...	15,000	26,000	+ 11,000	From Great Britain ...	328,000	753,000	+ 425,000
„ Other countries ...	4,000	3,000	— 1,000	„ Other countries ...	5,000	5,000	—
Total ...	264,000	267,000	+ 3,000	Total ...	333,000	758,000	+ 125,000
<i>Mining machinery.—</i>				<i>Locomotives.—</i>			
From Great Britain ...	48,000	43,000	— 5,000	From Great Britain ...	323,000	299,000	— 24,000
„ Germany ...	1,000	—	— 1,000	<i>Rails and fishplates.—</i>			
„ United States ...	43,000	40,000	— 3,000	From Great Britain ...	451,000	423,000	— 28,000
„ Other countries ...	—	1,000	+ 1,000	„ Belgium ...	1,000	—	— 1,000
Total ...	92,000	84,000	— 8,000	Total ...	452,000	423,000	— 29,000
<i>Machinery, other (except textile and agricultural).—</i>				<i>Telegraph construction materials.—</i>			
From Great Britain ...	942,000	902,000	— 40,000	From Great Britain ...	70,000	86,000	+ 16,000
„ Germany ...	101,000	114,000	+ 13,000	„ Other countries ...	1,000	—	— 1,000
„ Belgium ...	6,000	6,000	—	Total ...	71,000	86,000	+ 15,000
„ United States ...	91,000	62,000	— 29,000	<i>Copper and copperware.—</i>			
„ Other countries ...	12,000	19,000	+ 7,000	From Great Britain ...	28,000	134,000	+ 106,000
Total ...	1,152,000	1,103,000	— 49,000	„ Other countries ...	15,000	10,000	— 5,000
<i>Railway carriages, &amp;c.—</i>				Total ...			
From Great Britain ...	969,000	883,000	— 86,000	From Great Britain ...	28,000	134,000	+ 106,000
„ Belgium ...	19,000	7,000	— 12,000	„ Other countries ...	15,000	10,000	— 5,000
„ Other countries ...	14,000	26,000	+ 12,000	Total ...	43,000	144,000	+ 101,000
Total ...	1,002,000	916,000	— 86,000				
<i>Locomotives and tenders, and parts thereof.—</i>							
From Great Britain ...	490,000	526,000	+ 36,000				
„ Germany ...	3,000	5,000	+ 2,000				
Total ...	493,000	531,000	+ 38,000				
<i>Rails and fishplates.—</i>							
From Great Britain ...	486,000	557,000	+ 71,000				
„ Germany ...	3,000	33,000	+ 30,000				
„ Belgium ...	5,000	2,000	— 3,000				
Total ...	494,000	592,000	+ 98,000				
<i>Glass lampware.—</i>							
From Great Britain ...	9,000	9,000	—				
„ Germany ...	30,000	21,000	— 9,000				
„ Austria ...	28,000	21,000	— 7,000				
„ Other countries ...	15,000	12,000	— 3,000				
Total ...	82,000	63,000	— 19,000				
<i>Electrical instruments, apparatus, &amp;c.—</i>							
From Great Britain ...	294,000	391,000	+ 97,000				
„ Germany ...	28,000	35,000	+ 7,000				
„ Belgium ...	4,000	1,000	— 3,000				
„ Austria ...	5,000	4,000	— 1,000				
„ United States ...	4,000	5,000	+ 1,000				
„ Other countries ...	8,000	4,000	— 4,000				
Total ...	343,000	440,000	+ 97,000				
<i>Scientific, &amp;c., instruments.—</i>							
From Great Britain ...	92,000	102,000	+ 10,000				
„ Germany ...	7,000	5,000	— 2,000				
„ Belgium ...	4,000	—	— 4,000				
„ United States ...	2,000	2,000	—				
„ Other countries ...	2,000	5,000	+ 3,000				
Total ...	107,000	114,000	+ 7,000				
<i>Telegraph construction materials.—</i>							
From Great Britain ...	2,000	1,000	— 1,000				
In addition to the foregoing, the following were imported as Government stores:—							
<i>Instruments, apparatus, &amp;c. (except musical).—</i>							
From Great Britain ...	92,000	115,000	+ 23,000				
„ Germany ...	—	3,000	+ 3,000				
„ United States ...	—	1,000	+ 1,000				
Total ...	92,000	119,000	+ 27,000				
<i>Machinery.—</i>							
From Great Britain ...	165,000	187,000	+ 22,000				
„ Germany ...	—	23,000	+ 23,000				
„ United States ...	—	1,000	+ 1,000				
„ Other countries ...	1,000	—	— 1,000				
Total ...	166,000	211,000	+ 45,000				

## THE JAPANESE ELECTRICAL INDUSTRY.

### LARGE EXPANSION IN RECENT YEARS.

The use of electric power in Japan has made extensive progress during the past 10 years, and one-third of the industrial establishments in the country are now operated by means of this agency. According to an article published in the *Elektrotechnische Zeitschrift*, by Mr. Ludwig W. Schmidt, the great expansion of the electric motor in Japan is not only due to the advantages of electrical energy as a distributor of power in factories, but also largely to the surprisingly rapid development of Japanese industries, which has succeeded in trebling the number of factories in the past decade; and the predominance of this form of power now seems assured for factory working. Where electric tramways or central stations exist the energy for the driving of the motors is usually supplied from these stations, this being of special advantage in the towns, where the lighting and tramway load permits of a fairly cheap supply being afforded to the users of power. In many cases, however, the factory owners have installed their own generating plant, especially in the textile industry, the shipyards, metal refining works, and the mines. This fact is explained, in the instance of the mines, by the great distance which separates most of them from the real centres of industry, and the metal refineries have been compelled to establish individual plant mostly for the same reason.

The development in the use of electric power has been accompanied by the simultaneous extension of electric lighting. From the beginning of 1900 to 1910 the number of lighting companies has risen from 49 to 122; the buildings electrically lighted have increased from 47,701 in 1901 to over 600,000 in 1910; and the number of private lamps in use has advanced from 300,000 to 1,900,000, whilst the street lighting lamps have grown from 6,460 to 59,300 in the same period of years. Many of the lighting companies are also owners of tramways, and their total net receipts have increased nine-fold in the 10 years ended with 1910. Not only so, but the ratio of net profits to expenditure has constantly improved. It formerly stood at 3 to 1, but at present almost 50 per cent. of the total profits represents net profits. The electric tramways have found a specially favoured sphere of activity. As in almost all new industrial countries, so in Japan have the manufacturers begun to locate themselves as near to the coast as possible, and in this way a number of densely-populated industrial centres has arisen, where the transport of the workers to and from their place of employment has become a similar problem to that in New York, Berlin, and London. During the 10 years the number of towns provided with electric tramways has advanced from 11 to 40, the length of line from 72 to 692 miles, and the passengers from 46,477,000 in 1901, to 395,666,000 in 1911, and the invested capital from £1,500,000 to £18,700,000.

### THE POSITION OF NATIVE MANUFACTURING FIRMS.

The development in all branches of the consumption of electricity has naturally had a favourable influence on the sale of electrical manufactures, and the electrical trade of Japan for this reason has made a large advance since the beginning of the century. Until nearly the end of the past century, by far the greatest part of the turnover was effected by the importers; but

during the decade under consideration, the situation has become more favourable for the native manufacturing works. The history of the domestic industry is full of reactions and of successes only obtained after great trouble, and even in the present century the progress made by the native works has frequently been accompanied by failures. In particular it has turned out that many of the large works were equipped with inadequate capital, and this has led to financial losses in many cases, as it was impossible to bring the works quickly enough to the capacity for which they were designed. Various works which were projected with foreign capital either had to be abandoned before they were actually established, or they could only be successfully carried out after great difficulties had been overcome. Nevertheless, the industry has managed to reach a sound basis to some extent in the course of years, and it can now be regarded as having attained an assured position, although many works have not yet quite fully surmounted their juvenile defects.

The local demand has been greater than the capacity in many cases, and extensions had to be undertaken without sufficient capital being available. But the greatest want has been the lack of good and trained workers. It is true that the Japanese despatched engineers to Germany, England, and the United States in order to study the latest methods. As a result of the knowledge thereby gained no money has been spared in introducing the newest types of machinery, but the Japanese have been unable to impart the theoretical knowledge to their workmen. This difficulty has been specially noticed in the cable works, of which a number have arisen in recent years. In general, the cable factories work under tolerably favourable conditions, as they are usually in close relations with a large copper mine from which raw material is obtained at the lowest prices, and they are also protected by a high import duty. Nevertheless, they are not able to shake off foreign competition because the quality of the imported cables is generally better than that of the native product. The reason for this occurrence, according to a British Consular report, lies in the lack of sufficiently trained chemists in regard to rubber. Certain of the owners of cable factories have therefore adopted the course of obtaining the services of qualified foreign workers, but the latter are hampered by the fact that they are unable to make themselves sufficiently understood by the Japanese workers. While the imports of telegraph cables are, as will be seen, irregular, the imports of insulated wires show a constant advance, and the requirements have increased tenfold since the beginning of the century. The accompanying table illustrates the general course of the import trade during the past 14 years:—

IMPORTS OF ELECTRICAL MACHINERY, CABLES AND INSULATED WIRES.

	Machinery.	Telegraph cables.	Insulated wires.
1898 ...	£69,700	£18,500	£32,100
1899 ...	45,000	19,400	14,500
1900 ...	97,600	104,900	38,100
1901 ...	97,900	49,800	42,900
1902 ...	132,300	8,500	67,400
1903 ...	111,400	33,200	33,900
1904 ...	165,200	103,700	75,000
1905 ...	301,500	256,900	78,700
1906 ...	181,100	20,800	95,700
1907 ...	254,300	133,300	112,900
1908 ...	372,100	42,000	144,700
1909 ...	306,000	35,900	151,700
1910 ...	219,200	159,500	163,700
1911 ...	571,100	37,700	370,000

The manufacture of lamps and similar articles has largely increased. But although the domestic industry is at an advantage in relation to foreign competition through the import duties, the imports have not experienced any decline, and the business undertaken by Germany in this direction has been doubled in the past three years. Several of the large electricity companies have adopted the policy of importing certain parts from Europe or the United States and assembling them in Japan. This practice probably explains the fluctuations in certain articles of import in recent years. In conclusion, the author gives the following tables showing the respective exports to Japan of Germany, Great Britain and the United States in recent years:—

GERMAN EXPORTS TO JAPAN.

	1908.	1909.	1910.
Dynamos ...	£67,600	£58,550	£56,400
Armatures ...	7,150	1,650	4,800
Accumulators ...	2,400	2,400	20,300
Cables ...	94,150	28,500	163,950
Arc lamps ...	600	400	600
Searchlights ...	250	1,150	10,550
Glow lamps ...	10,800	10,650	25,600
Telegraph apparatus ...	3,500	600	3,400
Apparatus for power transmission ...	37,300	20,500	21,850
Apparatus for medical purposes ...	2,400	3,900	2,750
Measuring apparatus ...	5,850	14,550	21,300
Primary batteries ...	200	50	100
Heating apparatus, &c. ...	400	150	—
Insulating materials ...	—	—	50
Total ...	£232,600	£143,050	£331,650

BRITISH EXPORTS TO JAPAN.

	1908.	1909.	1910.	1911.
Rubber-insulated wires ...	£32,310	£25,550	£18,210	£19,120
Other insulated wires ...	28,895	53,615	39,690	49,965
Telegraph and telephone wire	41,060	64,615	262,205	100,500
Telegraph and telephone apparatus ...	4,050	3,030	3,245	1,800
Carbons ...	...	Not separately recorded.	...	...
Lamps ...	...	Not separately recorded.	...	...
Batteries ...	5,650	7,495	7,165	4,460
Unenumerated ...	12,565	18,155	24,090	24,145
Total ...	£124,520	£172,360	£374,695	£199,990

UNITED STATES EXPORTS TO JAPAN.

	1908.	1909.	1910.	1911.
Electrical apparatus, including telegraph and telephone materials ...	£88,960	£60,985	£67,780	£181,610
Machines ...	299,220	235,040	142,960	261,425
Total ...	£388,180	£296,025	£210,740	£443,035

JAPANESE STATISTICS.

The foregoing information is amplified by Mr. Arthur A. Brandt in the same journal, by extracts from the statistical annual which was recently issued by the Japanese Government, although the opinion is expressed that some of the figures contained in it rather underestimate the actual position of affairs in regard to certain branches of the industry. It appears that the total horse-power used in the whole of the Japanese industries increased from 316,000 in 1905, to 470,000 in 1908, 603,000 in 1909, and 816,000 H.P. in 1910. Of the latter, 938 dynamos represented 247,500 H.P., and 1,912 motors 66,844 H.P., although these are considered to be computed on too low a scale. Steam engines rank second with 308,000 H.P., and turbines and Pelton water-wheels third with about 90,000 H.P., the balance being formed by gas engines and petroleum engines. As to the apportionment of the forms of power among the different industries, the lead in the horse-power of dynamos and motors is taken with 177,000 H.P. by the special works, which include the mines and mining operations; the second position is held by the electrical works with 103,000 H.P. and the third by the textile mills with 38,000 H.P. in 1910, whilst these are followed by the chemical works and the machinery and ironworks. The total number of industrial workers is returned at 717,161, of whom only 3,145 are employed at electrical engineering works, thus showing that very few works exist which produce machines and apparatus, notwithstanding the great progress made in the applications of electricity.

It should, however, not be overlooked that the Japanese are busily occupied in endeavouring to manufacture to an increasing extent. Installation materials and small transformers and motors are already produced on a large scale, and the principle of cheapness rather than that of quality prevails in regard to native manufactures. The industry is supported by the Protectionist policy of the Government, and the increase in duties brought into operation in 1911 has led to rates which are prohibitive for certain articles. Under the effect of the Protectionist policy, for instance, the domestic glow lamp branch has already rendered itself independent of foreign manufacturers. Carbon-filament lamps, of which about 5,000,000 are probably required every year, are made exclusively in the country by three firms, as a duty of 40 per cent. *ad valorem* prevents foreign firms from competing with the Japanese. In the case of metal-filament lamps, which are not largely used for the time being, about 500,000 per annum are made in the country, but it will not be long before these lamps supersede the carbon lamps, owing to the supply works introducing the system of meters instead of fixed charges for supply. The wire filament is obtained from the United States, and the fact has to be reckoned with that the export possibilities for wire lamps also will soon come to an end.

The development of electric lighting next receives consideration. It is shown that the companies increased from 111 in 1909, to 122 in 1910, the paid-up capital from £5,539,100 to £12,242,000, and the number of connections from 437,104 to 602,681 in the same years respectively. Although the number of incandescent lamps in use in 1910 is stated at 1,900,000, Mr. Brandt declares that other sources represent a total of 2,000,000 of S.C.P. in 1910, and 3,000,000 in 1911. Concerning the progress of electric tramways it is found that the number of companies advanced from 34 in 1910, to 40 in 1911, the length from 363 miles to 431 miles, and the mileage under construction from 180 to 221 in the same years respectively, whilst the paid-up capital has risen from £9,438,000 to £16,087,900. As most of the large centres have now been provided with electric tramways, it is considered that the rate of progress in new construction will be slower in the future. As far as concerns the main railways, which are now almost entirely in the possession of the State, it is mentioned that the Government is making experiments with electric traction, and the section between Tokio and Yokohama is already in course of construction. In conclusion, it is submitted that it is difficult for Japan to provisionally maintain the level of development which has hitherto prevailed in consequence of the strained financial resources of the Government and private individuals. On the other hand, the electrical industry experienced a favourable expansion in 1911; and as the country is specially suitable for the applications of electricity, it is possible to reckon upon a further development of this industry in the future.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

### AMENDMENTS.

**COSTA RICA.**—The Customs authorities have recently decided that electric lamp-stands of basket work without ornaments and without silk linings are to be dutiable at the rate of 40 centavos per kg. gross weight. (100 centavos = 1s. 10½d.; kg. = 2'204 lb.)

**SOUTH AFRICA.**—H.M. Trade Commissioner in South Africa has recently called the attention of British exporters to the fact that duty in South Africa is levied on the "current value of the goods for home consumption at the place of purchase, including packing," under Article 20 of the South African Customs Union Convention, which is as follows:—

"The current value of such goods shall be taken to be the true current value for home consumption in the open market of similar goods at the place of purchase, bought in the ordinary way from the manufacturer or supplier, in normal quantities, including the cost of packing and packages, but not including agent's commission if it does not exceed 5 per cent., provided that in no case shall the true current value, as above defined, be less than the cost of the goods to the importer at the place of purchase."

In addition, therefore, to the actual selling price c.i.f. South Africa, importers should state on their invoices the current value for home consumption in the United Kingdom, "including the cost of packing and packages."

H.M. Trade Commissioner has also received complaints from importers in South Africa as to the manner in which quotations are made by some British exporting firms. One or two cases have recently come to his notice in which importers in South Africa, having based their calculations on c.i.f. quotations made to them by British firms, have found out on receipt of the invoice that these quotations did not include packing charges. It should be remembered that c.i.f. means the cost placed on board plus freight and insurance, and the omission, whether in a cabled offer or in a catalogue, of any item which goes to make up that cost should be stated, e.g., "packing extra, so much," or, if necessary, "packing extra, estimated at so much."

**VENEZUELA.**—The Customs Authorities have decided that electric lamps including the bulbs are to be declared on the Consular invoice, which must accompany them, as "Lamparas para alumbrado electrico inclusive los bombillos" and will be dutiable at the rate of 1'174 bolivares per kg. gross (25 bolivars = £1; kg. = 2'204 lb.). Fancy or other articles included in more highly taxed classes by reason of their nature, will not be classed as lamps merely because they are provided with a wire for lighting and a socket to hold the bulb. It should be noted that in filling up the Consular invoice, exporters must adhere to the wording in Spanish as laid down by the Customs.

A recent circular issued by the Customs Authorities points out how necessary it is that shippers should take the greatest care in filling up invoices. It has recently been their habit, when entering several parcels of the same goods on the same invoice to state particulars as to the number of the parcels, bracketing these together and entering the nature of the goods once only for all the parcels. This is not in accordance with the regulations and will not be allowed; the description of the goods must be repeated for each parcel. Another practice is to declare the goods by giving only a reference to the number of the item of the tariff under which they are dutiable, e.g.:—

Una caja aparatos comprendido in el No. 2 del Arancel.  
(One case of apparatus included under No. 2 of the Tariff.)

The contents of each package must be declared by giving the name of each article contained therein without using abbreviations, ditto, or commas signifying ditto, the materials of which the goods are made, and the quality which distinguishes the goods from other articles of the same name, dutiable under a different number of the Tariff, e.g., "Una caja aparatos para generar vapor del residuo del petroleo, (a case of machinery for generating steam from the residues of petroleum)."

In future heavy penalties will be incurred unless the regulations are strictly complied with.

**Bang goes Tuppence.**—Lossiemouth is a little burgh—in more senses than one. We confess that its fame had seldom reached our ears until September last, when in the interests of its 4,198 inhabitants it invited manufacturers to tender for an electrical installation. Prolonged deliberations no doubt have occupied the intervening months 'twixt then and now, for as recently as 10 days ago those who were privileged to tender, were informed that no decision had been come to in regard to the offers. Enclosed with this intimation, they have been favoured with the return of their guinea deposit—with a deduction of two-pence! The assumption is that this is made up as to two halfpences for postage, and another two for the cost of the postal order. The incident would be ludicrous were it not unfortunately indicative of a great deal that public tenderers have to put up with. We doubt whether the burgh has any electric lighting powers, and, may be, this is why nothing has been done.

8. "Non-spring two-way magneto control for motor-cycles." R. J. PRIDDEY. January 1st.
19. "Gears for electrically operating machine tools and the like." J. P. HALL. January 1st.
43. "Apparatus for electrically operating planing-machines and the like reciprocating tools." LANCASHIRE DYNAMO & MOTOR CO., LTD., A. P. WOOD and H. S. McLEOD. January 1st.
47. "Electrical apparatus for heating liquids." M. RUTHERS. January 1st.
74. "Mechanical grips for electrical wires." S. W. MARTYN. January 1st.
79. "Electrical terminals." S. W. MARTYN. January 1st.
80. "Electric incandescent lampholders." S. W. MARTYN. January 1st.
88. "Electric switches." F. BEKMER. January 1st. (Complete.)
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## PUBLISHED SPECIFICATIONS.

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### 1911.

- ELECTRIC CONDUCTORS. Q.M. Kallmann. 28,459. December 18th. (December 18th, 1910.)
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- ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. G. Cowcher. 29,326. December 30th.

### 1912.

- METHOD OF, AND APPARATUS FOR, CONDUCTING AND CONNECTING CABLES, FLEXIBLE TUBING AND THE LIKE TO ROTARY OR MOVABLE MACHINERY. H. M. Ackery. 889. January 11th.
- PROCESS FOR THE PRODUCTION OF NON-POROUS ELECTRO-DEPOSITED COATINGS UPON METAL SHEETS. B. Lowy and F. Mullet. 2,423. January 30th.
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- RECEIVING APPARATUS FOR ELECTRIC WAVES. F. Schneider. 18,086. August 6th. (April 15th, 1912.)
- TERMINALS SUCH AS CONTACTS AND ELECTRODES IN ELECTRICAL APPARATUS. British Thomson-Houston Co. (General Electric Co.) 535. January 6th.
- TELEPHONE SERVICE METERS. P. W. Wall. 1,167. January 15th.
- WIRELESS TELEGRAPH RECEIVING APPARATUS. Marconi's Wireless Telegraph Co. and H. J. Round. 8,055. February 6th.
- RECEPTION OF "CALL UP" SIGNALS IN WIRELESS TELEGRAPHY AND OTHER PURPOSES. F. L. Muirhead. 8,445. February 13th.
- ELECTRIC DISTRIBUTION SYSTEMS. British Thomson-Houston Co., H. W. Taylor, F. P. Whitaker and H. N. Egorborg. 8,532. February 13th.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

JANUARY 24, 1913.

No. 1,835.

## ELECTRICAL REVIEW.

## THE MARCONI CONTRACT.

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THE letter addressed by the managing director of the Marconi Co. to the Postmaster-General, and by him communicated to the Select Committee which is now inquiring into the contract provisionally signed, is a somewhat exceptional document. Its object is to express the company's desire that they may be relieved from the obligations of that contract, a proceeding to which no exception can be taken as an ordinary business operation, but the rhetoric by which the intimation is accompanied will seem to most people to be somewhat misplaced. Anticipating, as the managing director naively says, that the tender delivered on March 7th would be promptly submitted to Parliament and ratified, they retained "a very large responsible and experienced staff of engineers" in readiness to undertake the work. When the provisional contract was signed on July 19th they were, they think, reasonably entitled to expect that it would be forthwith submitted to Parliament for ratification, but a Select Committee was appointed instead.

Over three months have elapsed, 28 public sittings have been held and many witnesses called, but the Committee has had no evidence "from those best qualified to speak with experience on the subject," and in the meantime erroneous statements, technical and otherwise, "reproduced in the Press of nearly every country in the world," have been detrimental to the company's interests. And now it is proposed to appoint a technical Committee to inquire as to which is the best system, which the company would welcome, provided proper facilities were afforded for testing the evidence to be called before it, though they regret that it was not appointed three months ago. The delays were not contemplated by either party; it is inequitable, says Mr. Godfrey Isaacs, that his company should remain bound, and in order to continue to maintain the company's position "in an important industry developed in and conducted from this country, employing over 2,000 British workers, our engineers must be released, and Mr. Marconi and I must be free to attend to other important work."

The interim report of the Committee made it tolerably clear that the contract would not go through in its original form, so that the company cannot be said to be doing anything particularly heroic in withdrawing from the contract, and expressing their readiness to consider other terms when they are offered.

According to the City editor of the *Westminster Gazette*, the course taken by the company "is generally applauded in Stock Exchange quarters, because it is considered that it is good policy on the part of the company to force the pace as much as they can." To force the pace by unreasoned criticism of the proceedings of a Committee appointed by Parliament which has the decision in the matter seems to us to be of doubtful wisdom, whilst the general tone of the letter is, we fear,

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION

In the Press.

**H. ALABASTER, GATEHOUSE & CO.,**  
4, Ludgate Hill, London, E.C.

calculated to enlarge the circle of those who hesitate to entrust an important Imperial undertaking to private hands. There is, no doubt, some occasion for irritation to the parties who entered into the contract, but it should be realised that confidence is more likely to be restored by calmness and patience than by a display of irritation. The position and the opportunities of the Marconi Co. may be unrivalled, but they should be used with discretion, at least where Parliament is concerned.

#### The Ferranti Steam-Gas Turbine.

It has been common knowledge amongst his friends for some years that Dr. Ferranti was engaged upon important investigations in connection with the utilisation of "steam-gas"—i.e., steam superheated to a temperature far above its saturation point—in turbines, but little has hitherto been divulged regarding the details of the work, or the degree of success which had been attained. We are glad, therefore, to be able to reproduce from the James Watt lecture, which he delivered at Greenock last week—a lecture of deep interest throughout—some particulars which indicate the progress that he has made.

The fact that Dr. Ferranti's views have been embodied in a turbine of no less than 5,000 H.P. bears witness to the large scale upon which his experiments have been carried out, and preserves them from the suggestion that laboratory results may not be realised in practice. We are still without information as to the details of the construction which renders stripping impossible in spite of the use of extremely small clearances, but the statement that the H.P.-hour can be obtained with an expenditure of no more than 7 lb. of water at two-thirds load at once stamps the invention as one of the first importance. Not long ago Sir Charles Parsons himself, upon whose foundation modern turbine practice has been built up, expressed the view that the steam turbine had approached the limit of possible economy, but clearly there are still great possibilities of progress.

It will be observed that Dr. Ferranti strongly deprecates the construction of large oil engines, maintaining that the turbine is the right thing for large powers, and in view of the economy he has attained—taking capital cost into consideration also—it seems probable that the incentive to effort in this direction will in future be lacking. The suggestion that the power station of the future will embrace a large gas plant with by-product recovery plant, supplying gas to the boilers and heavy oil and petrol for the use of internal-combustion engines, recalls the views enunciated in "the Ferranti address" of 1910, and indicates that Dr. Ferranti looks forward with undiminished confidence to the dawning of the electrical age then foreshadowed. It will be remembered, too, that he then hinted at the possible successful development of the steam-gas turbine as one of the factors in producing that result. We wish him all success in the realisation of his prophecy.

#### British Electrical Superannuation Fund.

THE British Electrical Superannuation Fund, which was formed about 1900, appears to have had but a short life as such, for we understand that during the past year it was resolved to wind it up as on December 31st, 1911. It would seem that if all retirements took place at the earliest optional age of 60, instead of being spread mainly over the ages from 60 to 65, a deficiency of some £15,000 would be disclosed. When originally formulating the fund it was, we believe, the wish and endeavour of the British Electric Traction Co. to adopt a superannuation scheme capable of application to the possible needs or requirements of the electrical industry generally. The industry, however, with the exception of the City of London Electric Lighting Co., seems to have

ignored the idea, and its operations were therefore practically confined to the salaried employes of the British Electric Traction Co. and its subsidiary companies. We understand that in place of the British Electrical Superannuation Fund, a new fund has been constituted and inaugurated called the British Electrical Endowment Fund, which, however, we gather the City of London Electric Lighting Company has not joined, that company apparently being quite capable of carrying on a fund similar to the British Electrical Endowment Fund. The secession of the City of London Co. means the payment by the British Electrical Superannuation Fund to the City Co. of some £9,000. The managing trustees and the investment trustees of the Endowment Fund are empowered to hold all moneys recently belonging to the Superannuation Fund or investments representing the same, for the purposes of the Endowment Fund, and to apply them as provided by the rules of that fund, which we believe came into operation as from January 1st, 1912.

#### Copper.

THE total European visible supply still keeps fairly level, the figures given in Messrs. Merton's statistical circular being 43,160 tons for January 15th, 1913, against 43,241 tons for December 31st, 1912, the difference of 81 tons being a balance between the decrease in English stocks (1,499 tons), and on quantities afloat (100 tons), and the increase in French, Dutch and German stocks. The supplies are thus close up to deliveries, and show a fair figure (23,371 tons) for the half-month. The North American deliveries to Europe are fairly high; Spain and Portugal send the average quantity to England and France. Chile shipments are high, and Australian just average. If the deliveries were doubled the figures for the month would be fairly good; this, of course, depends upon whether the drop in price is maintained or not.

The world's supplies, including Holland and Germany, stood, at the end of December, at 90,225 tons, an advance on the figure for November of 8,478 tons. American producers' stocks, according to the Association, stood, on the same date, at 47,014 tons, an advance of 8,548 tons on the preceding month. The December production in the States, from the same source, was 64,000 tons, the home consumption taking 25,100 and export 29,330, leaving a surplus to stock.

The figures for each month in the year are given by the *Financial News* for January 9th, showing that this production was only exceeded in August and October, that July was fairly well up to it, the other months being lower, January and February showing least. The home consumption was brisk the first part of the year, reaching its maximum in October at 37,550 tons. The total production for 1912 is given at 706,000 tons, a quantity considerably higher than the 639,000 tons credited to 1911.

The reason for the drop in price, which amounts to £3 15s. since December 31st, is discussed in the *Financial Times* for 17th inst. The writer of the article is not inclined to consider the increase in American stocks a determining factor, but rather attributes it to the situation created by anticipations of continued expansion in commerce generally, and consumption of copper particularly, which have not been realised, tending to overload the market. The consumer also appears to have been apprehensive of a market showing signs of artificial prices, such as could be traced in those of September. Messrs. James Lewis summarise the conditions of trade in 1912, by dividing the year into two periods of six months, in the first of which prices improved, after falling to £61 per ton, under the influence of good trade and decreasing supplies.

The highest point was reached on June 20th, when standard was quoted at £80 cash. Prices were maintained, probably artificially, till the outbreak of war in the Balkans,

with the subsequent uncertainty and trade depression. Messrs. Lewis give the total home consumption of the United States at 110,100 tons, an increase of 113,500 tons over the preceding year. Consumption in Germany also increased by 31,000 tons, or 25 per cent., England and France being, apparently, the only considerable countries which lost ground. The world's consumption is given at 939,000 tons, as against 811,300 tons in 1911. The total production of the world, however, is estimated at 1,015,000 tons, an advance on 1911 of 110,000 tons. The United States increased its output by 71,000 tons, or over 14½ per cent., and further expansion in low-grade ores is anticipated. Chile has increased her output by 8,000 tons; Mexico, 11,000 tons; Spain and Portugal, 9,700 tons; and Canada, 7,000 tons. Russia and Australia are both increasing production, and much is expected from Central Africa.

Taking into account the upward tendency of production, and the present fairly high price, it seems probable that the average for standard in 1913 will be lower, unless the settlement of the Balkan trouble and improved commercial conditions in this country should unite to give an impetus to consumption.

**"The Surveyor."**—We note with pleasure that our valued contemporary, *The Surveyor*, arrived at its majority last week, and celebrated the occasion with a special issue dated January 17th. Since its first year, the journal has greatly increased in bulk and circulation, and has attained to a very high standing as the organ of the professions included within its full title—*The Surveyor and Municipal and County Engineer*. During the past 21 years, *The Surveyor* has witnessed vast changes in municipal engineering and in the organisation of municipal government, and has been enabled to play a prominent part in safeguarding the interests of municipal engineers. We believe, too, that, throughout its existence, it has remained in the hands of the original proprietor.

In the special issue, besides a general survey of the period, there are given special reviews of the advances made in electricity supply, highways—a subject which our contemporary has made its own—public buildings, refuse disposal, sewerage, street lighting, tramway progress, water supply, and legislation, the whole constituting a valuable and interesting *résumé* of the remarkable developments which have taken place in each of these important branches of municipal activity.

We congratulate the proprietor and all concerned in the production of this issue and on the attainment of the twenty-first milestone, and hope they will celebrate their jubilee under conditions no less auspicious.

**The Curative Waters of Bath.**—Last week a number of London doctors visited Bath and attended an informal conference on the radio-active waters of the city. According to the *Times*, Sir William Ramsay, in opening the conference, said the gas from the waters was now bottled up in steel bottles under pressure and used in spraying. There were three methods of profiting by the curative properties of the waters. If they were drunk they should be taken in small quantities and often. In the case of baths, the patient should be made negative in order that the particles given off by the radium could be absorbed through the skin. Where the method of spraying and breathing was adopted the patient should be made negative also, in order that the particles might decompose.

**Electroculture in Austria.**—An interesting account of results obtained by electroculture at Petrovic (near Prague), appears in a recent issue of the *Elektrotechnische Zeitschrift*. The experiments were carried out during the exceptionally dry summer of 1911, but, on a number of patches under the same management and subject to the same treatment in every respect except electrification, the yield of some crops was twice as great on the electrified as on the "control" areas. The high-tension discharge system was employed, steel wires being stretched across the fields at intervals of 100 yards between insulators mounted on wooden poles; 60 poles were in use in an area of 90 acres. On these steel wires rested a radiating network of 0.2 mm. diameter steel wires placed 10 yards apart. The height of the network was 12 ft. above ground level, so that ordinary carting operations were not hindered. In the small stations supplying the network, a high-frequency current (obtained by the aid of mercury interrupters), was transformed up to 100,000 volts and then rectified before admission to the radiating network. The total power consumption for the 90 acres was 2 amperes at 120 volts. The discharge was maintained only for a few hours per diem, and was necessarily entirely suspended in wet weather: it was purposely interrupted during very hot weather (since experience shows that the discharge treatment is useless or even injurious in the latter case).

The quality as well as the yield of the crops was much improved by the electrical treatment, and it is claimed that, if the radiating network is so designed as to take full advantage of the output from the transformer station, the capital cost of the whole equipment can be recouped by the increased returns during the first year of working.

## ELECTRICAL DEVICES FOR MEASURING THE INFLAMMABILITY OF COAL DUST.

THE second Report of the Explosions in Mines Committee to the Home Secretary has been issued, and deals with experiments made to determine the inflammability of various coal dusts.

The degree of "inflammability" of any combustible material can be defined as the degree of ease with which its oxidation can be effected so as to produce flame. It will be seen from this definition that the inflammability of any combustible material depends essentially on its chemical affinity for oxygen. The inflammability must also, however, be affected to a large extent by the physical condition of the combustible material, whereby it is rendered more or less open to attack by the oxygen.

When considering the relative degrees of inflammability of coal dusts, it can be accepted as an axiom that the finer the dust from any particular coal the greater its inflammability. This has been confirmed by a large number of experiments. Bearing this in mind, the consideration of the more important and more complicated problem of the influence of the chemical nature of the coal on the inflammability of the dust from it can at once be proceeded with.

The method of investigation chiefly followed by the Committee has depended upon the destructive distillation of different varieties of coal under different conditions. The apparatus used by the investigators is described below. Accurately weighed quantities of the dust were blown upon

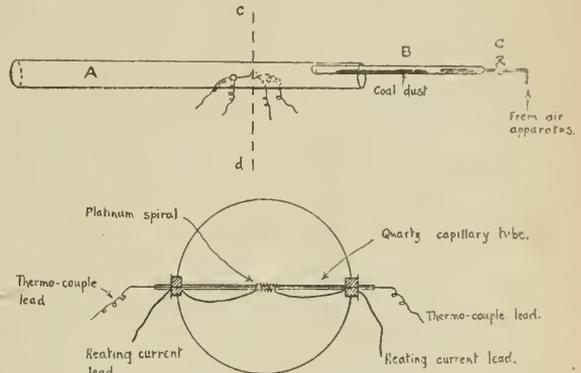


FIG. 1.

a platinum spiral maintained at the same temperature in each case, and their relative inflammabilities were judged by the impulses given to a ballistic pendulum by the sudden expansion consequent on the inflammation of the dust clouds.

Referring to fig. 1, A is a glass cylinder, 8 cm. in diameter and 140 cm. long, open at both ends. A platinum coil of No. 32 gauge wire, closely wound on to a tube of thin-walled quartz of capillary bore, passes horizontally across a diameter of the cylinder at a point 40 cm. from one end. Through the bore of the quartz tube a platinum and platinum-rhodium thermo-couple passes, and is connected to a milli-voltmeter calibrated so as to read temperatures on the Centigrade scale. By means of suitable connections, an electric current can be passed through the spiral, so that it can be heated to any temperature up to about 1,400 C., and maintained at a constant temperature by the adjustment of an external resistance. The length of the spiral is 17 mm., and its diameter 1.5 mm. The coal dust to be tested is blown across the heated spiral as a cloud of a fairly uniform density, successive trials being made until a temperature is found at which general inflammation of the dust cloud takes place.

To obtain the dust cloud, about 2 gm. of the sieved and dried dust is placed in a glass tube of 2.5 cm. internal diameter and 45 cm. long. This tube is closed at one end by a rubber stopper carrying a glass tap of 1 cm. bore. It is supported so that the open end is at a distance of 30 cm.

from the spiral. The tap is connected with an arrangement for giving a constant puff of air.

The method of making the determination is as follows:—The dried and sieved dust is introduced into the tube B so that it lies evenly over its whole length, and the tube is then closed by the rubber stopping and tap, and clamped in position. The platinum coil is then raised to such a temperature as previous trials may have indicated to be about that required. The dust cloud is then produced by suddenly opening the tap C. The air blast passing over the surface of the dust raises the top layer and carries it into the larger tube, and over the heated coil in a cloud that remains uniform during the stroke of the piston. If ignition takes place, the temperature of the platinum coil is lowered 10° or 20° C., and a fresh trial is made, and so on, until two temperatures are obtained, differing by 10° C., at

relative ease with which inflammable gases are evolved. The order of inflammability so obtained corresponds in a remarkable degree with the percentage of inflammable matter extracted from the same coals by pyridine. The Committee is of opinion that these two methods form a valuable means of discriminating between different coals in respect of the sensitiveness of their dusts to ignition. It must, however, be noted that these tests have been made with dusts artificially ground and sieved to an equal degree of fineness, and since coals differ considerably in their power of resistance to pulverisation, the friability of a coal must be taken into account.

There are three appendices to the report, dealing with the volatile constituents of coal, the extraction of coal by pyridine, and analyses of coals and their relative ignition temperatures.

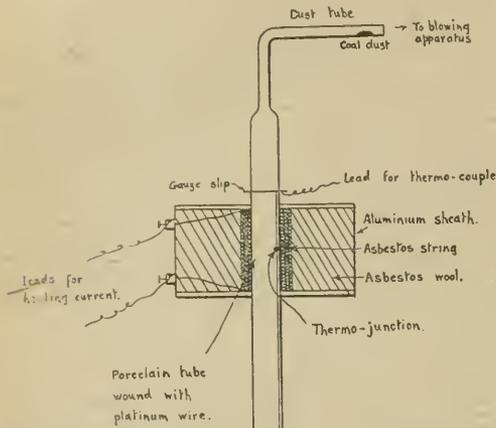


FIG. 2.

one of which inflammation takes place, whilst at the other the dust cloud passes over unignited. The mean temperature is then taken to be the ignition temperature of the dust under the conditions of the experiments.

The French mining authorities have carried out experiments dealing with the same problem, and their index of inflammability is the size or length of the flame produced when a given quantity of the dust is blown through a vertical porcelain tube of 25 mm. internal diameter and 10 cm. long, heated to a temperature of 900° C. The Home Office Committee has made similar experiments, employing the apparatus shown in fig. 2.

The dust, carefully sieved and dried, is introduced into the horizontal dust tube, its weight being 0.2 gm. The wide portion of this dust tube is then placed vertically in the small electric furnace, a slip of copper gauze being introduced between the furnace tube and the dust tube. The temperature, measured by a platinum and platinum-rhodium thermo-couple passing through the furnace and in contact with its walls, is then raised to 900° C. and maintained constant. A tap, which connects the dust tube to the apparatus for giving a constant puff of air, is now quickly opened. All the dust in the dust tube is thus projected downwards through the furnace. It ignites, and a flame appears underneath. This flame is photographed, the experiments being made in the dark, and the sensitised plate being exposed a little time before the tap is opened and allowed to remain exposed until all flame has disappeared. It is from the appearance of such flames that the French experimenters judge the relative inflammabilities of the different dusts.

In making these experiments the Committee found that, provided all the experimental conditions were maintained rigidly constant, the size and type of flame obtained from one particular coal remained remarkably constant from one experiment to another. Comparison between one coal and another by means of the photographs of their flames can, therefore, be relied on.

The experiments show that the relative inflammability does not depend upon the total volatile matter, but on the

## THE NATIONAL INSURANCE ACT, 1911.

### OUTWORKERS. CONTRACT OF SERVICE.

By JOS. J. H. STANSFIELD, F.C.I.S.

THE first schedule to the National Insurance Act, 1911, consists of two parts, the first containing a list of employments within the meaning of that part of the Act referring to health insurance, and the second a list of exceptions.

Paragraph (c) of the first part provides that insured persons includes outworkers—that is, persons to whom articles or materials are given out to be made up, cleaned, washed, altered, ornamented, finished or repaired, or adapted for sale in the home or other premises not under the control or management of the person who gave out the articles or materials, unless the Insurance Commissioners have by Special Order excluded any particular class or description of such outworkers.

The amount of insurance payable for outworkers in many cases causes difficulty. Where a person is continuously employed by one employer the difficulty is not great, and no hardship is laid either upon employer or worker beyond that entailed by the ordinary employer whose workpeople are engaged upon the premises of the employer, but many outworkers work for more than one employer, or only work at intervals, or are assisted by other members of their family. In such cases both employer and worker are placed at a disadvantage; the employer because of the intermittency of the employment entailing the insurance of a proportionately larger number of employes, and the outworker because more than one contribution per week would be payable, or because deductions would be made when employment might have been available only for a few hours during the week.

Official explanatory leaflet No. 26 shows how this difficulty may be overcome, contributions being payable under two methods. Method A is the ordinary method applicable to insured persons working on the premises of the employer, one contribution being payable for each calendar week (Monday to Sunday) or part of a week in which work is done.

Method B is called the "unit" system of payment, and by this system contributions are payable not according to weeks, but on the basis of the amount of the work done, special cards (A.O. for men and E.O. for women) being issued.

Where outworkers are working for more than one employer and Method A is adopted, the employers may agree to stamp the card in rotation, but if they do not so agree, each employer must, whenever work is brought in, stamp the card for each week or part of a week that has passed since the work was given out, unless contributions in respect of those weeks have been paid by some other employer.

Under Method A, only one contribution is payable for each week, but where Method B is also used and an outworker works for more than one employer, one card must be used for the one or more employers who use Method A, and a separate card for each employer using Method B.

Under this regulation more than one contribution may be payable for the same week, but after 52 contributions have been paid in any year, no further contributions need be paid for the year if the outworker applies to his or her approved society, or to the Insurance Commissioners for a certificate to this effect. On the other hand, an outworker regularly employed by an employer who is using Method A, and by another employer who is using Method B, may call upon the latter employer to also use Method A after the end of any quarter.

Under Method B one contribution is payable for each unit of work, however long or short a time the work may have taken. This unit is an amount of work which earns a certain sum fixed by the Commissioners for each trade, and it is intended to represent the amount an ordinary worker would earn if a full week were worked.

The following are a few samples of "units":—

1. Hand-hammered chain making up to and including  $\frac{1}{2}$  in. (*i.e.*, small sizes) 10s.
2. Dotted or tommed chain making and hand-hammered chain making of  $\frac{3}{8}$  in. diameter and over—up to  $\frac{1}{2}$  in. inclusive—20s.
3. The making of boxes or parts thereof made wholly or partially of paper, cardboard, chip and similar material. For female workers 12s.

Where no units have so far been fixed for any particular class of work a general unit of 15s. for male workers and 8s. 9d. for female workers has been fixed by the Commissioners, but where these general units are considered to be under or over the work value of a week, the Secretary of the Insurance Commissioners may be written to and unit values of a different amount may then be prescribed if thought desirable.

If a unit is, say 10s., and a worker brings in work for which 10s. 9d. is payable, two stamps need not be paid, and the extra 9d. may be carried forward towards the next unit. On the other hand, if work is for the first time brought in below the value of a unit, a stamp must be affixed, but no further stamp is payable until the total value of the unit is made up. In reckoning the value of work, any expenses incurred in doing the work must be deducted before arriving at the unit value.

The regulations as to employment of outworkers have recently been amended, and the amended regulations came into force on January 13th of this year. The Official Explanatory Leaflets, Nos. 25 and 26 (revised), deal with the question of outworkers in England.

The second part of the first schedule to the Act provides that outworkers who are the wives of insured persons are not insurable. This exception placed such workers in a better position than other outworkers, and an order has been made by the Commissioners, with the approval of the Treasury, to include such persons.

It is, however, pointed out that the Act provides (Sec. 2) that if she is ordinarily and mainly dependent for her livelihood upon some other person, a certificate of exemption can be obtained by applying to the nearest Customs and Excise officer. No contribution will then be payable by the worker, but the employer will still have to pay his own share of the contributions.

*Contract of Service.*—Paragraph (a) of the first part of the First Schedule to the Act uses the words "contract of service" in determining whether an employé is insurable or not, and cases occur where the Insurance Commissioners are asked to determine whether any particular class of worker comes within the Act.

Such an application was recently made by a number of insurance companies and friendly societies, who wished to know whether agents paid by commission or fees for part time or spare time service to canvass for business or to collect moneys, were employed under a contract for service.

On December 9th last the Commissioners held a public hearing, and decided that agents engaged under the agreements handed in by the companies and societies had to be insured, unless paragraphs (e) and (g) of the second part of the first schedule to the Act applied.

Paragraph (e) provides that agents paid by commission or fees, or by a share in the profits, or partly in one and partly in another such way, are not insurable as agents where they are mainly dependent on earnings from some other occupation or where they are ordinarily employed as agent by more than

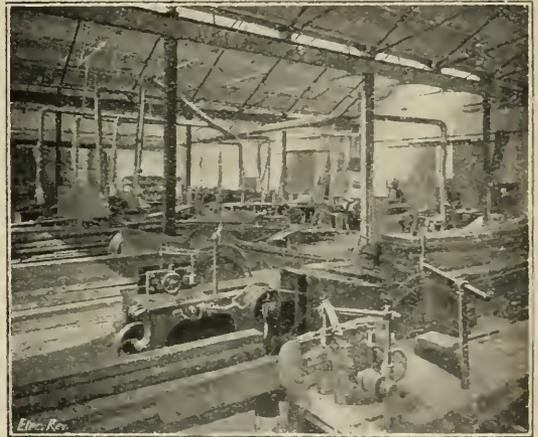
one employer, and his employment under no one of such employers is that on which he is mainly dependent for his livelihood.

Paragraph (g) provides that employment otherwise than by way of manual labour at a rate of remuneration exceeding £160 a year, or employment involving part time service only, at a rate of remuneration which, in the opinion of the Commissioners, is equivalent to a rate exceeding £160 a year for whole time service, is not insurable.

## THE ELECTRIC DRIVE IN THE WOOD-WORKING YARD.

Few to-day question the increased economy and efficiency to be obtained by the application of electrical power, but perhaps it has not made such strides in the wood-working industry as in other directions. This is chiefly because the proprietor, as a rule, has had too limited an idea of the benefits to be derived from electric driving. He has looked only for a decreased power bill, and has been quite unaware that an electrical power equipment would enable him to improve and quicken his processes, increase his output, and reduce his labour bill.

Where there is a public electrical supply available, very advantageous terms can often be arranged. But the important economies mentioned above make it advisable to use electrical power, even when no public supply is at hand. In such cases the steam boiler and engine may still be retained (and, if necessary, the wood waste still used as fuel), but instead of mechanically distributing the power through



GENERAL VIEW OF SAWMILL.

shafting and belts, the engine should be used to drive a dynamo, supplying current to drive motors coupled to individual machines or groups of machines.

Wood-working machines are very diverse in their characteristics, and require individual consideration in order to secure the best results. In nearly all cases the load is a very fluctuating one, due to knots, uneven sawing, and nipping of the timber, while there is always the liability of sudden overloads due to these causes. Gradual starting of the tools is a necessity owing to their very high working speed and heavy starting load, as in four-center planing and moulding machines, and it is equally necessary to be able to stop immediately in cases of emergency.

These conditions demand that the switchgear should be simple to manipulate, or it will absorb attention on the part of the workman which should be given to his work.

The motor must be automatically protected by the controlling device against damage arising from failure of voltage or from overloads, and the switchgear must be capable of frequently opening circuit on the occurrence of dangerous overloads, without itself sustaining damage.

It is also advisable completely to enclose the switchgear in one substantial housing, as, in spite of the elaborate system of suction pipes, the atmosphere is more or less charged with dust, which tends to percolate everywhere.

A conspicuous example of what may be achieved by a well-planned installation, embodying the most suitable form



LEA VALLEY MILLS: 30-H.P. MOTORS AND "CONSPED" CONTROLLERS DRIVING LINE SHAFTS.

of control, is afforded by Messrs. Lathom's Lea Valley Mills, of which the following is a brief description:—

The whole lay-out was arranged by the engineers of the Hackney Borough Council's Electricity Installation and Sales Department. The total horse-power at present installed is 280, and the voltage 240 and 480 volts D.C. The largest motor is of 50 H.P., and the smallest 2 H.P.

All the motors are shunt-wound, fitted with interpoles, and of the enclosed ventilated type, by Messrs. J. H. Holmes and Co., of Newcastle-on-Tyne. One 50-H.P. motor drives a line of shafting, which drives four 36-in. circular saw-benches. The second 50-H.P. motor drives two log frames of the vertical reciprocating type, by Messrs. Robinson, of Rochdale, each machine being capable of making any number of vertical cuts up to 24 simultaneously from logs up to 30 in. sq. and 12 ft. long.

One 15-H.P. motor drives a log-frame saw of the horizontal reciprocating type, by Messrs. J. Pickle & Son, of Hebden Bridge, which is capable of making one cut up to 48 in., cutting at the rate of 2 in. per minute.

Four 30-H.P. motors each drive a length of shafting, from which various moulding and planing machines, vertical spindles, circular saws and band saws are driven.

Other smaller machines are fixed for working saw-sharpening tools, &c.

The control panels at Messrs. Lathom's mills are all made by the Adams Manufacturing Co., Ltd., of London and Bedford, and of the well-known "Adams Igranite Conspede" type; they can be clearly seen in the illustrations. Each panel is enclosed in an iron housing of pillar form, and special precautions are taken in enclosing the control gear to exclude the dust effectively.

In individual driving it is even more essential than in group driving to provide means for rendering sudden overloads harmless, because in individual driving the motor has only power sufficient for the one machine that it drives, and no assistance is available from fly-wheels or countershaft pulleys, while the amount of kinetic energy stored in the moving parts of the machine and the motor is practically negligible. For instance, if a saw sticks, as it is always liable to do, the electric motor, in order to cope with the increased load, demands an abnormal amount of power from the mains. When this demand reaches a value likely to be injurious to the motor, the machine should be automatically stopped and the overload removed.

Automatic stopping under an overload is very trying to the control gear, and this is a point at which unsuitable controllers invariably fail and give trouble. The only satisfactory method of breaking a large overload current is to remove the actual break from the contacts of the starter altogether, and allow it to take place on a specially designed circuit-breaker, which should be fitted with very powerful magnetic blow-out and carbon circuit-breaking contacts.

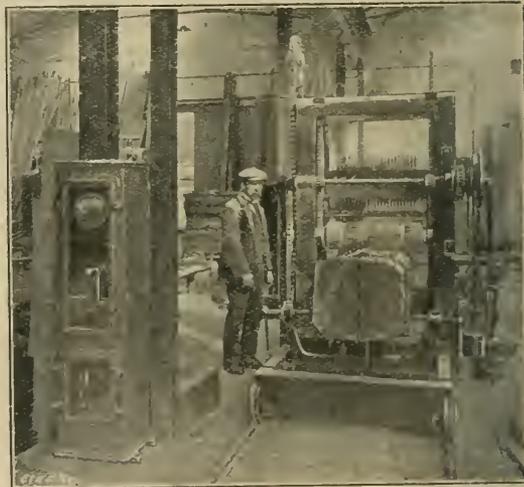
In the "Conspede" controllers the circuit-breakers are made to be self-resetting. They have no handle, the whole operation being entirely automatic, and no further attention is required to restart the motor after being stopped by an overload than simply to reduce the load to safe dimensions, and start again in the ordinary way.

The circuit-breaker and starter are so interlocked that the first movement of the starter handle in the direction for starting causes the circuit-breaker to close automatically, and should an overload occur, either through too-rapid starting or from any other cause, it will reopen, and no effort on the part of the operator will avail to keep it closed until the load is lightened. Furthermore, having opened, the circuit-breaker will not close again until all the starting resistance has been re-inserted. A backward movement of the starter handle immediately stops the motor by opening the circuit-breaker, thereby making the contacts

dead and protecting them against sparking and burning.

The panels have the great advantage of having only one handle, so that there is no possibility of the various operations being performed in improper sequence, as might occur if there were two or more handles, and the attendant were to operate them in incorrect order.

Each panel is provided with a stopping button at the side of the housing. These buttons are arranged to open the circuit-breaker, not to short-circuit the no-volt spools.



LOG FRAME, SAW OF THE VERTICAL RECIPROCATING TYPE, AND CONTROL PANEL.

This feature makes the panels equally suitable for stopping the machines as for starting them, as the main circuit is never broken on the starter contacts. Any number of these buttons may be fitted round the various machines, thus placing them entirely under the control of the workmen, so that the machines can be stopped immediately on emergency from any position.

We understand that since this plant was installed, over six months ago, the Council's engineers have not had to replace a single fuse.

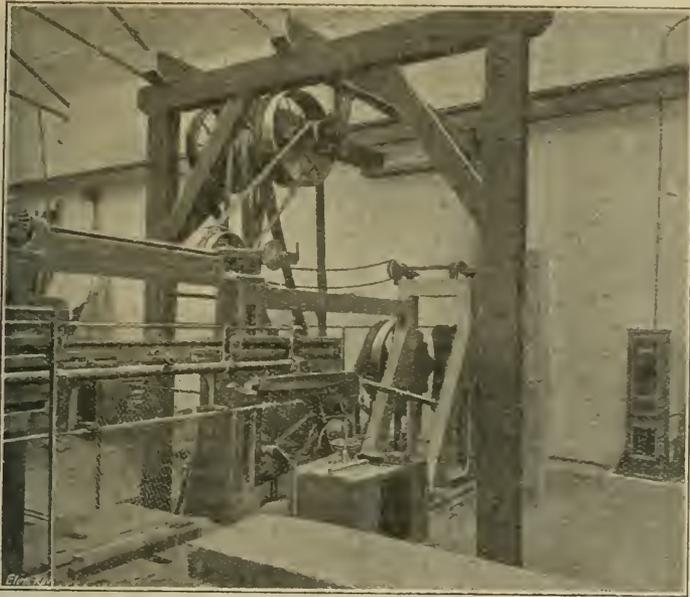
## CORRESPONDENCE.

Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

## Screw Caps for Radiator Lamps.

Replying to Mr. W. H. Allen's letter in your issue of January 17th, respecting the trouble with radiator lamps and lampholders, I agree that the ordinary bayonet type is quite unsatisfactory. The screw holder would be an improvement, but for some reason this type of holder is not popular in this country.

I have experienced the burning away of the plungers of the holders, and also the contact plates of the lamps continually, as many radiators pass through this department in



HORIZONTAL RECIPROCATING LOG FRAME SAW AT LEA VALLEY MILLS.

the course of a year. I think, however, I have overcome the difficulty by using "Mumps" holders, which lock the lamps in the holder. The porcelain body carrying the connections can be pressed forward to the lamp cap by means of a threaded ring to such an extent that the plunger sleeves engage with the lamp connections, thus forming a solid contact with the lamp. I have tested this form of lamp-holder since last September, and, in fact, all radiators now issued from this department are fitted with this particular type of holder. The holders cost nearly three times as much as the ordinary bayonet type, but the difference in cost is nothing compared with the saving in upkeep and satisfaction to the user.

S. E. Fedden, *Manager*.

Electricity Supply Department, Sheffield.

## The Case of the Sub-Man.

I was very pleased to see your remarks *re* personalities, and feel sure the stale "old chestnuts" apply neither to the average present-day wireman nor to the sub-man. But what has struck me is the abhorrence which every sub-man has to membership of the Electrical Trades Union, and I trust you will let me say a word in defence of that society. Allow me, first of all, to welcome the movement to bring together our central station men. Of course I should prefer them to be members of our Union, but failing that, I hope a good strong organisation will be built up. The E.T.U. has always fought for the betterment of the conditions of the workers in our industry, no-matter in what

capacity, and if, up to now, no great success has been effected, that is because the men outside our ranks have not seen the benefits of organisation. Yet, at quite a large number of central stations in London alone, the E.T.U. has been the means of getting the men employed there fairly large increases, and, honestly, I do not like to see this biting the hand, which (if it does not feed) at any rate helps it. The men employed at the stations at Poplar, West Ham, Battersea, L.C.C., &c., have had their wages largely increased through the efforts of the E.T.U., and that, too, Mr. Editor, without a strike. The minute books of these various concerns will prove whether I speak the truth or not. How many of the men employed at these stations are members of the E.T.U.? I wonder! How many would join to help pay for the benefits they are receiving, and to help keep them up? I wonder! Too degrading, I suppose. I have yet to learn of any of these increases of 5s., 7s., and in some cases even more per week, being refused because they were the outcome of actions taken by the E.T.U.

So I trust the sub-man will not run down quite so much the Electrical Trades Union, the members of which are trying to better the conditions of those who are employed in this industry of ours—and as regards the sub-man, it requires some bettering. We have it on the word of Mr. Balfour, Mr. Lloyd George, the Bishops of Hereford and London, &c., and all the leading scientists of to-day, that the first charge upon *any* industry should be a living wage for *all* the persons employed in that industry. If any industry was not able to stand that, it should be swept away, as it was a menace and danger to the community. If this is true, and I, for one, should not care to disagree in this case with the eminent persons named, then half of these islands would be without light and power, apart from anything else. So, sub-men, organise, join this Association, try to improve your status, and get a living wage, but don't be snobs. In conclusion, I will relate a little incident, *which is absolutely true*, and happened only a few months ago.

At a large mill in Lancashire all the hands were in their Trade Unions, except the engine room staff (about a dozen in number). But in these days of industrial unrest no one is safe, and the men and women employed at this mill demanded that the engine room staff should join their Union—viz., the E.T.U. The fat went forth from the manager that this should be so, and the engine room men were irate. A deputation met the manager and directors, and stated that *all* the men had conscientious objections to joining the E.T.U. Said the manager, "I have conscientious objections to *all* Trade Unions, but my conscience cannot stand in the way of my business. You will have to be like me—give your conscience a rest." They joined the Electrical Trades Union to a man, and their wages now are a bit more than they used to be, and their conscience is still resting.

So don't be snobs; we are not exactly mice, and even they have been known to help lions.

W. J. Webb.

London, W., *January 18th*, 1913.

Having read with considerable interest the many letters on central-station and sub-station engineers' grievances during the past few weeks, I am not at all surprised at the rather heated remarks. I myself being a central-station engineer agree with my fellow engineers and sub-station men. I might point out to Mr. Potter and his friends that the greater portion of the central-station engineers, &c., are men who have been through the shops of firms who manufacture the electrical and mechanical machinery used in central

stations. These men are the fit and proper persons to take charge because of their personal and practical knowledge of the machinery under their care. I understand that Mr. Potter is under the impression that wiremen are also fit and qualified men to enter upon central-station duties. I should like to point out that the wireman is a man used to wiring, erection of small motors, and occasional small factory work. As to central stations, his ideas are wrong. Where would the wireman be on a high-tension board? Another point is that central and sub-stations are in the first onset erected and fitted up by firms supplying the equipment and not by wiremen. As to the Association of Central-Station Shift Engineers, and Submen, &c., I quite agree that it is a thing much needed.

I will give the E.S.E.A. my support, and I hope that the secretary or a member will communicate with me as soon as possible. Mr. Potter need not be afraid that we shall upset the E.T.U., as I can assure him that the less we have to do with that society the better for all; we require trained men as engineers, not linemen or recruits. I consider that all engineers ought to pass an examination and hold a certificate as to qualifications.

Central-Station Engineer.

I have read with interest the recent letters *re* the association of submen. Why this should be necessary, I cannot say. Why not at once form an electrical association and include all grades who are connected with the running and maintenance of electrical plant? The submen are only a small section compared with the men who have charge of large plants in works, &c., where electrical power is used.

I have charge of plant for one of our leading newspapers, and there must be a large number in similar positions, and from experience I must say that to hold these positions requires highly skilled men and practical electricians; also there must be hundreds, if not thousands, of men in charge of plants in large works and business establishments in the British Isles. I know, personally, men who hold positions of this description whose salaries are from £3 to £6 per week, and I cannot say that it requires a college education to secure and keep these positions. A practical man is what masters require to-day. I have had my wiring experience with a firm of contractors, and very glad I am to know that I can do this class of work when required, and I cannot understand anyone classing himself an electrician who has not spent some time in wiring.

My point is this. The Electrical Trades Union only cater for the wiremen and armature winders, and their rules and rates of wages are for them alone; they have no rates for plant electricians, so, therefore, it is useless to join them. They may have a few in the society, but not many.

What I suggest to plant men (including submen) is to form an association or union, and not have it split into sections.

This correspondence was introduced in your paper some two years ago, and I think fell through owing to a certain section not wishing to come into contact with the other, and to make a successful start this time snobbishness must be left out.

I offered two years ago to do my share in Lancashire to form an association, and shall be pleased to do so now, and am sure should anyone write the editors of the REVIEW we could get into touch with each other.

Unity is Strength.

I have read with much interest the correspondence in this paper with regard to the case of the sub-man, and it seems to me that we are getting very wide of the mark at which this correspondence was started. Now, it is nothing more or less than an argument as to who is the greater "gentleman," a "sub-man" or a "wireman." Speaking from experience, I can say there are as good "wiremen" with breeding and training as there are sub-men. I myself have been a much looked-down-upon wireman for several years, although I have had a good college training, and technical and practical experience in sub-stations and power stations of every description. I heartily endorse "Switchboard's" remarks that a man to make a good engineer is not necessarily the man of good birth and upbringing, but what a man is in himself. If "Motor-Generator" and "Booster"

have had such an excellent training and experience, why do we find them in the position that presumably they are in? Why accept positions, in the first place, at such a low salary, when, with all their qualifications, they should be able to obtain better ones? If they accept responsible positions at a low salary to gain experience, and can afford to do so, why grumble? Also, if they have now obtained the experience they accepted the position to gain, why not leave and prove their worth by obtaining a more lucrative position elsewhere? If submen spent more time in trying to improve their positions, and themselves, by carrying out their duties conscientiously, and less time in running down people they consider to be their inferiors, perhaps they would find they would not have so much to complain about. Perhaps you think by the tone of this letter I am a wireman: I am not, but only trying to be fair to both sides. There is nothing to be ashamed of in being a wireman or a sub-man, as long as he proves himself to act as a gentleman. A good many so-called sub-station engineers would find it more advantageous if they knew a little more about wiring than they do now, and it would help them to understand their own positions a little better.

Old Sub-Man.

#### The Association of Electrical Station Engineers.

As acting chairman of the new Association of Electrical Station Engineers, I should like to make a few comments upon the correspondence that has been taking place in the REVIEW between enthusiasts on the side of the Association, and others who have not the necessary qualifications for membership.

With regard to the latter I have nothing to say, except that one cannot expect persons of dissimilar interests to be capable of seeing "eye-to-eye" in the matter in question.

As to the former gentlemen, with whom this letter is concerned, I think it would be better now for them to cease from exchanging uncomplimentary references with the "other side," as this behaviour will only serve to lessen the dignity of the, as yet, embryo Association, and act as a deterrent to a large number of very desirable potential members.

So far as I am empowered to offer advice on the subject, it would appear to be better now that unofficial correspondence on the Association and its objects should cease, for the tone of the majority of the letters is not calculated to inspire that respect for the organisation to which it should be entitled from the very beginning. Neither is it fair to Mr. Ebben and the others who are striving for the success of our Association that they should be hampered in their efforts by any prejudices that may arise, due to the over-enthusiastic effusions of a few supporters, however well intentioned they may be.

I trust that my desires as above-mentioned will receive thoughtful consideration from those to whom they are directed, so that the already very numerous difficulties with which the promoters are beset may not be increased by a few irresponsible remarks, which, perhaps, after a little thought, might not have been given publicity.

In conclusion, may I suggest that the best work that can be done for the Association at the present moment, is to canvass and persuade as many as possible of our colleagues and professional friends and acquaintances to be present at the next open General Meeting, to be held on February 6th, at the same hour and place as before.

Turbo-Alternator.

#### Village Lighting.

When you introduce your readers to special articles in your valuable paper by a leaderette, and say that anything has been written at your request, one at least hopes to derive some useful information from a perusal of such matter, for the burden of keeping pace with all the weekly engineering journals is very considerable to busy men, so that when seven columns of your paper are devoted to a subject of great interest to the industry generally, it is disappointing to find such a lot of unreliable matter filling your paper, as occurs in your current issue.

You suggest that "the work of small supply stations is very attractive, and if generous terms are offered, there

should be no difficulty in getting first-class men to throw their whole energy in the business."

I should like to know how long the energy of this first-class man would be required in loading up a 10-kw. generating station, which, I presume, would be made up of second-hand plant, mains and buildings, if it is to cost only £500, and further, what would become of this fortunate individual's energy after, say, one year's work in a district of 1,000 inhabitants, and what his remuneration would then amount to? Mr. Wurdale says that these men make as much money as chief assistants in towns with a population of 50,000 (I hope they make it honestly, for they would have much humble work to do), but do they?

I need not refer to many statements in the article which are as doubtfully correct as they are elementary, but surely, if the writer had any real knowledge of his subject, he would never have committed himself to the half-truths that he presumably picked up during his "fortnight's holiday" here and there, for on page 46 he describes a plant upon which he says no expense was spared, and must therefore have cost well over £1,000, having an output of 6,100 units per annum, and the total costs, including capital charges, work out at 1.8d. per unit.

Now, Sir, 6,100 units at 1.8d. amounts to £45 15s., and as the investor would expect at least £50 as interest on £1,000, where do the generous terms or the wages of the engineer come in? The whole thing is so absurd as to be valueless, and the article would have found a better place in a 3d. paper, notwithstanding the description of an undertaking with an output of 26,000 units, and an average cost of 3d. per unit, for while this may be accepted as reasonable, the article savours of so much second-hand information as to make the whole appear doubtful.

My only excuse for these few remarks is that, having carried out a number of installations in all sizes for such purposes as the writer describes, I know that many of his statements are unreliable, and that people contemplating such installations would do well to have more information before embarking upon even a 10-kw. equipment for public supply purposes.

January 14th, 1913.

Willesden.

I am obliged to you for an advance copy of "Willesden's" letter. If he will read either your leader or the article again, he will see how the man in charge finds work and wages to last him more than 12 months; at that particular place it has lasted over five years, and is still increasing—i.e., general work in the district. Regarding the costs at Caldly coming out at £45 odd total, if he will read the article he will observe that it is stated distinctly that such a station cannot find a decent wage for a man, but other duties do, and this plant runs three days a week only. The figure of 1.8d. per unit is not the total cost including all capital costs, but including all *maintenance* costs, and I regret that the error slipped in.

Those elementary matters against which I have uttered warnings, are matters which have, in my experience, caused the failure of many such schemes. The lines which I recommend are those which have proved successful, and of this I have first-hand knowledge, carefully filed and tabulated, and am able to prove every statement. When "Willesden" can become courteous, I will discuss the matter with him.

W. T. Wardale.

I have read with great interest the article by your correspondent dealing with village lighting schemes, and I would like to mention that there are in Ireland several quite small village schemes which are working successfully. I myself carried out recently what I think is really the smallest public lighting scheme in the United Kingdom. This was the lighting of a village in Co. Fermanagh, having a population of only 250. At one end of the main street there was a disused corn mill with a plentiful supply of water and a good fall. I pointed out its advantages as a potential generating station to some of the principal residents, who immediately took the matter up and formed a company.

The total output of the plant is 6 kw., and it consists simply of a 10-B.H.P. turbine driving a Newton dynamo, the turbine being fitted with a governor; no attendant is

required. The turbine is started up half an hour before lighting time, and left running all night. In order to reduce noise to a minimum the drive from the vertical shaft of the turbine to the dynamo shaft is worked with a quarter twist belt; this also had the advantage of keeping down initial expense, which is the main feature in schemes in this country. Current is supplied by meter at 6d. per unit. The plant has been working now for nearly 12 months, and has certainly paid its way handsomely.

J. S. Loughnan.

#### The Regulation of Street Traffic.

A policeman has been killed by a motor-bus at Ludgate Circus. Research into London history teaches us that the last accident to a policeman at Ludgate Circus took place after the Battle of Parliament Hill, and was caused by the scythe on Queen Boadicea's chariot, which formed a part of the procession of the Roman Army when returning victorious from that bloody fight.

I may point out that Ludgate Circus was then no circus, but was laid out as such after that accident in order to render unnecessary the presence of a traffic controller. The circus dropped into desuetude on the introduction of four-wheeled vehicles. These had no lock or swivel, and were thus unsuitable for a circus. Having dropped out of use, although the reason has disappeared, yet our authorities, having no reason, cannot resuscitate the circus, but prefer to kill policemen. If, however, a semaphore signal is necessary, need it be a living one?

Some years ago a man named Faraday invented electricity. By means of this agent a man placed, say, 12 ft. above the middle of a street, say, at the foot of Ludgate Hill, could by means of press buttons direct the traffic by means of a wooden semaphore. To please our conservative authorities, it might be painted and shaped to resemble a policeman, and thus serve to secure, at once, safety and beauty, and harmonise with the conservative mind of unduly constituted authority. As you, Sir, know something about electricity, perhaps you would be so good as to acquaint Scotland Yard with the properties and powers of that substance, so that, before the sun grows cold and the ice age is again upon us, and Ludgate Hill becomes a glacier down which police-destroying vans will skid violently like Gadarene swine, that noble institution may awaken to the fact that we have moved since Thorneycroft's models passed so violently off the stage.

B.

#### British Laboratories for Electrical Goods.

The very interesting and valuable report to the B.O.T. by Mr. C. Hamilton Wickes—published in your issue of January 3rd—should not be allowed to pass into oblivion, hence my few comments thereon. I had expected abler writers to take the matter up.

Consider the case broadly: In the U.S.A. and Canada where these regulations are in force, there is an English-speaking population two and a-half times that of Britain, and their purchasing power of electrical commodities is at least proportionately large.

The underwriters' capital is to a very large extent British, but the technical staff which drafts the regulations, and which adjudicates on the merits of appliances submitted, is entirely American, and this staff can impose its veto on British-made goods destined for Canada.

Now, if U.S. officials will impose a tariff on other nations' goods in order to favour native manufacturers, it is a fair presumption that they will have a tendency to utilise their inspectorial veto to secure the same result. This is scarcely a fair or satisfactory position to Britishers, as we impose neither tariff nor veto on their goods which are imported here.

Really, in equity, we should have a similar testing laboratory mainly controlled by the insurance companies (underwriters) in Britain—the two working under identical rules, and the certificate of either being accepted by the other.

There appears no insurmountable reason why we should not do a larger export trade with the U.S.A. The tariffs they impose on electrical goods are heavy (about 45 per cent. *ad valorem*), but the protective influence of tariffs is in

general a diminishing influence, and 45 per cent. tariff does not mean anything like a 45 per cent. handicap *now*. Speaking broadly, since that 45 per cent. duty was imposed, American manufacturing costs have been rising steadily in a greater ratio than our own as a result partly of the tariff, until perhaps to-day the handicap against us is very small comparatively, and unless the tariffs are again raised against us there is approaching a time when we will be able to send manufactured goods there quite as freely as they now send here.

This is my reason for regarding the present as an opportune time for establishing a testing and certifying laboratory in this country.

I think Mr. Wickes is in error in stating that each individual article must bear the stamp or label of the U.L.C. A moment's reflection must reveal its impracticability. Nor could each article be tested.

Fancy, say, arc lamps made in New Jersey and wanted in Boston. Must they all go to the Chicago Laboratory for test and label and travel an extra 1,600 miles in so doing? Apply the same idea to heavy machinery.

No. What probably happens (or is intended to happen as the rules have not yet obtained full sway) is that one appliance of a type is submitted for test and, if approved, is advertised in some recognised gazette or journal. The writer has very recently bought appliances—American made—and used them in a building in the States under close fire inspection, and they were not labelled or marked, nor was any mark obvious on hundreds of other appliances in use there. There were, however, notices in some cases which read "passed by the underwriters."

A testing authority in this country should be mainly under the control of insurance companies, so far as fire risk is concerned, and supported partly by manufacturing subscribers and others interested and by fees for testing and certifying as in the U.S.A.

As the insurance companies have evidently found the system of value in the States, they would doubtless find it an advantage here also.

The problem is—how to induce them to make a start here.

John Dugdill.

Fairsworth, *January 20th, 1913.*

#### Electrical Trade in China.

I read your leading article, *re* China, and Mr. Williams's contribution in your edition of November 8th with considerable interest, but speaking with some experience of the electrical trade in China, I cannot do otherwise than feel that both your good selves and Mr. Williams leave out two very essential features in your paeans of enthusiasm for the China trade.

Of course, the trade will come and you know from our many conversations that it would be hard to find anyone with a more firm belief in the future of the electrical trade in China than myself.

The two greatest difficulties to be contended with are, first, finance, and secondly, German competition.

In dealing with the question of finance, it is necessary to realise that if a firm is fortunate enough to secure a contract, it requires a plentiful supply of cash to carry it through.

The best terms it is possible to secure from Home manufacturers are for them to draw on the firm in China at so many days' sight, but in many cases cash against documents in London is insisted upon. Now on these terms you will see that in the former case the importer in China does not have to pay for his goods until they arrive or at some time during the usance of the manufacturer's bill. This means that the goods are financed for the voyage out, for which interest at 6 per cent. is charged.

The latter system of payment in London is very hard indeed on the importer, as he is then out of his money for about 60 days longer than he otherwise would be, while it saves only the 6 per cent. on the sight draft, so you will appreciate that if there is much cargo afloat being paid for in this manner, it is apt to leave the importer in China with his capital tied up.

The terms of payment obtainable from the Chinese have become very stringent, and the period required by them so

long, that it is very difficult for a firm with a moderate capital to accept contracts at all.

The reason for these long credits is more or less easy to find, and one need not look outside the offices of the huge Continental manufacturers in this country, who have found that the only way to beat down competition is to give such credit as no agent could possibly grant.

The wealthy Continental trusts, as they really are, being able to sell complete installations without going outside their group for any material whatever, are, of course, able to outbid our British manufacturers of whom not one is capable of supplying from his whole works everything that is necessary for a plant, and besides this, a nicely protected home market is reserved for them, and a brisk healthy market is presented to them for nothing in our own island, so that there is a very large playground for our Continental friends to enjoy. Our own manufacturers, who are too numerous, have to fight for their own market, and, speaking electrically, are, with one or two exceptions, such as the great cable companies and a large Lancashire house, hard up and have no money for pushing and creating a practically new market; a glance through the electrical share quotations in your own journal clearly indicates the state of the electrical manufacturing concerns in Great Britain.

Now, as to the competition, I have culled from the *Official Gazette* of the Shanghai municipality the last three examples: In May last, 16 60-B.H.P. three-phase motors were purchased; the results were—British, £756, £636, £633; German, A.E.G., £573; Siemens, £492.

The next tender was called for in September for 18 motors. British prices were—£1,133, £1,166, £938; American, £1,083; German, A.E.G., £906; Siemens, £790. In October tenders for 13 motors brought out the following: British, £1,383, £1,345, £1,327, £1,218, £1,232; American, £1,320; German, A.E.G., £1,097; Siemens, £1,047. These figures will give you a good idea as to the competition to be faced by British manufacturers in China.

Why our British prices are so high, I do not know, unless they are due to the competition in our own country, the number of small companies which each have their directors, offices, staff, &c., and which could be run so much cheaper if they were amalgamated.

Besides the difficulties I have already outlined, it is a cruel blow to us British representatives when our own Government give our strongest competitors their patronage. It is not difficult to imagine the advertisement which will no doubt be used to the fullest extent by our German friends, by their being able to say that even the British Government gives us work, so our material must be better than that made in their own country.

Edgumbe Brighten.

Shanghai, *December 27th, 1912.*

#### Small Power Installations.

May I suggest that it would be eminently interesting to station engineers and other power users to hear representative views on the respective merits of the Marshall economic steam power plant, as compared with those of suction gas and oil, for small power units?

Station Engineer.

**Siemens Rifle Club Dance.**—Although a comparatively new institution, the Siemens Dalston Rifle Club, is thoroughly appreciated by both male and female members of the staff. In connection with this club a dance and social was held on Friday evening at Northampton House, Highbury, which was specially engaged for the purpose, and a party of between 100 and 150 thoroughly enjoyed their first social gathering under the auspices of the shooting men. The dancing hall, refreshment room and card room were illuminated with "Wotan" lamps in Holophane reflectors. A set of 14 dances figured on the programme, with four extras. The proceedings commenced at 7 o'clock and finished shortly after midnight—the whole of the time being well occupied. In the social section of the entertainment, Messrs. A. and B. McFarlane, Hicks, Bardell and Higgins all contributed interesting items. Mr. Hayden (the secretary of the club) acted as M.C. This "sighting shot" was restricted to members of the Dalston staff.

**NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.**

**New Calculating Device.**

We have received from Mr. H. W. BROWN, of 169, Cathall Road, Leytonstone, N.E., a novel device for calculating the combined resistance of two or more shunt circuits, which we illustrate here-with. The mode of operation is as follows:—Take as an example two circuits, one of 75 watts and the other of 25 watts. The thread hanging from A would be stretched across to 75 on the right-hand side of the scale, and that from B to 25 on the left-hand

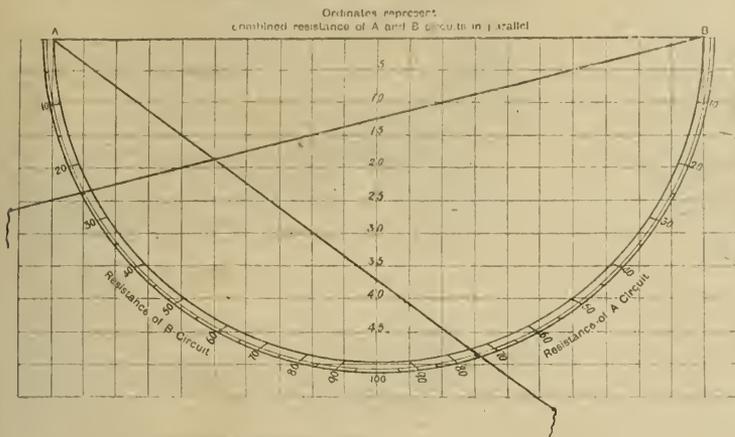


FIG. 1.—DEVICE FOR CALCULATING THE JOINT RESISTANCE OF TWO CIRCUITS IN PARALLEL.

side. Where these two threads cross, the combined resistance of the two circuits can be read off by means of the horizontal lines. It will be seen that the range of the device can be extended, and that the percentage of current in each circuit could be read off by means of the vertical lines.

It is easy to see how the device is constructed; the theory of its operation may afford an interesting problem for readers who are not mathematicians—the latter will see it at a glance.

**Carron Cooking and Heating Appliances.**

THE CARRON CO., of Carron, Stirlingshire, have recently issued a well-illustrated booklet dealing with their electrical cooking and heating appliances, consisting of cooking ranges, grillers, hotplates,

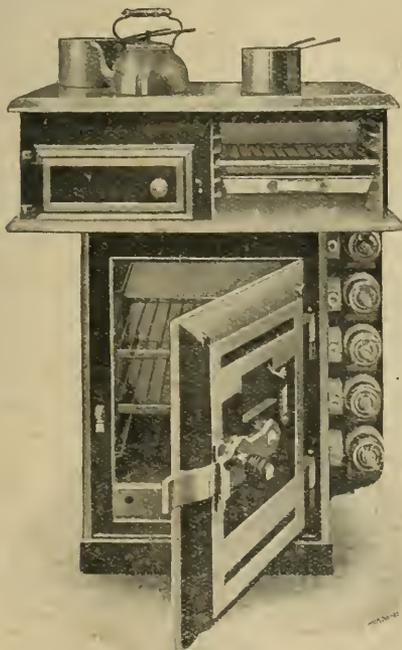


FIG. 2.—CARRON ELECTRIC COOKING RANGE.

steaming ovens, urns, and a variety of designs of luminous radiators and convectors. The company has a reputation of over 150 years'

standing in iron manufacturing, and it is a matter for congratulation that its extended knowledge of cooking and heating apparatus is now being applied with a view to furthering the latent development in connection with such apparatus, viz.—Electric cooking and heating.

While space does not permit us to deal at length with the firm's electrical productions, we illustrate one or two typical pieces of apparatus produced by it. Thus fig. 2 is an electric range, consisting of an oven with a grill, hot closet, two circular boiling plates and a warming plate mounted over it. The oven and hot closet are white porcelain enamelled inside, and the former is fitted with removable hangers and grid shelves and provided with an inspection window in the door to enable the progress of the cooking to be watched. The cooking temperature can also be

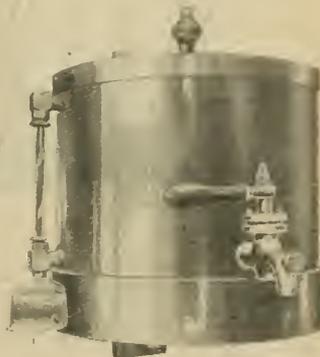


FIG. 3.—ELECTRIC URN.

ascertained without opening the door by means of a thermometer provided, and the heating elements can easily be replaced *in situ*. The oven is rated at 3,000 watts, the grill at 1,300 watts, and each boiling plate at 800 watts.

The company also makes a more expensive combination cooking range, consisting of an oven—with a full-sized inner glass oven door, to allow of inspection while cooking, without heat loss—and beside it a double grill and toaster with a hot closet beneath, while

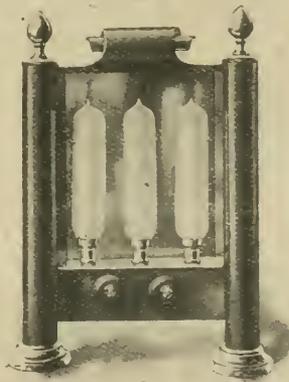


FIG. 4.—CARRON THREE-LAMP RADIATOR.

on the top of the range are hot-plates for boiling, &c. Three heats are provided, and, in connection with the switches, two plugs and sockets for connecting to the main cable.

We further illustrate in fig. 3 a brass and copper urn, electrically heated, and suitable for restaurant use. This is claimed to boil 2 gals. of water in 22 min., the minimum heat being obtained on 1,500 watts and the maximum on 3,000 watts. The company has a number of registered radiator designs in cast-iron, brass or copper, one of which, built in black, copper or brass finish and for two, three or four lamps, we illustrate in fig. 4.

In the case of the convector heaters, built for any number of heating elements up to six, the latter are guaranteed for two years.

**A Single-Phase Prepayment Watt-Hour Meter.**

THE BRITISH THOMSON-HOUSTON CO., of Rugby, are introducing an A.C. prepayment watt-hour meter, which is claimed to represent a distinct advance in the design of watt-hour meters of the induction type. It is manufactured in the 3 and 5-ampere sizes for any voltage required, and so that the rate of payment can be easily

changed without recalibrating the instrument or taking the dial to pieces.

The mechanism and the meter element are mounted in a cast-iron case and are protected by a dust-proof cover, and a window is fitted in the latter, through which the dial and coin indicator may be read. The indicator records the number of coins standing to

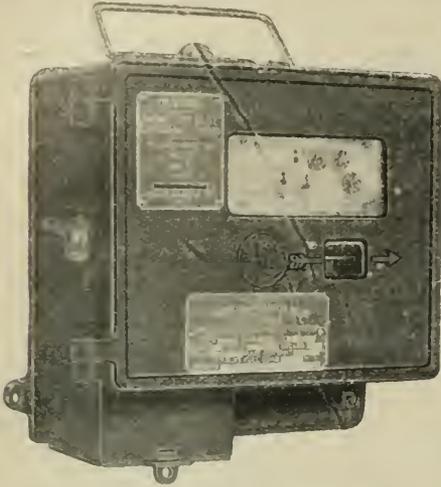


FIG. 5.—THE B.T.H. PREPAYMENT METER.

the credit of the consumer and the meter dial registers the total number of units consumed. The prepayment mechanism consists of a main control switch of the single-pole, quick-break, knife-blade type, which is closed mechanically when a coin is paid into the meter. This switch is held closed so long as there is any current remaining to the credit of the consumer, but opens automatically when the coin indicator reaches zero. The coin box is capable of containing 120 pennies and can easily be

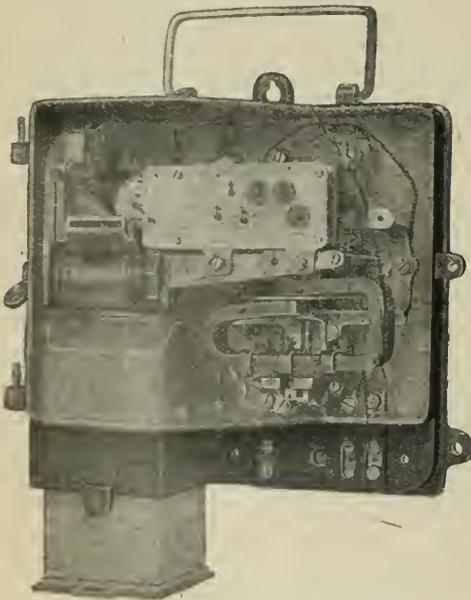


FIG. 6.—B.T.H. PREPAYMENT METER, OPEN.

emptied by withdrawing the till, which is secured either by a seal or padlock, as desired. A separate cover protects the terminal box, enabling this portion to be sealed independently of the other parts of the meter.

In operating the meter, the coin handle is turned to the right, the coin inserted, and the handle turned back again; this closes the switch and the coin indicator advances one division, and so on for each coin inserted, while the indicator travels back towards zero as current is consumed, the switch opening when zero is reached.

#### Brooke Emergency Ship-Lighting Set.

Our illustration, fig. 7, shows a 20-kw. generating set by MESSRS. J. W. BROOKE & CO., LTD. of Lowestoft, supplied for emergency ship lighting and deck lighting on board a new vessel being built for the Union Steamship Co. of New Zealand.

The engine is a 28-H.P. nominal four-cylinder motor, with dual magneto ignition and centrifugal governor, which controls the speed from no load to full load within 1½ per cent. variation.

The engine is coupled to a Siemens compound-wound dynamo, producing current at 110 volts.

The plant is self-contained, with its own radiator; this is in order that it will not be necessary in emergency to have to suck

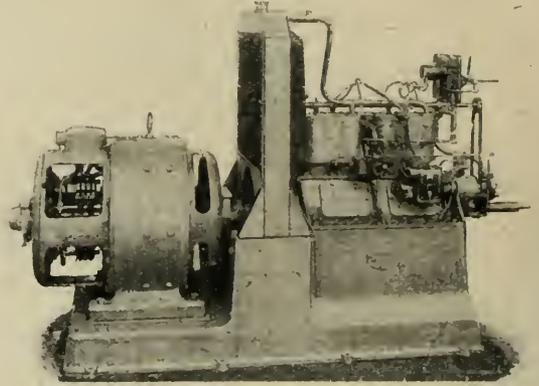


FIG. 7.—BROOKE EMERGENCY SHIP-LIGHTING SET.

water from the sea level, which, of course, is often, in big ships, below the limit of suction distance.

The engine is arranged to run on petrol, as it is very preferable to paraffin, owing to the greater handiness and more rapid starting up and greater reliability.

#### The "Globus" Lamp.

A new pattern of glow lamp has been introduced by the "GLOBUS" BELEUCHTUNG- UND HEIZUNGS-INDUSTRIE G.M.B.H., of Fontane Promenade No. 14, Berlin S. 59. It is intended especially for signs and illuminations, and is illustrated in fig. 8; it is made for 14 volts, so that on 110 volts eight lamps can be run in series, and is rated at 1 watt per candle, although the filament is of carbon, the light being concentrated along the axis of the lamp as shown in fig. 9. This effect is not obtained by silvering the back of the bulb, but by the special form of the bulb and the central collector, so that a 2-c.p. lamp is made to give 8 c.p. along

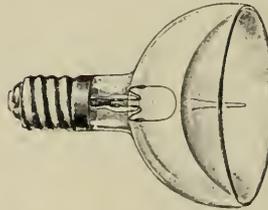


FIG. 8.—THE "GLOBUS" SIGN LAMP.

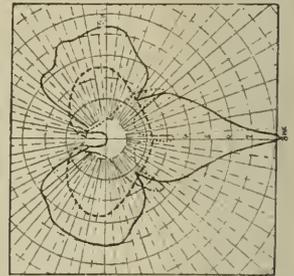


FIG. 9.—ILLUMINATION CURVE OF "GLOBUS" LAMP.

the axis in a conical pencil of light. The figure shows (dotted) the ordinary shape of the illumination curve, as well as the special shape of the "Globus" lamp, whence it will be seen that the usual type of incandescent lamp is ill adapted for end-on illumination. Carbon filaments are used because, unlike metallic filaments, they do not take an excessive rush of current at the moment of switching on, and it is claimed that in the case of flashing signs this enables the carbon filament to be as economical as the tungsten. The form of the bulb, it is said, renders it almost unbreakable.

#### New G.E.C. Ironclad Reversing Switches.

For the control of small motors, particularly such as are used in connection with portable tools, the GENERAL ELECTRIC CO., LTD., have recently devised appropriate switchgear which is an improvement over that now in use. The new "push-on" and "push-off" switch is specially recommended for attaching to portable electric tools, and the like, where a quick make-and-break action is required. The contacts of this switch are massive, and supported on ebonite insulation; they are run on small wheels which reduce friction to a minimum and thus give a free-and-easy action to the "on" or "off" movement. The case is of aluminium. This switch is suitable for any current up to 8 amperes, 110 volts. The dimensions (overall) are 7½ in. × 3½ in. × 2½ in. The small drum type reversing switch (illustrated in fig. 10) has also been designed by the company especially for use with Witton-Kramer tools. This switch is constructed with a portable handle; its glands are

arranged to serve as efficient cord grips to hold securely the indicator cables. The fingers are renewable. The revolving drums are of cast-iron, and the entire switch is rainproof; it is suitable

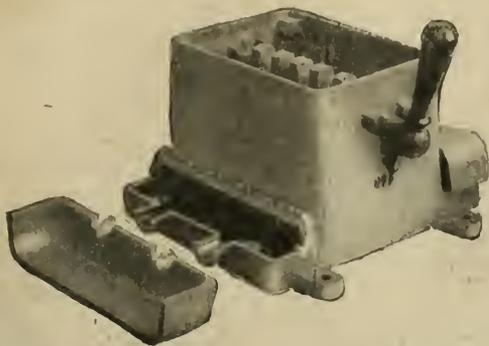


FIG. 10.—G.E.C. DRUM-TYPE REVERSING SWITCH.

for any motor up to 2 H.P. at 240 volts. Its dimensions are 7 in. x 8½ in. x 5½ in.

**"Tricity" Ship Heaters.**

THE BRITISH ELECTRIC TRANSFORMER CO., LTD., of Hayes, are introducing a type of non-luminous low-temperature heater, taking very small power, for ship heating.

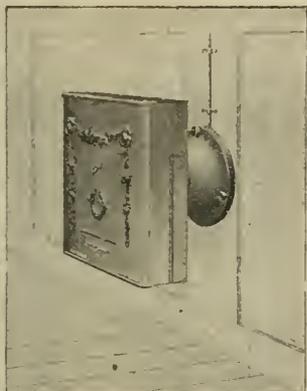


FIG. 11.—BULKHEAD TYPE "TRICITY" METER.

The heater unit consists of a strong, heavily webbed, cast-iron grid, containing the Berry patent element, giving an effective heating surface of about 4½ sq. ft. This grid breaks up the air

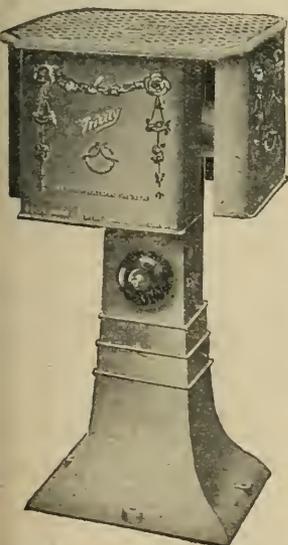


FIG. 12.—MULTIPLE UNIT HEATER.



FIG. 13.—PEDESTAL HEATER.

particles to give the best heating of the air by convection. The grids attain a temperature of about 500° F. in 15 to 20 minutes, with a consumption of 250 watts, which is the wattage consumption of a single lamp of a four-light luminous radiator and the apparatus is covered by an ornamental cover or guard, to form the funnel for the heated air. The heaters are made for all standard voltages from 100 to 250, and can be supplied, as illustrated, either bulkhead pedestal or multiple-unit pattern, and suitable for any form of wiring.

When it is desired to use them in saloons, they can be installed in groups under settees, a special "settee" type 750-watt heater being supplied, with an overall height of only 8 in.

**LEGAL.**

**ELLIS v. THE OSRAM LAMP WORKS, LTD.**

By this action, which was tried by Mr. Justice Neville in the Chancery Division last week, the plaintiff, as lessee of Poplar House, Hammersmith, claimed an injunction and damages in respect of an alleged nuisance of noise, smell, and vibration caused by the defendants' works, which were adjacent.

From the opening statement of MR. CAVENAGH, who appeared for the plaintiffs, it appeared that negotiations for a tenancy of the house were entered into in 1908 with the Robertson Electric Lamp Co., who were the then owners, and who were also the predecessors in title of the defendant company. The rent was to be a weekly one, increasing from year to year for three years; but subsequently an arrangement was come to for a fixed weekly rent on a three years' agreement. Bad smells emanated from the defendants' works, accompanied by loud explosions, which had recently become so bad that the plaintiff had had to vacate the premises, and damages were claimed in respect of both that and also in respect of damage alleged to have been done to some outbuildings used for storing theatrical scenery.

Evidence was called in support of the plaintiff's case, and MR. JENKIN, K.C., for the defence, contended that, on the true construction of the agreement, the tenancy was merely a weekly one, and, further, that there had been no appreciable nuisance.

Evidence was called for the defence to prove that, though some nuisance did exist in the years 1908 and 1909, new plant was installed, and since 1910 any nuisance that there might have been had ceased to exist.

His LORDSHIP, in giving judgment, said that the conclusion he came to upon the evidence was that there was no such nuisance as to render the plaintiff's house uninhabitable, and as it was upon that the case for damages was principally based, the action must fail. There appeared, however, to be some damage in respect of the outbuildings, but it was small, and he would estimate it at £7. The costs of the action would be the defendants', but a counterclaim raised by them would be dismissed without costs.

**GRAETZIN LAMP AGENCY.**

MR. JUSTICE SCRUTTON was occupied during January 15th, 16th 17th and 20th in the Commercial Court of King's Bench, in hearing an action brought by Mr. Bernard Braunstein, trading as Jaques, Braunstein & Co., of Carthusian Street, E.C., against Mr. Max Graetz, trading in Berlin as Ehrlic & Gretz, manufacturers of electric appliances, to recover damages for breach of agreement of agency for the sale in this country of the defendant's electric lamps.

MR. DUKE, K.C., appearing for the plaintiff, said, in the course of his opening address, that the plaintiff was a gentleman who had been engaged for many years in London in the sale of gas fittings and fittings for electric lighting. The defendant was a manufacturer of electric light fittings in Germany, and he entered into an agreement with the plaintiff, under which he (plaintiff) was to have the exclusive agency for the sale of the defendant's goods in this country for a period of years. It was for a breach of that agreement that the plaintiff claimed damages. What had happened was that the defendant had himself set up in business in this country by forming a limited company to carry on the business, of which the plaintiff was to have the sole agency. At the beginning of 1907 an agreement was entered into, under which plaintiff for a period of six years was to have the exclusive agency for the sale of the defendant's electric lamps. The business was successful and a large trade was done. In December, 1908, the defendant, who had become patentee of a new metal-filament lamp called the Graetzin lamp, approached the plaintiff with a view to his taking up the agency for the sale of that lamp. An agreement was entered into under which, if the plaintiff was able to sell in this country £5,000 worth of the Graetzin lamps within a year from the time he received the final samples, he should have the exclusive agency for two years, and if in the course of the second year he was able to make sales to the extent of £10,000, he was to have the exclusive right for a further period of five years. Under the events which happened the plaintiff became entitled to an exclusive right for the term of two years and an additional five years which began at the end of the first period. The first two years would expire in June, 1911, and the additional five years would therefore carry the agency on until June, 1916. The events which put an end to the agency occurred in the summer of last

year. In the electric lamp business it was necessary to be in the market with the goods in the spring of the year, but the defendants had not their samples ready in time. To give plaintiff a fair prospect of doing a substantial business in the following winter, he ought to have had the samples in February, as the custom was to take the orders in the spring and deliver in the autumn. Agreements were made by the plaintiff with other firms, but while they were given the right to sell, they did not interfere with his business. It was arranged with Krupka & Jacoby that they should take up an agency, but their business did not come up to the minimum, and subsequently the defendant arranged with them that they should form an English company to carry on the whole of the defendant's business in England, including the business then being carried on by the plaintiff, and that they should have the sole agency for the sale of the defendant's electric lamps. In August of last year the defendant wrote to the plaintiff a letter purporting to cancel the plaintiff's agency, and informing him of the agreement with Krupka & Jacoby, and requesting him to cease taking orders.

MR. JUSTICE SCRUTTON said that as there was no jury, he would like to hear what the defence was before the plaintiff's witnesses were called, in order that he might better understand the bearing of the evidence.

MR. ATKIN, K.C., appearing for the defendant, said that, in the first place, he contended that there had been no breach of the agreement, and that the plaintiff had not duly performed all the conditions under the agreement. The agreement with Krupka & Jacoby was no breach of the agreement between the plaintiff and the defendant, and the defendant had always been ready and willing to employ the plaintiff.

MR. BERNARD BRAUNSTEIN, the plaintiff, was then called, and gave evidence generally bearing out his counsel's opening. He said that he had long acted as an agent in this country for the sale of foreign gas and electric fittings. Until the end of 1905 he had been acting for Spinn & Sohn, and had a considerable connection amongst the purchasers of gas and electric goods. In 1906 he was introduced to the defendant firm, and at that time he was doing business to the amount of 100,000 marks a year. In 1908 he was approached by Graetz with regard to putting an electric lamp upon the market. He went to Berlin and entered into an agreement with defendant, and as the result of a discussion, he subsequently negotiated a sub-agreement with the Welsbach Co. for the sale of the lamps. That was in March, 1910. The agreement continued for two seasons, and was very successful. He did not receive the prices and samples from the defendant until it was too late to take advantage of the season. All business was practically done before April, and he did not get his prices until May. The firms with which he dealt complained of the price because Jacoby's were selling lower. When he was in Berlin he had pointed out to the defendant that improvements in the lamp were necessary.

MR. DUKE: What do you value the business at—what have you lost by the breach of agreement?—I made 100,000 marks in the first year, and in the second year I made four times as much.

Witness, continuing, said that the sale of electric lamps was an increasing quantity, because they had been much improved, and they were 25 per cent. cheaper than they were six years ago. The current was cheaper also, with the result that, while gas lighting was going down, electric lighting was going up.

Asked as to the increase in the sale of the metallic-filament lamps, the witness said that, on the basis of the contract, he would have been able to obtain from £3,000 to £4,000 a year.

In cross-examination by MR. ATKIN, K.C., for the defence, witness said that, in respect of the electric lamp agency, the agreement stipulated that he was to introduce the goods into England at his own expense. The business was not a very easy one to introduce at the beginning, as others had possession of the market. The only commission earned by him on his electric agreement was upon the Welsbach orders. In 1912 he was not able to sell, because he could not get the prices from the defendant.

Re-examined: He found from the invoices that five times as many unstamped lamps were sold as those which were stamped, because the unstamped, although the same article, could be sold at a cheaper rate.

This was the plaintiff's case.

MR. ATKIN submitted that there had been no breach of agreement. The plaintiff soon found that he was unable to do much unless he could get the lamp known on the market, and hence he was willing to fall in with the suggestion of the defendants to let Krupka & Jacoby take up the business, and the agreement with that firm was negotiated by plaintiff. It was a term of the arrangement that his commission should be reduced from  $\frac{3}{4}$  to  $\frac{2}{4}$  per cent.

Continuing his address on Jan. 16th, Counsel submitted that there had been no breach of agreement, because the only arrangements entered into were those with Krupka & Jacoby, to which Mr. Braunstein had consented. Messrs. Graetz, he said, were entitled to sell goods to Krupka before the agreement, and all that had happened was that they had continued to sell goods as before. There had been no breach in relation to the payment of commission, as the plaintiff alleged, because at the time the writ was issued no commission was due.

HIS LORDSHIP said it occurred to him as a possibility that there had not been a final repudiation of the agreement, and that the plaintiff had jumped at a conclusion when he issued the writ. In that case there might be another action arising, to determine the position of the parties. When the evidence was over he would formally ask whether it was desired to amend, as "two bites at a cherry" in an action of this description seemed to be rather undesirable.

MR. MAX SCHULTZ, general manager to Ehrich & Graetz in Berlin, was called, and gave evidence as to the making of the contract with Krupka & Jacoby, and said that when he came to London to see them in 1910 in connection with closing the agreement for the contract, the plaintiff complained about the price of the lamps being too high for him to compete successfully with others. He did not complain of not having received price lists. He (witness) came over to this country again in January, 1912, and saw Mr. Jacoby and Mr. Braunstein, when they discussed the question of the cost of the lamps. Competition was very severe at that time owing to the German Incandescent Co. making a reduction in price. That was, he thought, at the beginning of 1911, and the English manufacturers soon followed by making reductions also.

In cross-examination, Witness said that he assisted in making agreements with Mr. Braunstein in reference to gas as well as electric fittings, and prices were always discussed when they met. The prices submitted to Krupka & Jacoby were not the same as those submitted to the other accepted firms. They were somewhat lower.

Had the firm special prices for the non-stamped metallic-filament lamps?—No difference was made. The supply of non-stamped lamps to England was smaller than that of the stamped lamps. There was no difference between the stamped and unstamped lamps. Cheaper prices were first quoted to Krupka & Jacoby about November, 1912. Reductions had been made to Mr. Braunstein in some instances.

Witness was further closely cross-examined as to the reduction in price which the defendants had made, and he would not deny that a reduction of 10 per cent. in the price of 16 to 50-c.p. lamps had been made to Lott, Abbott & Co. some time before the plaintiff was informed of the reduction.

In re-examination, Witness said that he was a director of the Graetzine Light, Ltd., which dealt entirely with gas, the object of the company being to take over the British business in gas lighting as carried on by Messrs. Graetz. It was proposed that the Krupka and Jacoby Co., Ltd., should deal with the electric lighting.

MR. HORACE BARRETT, a member of the firm of solicitors acting for the defendant and for Krupka & Jacoby, gave evidence of the circumstances under which the agreements with Ehrich & Graetz were drawn up, and as to the steps taken for the purpose of forming the two companies.

MR. MAX GRAETZ, the defendant, said he carried on business in Berlin in incandescent lamps, high-pressure lamps, and oil lamps under the title of Ehrich & Graetz. It was a very large business, and he employed thousands of hands. The plaintiff had been his agent for some years, and from time to time he came to Berlin to discuss business. In April, 1912, there was a discussion with regard to gas lamps, and witness at that time told him that his services as agent for gas would not be continued. Nothing had been done to terminate his agency for electric lamps.

On the case being resumed on Friday, January 17th, MR. BARRETT, the solicitor, was recalled for cross-examination by MR. DUKE. He said that premises were taken on behalf of the company at 26 to 36, Chapter Street, Westminster, and it was there that the whole of the English business was to be done. They were held in trust for Graetz in the name of Jacoby. The premises had been reconstructed, the money for which had been provided by Messrs. Ehrich & Graetz under the name of Krupka & Jacoby.

MR. DUKE: Was the only object in forming the two companies in England to be wide awake in case of any alleged infringement of patent?—So far as Krupka & Jacoby were concerned, that was the primary object. In substance, the £5,000 capital and £8,000 debentures in the company were to be held in trust for Ehrich & Graetz, but ultimately for the British Electric Light Co.

MR. MAX GRAETZ, the defendant, was recalled and cross-examined by MR. DUKE. He said that during the past six months he had not been doing more business than in former years. The business had not all been done through Messrs. Krupka & Jacoby. Mr. Braunstein was still his agent for electric lamps and fittings, and would continue in that position during the current year.

Has any action been brought against you for infringement of patent?—Yes, by the General Electric Co. They threatened an action against us by letter.

Did you send that letter on to Mr. Braunstein?—No. That was at a time when Mr. Braunstein had ceased to answer us. It was after August 6th, 1912. The first threat reached us in October or November of that year.

Can you tell why you did not communicate to Mr. Braunstein the arrangement you were making with Krupka & Jacoby during the first part of 1912?—The main reason was that the profit which Mr. Braunstein derived from the gas business was as much as the salary of Krupka & Jacoby.

Is the salary of Krupka & Jacoby £1,200 a year each?—It was something more than that—25,000 marks.

Continuing, witness said that the business done through Mr. Braunstein had dropped during recent years, and in dealing with the gas themselves they were able to raise the business again. He had had experience which told him that it was not wise for one company to deal with both gas and electric lighting, and therefore it had been determined to form two companies.

MR. OSCAR KRUPKA, a member of the firm of Krupka & Jacoby, Ltd., gave evidence as to the agreement between the company and the defendant, and said that he was a large dealer in electric lamps.

MR. DUKE: Has any action been brought against you for infringement of patents?—Yes, by the Osram Lamp Co. The action was brought, said the witness, against him personally, as well as against Krupka & Jacoby, Ltd. He did not consider that his lamp was similar to the Z lamp. The writ in the action was issued in

November of last year. The Grætzin lamps bearing trade-marks were 75 per cent. of the whole amount received.

DR. J. DUNCHEK, a German advocate, was called to prove the German law in relation to the termination of an agency. He said that in German law an agent had no actionable right to work, but was confined to his claim for commission. The German law did not recognise a sole agency. In view of Patent disputes, the principal would stop an agency, because the German law regarded patent infringement as a criminal offence, and the principal might be subjected to very heavy damages. If an agent turned his business into a company, of which he was to be managing director, the employé could not interfere, but if some other person was appointed manager, the position might be different.

On the case being resumed on Monday, further evidence was given as to the German law relating to agreements.

MR. ATKIN, K.C., addressed the Court upon the evidence, dealing at length with the terms of the contract, and the interpretation put upon them by German law and by English law. In either case, he argued, there had been no breach. As to the damages, assuming that the contract had been broken, his Lordship, in considering the amount, would have to take into account the fact that Mr. Braunstein had admitted that he could not get the goods at a price which would suit the customers. Further, he could not forecast the result of the patent actions, because if the defendant's goods were an infringement of patent, the sale would be destroyed, and the business taken out of the hands of the defendant. The agency would thus come to an end.

MR. DUKE, K.C., for the plaintiff, contended that the agreement was governed by the law of the place where it was carried out, which was England. On the question of damages, counsel said that the business of the defendant was a very valuable one, and the suggestion that they were frightened about patentees bringing actions was "all moonshine." The trade in electric lighting was increasing from year to year, and the privileges purporting to be secured by the agreement of 1908 were increasingly valuable.

His LORDSHIP reserved judgment.

#### ELECTRICITY IN MINES.—APPEAL.

JUDGMENT was delivered on Friday by the Lord Chief Justice and Justices Coleridge and Rowlatt in the King's Bench Divisional Court, in the appeal by Mr. John Atkinson, an Inspector of Mines, against a decision of the Gateshead Magistrates, who had declined to convict Mr. H. M. Imrie, manager of the Chopwell Colliery, near Gateshead, for an alleged offence under the Coal Mines Regulation Act (Electricity Rules).

The charge was that Mr. Imrie had contravened the rules by not having an electric switch-box earthed, and the Magistrates refused to convict, holding that no offence had been committed. It was pointed out that the whole question was whether earthing of the switch-box was construction or installation. Mr. Imrie's contention was that it was construction, while the Inspector argued to the contrary. If it was construction then the rules did not apply, because the apparatus had been constructed before 1911, and they applied to apparatus erected after that year. It was stated that the switch-box in question was for controlling a portable electric motor, which worked a conveyor for carrying coal, and it was alleged that the box was not earthed to the insulation system. On May 3rd, 1912, the box was out of order, and a workman, touching it, received a shock which proved fatal. Counsel argued that, if the box had been earthed, this might not have happened.

The Court now dismissed the appeal, with costs.

THE LORD CHIEF JUSTICE said he had read the judgment of Mr. Justice Coleridge, and agreed to it, so there was very little he could add. The point for decision was whether the apparatus in question came within the exemption in Provision 20 (B) of the Act, and whether earthing it would be construction or installation. The two things ran very close together, so that the point was rather difficult to decide. He had looked at the description of the apparatus which was in use before June, 1911, and came to the conclusion that it came within the meaning of "construction," and he, therefore, could not come to any other conclusion than that arrived at by the Justices, viz., that no offence had been committed by the respondent.

MR. JUSTICE COLERIDGE said the case for the appellant was that a switch-box was not earthed in connection with the insulation system in contravention of Sec. 8, Sub-Sec. 8, of the Coal Mines Regulation Act (electricity rules). Respondent claimed exemption under Sec. 20, Sub-Sec. 6, which excepted from the provisions of Sec. 8 any apparatus which was in use prior to June, 1911, so constructed or adapted so as to comply with the requirements in vogue relating to the construction of electrical apparatus in mines before that date. If earthing by connection with an earthing system meant construction of electrical apparatus, the exemption applied; otherwise it did not. In order to earth a switch-box it had been found necessary to connect it with another cable in addition to the one already connected with it. Was that an alteration or addition or construction of electrical apparatus? Apparatus, according to the definition clause, included all machines and fittings in which conductors were used, or in which they formed part. A switch-box was, therefore, apparatus. For the earthing of a switch-box a different apparatus was necessary. The Magistrates, after viewing the apparatus, came to the conclusion that to connect one with the other you must reconstruct. It was said for the appellant that if you add you do not reconstruct but install. If by adding to the apparatus the addition formed part of the whole, then he came to the conclusion that you construct, and to construct was to put parts of the whole together according to some regular and definite plan. The added cable would be, in his opinion, part of

the whole electrical apparatus, and therefore part of a construction, and as construction brought the apparatus within the exemption, there could be no offence, seeing that the switch-box was constructed before 1911.

MR. JUSTICE ROWLATT agreed, and the appeal was dismissed with costs, as before stated.

#### TRAMWAY ACCIDENT CLAIMS.

IN an action against the Dumbarton Burgh and County Tramways Co., Ltd., Dumbarton, for personal injuries, a jury in the Court of Session awarded a widow £50.

A jury under Lord Skerrington in the Court of Session last week, also awarded £200 damages to a grocer in respect of injuries sustained by his child through being knocked down by an Edinburgh cable car. The pursuer attributed fault to the defenders in respect that the driver of the car failed to keep a proper look-out and give warning of the approach of the car. The defenders denied fault and pleaded contributory negligence. The claim originally was for £1,000.

#### SMITH v. IMPERIAL LIGHTING CO.

IN the City of London Court on Tuesday, before Judge Lumley Smith, K.C., Mr. David Smith, trading as David Smith & Co., 3, Red Lion Court, Fleet Street, claimed £3 10s. 2d. against the Imperial Lighting Co. for electric lamps supplied.

Defendants' representative said that the lamps would only burn for a few hours, and then went out. They were put up at the Society of Motor Manufacturers' Show at Olympia. In all, 53 bad lamps were returned.

Plaintiffs said they sent 600 lamps to the defendants; they were all tested. About 32 were returned; they had burned for 200 or 300 hours. When a metal-filament lamp was touched, the filament shortened, and then double the amount of the current had to be passed through it. They might go out or blacken at once. The lamps sued for were injured after they were delivered. They were roughly used. They were 1s. 4½d. each. He did not hold himself responsible unless the lamps were returned within three days of delivery.

JUDGE LUMLEY SMITH said he remembered going to the Motor Show and seeing the lamps. Lamps could not be tested in three days, surely?

Plaintiffs said three hours was sufficient.

JUDGE LUMLEY SMITH said he knew the metal filaments were very difficult to carry.

Defendants' representative: We handle a great many.

JUDGE LUMLEY SMITH said they ought to be carried in an ambulance, because, if they were carried in a van, they got broken. He found for the plaintiffs for £3 and costs.

## BUSINESS NOTES.

**Royal Ediswan.**—We note that the EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., of 36, Queen Street, E.C., makers of the Royal Ediswan metal-filament and carbon-filament lamps have received the honour of appointment to Her Majesty Queen Alexandra. The firm now has an attractive poster issued by its Publicity Department displayed on the London hoardings.

**Some Recent Pump and Turbine Orders.**—MESSRS. BOVING & CO., LTD., report having received a considerable number of orders for Victoria turbo pumps, including the following:—The Weardale Steel, Coal and Coke Co., Ltd., one pump to deliver 450 g.p.m. against a head of 520 ft.; the South Bukeru Tin Mines, Ltd., one pump to deliver 600 g.p.m. against a head of 60 ft.; the Rhodesia Katanga Junction Railway and Minerals Co., Ltd., one pump to deliver 1,000 g.p.m. against a head of 200 ft.; the Tharsis Sulphur and Copper Co., Ltd., two units, each delivering 560 g.p.m. against a head of 322 ft. The pump for the South Bukeru Tin Mines is for hydraulic purposes.

Water turbine orders recently received include:—Two units of 1,340 H.P., for the Nippon Chemical Co., Japan; a unit of 265 H.P., Messrs. J. Hoyle & Sons, Lancs.; a unit of 160 H.P., F. H. Walter & Co., Rio de Janeiro; a third unit of 420 H.P., New Plymouth (N.Z.) Council.

An order has also been received from the L.C.C., for four centrifugal sewage pumps, for the Crossness station, each to deliver 25,600 g.p.m. against a head of 30 ft., and each coupled to a forced lubrication engine of 270 H.P.

**Bankruptcy Proceedings.**—WM. ROBERT REYNOLDS, electrical engineer, lately carrying on business at Queen Victoria Street, E.C., and elsewhere.—At a sitting of the London Bankruptcy Court held last week before Mr. Registrar Brougham, this public examination was held. The debtor returned total liabilities £1,253 (unsecured £521) and assets valued at £26. Replying to Mr. J. B. Knight, Official Receiver, the debtor stated that having for many years been in employment as an electrician, he, with a partner, started a similar business in February, 1905, at 17, Queen Victoria Street, under the style of "G. Askey & Co." Witness borrowed £50 from his father to put into the business. The partnership was dissolved in October, 1905, witness taking over all liabilities and assets,

and continuing alone under his own name. The business throughout had consisted entirely of installation work. In March, 1906, he removed to 313, High Street, East Ham, and subsequently to various other addresses in the immediate vicinity. In October, 1911, he opened another shop at 614, Romford Road, and in February, 1912, a further shop at 31, The Promenade, Palmer's Green. Owing to want of capital he was unable to keep all the shops going, and was losing money. In March, 1912, with the object of raising funds, witness sold his businesses to W. R. Reynolds, Ltd., which was formed with a nominal capital of £250. He received £1 share in the company, and the appointment of managing director at £150 per annum. The shop at 614, Romford Road, was closed in June, 1912; the company had traded at a loss, and in October last two judgment creditors levied executions at the remaining shops. Witness added that since August, 1910, he had speculated in freehold and leasehold house properties in the East Ham district. To losses on such speculations and to want of capital he attributed his present position. The examination was concluded.

*Re* J. W. MAY & Co. (Jerome Walter May, trading as), importers of lighting and other specialities, 33, Cock Lane, Snow Hill, E.C.—An application for an order of discharge was made last week at the London Bankruptcy Court by this bankrupt, who failed in October, 1911. The Official Receiver reported that the probable debts amounted to £8,725, the assets valued by the bankrupt at £1,085, had produced £547, and a dividend of 9d. in the £ had been paid to the creditors. The bankrupt came to this country from America in 1905, and for three years acted as manager for a firm dealing in lighting specialities. In May, 1908, he commenced a similar business in partnership with another person, with a capital of £300; the partner retired at the end of that year, and the bankrupt continued the business until July 15th, 1911, when he executed a deed of assignment in favour of a trustee acting on behalf of the creditors generally. The bankrupt attributed his failure to robbery by employes, heavy household expenses through the illness of his wife and family, want of capital, bad debts, and loss of trade by reason of his inability to attend properly to the business. The discharge was suspended for two years on the grounds of (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; and (2) imperfect books of accounts. Order entered accordingly.

W. LONGDON & V. G. COBB (Longdon & Cobb), electrical engineers, Nottingham.—Receiving order made January 15th on debtors' own petition.

R. E. WALKER, electrical engineer and cycle agent, Hereford.—Supplemental dividend of 3½d. in the £ payable February 1st at Official Receiver's office, 2, Offa Street, Hereford.

**Sweden.**—The output of the Allmänna Svenska Elektriska A.-B. last year showed a satisfactory increase, 8,000 electric machines having been turned out, of a total capacity of 360,000 H.P. The deliveries for the three foregoing years were:—1909, 105,000 H.P.; 1910, 230,000 H.P.; and 1911, 220,000 H.P.—*Affärsvärlden*.

**Norway.**—THE CHRISTIANIA ELECTRICAL WORKS have quite recently placed an order with the A/S Norwegian & Brown-Boveri for two transforming plants, each consisting of four machines of a capacity of 1,200 H.P. each. The machines are to be built at the company's works at Sköien, and are to be completed by June this year. The company has previously delivered to the municipal works three similar plants.

**Book Notices.**—*The Russian Year-Book, 1913.* Edited by Dr. Howard P. Kennard. London: Eyre & Spottiswoode, Ltd. 10s. 6d. net.—This, the third edition of this valuable work, is, happily, not quite so bulky as the last, as a different paper is used, but it contains quite as vast an amount of information, either written or compiled by experts on Russian affairs, or prepared by the co-operation of those in authority. The development of Russia naturally must promote great increase in engineering requirements, including, of course, electrical, and British firms who look for a larger share of business in that part of Europe and Asia will doubtless be better equipped after making a study of the material here brought together for them in convenient form. Commercial, financial, mining, agricultural, municipal and other affairs have special sections devoted to them, and "Electricity" and "Electrical Dynamotors and Motors" have place in the "Trade Reports" section. Customs tariffs are fully tabulated. A calendar for 1913 indicates the dates of Russian fairs, festivals, &c.

*Elementary Manual on Applied Mechanics.* By Prof. A. Jamieson. London: Charles Griffin & Co. Price 8s. 6d.—The tenth edition of this popular work appears just after the lamented death of the author, whose remarkable faculty of exposition to engineering students enabled him to write a series of text-books which obtained a very wide vogue. The present work has been revised and enlarged, and the author has added recent information bearing upon examinations, together with sets of the latest examination papers of various bodies. He has also incorporated in this volume the table of engineering symbols, units and abbreviations employed in his larger text-books, as well as the symbols adopted by the International Electrotechnical Commission at Turin in 1911. One of the leading features of these books is the lavish provision of fully worked examples throughout the work, whereby any difficulty that may be experienced in following the abstract discussion of a proposition is removed by the concrete illustration thus afforded. There is also a wealth of line drawings and half-tone illustrations, constantly reminding the reader that the principles which he is studying have an immediate bearing on the practical applications of engineering to the needs of everyday life, and thus engaging and retaining his interest in a subject which, if improperly treated, can be made as dry as dust.

*Text-book of Applied Mechanics.* Vol. I. Price 6s.—This book, by the same author and publisher as the foregoing, is the first of the five volumes which compose the complete work, now commencing its ninth edition, and as we reviewed the seventh edition less than three years ago, we need neither notice it at length nor demonstrate its obvious popularity. Most of what we have said above regarding the elementary manual applies also to this volume, of which we can hardly speak too highly.

"Lockwood's Builder's, Architect's, Contractor's and Engineer's Price Book for 1913." Edited by F. T. W. Miller. London: Crosby Lockwood & Son. Price 4s.

"Über die Patentsituation in der Automatischen Telephonie." By F. Aldendorff. Berlin: S. Heimann & Sohn.

"Quarterly Trade Journal of the British Chamber of Commerce of Turkey." No. 20, 1912. Constantinople: The Chamber. Price 2s. 6d.

"A Handbook of Wireless Telegraphy." By J. Erskine Murray. Fourth Edition. 1913. London: Crosby Lockwood & Son. Price 10s. 6d. net.

"The Repayment of Local and Other Loans." By Edward Hartley Turner. London: Sherratt & Hughes. Price 21s. net.

"Design and Construction of Steam Turbines." By Harold M. Martin. London: *Engineering*. Price 25s. net.

"List of Works on Aeronautics in the Science Library." "Catalogue of an Exhibition of Apparatus Illustrating the Application of Scientific Principles to Aeronautics." London: Wyman and Sons, Ltd. Price 4d. and 1d. each.

"Papers and Reports Relating to Minerals and Mining in New Zealand." 1912. Wellington, N.Z.: Government Printer.

"Specifications for and Measurement of Standard Sieves." Washington: Government Printing Office.

"Annales des Postes, Télégraphes et Téléphones." 1912. Paris: A. Dumas. Price 6 fr.

"Elektro-Ingenieur-Kalender, 1913." Berlin: Oscar Cablenz. Price M. 2.50.

"Transactions of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 3. January, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"Boletín de la Sociedad de Fomento Fabril." December, 1912. Santiago de Chile: The Society.

"Bulletin of the Association des Ingenieurs Electriciens." October, 1912. Liège: The Association. Price 5 fr.

"The A.B.C. Fiscal Handbook." 1s. net.; post free, 1s. 3d. "Two Great Tariff Trials of 1912." By W. E. Dowding. 3d. net. London: Free Trade Union.

**Messrs. Ernest Scott & Mountain's Works Purchased.**—The works of MESSRS. ERNEST SCOTT & MOUNTAIN, LTD., Gateshead, have been purchased on behalf of MESSRS. C. A. PARSONS & Co., of Heaton Works, Newcastle-on-Tyne, together with the more important portions of the plant and machinery and the goodwill. Owing to the large number of inquiries received by Messrs. Parsons, and to some very large contracts recently undertaken by them, the works will, in the first instance, be chiefly engaged in assisting their general manufactures, as well as continuing the business carried on by Messrs. Scott and Mountain.

**River Plate.**—Amongst the principal electrical goods imported during the first nine months of the year we find the following (values in dollars gold):—Accumulators, \$47,370; insulators, \$99,236; cables and wires, \$2,231,293; telephones, \$58,623; arc carbons, \$109,702; dynamos and motors, \$1,391,131; switches, \$88,470; arc lamps, \$106,960; incandescent lamps, \$344,401; meters, \$359,604; lampholders, \$57,647; ventilators, \$22,936. The total value of the electrical goods imported was \$6,941,984, an increase of \$2,066,601.—*Review of the River Plate*.

**Catalogues and Lists.**—THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Advance copy of a new price list describing, illustrating, and giving price and dimensional information respecting, their B.T.H. A.C. pre-payment watt-hour meter, single-phase house service type.

THE BRITISH THOMSON-HOUSTON CO., LTD., Mazda House, London, E.C.—12-page pamphlet entitled "A New Way to Sell Fittings"—building them up on the sectional system. The various parts going to make up a complete fitting are illustrated in the list. The tungstolier sectional fitting, it will be remembered, was described in these pages a short time ago. The contractor who is hampered by the cost of keeping large showroom facilities for the display of fittings can keep the separate ready-wired parts of this type of fitting ready for assembling in a few minutes, and thus needs less showroom and stock room accommodation.

MESSRS. E. A. REED & Co., LTD., 14, Victoria Street, London, E.C.—Catalogue consisting of a number of illustrated sheets showing and briefly describing their elevators and conveyors for sacks and boxes, vertical box elevators, tray conveyors for coal and ore, gravity roller conveyors, steel buildings, roofs and chimneys.

THE LONDON ELECTRICAL TRADING CO., LTD., Palmerston House, Old Broad Street, London, E.C.—Illustrated and priced showcard of the "Pygmy" electric heater. We understand that nearly 10,000 of these heaters have been sold since they were first placed on the market last autumn. Copies of the showcard can be obtained from the firm or any of their agents.

THE DUSSEK BITUMEN CO., Canal Bank, Deptford, London, S.E.—Two pamphlets have been received; one of 12 pages gives particulars of their joint box compound (Trinitide) and tests thereon, while the other of 14 pages contains an imposing list of electric supply authorities in all parts of the kingdom who are using this compound, together with a collection of testimonials from some of

them. Copies of both lists will be sent to anybody interested in mains work.

MESSRS. DETROIT ENGINE WORKS, 94, Hatton Garden, London, E.C.—Illustrated price lists relating to the Detroit stationary oil and petrol engines.

THE HART ACCUMULATOR CO., LTD., of Marshgate Lane, Stratford, London, E., have prepared a very effective wall showcard. The pictorial part of the design embodies illustrations of typical Hart central station batteries and batteries for private installations and other purposes.

MR. A. BURROUGHS, 28, Hatton Wall, London, E.C.—Illustrated leaflets showing the firm's electric illuminated box signs for outside service, and standing signs for window and counter display.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park.—Small folder relating to spare parts for control gear. An illustration of a disassembled controller has a letter index to the separate parts, which can all be supplied from stock. Also a folder dealing with oil-insulated self-cooling transformers.

THE BRITISH ELECTRIC TRANSFORMER CO., LTD., 29A, Charing Cross Road, London, W.C.—Illustrated catalogue, No. 29, describing the "Tricity" non-luminous electric heater for service on board ship. Pedestal and settee types are both shown.

**Private Arrangements.**—R. GREGSON & Co., electrical engineers, 12, George Street, Ashton-under-Lyne, and 38, Bank Street, Rawtenstall.—The creditors interested herein were called together recently at the offices of Messrs. Hurst & Hewitt, Commercial Chambers, Corporation Street, Manchester, when a statement of affairs was presented showing liabilities of £680, all of which were due to unsecured creditors. The assets were estimated to realise £714, and a surplus was thus disclosed of £34. The assets consisted of stock-in-trade at Rawtenstall, £42; stock at Ashton-under-Lyne, £50; fixtures, fittings and utensils, £20; book debts at Rawtenstall, £210; and book debts at Ashton-under-Lyne, £392. It was reported that the business had been carried on in partnership, the partners being Richard Gregson and Wm. Gartside. They started trading about three years ago, each having a capital of about £500. Each of the debtors managed one of the businesses. It was stated that the business had been losing money, and the last balance-sheet which was prepared in March, 1912, showed a surplus of a little more than £500. In consequence of proceedings, the debtors consulted their solicitors before Christmas, when they were advised to execute a deed of assignment. Gregson did not attend at the offices to sign the deed, but he had since sent the key of the Ashton-under-Lyne premises to the trustee, together with some money. It was also reported that Gregson had gone away. The accountants subsequently made inquiries, and found that the books had not been properly written up since the date of the last audit. In the absence of Gregson, an application was made to the Registrar of the County Court for leave to register the deed in that debtor's absence. The application was refused, but the matter was taken before the Judge, and after reviewing evidence, he acceded to the application. It was, however, stated that Mr. Gartside owned a dwelling house of the value of £250, and he had deposited the deeds of that property with the trustee, and the assets would be accordingly increased. Sympathy was expressed with Mr. Gartside by the creditors, and after a short discussion it was decided that the deed of assignment already executed should be confirmed. The following are creditors:—

W.T. Henley's Telegraph Works, Ltd. . . . .	£174	Richardson & Co. . . . .	£31
Baxendale & Co. . . . .	100	Eokstein, Heap & Co. . . . .	29
Foster Engineering Co. . . . .	77	Union Electric Co. . . . .	22
Veritys, Ltd. . . . .	39	Edison & Swan Co. . . . .	16
		Siemens Bros. & Co., Ltd. . . . .	18

**Dissolutions and Liquidations.**—NORTH METROPOLITAN TRAMWAYS CO.—A meeting is called for February 20th at Electrical Federation Offices, London, to hear an account of the winding up from Messrs. Geo. Richardson and J. McLeod.

COWPER-COLES INVENTIONS DEVELOPMENT CO., LTD.—A meeting is called for February 25th at 1 and 2, Old Pye Street, Westminster, to hear an account of the winding up from the liquidator, Mr. W. Craddock.

MERSEY ENGINE AND PRODUCER CO., LTD.—At a meeting called for February 24th, at 3, Lord Street, Liverpool, Mr. W. E. Mounsey, the liquidator, will give an account of the winding up.

THE ELECTRICAL WIRING AND ACCESSORIES CO., Boot Buildings, Market Street, Aberdeen.—Messrs. J. A. Bosher and R. S. Belsten have dissolved partnership. Mr. Belsten attends to debts, &c.

**Finding Lost Pipes.**—There have been several inquiries regarding the apparatus for this purpose described in our issue of December 20th, 1912. We are now able to state that the makers are Messrs. Edwin A. Mansfield & Co., 12, Beckenham Road, New Brighton, U.S.A., from whom we have received a pamphlet describing the system, and giving a long list of water and gas companies and municipalities who use it.

**Annual Dinner.**—The staff of the ELECTRIC CONSTRUCTION CO., LTD., held their sixth annual dinner on Friday, January 17th, at the Star and Garter Hotel, Wolverhampton. The managing director of the company (Mr. James Gray) presided over a good muster, the vice-chair being occupied by Mr. William Bulloch (a director and general manager of the company). Mr. David Willock (secretary of the company) was also present. After dinner, musical items were rendered by various members of the staff, including a "turn" by "The Shockers," a quintette of pierrots, whose performance—including several topical items written by one of the troupe—was thoroughly enjoyed. The managing director, replying to the toast of "The Company," proposed by Mr. Sam. Antwis—the oldest

member of the staff present, with 30 years' service—referring to the harmonious relations existing between the directors and the staff, said, in these days of labour unrest they prided themselves on the fact that they had never had a serious dispute with their employes, and spoke very hopefully of the prospects of the company. Mr. W. Bulloch, in proposing the toast of "Our Chairman," spoke of the valuable services rendered to the company by Mr. Gray, and of the esteem and affection with which he personally regarded him. The toast of "Our Vice-Chairman" was proposed by Mr. R. Massey, and acknowledged by Mr. Bulloch. The "Dinner Committee and Artists" was proposed by Mr. D. Willock, and responded to by Mr. W. M. Furniss.

**Spain.**—A foreign Consular report from Barcelona says, among other things, that without belittling the success Germany has had in Spain, it can be truly said that, if the dynamos and the larger apparatus are excepted, the goods supplied are often of very moderate quality, and would not readily be disposed of in any other European market. This is the result of the low prices at which German manufacturers are prepared to take the business solely with a view of discouraging competition by the electrical industries of other countries. It is not likely, however, that Spain will continue indefinitely to buy cheap goods which do not wear well, and, therefore, if the German plan of campaign is not altered, it is probable that her manufacturers will lose a great deal of the business that is now in their hands—at any rate as far as accessories are concerned.

**Calendars.**—MESSRS. W. A. WALBER & Co., 38, Victoria Street, Westminster, S.W., have issued a large wall calendar, the central feature of which is a collection of miniature half-tone illustrations of machine tools made by the firms for whom they are agents.

From the ELECTRICAL ACCESSORIES SUPPLY STORES, of 9, Queen's Terrace, Sheerness-on-Sea, we have received a neat little calendar with monthly tear-off slips.

THE BAT METER CO., LTD., 3, Eden Street, Hampstead Road, London, N.W., has likewise issued a wall calendar with monthly slips. The upper half of the sheet shows a large illustration of one of the firm's electrical meters.

MESSRS. BRECKNELL, MUNBO & ROGERS, LTD., of Thrissell Street, Bristol, have prepared a calendar with monthly slips for 1913, above which there is a print in colour of "Past and Present—H.M.S. *St. Vincent* leaving Portsmouth Harbour"—always an interesting comparison.

THE SUN ELECTRICAL CO., LTD., of Charing Cross Road, W.C., ask us to say that, in consequence of the extraordinarily large demand for the pencils prepared by them as a New Year souvenir, their stock is exhausted, and they regret inability to comply with all the requests.

**Trade Announcements.**—Mr. Fred. E. Trill has entered into partnership with Mr. E. A. Shaw, electrical engineer. The business will be carried on as heretofore under the style of EDWARD A. SHAW & Co., at Cape Town.

MR. R. E. CONNOLD has taken over the business formerly carried on at 6A, Parade, Canterbury, by Mr. L. A. Wells, electrical engineer and contractor.

MESSRS. J. E. ELLIOTT & Co., electrical engineers, of Broad Street, Oxford, have recently opened offices at 10, Adam Street, Adelphi, W.C.

THE SHIPLEY FAN CO. have removed to Valley Works, Shipley, owing to increased sales of fans and motors. Telephone number, "320 Shipley." Illustrated cards received show their blowing fan, exhausting fan, and Sun electric fan.

## LIGHTING and POWER NOTES.

**Aberdeen.**—Mr. Bell, the electrical engineer to the T.C., has reported on the necessity of extending the generating plant of the Corporation at a cost of £15,510. The estimates provide for a 3,000-kw. turbo-alternator with condenser, &c. (£9,750), 1,500 kw. of converting plant (£3,600), switchgear, &c. (£750), and contingencies (£1,410). The new turbine plant will replace two existing 200-kw. engine sets which are out of date.

**Arbroath.**—A difference between the Town Council and the North of Scotland Entertainments, Ltd., regarding the payment of £212 for electrical equipment in connection with the reconstruction of the old Corn Exchange buildings, has been satisfactorily settled.

**Argentina.**—In connection with La Societa Italo-Argentina di Elettricit, the new company which has lately been formed in Buenos Ayres under Italian auspices with a capital of £440,000, to establish electricity supply undertakings in Argentina, the Pirelli Co., of Milan, Messrs. Tosi & Co., of Legnano, the well-known Italian turbine builders, and Messrs. Doveri & Co., of Baden, Switzerland, are reported to be interested in this concern.

**Ayrshire.**—More light is wanted at Troon, a popular watering place, and it is suggested that electricity should be introduced. It is believed that the T.C. will consider the matter.

**Blackrock.**—A special meeting of the Council was held on Saturday to consider what action should be taken with regard to the proposal of the Dublin Southern District Electric Supply Co. to apply to the B. of T. for a prov. order giving it liberty to supply the Blackrock district with electric current. The town clerk pointed out that the Dublin Southern Co. would supply electricity at a fraction under 5d. per unit for private purposes to the consumers in the district. The Pembroke Council would also be disposed to favourably consider the supply of electric current at the boundary of the township on terms ranging from 2½d. for 100,000 units per annum to 1½d. for a consumption exceeding 325,000 units, for a period of three years (beyond which the Council would not contract) renewable at the same terms, and it would supply at 2½d. per unit, irrespective of the quantity consumed, up to March 1st, 1914. The position, therefore, appeared to be that the Council could either decline to waive its right to the notice which should have been given by the promoters of the company in July last, with the result that Blackrock must be left out of the proposed order, or it could make an arrangement with the Pembroke Council. The Dublin Southern Co. had written stating that it was not greatly concerned whether Blackrock was included or not in the order. It was decided unanimously not to waive the Council's right to the notice which should have been delivered in July last; and further, that the district should be canvassed for consumers.

**Blackburn.**—The Mayor is to perform an interesting ceremony to-day at the electricity works, when he starts the new generating plant installed at a cost of £9,000. The new plant consists of two turbo alternators, two rotary converters, and the necessary switchboard, &c. These are the first turbines to be put down in Blackburn; when the first one was ordered, 12 months ago, it was got partly to enable the Corporation to start an extra-high-tension supply for cotton mills and large works. Before it was on its bed there was a demand from two mills for half of its capacity of 2,000 kW, and since then practically another 1,000 kW. has been arranged for. With the full capacity of one turbine spoken for, the Electricity Committee decided to put down another. The new plant generates three-phase alternating current at 6,600 volts, and has a speed of 3,000 R.P.M. The two rotary converters are already in position; each has a capacity of 1,000 H.P. and a speed of 600 R.P.M. The two cotton weaving mills to be run by the first turbines are the one at Skew Bridge, which has 1,040 looms, and Cicely Bridge extension, 370 looms; each loom has its own motor. The new plant has been installed by the British Westinghouse Co. A cooling tower, 106 ft. high, is shortly to be erected. The tower foundations and auxiliaries will cost approximately £2,600, and it will be capable of dealing with 200,000 gallons per hour. The order has been placed with the Davenport Engineering Co. The whole of the work has been done to specifications by Mr. Wheelwright, the borough electrical engineer.

**Bolton.**—The Electricity Committee has referred to the chairman and vice-chairman, applications from the following mills and works for current for motive power:—Messrs. Slater & Co., Ltd., Bolton Bleachworks; Messrs. R. Entwistle & Co., Lincoln Mill; Messrs. J. Marsden & Co., Britannia Works; Messrs. Winder and McKean, Bradford Mills, and the Victoria Mill.

**Brighton.**—The T.C. has decided to install an electric cooking outfit, at a cost of £55, on the Crown Street premises of Messrs. Stafford, who are constructing a new staff kitchen. The firm has promised to use electricity if the Council puts in the apparatus.

**Church (near Oswaldtwistle).**—The U.D.C. has decided that Blackburn Road and Market Street be lighted by electricity, and a sub-Committee has been appointed to make arrangements and report.

**Continental Notes.**—**FINLAND.**—It is announced from Helsinki that the Finnish Senate has discussed the question of the utilisation of the falls on the River Vuoksia, and that an inter-Departmental Committee has been appointed to draw up the conditions for the immediate utilisation of the Grande Imatra Falls. The electrical energy generated will be utilised for traction purposes on the Saimenski Canal, for the electrification of the St. Petersburg-Viborg railway, for lighting and power purposes in the town and district of Viborg, while part will be transmitted to St. Petersburg for a similar purpose. It is estimated that the portion of the falls to be utilised will yield an electrical output of 450 million kW-hours per year. The necessary plant will be installed on Government account, the Finnish Senate having decided not to hand it over to private concessionaires.

**NORWAY.**—The Municipality of Tromsø has recently contracted for a new electricity works, with equipment by the Elektrisk Bureau of Christiania. Two generators of 600 H.P. each, with the necessary transformers and switches, will be installed. The electric power will be derived from a waterfall situated at some distance from the town, and will be transmitted at 12,000 volts. This undertaking is not a very big one, but it has some very interesting features in regard to the question of transmission. Tromsø is situated on an island, while the waterfall, from which the energy is to be obtained, is situated on the mainland. This necessitates the transmission of power by submarine cables across two sounds, one of which is 550 m. wide, and the other 625 m. The works are to be completed by August next.

The Elektrisk Bureau has also obtained an order from the Sulitelma Copper Mines for the delivery of two generators, to be installed at the Fineide power station, which will be extended.

The municipal authorities of Christiania are reported to be con-

sidering a scheme to establish a plant, 25 miles from the city, to utilise the water power of the Halfred and Solberfos Falls on the River Glommen, in the generation of electrical energy. It is stated that about 27,000 H.P. will be available.

**GERMANY.**—The recently-formed Thuringer Electricitäts Lieferungs Gesellschaft has placed a contract with the A.E.G. for the construction of an overland transmission station for the Duchies of Gotha and Meiningen, and the districts of Schmalkalden and Schleusingen. The power station, which will have a temporary capacity of 14,000 H.P., will be located near Altenbreitungen a.d. Werra.

The municipal authorities of Hagen, Westphalia, are reported to have placed an order with Messrs. Brown, Boveri & Co., of Mannheim, for what it is claimed will be the largest steam turbine and dynamo so far built. It will be of 35,000 H.P., and is to be added to the plant at the municipal central station at Hagen.

**Cromer.**—At a meeting of the U.D.C. on January 13th it was decided that the proposed transfer of the electric lighting undertaking to Messrs. Edmundsons should remain in abeyance with a view to a referendum of all the ratepayers being taken at once on the question.

**Croydon.**—The B.C. has sanctioned the sinking of a well at the electricity works at a cost of £1,200. Owing to the proximity of the River Wandle, the amount of water to be extracted must not exceed an average of 4,000 gallons per hour in any period of 30 days.

**Dawlish.**—The U.D.C. has decided to increase the number of street electric lamps by 30.

**Ealing.**—The chairman and borough electrical engineer have been instructed by the B.C. to make inquiries and report upon a letter received from Messrs. Hancock & Dykes, on behalf of the Fixed Price Lighting Co., for putting its scheme into operation in this district.

The B.C. has decided that in future the charge for electric current supplied for outside illuminated signs and for outside incandescent shop lighting shall be 4d. per unit.

**Edinburgh.**—In spite of protests from the electrical trade of the city, the Corporation has decided to retain in its prov. order the clause which gives it power to sell and hire electrical apparatus. In one respect, however, the recent deputation from the traders heard by the Council has prevailed, for the Corporation will not carry out any wiring. Mr. Walter Finlay, who speaks on behalf of the traders, says what they desire is freedom from rate-aided competition, which is the most serious menace that can be met with so far as they are concerned. They contend that in Edinburgh there are ample showrooms for the consumers to see the most recent electrical appliances.

**Epsom.**—A town's meeting was held on the 15th inst. to consider the Bill which the U.D.C. proposed to promote in Parliament in order to provide further powers in connection with the municipal electricity and water undertakings and other matters. On behalf of the Council, it was stated that the electricity undertaking was costing the town £1,120 less than in 1908, and that a proposal was to be immediately considered to reduce the price of current for power purposes from 2½d. to 1½d. per unit. A vote was taken which showed a majority of about 2 to 1 against the Bill.

The R.D.C., on January 15th, approved of plans for the extension of the mains of the Leatherhead and District Electricity Co. from Fetcham to the Effingham district. The company has also submitted a draft prov. order for electric light in the parishes of Cobham, Stoke D'Abernon, Great Bookham, and Little Bookham, and this was referred to a Committee.

**Glasgow.**—A special Sub-Committee of the Electricity Committee has been appointed to consider and report on a letter submitted on behalf of a number of electrical firms in Glasgow, for the organisation, under the auspices of the T.C., of an Electrical Manufacturers' Exhibition in the city.

**Guildford.**—An application has been made by the Electricity Supply Co., to the B. of T. for consent to construct a generating station on land adjoining the existing works of the company.

**Helsby.**—The P.C. is considering the advisability of utilising electricity at the sewerage works, and an estimate of the cost, as compared with gas, is being prepared.

**Hendon.**—The Colne Valley Electricity Supply Co. has agreed to the R.D.C.'s suggestions that the price of current should be fixed at 6d. per unit for lighting and 3d. for power, and that a clause should be included in the proposed prov. order giving the Council the option of purchasing the undertaking on the expiration of 21 years. Under these circumstances the Council's opposition to the scheme is to be withdrawn.

**Hoddesdon.**—The B. of T. has revoked the 1901 E.L. Order.

**Hove.**—A statutory town's meeting was held on January 17th to decide whether the Corporation shall promote a Bill in Parliament for the purchase of the Hove E.L. Co.'s undertaking. The Mayor pointed out that the purchase had been decided on, and it was now desired to obtain Parliamentary powers, as it was hoped that the repayment would then be extended over 40 years, while the alternative of L.G.B.'s sanctions would probably mean repayment in 15 to 20 years. The loan repayment for 40 years would only amount to £9,500 per annum, and would be about £14,000 for 20 years. The resolution was lost on a vote, and a poll of the ratepayers has been demanded.

**Knighton (Radnorshire).**—A largely-attended meeting of ratepayers has by an almost unanimous vote resolved that the private company which had applied for permission should undertake the electric lighting scheme, subject to its being acquired by the Council at a future date.

**Liverpool.**—Further extensions are proposed at the Lister-Drive power station, where additions were made in the early part of last year by the installation of two 2,000-kw. D.C. turbo-generators, and two 3,500-kw. turbo-alternators. At the meeting of the Electrical Sub-Committee on January 17th, a report was received from Mr. H. Dickinson, chief electrical engineer, on the proposed further extension of the works. Owing to the laying of additional tramways, and the increase in the number of cars running besides the considerably increased demand for current, the generating plant at Lister-Drive has required to be not only modernised, but considerably increased in capacity. The report recommends an increase capable of meeting present and future needs for many years to come. As the details were considerable, the Committee decided to take time for each member to study the scheme for himself, and it was agreed to deal with it at a subsequent meeting.

**Long Eaton.**—The U.D.C. on Monday gave instructions for plans, specifications and estimates to be prepared for extensions at the electricity works, with a view to a loan of £8,000 being applied for. The proposals are to install a 500-kw. steam dynamo and accessories, a Babcock & Wilcox water-tube boiler, and erect an engine room, boiler room and office extensions.

**London.**—BERMONDSEY.—An addition has been made to the assessment of the undertaking of £1,195 gross, and £530 rateable, in respect of the recent additions to the generating station.

**HACKNEY.**—The Electricity Committee reports having had under consideration the necessity of proceeding with the first part of the system of ring mains, sub-stations and sub-feeders in connection with the scheme adopted in March last for the extension of the undertaking. The maximum demands this year have already exceeded what was anticipated for next January, viz., 4,150 kw., and the strain of the heavy load was being acutely felt upon the mains and plant. A site for the northern sub-station, the Committee states, has been obtained, and immediate steps should be taken to secure sites for the south-eastern and south-western sub-stations. The immediate load that will be dealt with by these sub-stations will be approximately 1,700 kw., and to meet this load plant should be provided having a total capacity of 3,000 kw. With regard to the system of ring mains the Committee proposes to lay fibre ducts which will accommodate cables for 12,000 kw., with telephone cable and pilot wires. At present provision was being made for drawing in one cable only to deal with a load of 3,000 kw. when fed from both ends, or 1,500 kw. in the event of a fault occurring in the worst possible position. For the transmission of the low-tension current from the generating and sub-stations, it is proposed to use the existing feeder cables and to run out several new cables from the sub-stations. The general principle of the proposed arrangements is to increase the capacity of the feeders to existing feeding centres by joining existing cables in parallel, so that these centres may still be supplied from the generating works, at low pressure and without excessive loss, while the ends of the longer feeders will be cut off and connected to the sub-stations. The Committee recommends (1) that the proposed scheme of extensions be approved; (2) that tenders be invited for the erection of the three sub-station buildings and the sub-station plant; (3) that the necessary cables and boxes be purchased under the current contracts for these materials, and that tenders be invited for supplying and laying the conduits, &c.; (4) that application be made to the L.C.C. for loans aggregating £53,550.

**POPULAR.**—As loans of £2,885 for buildings, £1,000 for mains, and £2,115 for machinery are required in respect of extensions to the electricity undertaking, and as no better terms than 4 per cent. can be obtained, it has been decided to borrow the machinery amount from the Council's superannuation and pension fund at 4 per cent. interest, and the two remaining items from the L.C.C.

**SHOREDITCH.**—The Lighting Committee reports having carried out experiments over a long period with a new type of flame lamp for the purpose of improving street lighting. The electrical engineer reports that if magazine type flame arc lamps are adopted, not only will a great saving be effected after the new lamps are paid for, but an increase of nearly 100 per cent. will be gained in illuminating power. It is estimated that the saving per annum on a circuit of 21 lamps, including current and attendance, after allowing for the slightly increased cost of carbons, will be about £124. After fully considering the matter and in view of the great increase of vehicular traffic, also in the speed of all kinds of motor traffic, the Committee expresses the opinion that the improved lighting of the streets, especially main thoroughfares, is of urgent importance, and it has decided to purchase 96 lamps as follows:—48 "Metro-flam" arc lamps, burning 70-80 hours, from Johnson & Phillips, at £9 10s. each, and 48 "Angold" arc lamps, burning 90 hours, from the General Electric Co., at £10 each. An expenditure of £300 has been approved for the supply of new meters.

**Lowestoft.**—The electrical engineer reports that the total receipts of the undertaking amounted last year to £15,992, which shows an increase of £163 on the year's work, and which, after paying all working expenses and small extensions, left a gross profit of £7,489, which is equal to 7½ per cent. on the outlay. From this amount must be deducted payments made out of appropriation account for some work which it has been found necessary to carry

out. The interest and sinking fund charges have increased from £6,767 to £7,283. This large increase is entirely due to the short loans which the L.G.B. is now only allowing. The total number of units generated amounts to 1,567,990, showing an increase of 99,753.

**Mansfield Woodhouse.**—The U.D.C. has decided to have certain thoroughfares lighted by electricity. Double 100-c.p. lamps will be charged £10 each per annum, and double 50-c.p. lamps £5 10s. per annum. Under agreement with the Mansfield T.C., current will be supplied under the maximum demand system at 7d. and 2d., and on the flat-rate at 1½d. per unit for lighting; and for power at 4d. and 1d.

**Margate.**—The T.C. proposes to install three lifts in the town, one from the Fort Promenade to the Lower Promenade; another at Newgate Gwary; and a third from the Cliffs to the Lower Promenade at Palm Bay. The Works Committee is to prepare a report as to the cost, &c.

**Middleton.**—The application of the T.C. for sanction to borrow £7,200 for the purposes of the electricity undertaking was inquired into by Mr. T. C. Ekin, of the L.G.B., on January 17th. Mr. S. Pauls, borough electrical engineer, gave particulars of the requirements, which showed that out of the £7,200, it was intended to expend £5,200 on cables, and the remainder on a steam dynamo, and accessories. The Committee had been spending some £900 a year on mains, and he estimated that to meet the great demand for current it would have to spend £1,000 in the future. The Garden City accounted for a large increase, as well as the improvements in lighting. He was quite satisfied that they would be able to spend the money within the next three years. There was no opposition. In connection with this scheme, the Council has placed a contract with the Lancashire Dynamo and Motor Co. for a 300-400-kw. dynamo, and with Messrs. Belliss for an engine.

**Orsett.**—The R.D.C. has consented to the application of the County of London Electric Supply Co., Ltd., for a prov. order for electric light in the rural area.

**Portslade.**—The U.D.C. has resolved not to approve of the Bill of the Hove T.C. to purchase the undertaking of the Hove Electric Light Co., owing to Portslade being included in the area of supply, and to request the Hove Corporation to strike out everything contained in the Bill affecting the urban district.

**Queensferry (Ches.).**—The lighting of the district has been under consideration for some time, both by the P.C. and the West Saltney R.D.C., and the latter authority at its last meeting approved a resolution, passed by a ratepayers' meeting, that steps be taken to have Queensferry lighted by electricity. Mr. T. M. Dutton, who was present at the meeting of Queensferry ratepayers, considered that a suitable plant could be put down for about £1,500, and he suggested that a deputation should view the scheme in operation in Caerwyrle. The estimate referred to had, he said, been sent in by Sandycrofts, Ltd., but he was simply there to explain the scheme as an interested ratepayer, having severed his connection with that company. An amendment, suggesting that the Connahs Quay Gas Co. be again approached before anything definite was done, was rejected by a large majority.

**Rawtenstall.**—A new engine room has been added to the electrical generating station, with a 1,000-h.p. Belliss engine and three-phase alternator. The alternator has been made by the General Electric Co., and supplies current at a pressure of 3,000 volts. A second set which is being placed in the power house is an exact replica of the one above-mentioned. Three condensers of the ejector type have been installed, and a fourth is being added. A new intake, with screening apparatus, has also been installed, and a new boiler by Messrs. Yates & Thom. The demand for current is increasing so fast in both Bacup and Rawtenstall, that there is practically a full load waiting for the extended plant.

**Rochdale.**—At a meeting of the Corporation Gas and Electricity Committee last week, a letter was read from the Salford Corporation thanking the Committee for the help rendered at the time of the disastrous fire at Salford. One of the members of the Committee asked the electrical engineer if the Rochdale works were reasonably safe against such a calamitous outbreak, and Mr. Atchison replied that it was practically impossible for the Rochdale works, constructed as they are, to be burnt out, and as far as human foresight could do it, they were safeguarded against serious results from fire.

**Romford.**—After discussing the matter *in camera*, the Finance and Parliamentary Committee of the U.D.C. has further deferred action with regard to the applications for prov. orders for electric supply by the London Electric Supply Co. and Mr. W. T. Pressland. Further information is to be obtained.

**Sanderstead.**—At the last meeting of the Parochial Committee, it was stated that the County of London Co. had written to the Coulsdon and Beddington Councils, offering to light the streets under their jurisdiction at a moderate rate now that the company was bringing its own H.T. supply from Wandsworth. The Committee decided to write to the company, asking its charges and what roads would be included.

**Scarborough.**—The Corporation has appointed a special committee to consider and report upon the question of the exercise of its right of purchase of the local electric lighting undertaking.

**South Africa.**—The Paarl Cape Province ratepayers have sanctioned the raising of a loan of £35,000 to be expended on an electric light installation. The scheme proposes to use water as the prime motive power, and this is to be obtained from the Nantes and Bethal streams and stored in a reservoir on the mountain. The reservoir will have a storage capacity of 121,000,000 gallons. The engineer for the scheme is Mr. Thomas Stewart, M.I.C.E., of Cape Town. The dam is estimated to cost £22,000, plant and power station £5,100, and 12 miles of street lights and mains for private consumers £7,365.

**Southampton.**—The Corporation electricity department has just issued a well-printed booklet on "Heating by Electricity." A view on the cover shows the exterior of the up-to-date show-rooms at Above Bar, and the contents deal concisely with the various phases of electrical heating, which, as our readers are aware, has been energetically introduced by the local electricity department with very successful results. Included in the booklet is a list of a dozen local contractors.

**Surbiton.**—At the last meeting of the District Council, the report of Mr. J. F. C. Snell on the electricity undertaking for the six months ended September 30th, 1912, was considered. During the half-year 114,848 units were sold at an average price of 4'8d. per unit, as against 98,493 units at 4'9d. in the previous year, or an increase of 16,353 units, equivalent to 16'6 per cent., which he considered most satisfactory.

**Swansea.**—The electrical engineer has been instructed to prepare the necessary specifications, &c., for installing electric light at the new training college, and tenders are to be invited for carrying out the work.

**Swinton.**—An arrangement has been made between the District Council and the Lancashire Electric Power Co. whereby it will soon be possible for the Broad Oak Park area at Swinton to have a supply of electricity for lighting purposes. Subject to the sanction of the L.G.B., it has been arranged that the company shall deliver electricity at high pressure at the Council's boundary at Sindsley, and the Council will erect a transformer and lay supply cables through the park. The clerk has been instructed to make application for the necessary powers and for a loan of £600, and it is expected that the work will be proceeded with as soon as sanction is obtained.

**Uruguay.**—According to the *Review of the River Plate*, the Government has issued specifications for the erection of electric light works in various cities and towns. The 16 installations are divided into five groups; group "A" comprises La Paz and Las Piedras, which will receive their current from the Monte Video station. Group "B" comprises Guadalupe, Pando and Santa Rosa, which will each have their own station. Group "C" comprises San Eugenio and San Fructuoso, each with its own station, and Maldonado, San Carlos and Punta del Este, which will be served from a station at Maldonado. Group "D" comprises Dolores, Nueva Palmira and Rosario, each with their own station. Group "E" comprises Batlle y Ordóñez, Sarandi del Yi and Treinta y Tres, each with their own station.

**Venezuela.**—In our note of last week, for the Harbour of "Caracas" read "Curaçao."

**Wallasey.**—It is anticipated that at the next meeting of the Council the chairman of the Electricity Committee will bring forward a scheme for extending the electricity undertaking at a cost estimated at £65,000. For some considerable time past the demand for current for power purposes has exceeded the supply, in addition to which an application was recently received from a local business concern for an annual supply of 3,000,000 units. The responsible committee in the past has, however, failed to keep abreast with the times, the consequence being that the existing plant at the electricity station in Seaview Road, Liscard, is quite inadequate for present-day requirements. The new Committee proposes to remedy this and to embark upon a policy of a decidedly progressive character. The proposal is to erect, at an estimated expenditure of £60,000-£65,000, a new power station in the Poulton area, whence it is anticipated there will be a goodly number of consumers from the many industrial undertakings situated in the neighbourhood. In addition to this, power could be provided for working the tramway service at a cheaper rate than at the present time. It is thought an adequate extension and development of the electricity undertaking will have an important bearing upon the prosperity of the town.

**Watford.**—A provisional order is to be promoted next autumn for giving a supply to Bushey.

**Whitstable.**—At a meeting of the U.D.C., on January 14th, Messrs. G. Stainton, Campbell and Norman attended respecting the proposed electric lighting scheme. The Council was asked to grant permission for Mr. Campbell, on behalf of a company, to install an electric light system in the town by means of overhead wires, to utilise electricity for public lighting and sewerage pumping, and to undertake not to oppose the application for a prov. order. Mr. Stainton said the company would supply 50 or 60-c.p. lamps at 3'5s. per annum, against 3'10s. at present paid for gas lamps. The Council will consider the matter at a special meeting.

## TRAMWAY and RAILWAY NOTES.

**Blackpool.**—The Tramways and Electricity Committee has decided that application be made to the B. of T. for sanction to borrow £10,000 for the following extensions of the Corporation's tramway undertaking:—Extension of Marton tram depot; extension of workshop accommodation, Blundell Street depot; extension of storage accommodation, Blundell Street depot; six new open-type tramcars and electrical equipment therefor, and cables, sundries and accessories.

**Bournemouth.**—The long-debated question of Sunday running of the cars has at last been decided by a poll of the ratepayers, when 4,716 voted for and 4,268 against the proposal, showing a majority in favour of 448. A similar poll in 1906 resulted in a majority of 903 against Sunday running.

**Continental Notes.**—**AUSTRIA.**—The construction of an electric tramway between the towns of Parbuditz and Sezemitz, Bohemia, has been decided upon.

**FRANCE.**—A company styled the Chemins-de-fer Electriques de la Champagne has been constituted for the building and working of a network of local railways in the Départements de l'Aube et de l'Yonne. The gauge of the railways is 1 metre, and the extent of the system 194 km. Single-phase current is to be used, and the company will draw a portion of its supply from the Société Lyonnaise des Eaux et de l'Éclairage. A concession for 50 years has been secured.—*La Lumière Electrique.*

**Croydon.**—The Tramways Committee of the B.C. reported on Monday that it had considered a proposal from the L.C.C. for the running of through cars between London and Croydon. Having regard to the capital expenditure, estimated at about £60,000, which would be involved in adapting the Croydon system to suit the L.C.C. cars, the Committee recommended that the proposal be not entertained at the present time. The Committee also had under consideration reports by the town clerk and other officials regarding the powers of the Council in the matter of compulsory purchase of the portion of the South Metropolitan Electric Tramways within the borough. Having regard to the whole of the circumstances, the Committee recommended that those powers should not be exercised "at the present period." The routes affected are between the West Croydon terminus and the borough boundary (close to Mitcham Common), and from Church Street to the borough boundary in Stafford Road, Wallington (on the Sutton line). These recommendations were adopted. There was a long discussion over the Whitehorse Road route, which has been run at a loss since November, 1906, except for a period when it was closed. The manager (Mr. T. B. Goodyer) submitted an analysis of receipts, expenses, &c., for December 21st and January 3rd, representing losses of £963 and £1,573 respectively annually.

**Dundee.**—The Corporation Tramway Committee has delayed for three months consideration of the proposal to extend the railless traction system from Clepington Road to Lochee. Mr. P. Fisher, the manager, estimates the cost of equipping the proposed route at £1,000. Two additional cars would be required at £700 each, bringing the estimated total capital expenditure to £2,400. Mr. Fisher says the system has worked smoothly, and is as reliable as an ordinary tramway service. The earnings on certain days, reaching as high as 25'3d. per mile run, proved that with this system heavy traffic could be successfully dealt with. In this quiet winter time, from 2,000 to 3,000 persons were using the cars every week. The service proposed, he states, would be of considerable public benefit, and undoubtedly a traffic would be developed which in time would be a paying one.

**Glasgow.**—The T.C.'s Sub-Committee on Extensions is to consider the advisability, in the event of the route being extended from Baillieston to Coatbridge, of a further extension to Airdrie, as well as an extension from the present line at Clydebank to Duntocher and Hardgate.

**Holywell.**—The U.D.C. has decided to take up £3,000 worth of shares in the Mid-Flintshire Light Railway, subject to approval at a ratepayers' meeting. The R.D.C. has also decided to take shares to the value of £7,000, subject to the approval of the L.G.B.

**Irlam.**—The T.C. has been considering the question of installing a railless trolley system, or running motor-buses, but the matter is not going to be proceeded with at present. The clerk informed the Council last week that a private Act of Parliament, costing anything from £200 to £1,000, would be necessary, and also that the proprietor of the present horse 'bus system declared that the passenger traffic did not pay. In view of those facts, the suggested conference with local employers on the matter was not considered necessary.

**Leith.**—The Tramways Committee of the T.C. has asked the Management Sub-Committee to report upon the proposal to form an extension of the tramways from Seafield terminus to King's Road, Portobello.

**London.**—**ISLINGTON.**—A petition is to be lodged against the L.C.C. (Tramways, Trolley Vehicles and Improvements) Bill, for the protection of the Council's interests. The Committee in charge of the matter states that, as regards the proposal to work trolley vehicles, such powers, if obtained, will create a precedent which may render valueless the power of veto conferred upon Metropolitan Borough Councils by Sec. 23 of the L.C.C. (Electrical Power) Act

1900, which prohibits the placing of wires in any street for an overhead system of traction unless the Council of the Borough in which such street is situate has consented thereto. It is doubtful whether the Council has a *locus standi* to oppose the present Bill when in Committee of the House of Commons as regards this point, but it may become necessary at a subsequent stage for the Council to take action for the protection of its interests.

**Liverpool.**—The Tramways and Electricity Committee on January 17th considered the estimates for 1913, and found itself in a position to allocate £97,000 to the relief of the rates, a sum equal to a rate of 6½d. in the £. The profit has accrued, as to £67,000 on the tramways undertaking, and as to £30,000 on electric power and lighting. This is compared with £38,000 and £25,000 respectively in 1911.

**Matlock.**—A special meeting of the D.C. is to be held to consider what steps should be taken with regard to the working of the cable tramways.

**Oldham.**—It is stated that the Tramways Committee will probably place the order for two motor-buses shortly.

**Sheffield.**—The City Council has adopted the proposal of the Tramways and Electric Light Joint Committee for connecting the power stations, so that the supply from both may be available for the tramways.

**Southport.**—Mr. Mallins, of the Liverpool Tramways, recently made several recommendations to the Tramways Committee in regard to the reorganisation of the tramway service, and the Sub-Committee on the tramways recommended the abolition of all contracts and preferential fares, except current contracts and statutory charges to the working classes. At the T.C. meeting last week an amendment for the continuance of the contract tickets was defeated by 27 votes to 21. The T.C. decided to purchase two omnibuses at £900 each.

**Whitby.**—The U.D.C. has decided to acquire land for a lift tramway and lift from the beach.

would have been destroyed during the existence of the contract, by the operation of Clause 38 of the Patents Act. The witness agreed to prepare a memorandum of the modifications that he would propose in the contract.

Mr. Viggo Gandil was recalled, and repeated his statement that Mr. Farnall, of the Post Office, had definitely offered on behalf of the Postmaster-General to purchase the whole of the Poulsen patent rights. Mr. Farnall was also recalled, and said that he did not make any offer to buy. He was instructed by the Postmaster-General to find out whether the Poulsen people were prepared to sell their patents. He admitted that his previous answer did imply that there was an offer to buy. The Postmaster-General was afraid the Marconi Co. would buy up the Poulsen patents.

On Wednesday the examination of Mr. Farnall was continued and concluded, and Mr. W. R. Lawson, a financial expert, gave evidence.

**Norway.**—The Cabinet has decided to recommend the Storting to approve the Marconi wireless contract arranged on behalf of the State by M. Heflye, Director of Telegraphs.

**The Recent Storms.**—Some idea of the results of the recent snowstorms may be gathered from the facts that approximately 1,600 miles of telegraph and telephone wires were down in the north-east of England, and that for some days Newcastle-on-Tyne was practically isolated, except for its limited means of communication by underground wires.

**Scottish Telegraphs.**—A deputation recently waited on the Postmaster-General, with a view to inducing him to extend the underground cable to Dundee and Aberdeen, but Mr. Samuel stated that the revenue was only £16,000 a year, whereas the cost of the cable would be £130,000. Questioned in the House of Commons on Monday, Mr. Samuel admitted that the revenue should have been stated as £30,000, but even that would not justify so heavy an expenditure.

**Wireless Telegraphy.**—A contract has been placed by the Great Western Railway Co. for the erection of a wireless station close to Fishguard Harbour, to communicate with the company's cross-Channel steamers.

## TELEGRAPH and TELEPHONE NOTES.

**The Atlantic Cable Combine.**—An article in the *Postal Telegraph*, of New York, suggests that it is only a question of time before the U.S. Government will break up the combination which the Western Union Telegraph Co. has made in the trans-Atlantic cable business, by leasing the cables of the Anglo-American and the Direct United States Cable Companies, on the ground that it constitutes a flagrant violation of the Anti-Trust Act of 1890. In that event the British shareholders would have to resume possession of their cables and work them without an agreement with the Western Union.

**France.**—A large wireless station is shortly to be constructed on the Bay of Bourgneuf, on the west coast of France, at a spot two miles inland.

**Imperial Wireless System.**—The Select Committee on the Marconi agreement resumed its sittings on Monday, when a letter from the Marconi Co. to the Postmaster-General was read. The letter, which was a very long one, stated that when the tender of March 7th was submitted, the company supposed that the agreement would be drawn up and ratified within a few weeks, and accordingly retained in England a large staff of engineers in readiness to commence the work. Instead, however, of ratifying the agreement in July, Parliament appointed a Select Committee which had sat for over three months, but had not yet taken evidence on long-distance wireless telegraphy from those best qualified to give it, while erroneous statements had been published which were very detrimental to the company. The latter regretted that the proposed Technical Committee was not appointed three months ago; the staff of engineers had been kept idle for many months, at great cost to the company, and the cost of materials had risen substantially since the contract was entered into. Mr. Godfrey Isaacs, who signed the letter, submitted that it was inequitable that his company should remain bound whilst investigations never contemplated were continued over an indefinite period, and stated that in order to maintain the company's position here and abroad their engineers must be released, and Mr. Marconi and he must be freed to attend to other important work. He therefore requested the Government to agree to the company's treating the contract as no longer binding upon either party. When the investigations were completed his company would be prepared to devote their whole energy, experience and staff to the construction of the Imperial stations on such terms as might be then agreed, if the Government should so desire.

In the meantime Mr. Marconi and the company's engineers awaited the opportunity of appearing before the proposed Technical Committee. Mr. Marconi, who became a party to the agreement at the express wish of the Department, endorsed this letter so far as it concerned him personally.

The examination of Sir G. C. Marks, M.P., was then resumed. He said that he would recommend the Committee to proceed on entirely new lines, asking the company for a price for the installation independent of royalties, the sum to include the right to use their patents. What the Government had already done on their ships they could do on land; consulting engineers could be asked to prepare specifications and carry out the work. If Clause 3 had remained in the agreement, the whole value of the Marconi patents

## CONTRACTS OPEN and CLOSED.

### OPEN

**Aberdeen.**—February 10th. One 3,000-kw. turbo-alternator, with surface condenser and air pump, for the Corporation. See "Official Notices" to-day.

**Atherton.**—January 29th. One E.H.T. switchboard and one H.T. switchboard for the U.D.C. See "Official Notices" December 27th.

**Australia.**—VICTORIA.—February 21st. Four 1,500-kw. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

**WESTERN AUSTRALIA.**—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" January 10th.

February 27th.—Buildings and boiler house equipment, turbo-alternators and rotary converters, for a Government power station at Perth. See "Official Notices" to-day.

**SYDNEY.**—March 17th. Motors for the City Corporation.

**Belgium.**—LIERRE.—February 28th. Tenders are invited for a concession to install and work an electric lighting service. Particulars, Hôtel de Ville, Liège.

**BRUSSELS.**—January 29th. Tenders are required for the supply of cable and accessories for the Administration of the Telegraphs. Cahier des charges spécial No. 3,624. Tenders to the Administration des Télégraphes, Salle de la Madeleine, Brussels.

**Birkenhead.**—February 11th. Continuous-current electricity meters and house service fuse boxes, for the Corporation. See "Official Notices" to-day.

**Birmingham.**—January 27th. Stores for a year for the Corporation Tramways. Mr. A. Baker, manager.

**Bolton.**—February 13th. Turbo-alternators with condensing plant, water-tube boilers, economisers, switchgear and steam feed pumps, for the Corporation. See "Official Notices" to-day.

**Bridlington.**—February 8th. One 600-kw. turbo-generator, with switchboard and pipework extensions, for the Corporation. See "Official Notices" to-day.

**Canada.**—February 13th. Machines, motors, cranes, &c., for Transcona Railway shops. Specifications and forms of tender from Mr. W. J. Press, engineer, Ottawa.

February 10th.—One 1,500-kw. steam turbine and generator, for the City of Moose Jaw, Sask. See "Official Notices" January 10th.

**Cheltenham.**—January 30th. Electric light fittings for a year, for the T.C. Mr. J. S. Pickering, borough engineer, Municipal Offices.

**China.**—January 30th. High and low-tension underground cable, for the Shanghai Municipal Council. See "Official Notices" January 17th.

February 6th.—Six 625-k.v.a. three-phase oil-cooled transformers, for the Shanghai Municipal Council. See "Official Notices" to-day.

**Clacton-on-Sea.**—January 29th. One 250-kw. Diesel oil engine, generator, switchboard, &c., for the U.D.C. See "Official Notices" January 10th.

**Colchester.**—February 10th. Duplicate motor-driven air-compressor plant, with pipework, cables, switchgear, &c., for the Committee of Visitors, Essex and Colchester Asylums. See "Official Notices" to-day.

**Constantine.**—January 1st, 1914. The contract with the local gas company expiring in 1920, the Mayor is prepared to receive offers from individuals or companies prepared to provide a public and private lighting service either by gas or electricity, together or separately, in separate tenders or jointly. The concession will be for a term of years, and tenderers must offer advantages in the shape of a share in the profits, or free public lighting, and a graduated scale of prices for private consumers. Particulars at the Mairie.

**Costa Rica.**—As only one tender (from a French firm) was submitted for the 50-year electric tramway concession, the date for receipt of offers has been extended to January 31st. Further particulars appear in the last issue of the *Board of Trade Journal*.

**Dublin.**—February 13th. Water-tube boilers, economisers, pumps, conveying plant, pipework, &c., also boiler seatings and flue work, for the Corporation Electricity Supply Committee. See "Official Notices" to-day.

**Edinburgh.**—The Corporation invites tenders for the providing and fixing in position at the Usher Hall, Edinburgh, of a complete vacuum cleaning installation, the plant to include a stationary motor-driven rotary suction pump. Mr. A. Newington, Corporation electrical engineer.

**Egypt.**—March 31st. Section des Municipalités invites tenders for electric light installation at Damietta. Section I: Generating plant and tools and machines for repair shop. Section II: Distributing system, i.e., transformers, H.T. cables, and L.T. aerial lines. Sir A. L. Webb, Queen Anne's Chambers, Broadway, S.W., and Mons. le Directeur de la Section des Municipalités et Commissions Locales, Ministère de l'Intérieur, Cairo.—*Board of Trade Journal*.

**Epsom.**—The Water Co. are advertising for tenders for the installation of an electrical pumping plant at their works. Estimated cost, £465.

**Fleetwood.**—February 4th. One 500-kw. mixed-pressure turbine and continuous-current dynamo, with condensing plant, and one water-tube boiler, superheater and brickwork, for the U.D.C. See "Official Notices" to-day.

**France.**—PERONNE.—February 15th. Tenders are requested for the construction of a reservoir and the supply and erection of motors and pumps. Lot 1, motors and pumps 15,500 fr.; guarantee, 450 fr. Particulars, M. Lagrange, Ingénieur des Ponts et Chaussées, Péronne.

**Germany.**—CHARLOTTENBURG.—The T.C. will shortly be placing orders for a 6,000-kw. turbo-dynamo and necessary boiler plant for the municipal station. Particulars of the Magistrat, Charlottenburg.

**Glasgow.**—The Committee on Tramways, Works and Stores, has decided that in future each car shall carry a lifting jack, and the general manager, Mr. Dalrymple, has been instructed to get orders for the necessary number, over 800.

200 electric hand lamps for members of the police force. Mr. W. W. Lackie, chief electrical engineer, Waterloo Street.

**Grimsby.**—February 11th. One 1,000-kw. mixed-pressure turbine and continuous-current dynamo, with condensing plant, for the Corporation. See "Official Notices" to-day.

**Hoylake and West Kirby.**—January 31st. High-tension single-phase switchgear (eight panels) and one 50-k.v.a. single-phase transformer, for the U.D.C. See "Official Notices" January 17th.

**Italy.**—MILAN.—The scheme to electrify the tramway from Milan to Gallarate having received the sanction of the Consiglio Superiore dei Lavori Pubblici, orders for the necessary equipment may be forthwith expected.

**Leeds.**—February 19th. Coal and general stores for a year, for the Corporation electric lighting department. See "Official Notices" to-day.

**London.**—HACKNEY.—The Council will shortly be inviting tenders for the erection of three sub-station buildings and plant for same, opening ground and supplying and laying conduits, constructing draw-pits, &c., under the scheme set out in Mr. Robinson's recent report.

February 4th.—The Metropolitan Water Board is inviting tenders for Sec. 25, electric lamps and accessories, for one year. Specifications and forms of tender from the Clerk of the Board, Savoy Court, Strand, W.C.

L.C.C.—January 29th. Electrical installation at Cook's Ground Elementary School, Chelsea. S.W. See "Official Notices" January 17th.

**SHOREDITCH.**—The B.C. Lighting Committee will purchase 150 meters of various sizes, from 5 to 100 amperes, as required for new consumers.

**HAMMERSMITH.**—February 5th. General stores for a year, for the B.C. electricity department. See "Official Notices" to-day.

**H.M. OFFICE OF WORKS.**—February 5th. Main switches, main fuses, switch fuse and fuse boards, for three years. See "Official Notices" to-day.

**BERMONDSEY.**—February 17th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

**Nelson.**—February 3rd. One traction battery, one automatic reversible booster and switchgear, one D.C. motor-generator and switchgear, for the Electricity and Tramways Committee. See "Official Notices" January 10th.

**Salford.**—February 3rd. Rotary converters for the Corporation. See "Official Notices" to-day.

**Sheffield.**—February 5th. General stores for two years, for the City Electricity Supply Department. See "Official Notices" January 17th.

**Spain.**—February 8th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the establishment and working of a telephone exchange in the town of Ceuta.

The municipal authorities of Toledo have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

**Switzerland.**—LUGANO.—January 31st. Tenders are required for the installation of the electric light in the Lugano Station, the works including the supply and erection of about 2,000 glow lamps and seven arc lamps, cables, lines, &c. Plans and particulars from Bureau 21, Telegrapheninspektion der Kreisdirektion, 7, der Schweizer Bundesbahn, Lucerne.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

**Warrington.**—February 3rd. The Corporation is calling for tenders for an electric light installation at the Public Baths. Mr. A. M. Ker, borough electrical engineer.

**West Ham.**—January 24th. Engine-room stores, chemicals and A.C. house-service wattmeters, for the Council's electricity department. See "Official Notices" January 10th.

## CLOSED.

**Blackpool.**—The Tramways and Electricity Committee has decided to order from the United Electric Car Co., Ltd., six open type tramcars, similar to those previously supplied.

**Cape Town.**—The City Council has accepted the following tenders:—

W. T. Glover & Co.—83 miles aeri. braided wire, £613; 15 miles vulcanised rubber-insulated wire, £445; various lengths of paper-insulated, lead-covered and steel-armoured cable, £666.  
Telegraph Manufacturing Co.—10,000 yd. 19/14 bare copper wire, £468.

**Ealing.**—Tenders have been received by the B.C. Electricity Committee from the following firms for a new switchboard:—

Crompton & Co., Ltd.	Siemens Bros. & Co., Ltd.
British Westinghouse Co., Ltd.	General Electric Co., Ltd.
Switchgear Co., Ltd.	British Thomson-Houston Co., Ltd.
Ferranti, Ltd.	

Their consideration has been deferred till the next meeting of the Committee, the electrical engineer being instructed to prepare a schedule and report thereon.

**Glasgow.**—The T.C. has accepted the following tenders:—

White lead in oil.—Herd, Hastie & Co.  
Patent filling.—Craig Sharp, Ltd.  
Stopping place sign-posts and brackets.—J. and A. Law, Ltd.; Walter Macfarlane & Co.  
Route number plates.—P. and W. MacLellan, Ltd.  
Arc lamp carbons.—General Electric Co., Ltd.  
Black insulating tape.—A. Avstine.  
Flankton fuel.—Wm. Baird & Co., Ltd.; Wm. Dixon, Ltd.; R. Addie and Sons, Ltd.  
Old ralls.—P. and W. MacLellan, Ltd.  
Trolley cord.—W. C. Yuille & Co., Ltd.

The areas recently added to the city are to be fitted with fire alarms, in connection with which the following tenders have been accepted:—W. W. Glover & Co., Ltd., £312, for wiring; and the British Insulated and Helsby Cables, Ltd., £146, for insulators, &c.

The Electricity Committee has renewed the contract with the Tudor Accumulator Co., Ltd., for the maintenance of the battery at the Govan Electricity Works for a further period of 10 years at the rate of £202 per annum.

**Gosport.**—The Education Committee has accepted the tender of Mr. W. N. Walters, Gosport, for installing the electric light at the new school in Stone Lane.

**Hendon.**—Mr. F. R. Garrod has secured the order for electric lighting and heating at the Alexandra Club.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government Departments named:—

**WAR OFFICE.**

Storage batteries.—Tudor Accumulator Co., Ltd.  
 Electric cable and wire.—Hooper's Telegraph and India-Rubber Works, Ltd.; London Electric Wire Co., and Smiths, Ltd.; Siemens Bros. and Co., Ltd.  
 Hellographs.—W. Otway & Co., Ltd.; Siemens Bros. & Co., Ltd.  
 Electric lamps.—Brimdown Lamp Works, Ltd.; Crystalco, Ltd.  
 Electric motors.—Lancashire Dynamo and Motor Co., Ltd.  
 Switchboards, &c.—British Thomson-Houston Co., Ltd.; Cox-Walters, Ltd.  
 Switches.—Ward & Goldstone.  
 Installation of electric light, &c., Fort Pitt Military Hospital, Chatham.—A. V. Atkins & Co.  
 Laying cable at Royal Military College, Sandhurst.—Siemens Bros. and Co., Ltd.

**INDIA OFFICE: STORE DEPARTMENT.**

Cable.—Liverpool Electric Cable Co.  
 Magneto wall sets.—Peel-Conner Telephone Works.

**CHOWN AGENTS FOR THE COLONIES.**

Telegraph poles.—Siemens Bros. & Co., Ltd.  
 Wireless telegraph apparatus.—Marconi's Wireless Telegraph Co., Ltd.

**GENERAL POST OFFICE.**

Telephone apparatus.—London Electric Wire Co., and Smiths, Ltd.; Western Electric Co., Ltd.  
 Submarine cable.—Siemens Bros. & Co., Ltd.  
 Telephonic cable.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.  
 Cases for dry cells.—British L.M. Erierson Manufacturing Co., Ltd.  
 Stoneware ducts.—Albion Clay Co., Ltd.  
 Insulators.—Taylor, Tunnitch & Co., Ltd.  
 Telegraphic ironwork.—Bullers, Ltd.; Guest, Keen & Nettlefolds, Ltd.  
 Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; P. Smith & Co., incorporated in the London Electric Wire Co., and Smiths, Ltd.  
 Rod zincs.—Siemens Bros. & Co., Ltd.  
 Power plant and wiring, Valencia Wireless Telegraph Station, Co. Kerry.—Johnson & Phillips, Ltd.  
 Telephone exchange equipment, Mansfield.—Peel-Conner Telephone Works, Ltd.  
 Extension of No. 2 Telephone Exchange, Cardiff.—The Automatic Telephone Manufacturing Co., Ltd.  
 Extensions to Central Telephone Exchange, London, E.C.—Western Electric Co., Ltd.

**Ipswich.**—The Dock Commission has accepted the tender of Messrs. Ransomes & Rapier, Ltd., for an electric travelling crane, at £1,300.

**London.**—L.C.C.—The Highways Committee received tenders as under for about 3½ miles of grooved trolley wire required for the overhead tramways system:—

	Per mile.
	£ s. d.
T. Bolton & Sons, Ltd. . . . . (accepted)	109 4 0
B.I. and Helsby Cables, Ltd. . . . .	112 11 6
	(less 2½ %)
Thompson & Co. . . . .	116 0 0

For the supply of 3,000 pairs of tramway rail fish-plates the offers received were:—

	Per ton.	Total.
	£ s.	£
Cammell, Laird & Co., Ltd. . . (accepted)	9 15	780
Walter Scott, Ltd. . . . .	12 10	869
Alfred Clare & Co. . . . .	( 24 10 per bar )	2,621
	( or 17s. 6d. a joint )	

Messrs. Elliott Bros. are to supply 17 instruments for testing magnetic brake coils, at £10 11s. 6d. each.

The Stores and Contracts Committee recommends that contracts with the following be approved:—

Electric fittings.—Accles & Pollock, Ltd.; British Westinghouse Electric and Manufacturing Co., Ltd.; Elliott Bros.; and General Electric Co., Ltd.

The Stores and Contracts Committee reports having accepted tenders as under during the recess:—

Electric fittings.—Atlas Carlton and Battery Co., Ltd.; B.I. and Helsby Cables, Ltd.; Cooper & Roberts; Dorman & Smith; Edison & Swan Co.; Electrical Manufacturing and Supplies Co.; Elliott Bros.; W. Geipel & Co.; General Electric Co., Ltd.; Hart Manufacturing Co.; W. McGeoch & Co., Ltd.; A. Round; Veritys, Ltd.; W. White & Co.  
 Machine belting.—J. Hendry; Hepburn, Gale & Ross, Ltd.

**SHOREDITCH.**—The B.C. Lighting Committee, following a report by the electrical engineer on experiments with new type flame lamps, recommends the purchase of 48 "Metroflam" arc lamps (70-80 hours) from Messrs. Johnson & Phillips, Ltd., and 48 "Angold" arc lamps (90 hours) from the General Electric Co., Ltd., the total cost being £936. The great increase of vehicular, especially motor, traffic necessitates improved lighting of the main thoroughfares without delay, and the adoption of the above lamps will give a greater illuminating power by nearly 100 per cent. as compared with the existing 12½-ampere, 1,500-C.P. lamps. The new type of lamp, for one-third less current, 8 amperes, gives 2,500 C.P., "and has in addition a better fog-penetrating effect." It is estimated that the saving per annum on a circuit of 24 lamps, including current and attendance, after allowing for the slight increase in the cost of carbons, will be about £121. The first cost of the new lamps will be covered in less than two years. The work will not be commenced until the close of the financial year.

For the supply of lead-covered, paper-insulated service cables, the Committee recommends the acceptance of the tender of Messrs. Siemens Bros. & Co., Ltd., the lowest submitted, as under:—  
 1 mile 7/16, £70; ½ mile 7/14, £90 per mile; ¼ mile 19/16, £133 per mile; ⅓ mile 19/14, £187 per mile.

**BATTERSEA.**—The B.C. has decided to renew its contract with Callender's Cable and Construction Co., Ltd., for the supply of cables, &c., for a further period of one year.

**Salford.**—The Guardians have accepted the tender of Messrs. Willoughby & Willcox for the installation of electric light and bells at the new offices (#142), and the tender of Mr. Gilbert Matthews for provision of electric fittings for board room, laundry and clerk's office (£25).

**Stockport.**—The T.C. has accepted the tender of Lord Vernon for Warsop and Poynton slack coal for the electricity works at 10s. 10d. per ton; and that of Mr. John Faulkner, of Manchester, for a lightning conductor, at £10 15s.

**FORTHCOMING EVENTS.**

British Electrical and Allied Manufacturers' Association, Friday, January 24th. At 7 for 7.30 p.m. At the Savoy Hotel. Dinner.

Royal Institution.—Friday, January 24th. At 9 p.m. Discourse on "Recent Advances in Scientific Sheet Metallurgy," by Prof. J. O. Arnold.

Thursday, January 30th.—At 3 p.m. Lecture on "Recent Research on the Gas Engine," by Prof. B. Hopkinson. (Lecture 1)

Physical Society.—Friday, January 24th. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "The Electrical Conductivity and Fluidity of Strong Solutions," by Mr. W. S. Tucker; "The Resistance of Electrolytes," by Messrs. E. W. J. Smith and H. Moss; and "The Recalcination of Iron Carbide," by Messrs. E. W. J. Smith and J. Gould.

Junior Institution of Engineers.—Saturday, January 25th. At 11 a.m. Visit to the Houses of Parliament for inspection of heating, ventilation, &c.

Friday, January 31st.—At 8 p.m. At the Great Eastern Hotel, E.C. Institution smoking concert.

Royal Society of Arts.—Monday, January 27th. At 8 p.m. Cantor lecture on "Liquid Fuel," by Prof. V. B. Lewes. (Lecture 11.)

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, January 27th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "The Application of Electricity to the Lighting of Residences, Business Premises and Factories," by Mr. S. I. Ellis.

(Manchester Section).—Tuesday, January 22th. At 7.30 p.m. At the University, Manchester. Paper on "The Use of a Large Lighting Battery in connection with Central Station Supply," by Mr. H. F. Wbysall.

(Yorkshire Section).—Wednesday, January 23th. At 7 p.m. Meeting at the University, Sheffield.

(Students' Section).—Wednesday, January 23th. At 7.45 p.m. At the Institution. Paper on "The Conditions Influencing the Design and Minimum Manufacturing Cost of Induction Motors," by Mr. E. T. Driver.

Institution of Civil Engineers.—Wednesday Evening, January 23th. Students' visit to the Edgware Road-Paddington extension of the London Electric Railway.

The Electrical Engineers' Ball.—Friday, January 31st. At 9 p.m. Hotel Cecil, London.

**THE ELECTRICAL ENGINEERS (LONDON DIVISION).**

Commanding Officer—Lieut.-Col. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, January 27th.—"A" Company. Recruit training, 7 to 10 p.m. company training, 7 to 10 p.m.

Tuesday, January 28th.—"B" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Thursday, January 30th.—"C" Company. Company training, 7 to 10 p.m.

Friday, January 31st.—"D" Company. Recruit training, 7 to 10 p.m. company training, 7 to 10 p.m.

Saturday, February 1st.—"B" Company. Week-end run at Fort Coalhouse, East Tilbury. Parade at Fenchurch Street Station at 3 p.m., for train leaving at 3.25 p.m. Dress:—Service dress, putties and greatcoats. No arms will be taken.

"A" Company. A lorry run will take place this day. The lorry crew will parade at Headquarters at 2.30 p.m. Dress:—Service dress, putties and greatcoats. No arms will be taken.

Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,  
 For Officer commanding L.E.E.

**The Lighting of Factories and Workshops.**—It is announced that the Home Secretary has appointed a Committee to inquire and report as to the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, having regard to the nature of the work carried on, and the protection of the eyesight of the persons employed, and the various forms of illumination. The members of the Committee are:—Dr. R. T. Glazebrook, Director of the National Physical Laboratory (chairman); Mr. L. Gaster, Prof. Francis Gotch, Mr. J. Herbert Parsons, Mr. W. C. D. Whetnam, and Sir Arthur Whitelegg, Chief Inspector of Factories. The secretaries of the Committee are Mr. D. R. Wilson, one of His Majesty's Inspectors of Factories, and Mr. C. C. Paterson, of the National Physical Laboratory. Any communications on the subject of the inquiry may be addressed to Mr. D. R. Wilson, at the Home Office.—The Times.

## NOTES.

**Parliamentary Notes.**—ADMIRALTY CONTRACTS.—Mr. Barnes, on January 15th, asked the First Lord of the Admiralty whether, in connection with the strike of electrical workers on the Clyde, he could state the result of the inquiry into the alleged violation of the fair-wages clause by the Government contractors in employing apprentices to perform electrical work instead of fully qualified men at the proper rates of wages; and whether the Admiralty was satisfied that no breach of the clause had been made to the benefit of the employers' and the prejudice of the workmen. Dr. Macnamara replied that as the result of the inquiry, it appeared that during the progress of certain work to complete the *New Zealand*, the electricians of the district struck work with a view to obtaining an additional  $\frac{1}{2}$  an hour in their rate of wages. It was understood that the Fairfield Co. offered to concede this demand so far as the men engaged on this ship were concerned, in order to avoid interruption in the work, but that offer was declined in the absence of a similar concession throughout the district. The ship had already been delayed, and it was important that there should be no further delay. The company, therefore, employed 14 apprentices to do the work eight of whom were in their fourth or fifth year, and five in their third year. No boys were employed all night after having worked during the day, and only some of the older apprentices employed during the day were allowed to work overtime up to 9.30 p.m. The whole of the work so carried out was finished and tested to the entire satisfaction of the Admiralty representatives. In all the circumstances the Admiralty did not consider it necessary to take any further action in the matter.

POST OFFICE ELECTRIC LIGHTING DEPARTMENT.—In Tuesday's Parliamentary Papers, Mr. Barnes asked the Postmaster-General if engineers in the electric lighting department were paid overtime rates, in accordance with the conditions accepted, and generally observed, by the employers and employed; and if they were paid for Sundays and Christmas Day, in accordance with such conditions; namely, were they paid one and a quarter time for the first two hours, one and a half for time after that, excepting the days mentioned, and for those were they paid at the rate of double time? Mr. H. Samuel replied that the honourable member presumably referred to the minor grades of the electric light staff, i.e., shift officers, circuitmen, enginemen, &c. Such men received overtime pay at rate and a quarter on weekdays, and rate and a half for duty in excess of the scheduled attendance on Sundays. Scheduled duty on Sunday was not specially remunerated, as the Post Office scale of pay covers  $5\frac{1}{2}$  hours' scheduled attendance on any six days out of the seven. A few men in London, originally employed under factory conditions, retained the privilege of payment for overtime at rate and a quarter for the first two hours, and then at rate and a half, with double rate for duty in excess of the scheduled attendance on Sundays. Extra duty performed on Christmas Day was paid for at Sunday extra duty rates.

**E.T.B.I.**—The whist drive recently mentioned in our pages was held on Friday, January 17th, at Slater's Restaurant, 50, Cannon Street, E.C. The main object of the entertainment was to endeavour to get the members of the staffs of some electrical firms to take an interest in the Institution. It was primarily organised amongst the members of the staffs of the General Electric Co., Sterling Telephone and Electric Co., Ltd., and the Union Electric Co., but, in addition, other ladies and gentlemen came, there being 128 players, in addition to the members of the Committee, &c. The Committee consisted of Mr. Champion (Union Electric Co.), Mr. Crow (Sterling Telephone and Electric Co.), Mr. Williams (General Electric Co.) and the secretary of the Electrical Trades Benevolent Institution. Mr. Crow was elected to be the M.C., and he carried out his duties to everyone's satisfaction, the full programme being completed and the prizes distributed on the stroke of 11 o'clock. The other members of the Committee worked extremely hard, with results which were most thoroughly satisfactory. Immediately after the interval a short address was given by the secretary, Mr. Hawes, dealing in a full and informing way with the essential features of the Institution, its objects, &c., and answering the statements that were sometimes made to the effect that the Old Age Pensions and the National Insurance Act were reasons for not troubling to support the Benevolent Fund. The prize fund was subscribed to by the following:—General Electric Co., Mr. Guy Burney, Mr. Justus Eck, Mr. F. B. O. Hawes; and the prizes were kindly given away by Mrs. Ritchie.

**Miners' Lamps.**—According to the *Times*, the Home Secretary has approved, under Sec. 33 of the Coal Mines Act, 1911, the Hailwood lamp No. 1, and the Oldham emergency electric lamp, the latter only for use in time of accident or by officials, for use in all mines to which the Act applies. Copies of the approving order containing specifications of the lamps will shortly be issued by the Government printers.

**Will.**—The *Daily Mail* states that the late Mr. W. Bottomley, of Glasgow, one of the first directors of Messrs. Kelvin and White, Ltd., and for many years assistant to Lord Kelvin in his scientific work, left £3,788 personal estate.

**Aluminium.**—A neat little booklet setting forth the leading properties of aluminium and the various forms in which it is supplied has been issued by the British Aluminium Co., Ltd., who will send copies to any readers who use the metal. Electrical data are included, and the information will be useful to engineers, draughtsmen and others interested in the subject.

**British Tramway Statistics.**—A Board of Trade return of the finance and traffic of British tramways for 1911-12 contains the following particulars:—

	1910-11.	1911-12.
Miles open ... ..	2,597	2,637
Cars running ... ..	12,709	12,944
Miles run by cars ... ..	310,494,243	323,354,389
Passengers carried ... ..	2,907,477,120	3,127,318,732
Electrical units used ... ..	516,241,612	548,695,979
Gross receipts ... ..	£13,777,001	£14,726,068
Working expenditure ... ..	£8,500,941	£8,924,420
Net receipts ... ..	£5,276,060	£5,801,648
Relief of rates ... ..	£270,435	£488,509
Aid from rates ... ..	£68,055	£62,132

Of the 290 undertakings, 172 belong to local authorities and 118 to companies or individuals. Local authorities made a net profit of £4,233,871 on the year's traffic, out of which, in addition to setting aside £488,509 in relief of rates, they applied £1,247,908 towards the reduction of tramway debt and carried £975,504 to reserve and renewal funds. In the cases of three local authorities and six companies, the returns show an excess of working expenditure over gross receipts.

**Association of Electrical Station Engineers.**—An informal meeting was held on Thursday, January 16th, at 69, Fleet Street, E.C. Twenty-one representatives of electrical stations attended. A report was made on the enormous amount of correspondence received, in reply to an announcement in the *ELECTRICAL REVIEW*. It was stated that the general opinion of the correspondents was that a business-like "Association" should be formed immediately, and that practically the whole of the technical staffs of the undertakings they represented would become members. Previously to January 14th prospective members numbered well over 500, but as a large amount of correspondence containing names of prospective members has been received since the above date, the number has probably reached 1,000. After lengthy discussions, several resolutions were passed, details of an application form were agreed to (which is to be printed at once), and the next general meeting was arranged for February 6th, 1913. The following resolutions were passed:—

1. That the Association be called "Association of Electrical Station Engineers."

2. That the objects of the Association be—

To raise the efficiency and general status of members of the Association.

To provide means for social intercourse among its members, for their improvement, advancement, and recreation.

To form an information bureau for the general assistance of members and employers.

3. That the essential qualification for membership shall be that the prospective member must be qualified for, and hold a responsible position in, an electrical undertaking for power, lighting or traction.

4. That a chartered accountant be approached to take charge of the finances of the "Association."

5. That all announcements with regard to the "Association" be advertised in the *ELECTRICAL REVIEW*.

Mr. W. J. Ebben was elected hon. secretary.

**Motor-Bus Obstruction of Tramcar.**—At the Greenwich Police Court last week, W. F. Gilbert was fined 10s. and 23s. costs for wilfully interfering with the London County Council tramway traffic at New Cross Road. Mr. Greenwood, for the L.C.C., said (as reported in the *Standard*) that the case was one of importance to the public who used tramways and motor-omnibuses. The defendant was a driver in the service of the L.G.O. Co. The evidence would show that the motor-omnibuses were not content to go in for fair play; they wanted all the passengers.

Arthur Dunn, conductor of the tramcar, said that on November 9th his car drew up at the "island" at New Cross Gate. The defendant's motor-omnibus pulled up close to the tramcar, the front of the omnibus being close to the step which passengers used to get on and off his car, a very small space being left for people to alight or join the car. The front of the omnibus was practically level with the step of the car, and people would have had to pass in front of the omnibus to get to the car. People waiting on the "island" could not reach his car, and he had to go on and leave them. The defendant declared that the London County Council really obstructed him. The Board of Trade regulation was that when one vehicle came up the one in front should proceed. There was not room for a tramcar and an omnibus, and he could not avoid his omnibus partly covering the step of the car. The car stopped so suddenly that he could not do otherwise.

**Shock Accident Claim.**—The *Glasgow Daily Herald* states that some time ago an action was raised in Paisley Sheriff Court against the Paisley District Tramway Co., for damages in connection with an accident which occurred to a boy who was travelling on one of the company's cars. The boy was barefooted, and was seated on the top near the metal pillar which supports the trolley-pole. The record in the case stated that through defective insulation, or some other cause, the metal pillar became charged with electricity, with the result that when the boy's naked foot touched it he received a severe shock, with serious and painful injuries from burning. In consequence of his injuries the boy was laid up for six weeks. The company has now offered a satisfactory sum in full settlement, which has been accepted, and the action will be taken out of Court by joint minute.

**Accidents.**—**JOHANNESBURG.**—Our Cape correspondent writes:—"At the Bantjes distributing station of the Victoria Falls Power Co. an explosion of an oil switch recently caused serious burning injuries to two engineers. In the first place, one of the feeder switches tripped, and whilst an assistant engineer named Davis was telephoning to the company's control department to report the occurrence another oil switch exploded. The explosion burst open the iron doors between the operating passage and the switch passage. Flames passed into the operating passage, and Davis was severely burnt about the face and hands. A probationer named Jones was also burnt, but to a less degree. The cause of the explosion is believed to be lightning on the transmission line, which caused the first switch to trip and fire the oil. This caused a short-circuit, which in turn caused the explosion of the second oil switch."

**MOTHERWELL.**—Hugh Bird, electrical fitter, of Motherwell, while working at an electrical crane, was seriously injured by being jammed between the carriage and an iron box.

According to a Glasgow paper, Adam Sommerville, a young electrical engineer, was removed to the Western Infirmary, Glasgow, suffering from injuries sustained while at work in Messrs. Hurst, Nelson & Co.'s wagon works, Motherwell. He was passing a machine when he became entangled in the belt, and was thrown violently to the ground.

**Educational Notes.**—A special series of lectures on Illuminating Engineering is now in progress at the Polytechnic, Regent Street. The first section of the course, dealing with gas, electric, acetylene and air gas lighting, &c., has now been concluded. On Friday, January 17th, the first lecture of the second half of the course, dealing with illumination and the eye, was delivered by Dr. W. J. Etiles. The remaining five lectures, commencing to-day, are to be given by Mr. J. S. Dow, and will deal with practical applications, including such questions as the measurement of light and illumination, colour, shades and reflectors and indoor and outdoor illumination.

Prof. Stephen H. Dixon, Professor of Civil Engineering in the University of Birmingham, has accepted an invitation to give a special course of lectures in Municipal engineering at University College during the current term. The course was to begin on Tuesday last, at 4 p.m.

**The Thames Ironworks.**—The appeal of Mr. Arnold F. Hills against Mr. Justice Eve's order of December 20th last, for the immediate closing of the works, was, on Saturday, dismissed by the Court of Appeal.

**Tramway Social.**—On 15th inst., the ninth annual tea and social of the Gateshead and District Tramway Co.'s employés was held at the Parish Hall, Rawling Road, Gateshead, the number present, including ladies, being 150. Mr. W. Morrison, the general manager, made a brief speech, and, in addition to referring to the friendly relations existing between the company and its employés, he mentioned that the employés' Benevolent Society's funds stood at the satisfactory figure of £204. A programme of music and song followed.

**Denial.**—Messrs. Loxley & Co., Ltd., of Leeds, write as follows:—"We have recently heard that rumours are going about that we have obtained an order for electric wiring of the Bordesley Post Office, Birmingham. We wish to deny this absolutely, as we do not quote for electric wiring."

**Marconi Litigation.**—In the King's Bench Division Mr. Justice Scrutton has had before him for several days this week the action of Marconi's Wireless Telegraph Co., Ltd., v. Goukassoff and Tischenko, in which plaintiffs claim damages for breach of contract in respect of an option for sale of shares in the Russian company. On Wednesday his Lordship said that he would give judgment to-day (Friday), but it would be against the defendants for damages, but the amount of the latter would be affected if in the meantime a sufficient number of shares were put under the control of plaintiffs. In another case plaintiffs also claimed damages against one Baruch for having maliciously induced the above defendants to break their contract with the plaintiffs. Judgment was given for the defendant.

**The Alkum Accumulator.**—Referring to the paragraph in our last issue on the new electric storage battery brought out by Messrs. Worsnop & Co., Ltd., of Halifax, we learn that one of its features is that no acid or lead is used in its construction. As its name, "Alkum," implies the fluid employed is of an alkaline nature. Its chief component is nickel, while the containing case is of welded steel. It is claimed that the electrodes and electrolyte are practically permanent, as the liquid is unvarying and only requires making up with distilled water, while the electrodes consist of insoluble material carried in nickel cages. It is further claimed that the cells cannot be overcharged, and that they may remain uncharged for long periods without damage, while jarring and jolting do not affect them. We have seen a charging and discharging curve of the new batteries, which shows that the discharge is not only extremely gradual, but that it maintains its voltage almost to the end. Specimens of the Alkum accumulators can, we understand, be inspected at the depot of the Motor Lighting Co., 13, Pantou Street, Haymarket, London, S.W.

**A Lambeth Lift Contract.**—In connection with applications invited by the Lambeth Board of Guardians for tenders for the installation of two electric lifts at the Infirmary, Brook Street, and another at the Workhouse, Kenrew Road, the following firms sent prices and specifications. The figures represent the price quoted for installing the three lifts, for the two lifts at the infirmary, and for the one at the Workhouse only, respectively. At a meeting of the sub-Committee on Wednesday last, the tender of Messrs. Waygoods, Ltd., Falmouth Road, S.E., was accepted.

Aldous & Campbell, Ltd.—	£1,450 (17 weeks),	£950 (12 weeks),	£500 (10 weeks).
Easton Lift Co.—	£1,680 (12 weeks),	£1,115 (12 weeks),	£644 (10 weeks).
Lift and Hoist Co.—	£1,521 (16 weeks),	£1,020 (16 weeks),	£480 (16 weeks).
Medway's Safety Lift Co.—	£1,630 (16-18 weeks),	£1,307 (12-13 weeks),	£583 (16-18 weeks).
Otis Elevator Co.—	£1,845 (10-12 weeks),	£1,255 (10-12 weeks),	£500 (10-12 weeks).
A. W. Penrose & Co.—	£1,128 (15 weeks),	£918 (14 weeks),	£490 (14 weeks); with extras.
Scholey & Co., Ltd.—	£1,593, £1,100, £493.		
Smith, Major & Stevens.—	£1,010 (15 weeks),	£1,120 (13 weeks),	£520 15s. (11 weeks).
W. Wadsworth & Son, Ltd.—	£1,486 (20 weeks),	£1,006 (12 weeks),	£490 (eight weeks).
Waygoods, Ltd.—	£1,566 (15 weeks),	£1,081 plus 6 per cent. if divided (12 weeks),	£592 plus 5 per cent. if divided (—).

**Institution and Lecture Notes.**—**ASSOCIATION OF MINING ELECTRICAL ENGINEERS (WEST OF SCOTLAND BRANCH).**—The monthly meeting of the Branch was held on January 18th, when discussion was resumed on the papers read by Mr. Campbell King on "The Electrification of a Group of Small Collieries," and by Mr. S. A. Simon, Glasgow, on "Speed Control of Three-phase Motors."

**INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION).**—On January 14th, Messrs. J. S. Nicholson and B. P. Haigh read their paper on "A Single-Phase Motor with Pole-Changing Windings," before the Scottish Local Section at Glasgow, and a discussion followed.

Mr. Halley Craig said that if the authors' work had been done a long time ago there would have been a change in the methods which would have put electricians 20 years in advance of where they now were.

The Chairman said that when they were arranging for the first Electric Lighting Bill, people were very much astonished when Mr. Ferranti announced that he had an alternating motor up his sleeve; they could not believe that.

The members were afterwards conducted over the laboratory, where the motor was exhibited in motion.

Introducing a discussion on the "Mathematical and Scientific Training of Engineers" at a meeting of the WESTERN BRANCH OF THE ASSOCIATION OF SCIENCE TEACHERS OF SCOTLAND in Glasgow on 18th inst., Mr. Henry Mavor argued that mathematics was absolutely essential to the study and understanding of science in every stage of its development. The German educational practice in this respect was compared to our own, to the discredit of the latter, but he thought it was unwise to push the comparison as far as it was often done. The Germans were certainly ahead of us in some special branches of knowledge and industry, but as certainly were not ahead of us as a whole. In electrical affairs, for instance, few inventions were German. His concrete opinion was that the whole training of an engineer must be founded upon the fact that he was an engineer actually engaged in the work of construction in the workshop.

A paper on "Electrical Locomotives for Main Line and Suburban Services" was read at a meeting of the Scientific Society of the Royal Technical College, Glasgow, on Saturday last by Mr. B. P. Haigh, of the Engineering Department of the University of Glasgow.

**Damaging an Electric Meter.**—At Newton Abbot, South Devon Petty Sessions on Tuesday, Wm. Ireland Islesworth was bound over to be of good behaviour for six months and ordered to pay 16s. 6d. costs, for damaging a meter belonging to the Newton Urban Electric Supply Co., Ltd. Defendant tampered with the meter, and abstracted 6s. from it, but the charge of larceny was not gone into. "I fancy it would be a funny thing," said the defendant, "if I wanted to rob the meter, that I should take out 6s. and leave 11s. behind." Mr. Hitchings, solicitor to the company, said "that is an old trick."

**Appointments Vacant.**—Electrical engineer and manager, for the Wolverhampton Corporation (£600); meter tester, for the Shanghai Municipal Council Electrical Department (£21 per month); electrical engineer, for the Burgh of Wishaw; charge engineer, for the Wakefield Corporation Electricity Department (35s.); switchboard attendant for the Newport (Mon.) Electricity Department (25s.). See our advertisement pages in this issue.

**Inquiries.**—A correspondent asks for the names of firms supplying a complete line in wiring accessories designed for open wiring with ordinary flexible. Makers of brushes for electrically-driven boot-cleaning machines are asked for.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—Owing to the appointment of Mr. J. M. Dawson, who for the last 7 years has been engineer-in-charge at the electricity works, formerly of the Hanley Town Council, and now of the Stoke-on-Trent Town Council, to the position of engineer-in-chief of the Bethnal Green Board of Guardians, London, a vacancy was created on Mr. Yeaman's staff, and as the new power house will shortly be running, two appointments were made from the selected candidates, namely, Mr. F. Hurst, who was charge engineer in the Runcorn generating station of the Mersey Power Co. (as already announced here), and Mr. A. McKay Kissack, who was erecting engineer for the British Westinghouse Co., Ltd.

Mr. James Forsyth, shift engineer, Motherwell Corporation electricity works, has resigned and taken up similar duties at the Poplar electricity works. Mr. Slade, of London, takes up duties as shift engineer at Motherwell.

The Swinton and Pendlebury U.D.C. has fixed the salary of the electrical engineer, Mr. H. C. Besbridge, at £161 per annum, from December 1st, the date of his appointment.

Mr. Ernest Marks has been permanently appointed to the position of meter tester to the Islington "r" tking.

Mr. K. S. Nebel has resigned his position with Messrs. Mather and Platt, Ltd., Manchester, in order to take up an appointment in Berlin.

The Aldershot U.D.C. has increased the salary of Mr. F. H. Eberl, first assistant at the electricity works, to £130 per annum.

Mr. W. H. Tunncliffe, of the Salt Union (Mersey Power Co.), Runcorn, has been appointed junior shift engineer at the Rotherham Corporation electricity works.

The Stepney B.C. Electricity Committee has recommended that the salary of the borough electrical engineer and manager be increased from £750 to £800 per annum, and by an additional £50 on January 1st, 1914.

**Tramway Officials.**—The Oldham Tramway Committee has recommended the Council to grant an advance from £350 to £400 per year in the tramway manager's salary.

**General.**—Mr. Graham Montague, of Bristol, consulting engineer and surveyor, announces that, having accepted an appointment as engineer to the Egyptian Government P.W.D., he intended sailing yesterday for Cairo, and that all correspondence should be addressed to him care of Public Works Ministry, Cairo, Egypt.

Owing to pressure of business, Mr. J. Mould has found himself obliged to resign the hon. secretaryship of the I.E.E., Students' Section, and Mr. Geo. W. P. Page has been elected to the position.

Mr. J. J. Chiswell has resigned the position of sales manager with the Brimsdown Lamp Works, Ltd., as from December 31st last.

The engagement is announced of Mr. Brian Crossley, youngest son of the late Sir Wm. Crossley, Bart., to Margaret Lilian, elder daughter of Mr. J. W. Sidebotham, of Bowdon, Cheshire.

Mr. John Coates, M.Inst.C.E., senior partner of the firm of John Coates & Co., Ltd., of Westminster, has been appointed to carry out the work of the inspection of material purchased for the Commonwealth railway construction and rolling stock in connection with the Australian Trans-Continental Railway.

It is stated in the *Times*, that Sir W. B. Forwood, in consequence of continued ill-health, has resigned the chairmanship of the Liverpool Overhead Railway, and Mr. Harvey Cecil Woodward has been appointed in his place.

The *Financier* states that Mr. C. N. Murphy has joined the board of Universal Cheap Cables, Ltd.

According to the *Times*, the Postmaster-General has appointed Mr. J. J. Kenny, of the Dublin Telegraph Office, to be Controller of that office in succession to Mr. Michael O Toole, who has retired.

**Obituary.**—Mr. T. Thompson.—The death has taken place at Cleckheaton (Yorks.) of Mr. Thos. Thompson, late of Dundee, who was for upwards of 31 years the Scottish representative of Messrs. Edward Green & Sons, Ltd., of Wakefield and London. He was 74 years of age.

HERR W. BRAUN.—The death is announced from Frankfurt-am-Main, of Herr Wunibald Braun, one of the founders of the electrical engineering firm of Messrs. Hartmann & Braun.

## NEW COMPANIES REGISTERED.

**Vickstow Cars, Ltd.** (126,511).—This company was registered on January 14th, with a capital of £12,500 in £1 shares, to carry on the business of manufacturers of and dealers in motor-cars, lorries, petrol-electric motors, oil and gas engines, electrical machinery, flying machines, cycles, &c. The subscribers (with one share each) are:—J. M. Henderson, 21, Moorgate Street Buildings, E.C.; chartered accountant; W. J. Bristow, 30, St. James' Street, S.W., automobile engineer. Private company. The number of directors is not to be less than three or more than seven; the first are J. M. Henderson (chairman), N. H. Brandon, C. L. Lowe and F. W. Balmer; qualification, 100 shares; remuneration, £250 each per annum and a percentage of the profits. Registered office, 69, Beainghall Street, E.C.

**General Telautograph Co., Ltd.** (126,527).—This company was registered on January 15th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, telewriters, telautographs and other apparatus, dynamos, lamps, wires, cables, insulating materials, accumulators, &c., and to adopt an agreement with the Gray National Telautograph Co., the International Telautograph Co., the Gray National Telautograph Co. and the National Telewriter Co., Ltd., for the acquisition of certain patents and rights relating to an invention known as the Telautograph or Telewriter. The subscribers (with one share each) are:—E. B. Ellice-Clark, 2, Palace Court, W., civil engineer; P. B. —, 35, Queen Victoria Street, E.C. Private company. The first directors (to number two) are T. Birnbaum (nominated by the Gray European Telautograph Co., the International Telautograph Co. and the Gray National Telautograph Co.), and Sir J. G. Craggs (nominated by the National Telewriter Co., Ltd.); remuneration according to profits. Registered office, 20, Bocklersbury, E.C.

**Strode & Co., Ltd.** (126,543).—This company was registered on January 15th, with a capital of £20,000 in £1 shares (5,000 preference), to carry on the business of mechanical, electrical, hydraulic and general engineers and contractors, &c., to take over the business carried on at 3 and 4, St. Paul's Churchyard, E.C., and 48, Osnauburg Street, N.W., as "Strode and Co.," and to adopt an agreement with D. M. Strode and G. W. Strode. The subscribers (with one preference share each) are:—D. M. Strode, 43, Osnauburg Street, N.W., engineer and contractor; G. W. Strode, 48, Osnauburg Street, N.W., engineer and contractor. Private company. The number of directors is not to be less than two or more than five; the first are D. M. Strode (chairman), G. W. Strode and A. E. Cumberbatch, each of whom may retain office while holding 100 ordinary shares. Registered office, 48, Osnauburg Street, N.W.

**International Power and Light Trust, Ltd.** (126,531).—Registered January 15th, by Asburst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital £10 in £1 shares. Objects: To carry on the business indicated by the title. In the event of the whole of the shares not being subscribed by March 31st, 1913, the company shall be dissolved. The signatories (with one share each) are:—J. A. Fuller, 110, Sirdar Road, Wood Green, N., clerk; J. H. Chapman, 28, Albanon Crescent, Lewisham, S.E., clerk. Private company. Table "A" mainly applies.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**British Ever-Ready Electrical Co., Ltd.**—A memorandum of satisfaction in full on December 31st, 1912, of debenture dated April 6th, 1904, to July 23rd, 1907, securing £7,600, has been filed.

**English Electrical Co., Ltd.** (112,639).—Capital £5,000, in £1 shares. Return dated March 8th, 1912; 526 shares taken up; £526 paid; mortgages and charges, £10,000.

**Lamplough & Son, Ltd.**—Mortgage on the company's undertaking and property, present and future, including the uncalled capital, dated January 4th, 1912, to secure £703. Holders: Charles Hoare & Co., 37, Fleet Street, E.C.

**Lichtenfeld Burglar Alarm, Ltd.** (112,522).—Capital £3,000 in £1 shares. Return dated December 19th, 1912 (filed December 19th), 1,710 shares taken up. £1 per share called up on 1,210. £1,210 paid. £500 considered as paid. Mortgages and charges: Nil.

**South London Electrical Supply Corporation, Ltd.**—Issue on January 7th, 1913, of £5,170 debentures, part of a series of which particulars have already been filed.

**Delagoa Bay Development Corporation, Ltd.** (76,099).—Capital, £166,800 in 10s. shares. Return dated November 14th, 1912, 267,400 shares taken up. 10s. per share called up on 177,400. £83,740 paid, including £400 on 100 shares forfeited. £45,000 considered as paid on 90,000 shares. Mortgages and charges: £197,100.

**Nairobi Electric Power and Lighting Co., Ltd.**—Particulars of £2,000 6 per cent. fourth mortgage debentures, created December 4th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, but excluding certain specified exceptions. No trustees.

## CITY NOTES.

**City and South London Railway Co.**—The accounts for the half-year to December 31st show a balance after providing for the debenture stock interest, the payment of the dividend on the 5 per cent. preference stocks, 1891, 1896, 1901 and 1903, and the transfer to the renewal fund of £1,500, sufficient to allow the payment of a dividend on the consolidated ordinary stock at the rate of ½ per cent. per annum, carrying forward £2,588. The dividend for the corresponding period last year was at the rate of ½ per cent. per annum, carrying forward £2,814.

**Liverpool Overhead Railway Co.**—The directors recommend the payment of dividends at the rate of 5 per cent. per annum on the preference shares, and 2½ per cent. per annum on the ordinary shares for the half-year ended December 31st last.

**Nairobi Electric Power and Lighting Co., Ltd.**—An interim dividend at the rate of 6 per cent. on the cumulative preference shares, in respect of the years 1906 and 1907, is to be paid.

**Metropolitan District Railway Co.**—The directors announce a dividend at the rate of 2 per cent. per annum on the second preference capital. £10,000 is being placed to renewals account, and £8,500 carried forward, as compared with £2,000 last year.

**Montreal, Light, Heat and Power Co.**—The directors have declared a dividend of 2½ per cent. on the paid-up capital stock, being at the rate of 9 per cent. per annum, for the quarter to January 31st.

## Lanarkshire Tramways Co.

The directors' report for the half-year ended December 31st, 1912, says that the revenue was £41,910, and the expenses were £22,190, leaving £19,720. From this the following are deducted:—Contributions payable to local authorities, £852; interest on debentures, £909; interest account, £531; expenses in connection with Lanark County Tramways Act, £818; amounts written off, as per revenue account, £137 = £3,246; leaving £16,471, plus £5,200 brought forward, making a balance of £21,674. Of this amount £9,500 has been placed to reserve for depreciation, and the balance is to be disposed of as follows:—£10,290 to dividend at the rate of 6 per cent. per annum for the half-year on the issued share capital; £307 to directors (being 10 per cent. of net profits after payment of 5 per cent. dividend); £1,577 to revenue new account. The traffic receipts show an increase of £1,890, and the expenses an increase of £1,947, as compared with the corresponding half-year of 1911. The increase in expenses was mainly due to the enhanced price of coal, heavier charges for maintenance of permanent way and for local rates, and to the additional charge created by the National Insurance Act. The directors have transferred £9,500 to reserve for depreciation. Interest has also been credited to the reserve, making a total contribution for the year of £11,448. A dividend for the half-year at the rate of 6 per cent. per annum is recommended, making 5½ per cent. for the year. The company's action against the Lanark County Council to restrain the Council from utilising, for the purpose of building a new road known as Coronation Road, at New Stevenston, part of the £7,500 paid by the company to the County Council under the order of 1903 for road widenings, was successful. The County Council intended appealing, and at its request the matter has been arranged on satisfactory terms. The Lanark County Council will shortly proceed with the construction of tramways from Uddingston to Bellshill, Mossend and New Stevenston, to connect up with the company's lines. These new lines will be leased to the company under the agreement referred to in the directors' report for June 30th, 1912. The expenses in connection with the Lanark County Tramways Act, £818 have been written off. It is the company's intention to shortly inaugurate a service of motor-omnibuses. During the past year 10 additional debentures of £50 each have been issued. A further amount of £4,987 was invested during the half-year in trustee securities.

Half-year ended.	Gross profit.	Divi. ends.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car. mileage.	No. of cars.
June 30, 1911..	£17,173	54 %	21·25	7,074,121	£36,002	1·22d.	885,322	60
Dec. 31, 1911..	19,773	63 %	23·32	7,757,442	39,476	1·22d.	940,697	64
June 30, 1912..	16,577	63 %	23·32	7,032,736	36,570	1·26d.	893,927	64
Dec. 31, 1912..	19,730	6 %	23·32	8,202,018	41,867	1·21d.	955,164	64

## Edinburgh and District Tramways Co., Ltd.

FROM the annual report it appears that the profit for 1912 is £33,933, as against £35,771 in 1911. The total receipts were £297,468, compared with £292,477 in 1911. The expenditure was £263,535, as against £256,706 a year ago. The traffic receipts per mile run were 10·61d., as against 10·49d. in 1911; other receipts per mile run amounted to 0·08d., the same as the previous year, the total receipts per mile run, therefore, being 10·69d., as against 10·57d. in 1911. The expense per mile in respect of working expenses and general charges was 5·45d., as against 5·27d. in 1911; while in respect of Corporation charges for rent, it was 4·02d., as against 4·01d., a total expenditure per mile run of 9·47d., as compared with 9·28d. in 1911. The profit per mile run was 1·22d., as compared with 1·29d. in 1911. The mileage open was the same as in the previous year (25½), and the miles run were 6,676,755, an increase of 35,870. The total passengers carried (including estimate for season tickets) were 64,034,090, an increase of 1,466,502 over 1911. The sum at the credit of the preference shareholders is £5,112, which the directors recommend should be dealt with as follows:—(1) In payment of ordinary dividend for the half-year to December 31st, 1912, at the rate of 5½ per cent. per annum, £2,062; (2) in payment of additional dividend of 4 per cent., £3,000; (3) in carrying forward to the credit of the preference shareholders £49. The sum at the credit of the deferred shareholders is £7,370, and the directors recommend that it should be dealt with as follows:—(1) In payment of a dividend of 8s. per share for the year to December 31st, 1912, £7,000; (2) and in carrying forward to the credit of the deferred shareholders £370. The motive power expenses (cable) totalled £19,356, and the cost of maintenance of cars, lines, cables, machinery, &c., was £40,156. Corporation charges, in respect of the rent of the tramways, amounted to £104,505. Passengers' fares represented a sum of £291,397.

**Metropolitan Railway Co.**—The directors have declared a dividend on the ordinary stock for the past half-year at the rate of 1½ per cent. per annum, placing £7,500 to renewals and depreciation fund and carrying forward £9,500. A year ago the dividend was the same, £5,000 was set aside for renewals, and £9,200 was carried forward. The dividend on the surplus lands stock is at the rate of 2½ per cent. per annum, the same as a year ago, while £800 is carried forward, against £700.

**Electric Construction Co., Ltd.**—The directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended November 30th.

**London Electric Railway Co.**—The directors have declared a dividend at the rate of 1 per cent. per annum for the past half-year on the ordinary stock, placing £7,500 to renewals and carrying forward £3,000, as compared with £2,400 a year ago.

## Chatham and District Light Railways Co.

The directors report for the half-year ended December 31st, 1912 shows that the revenue was £23,977, and the expenses were £13,276, leaving £10,700, less rent of Rochester Corporation lines £1,872, interest on debentures £1,192, interest account £156 = £3,250, leaving £7,451 plus balance brought forward from June, 1912, £2,111, making a balance of £9,562. Of this amount, £4,500 has been transferred to reserve for depreciation, and the directors recommend a dividend at the rate of 5 per cent. per annum for the half-year on the preference shares, absorbing £2,910, a dividend at the rate of 3 per cent. per annum for the half-year on the ordinary shares requiring £1,590, carrying £562 to revenue new account. The traffic receipts show an increase of £12, and the expenses an increase of £411, as compared with the receipts and expenses for the corresponding half-year of 1911, the increase in expenses being mainly due to the enhanced price of coal. During the half-year £2,100 debentures of the company were purchased and redeemed. The difference between the purchase price and par value has been added to reserve for depreciation. A further amount of £3,500 was invested during the half-year in trustee securities. Two additional cars were purchased and put into service in December.

The meeting will be held at 83, Cannon Street, E.C., on February 4th.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car. mileage.	No. of cars.
June, 1911 ..	14·98	4,372,850	£21,101	1·16	651,534	45
Dec., 1911 ..	14·95	4,843,236	23,622	1·17	671,790	45
June, 1912 ..	14·98	4,165,807	21,570	1·16	644,512	46
Dec., 1912 ..	14·98	4,850,273	23,634	1·17	667,292	47

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in—

Universal Cheap Cables, Ltd.—20,000 shares of £1 each fully paid, Nos. 1 to 23,000.

And to allow the following to be quoted in the Official List:—

Cordoba Light, Power and Traction Co., Ltd.—300,000 6 per cent. preference shares of £1 each (special application).

Rhondda Tramways Co., Ltd.—Further Issue of £40,000 5 per cent. first mortgage debentures (registered) of £100 each.

The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Calgary Power Co., Ltd.—Further issue of £31,000 5 per cent. 80-year first mortgage bonds of £100 each (Nos. A8,802 to 4,111).

Pennsylvania Water and Power Co.—Further issue of \$200,000 first mortgage sinking fund 5 per cent. gold bonds, 1940, of \$1,000 each (Nos. 7,681 to 7,850).

**Great Northern and City Railway Co.**—The report as published in the financial newspapers, states that the total revenue receipts for the six months to December 31st amounted to £39,039, and the cost of working to £21,144, being at the rate of 54·11 per cent. The net revenue, including the balance of £184 brought from last half-year, amounts to £18,099, which is insufficient to meet the company's fixed charges for the half-year. The sum of £5,086, which has been provided from outside sources, has enabled the company duly to meet these charges. The number of passengers for the six months, including season ticket-holders, was 5,968,363, as against 6,119,506 for the corresponding period last year. The number of local season tickets issued during the half-year was 2,191, as against 2,327 for the half-year to December 31st, 1911. The number of three-route season ticket-holders using the company's line during the half-year was 2,889, as against 3,013 for the corresponding half-year. As already notified, the directors have, subject to the consent of the shareholders and to the necessary Parliamentary sanction being obtained, come to an agreement with the Metropolitan Railway Co. for the taking over by the last-named company, as from June 30th, 1913, of the undertaking of the City Co. The agreement came to have been embodied in a Bill which will be submitted in the ensuing session of Parliament. The necessary meetings of the shareholders of the company will be held after the half-yearly meeting for the purpose of submitting the proposals to the acceptance of the proprietors. The arrangement, which involves the dissolution of the company, is one which the directors recommend to the proprietors for their acceptance.

**Fusion of the London United and the Metropolitan Tramway Companies.**—The holders of upwards of 75 per cent. of each class of share in the Metropolitan and the London United Tramway Companies having accepted the scheme for the fusion of their interests in the companies named with the new company formed for giving due effect thereto, viz., The London and Suburban Traction Co., Ltd., the latter company, in a recent circular, now intimates that in consequence of this support the fusion scheme has become binding, and it is forwarding transfer forms to shareholders in the companies indicated to enable them to transfer their holdings to the Suburban Co., so that as soon as practicable after the registration of the transfers the shares and/or debenture stock of the Suburban Co., to which the acceptors of the scheme are entitled may be issued to them with scrip certificates to bearer for the fractions, if any.

**British Columbia Electric Railway Co., Ltd.**—The directors have declared a dividend at the rate of 5 per cent. per annum on the non-cumulative preferred ordinary stock for the half-year to December 31st, together with an additional dividend at the rate of 1 per cent. per annum for the same period.

**Brazilian Traction, Light and Power Co., Ltd.**—The directors have declared a dividend of 1½ per cent.

### Machine Tool and Engineering Association, Ltd.

In their second annual report the directors state that since their last report 23 firms have joined, bringing the membership up to over 100. The financial position is satisfactory, the balance in hand, after meeting all current liabilities, amounting to £3,954. It is proposed to invest £3,000 of this at once, the remainder being left either on deposit or current account at the bank. The directors do not recommend the payment of a dividend, as they consider it necessary that the association should have ample funds at command for future requirements. It has been decided to transfer the offices of the association to Queen Anne's Chambers, Broadway, Westminster, S.W.

The Exhibition at Olympia was successful, both from the point of view of the association as a whole, and, so far as information is available, from that of the individual members who exhibited. The total number of exhibitors was 292, the total attendance of the public about 100,000. The proportion of profit on the Olympia Engineering Exhibition appearing in the account was to December 31st, 1912, £3,998. The association was approached by the Exhibitions Branch of the Board of Trade with the view of joint action in organising a collective exhibit of machine tools at the Ghent Exhibition, and the suggestion was approved by the association, but when invitations to apply for space were sent out to the members, the response was so inadequate as to make it clear to the directors that a representative display was impossible, and the scheme was, therefore, abandoned.

The annual meeting was to be held yesterday at Caxton Hall, S.W.

**East London Railway Co.**—In their report for the six months ended October 31st, the directors say that it had been hoped that the electrification work in hand would have been completed in time for the line to be opened for electrical working on March 1st. In view, however, of some delays which have unavoidably occurred in the construction of a sub-station the line will probably not be ready for opening until about a month later.

**Japan.**—The Yokohama Electric Co., of Yokohama, reports a profit of £39,088 for the last half-year, out of which a dividend at the rate of 11 per cent. per annum is being declared.

## STOCKS AND SHARES.

Tuesday Evening.

STOCK EXCHANGE markets are confused and obsessed by the complexion of the Near Eastern question. Whereas a couple of months ago delay was supposed to make for peace, at the present time the protracted nature of the negotiations is read rather as a bear factor. It certainly has a very restraining effect upon business, and the inevitable tendency is to let prices sag. Expectation looks for peace to be maintained, but this optimism is of subdued sort, and agreement is unanimous that anything might happen by precipitate action on the part of one of the many parties interested.

The Home Railway dividends which have appeared up to the present are not particularly brilliant performances. So far as the electric lines are concerned, the District declaration was the first. The company announces 2 per cent. on its Second Preference stock, and carries forward £8,500, the former being at the same rate as a year ago, and the latter being increased by £6,500. On the figures being published, however, Districts dropped from 42 to 40½. The Metropolitan declaration, made to-day (Tuesday), is at the rate of 1½ per cent., with £9,500 forward, the dividend being the same as that of a year ago. The Surplus Lands stock receives 2½ per cent. "Mets" fell sharply to 52, but rallied to 53½, thus showing a net gain of ½ on the week.

The London Electric Railways announces a dividend at the rate of 1 per cent. per annum, and the City and South London reduces its ½ per cent. of a year ago, to ¼ per cent., with £2,588 carried forward, against £2,814. The price of the stock, however, was not affected by the declaration.

Underground Electric shares have shown remarkable strength, and the Ordinary at the end of last week touched 5½ bid, reverting later to £5, which still leaves a rise of 2s. 6d. after their previous advances. The 6 per cent. Income Debenture stock is also better, and so are the 1s. shares, but the company's Income Bonds are ¼ down. There are no quotable changes in Central London, or in Great Northern and City shares. The latter company has just issued what is likely to be its last report, previous to being taken over by the Metropolitan Railway. London United Tramways retain their prices, and this group as a whole is steady.

The electricity supply market shows firmness in several directions. For example: Bromptons are ¼ higher, and so are Edmundsons' Preference and St. James' Ordinary; while rises of ¼ have been secured by Metropolitan Preference and Edmundsons' Non-Commutative Preference. On the other side of the sheet, South London and County Ordinary are both lower, the latter losing ¼. Midland Corporation Debenture has been in demand, and the quotation has risen to par. One or two proposals are in the air for the flotation of provincial electric supply companies, and the latest which has come under our notice is a scheme for uniting several well-known towns on the Sussex coast for this purpose.

The mention of new issues is a reminder of the draft prospectus in circulation with particulars of the Hydro-Electric Concessions, Ltd., a small concern with a capital of £21,000, formed to investigate and organise hydroelectric power and public utility enterprises in various parts of the world. The ultimate purpose, of course, is to form large public companies through this parent. No doubt the success of the hydroelectric power companies in some of the Canadian cities is at least partially responsible for this last project.

Latin-Canadian enterprises are mostly a firm market, the steady progress which the best of them are making, leading to quiet absorption of the various issues. The Kaministiquia Power Company, for instance, has just raised its dividend to 5 per cent. for the new quarter, while issuing an excellent report in respect of the past financial twelvemonth. Shawinigan Water has risen 3½. British Columbia Electric stocks are all strong, with rises in the Deferred and Preferred stocks. Rio bonds are ½ better, and so are Sao Paulo bonds. Brazilian Traction shares rose to 102 on strong buying orders from a Brussels group. Southern Electric Trams of Buenos Ayres Debenture put on 2 points, and several prices which were quoted *ex* dividend last Thursday have started to recover part of the distributions. Affairs in Mexico, according to the latest intelligence, are still in a very unsettled condition, though this does not appear greatly to trouble proprietors of the utilities companies' shares and bonds. Other foreign tramway and power descriptions are firm, with the exception of Northern Light and Power bonds, the price of which has been marked down from 27½ to 15. A seller apparently forced stock on to an unwilling market, and purchases were made at 10. As a simple gamble, the bonds might be worth buying about 11 for an upward reaction. Kalgoolie Preferences are ¼ lower at 11s. 3d. Madras Electric Debenture rose 1 to 102.

Excitement has quieted down to a large extent in the market for National Telephone stock, but the price shows a still further depreciation, and stock changed hands several times below par early this week. Estimates of the price at which the stock will be repaid are extremely wide, ranging from about 150, predicted by the *Daily Telegraph*, to 93, which the *Economist* conservatively calculates—the other prophets making various estimates between these figures. The award is condemned indignantly and unsparingly by many disappointed holders, who stigmatise it as sheer robbery and spoliation; but it has a few defenders, and these contend that though the taxpayer may have got a good bargain, it is by no means the absurd one which National Telephone Deferred proprietors in some cases maintain. The *Daily Telegraph*, by the way, informed us on Tuesday that Consols had declined on the previous day to 74½ "per oz," so maybe its Telephone calculation is worked out by some table other than sterling.

The Marconi market has recovered some of its mercurial properties, the price moving very fast between 3½ and 4½. On publication of the letter addressed by the company to the House of Commons' Committee, asking for the contract with the Government to be nullified, the Stock Exchange market was completely puzzled, and, for the moment, the price of the shares dropped. Discussion and debate on the company's object in doing this led to the view that it was a bold policy which might have a very useful effect. The fear that another Committee might be appointed to deal with the agreement alone had led to the idea that it might be many months before any definite agreement was reached, and what the Stock Exchange hates above anything else is suspense. The company's request for the agreement to be voided was, therefore, hailed as likely to whip up matters rapidly; and the bears saw in it sufficient justification for climbing in, because if the agreement is ratified, it is fairly safe to assume that Marconis will not stop at 3½ for long. The Preference shares and the shares of the subsidiary undertakings rallied in sympathy, the whole market taking on a better appearance.

Other Telegraph stocks are quietly firm. There was a slump in American Telephone and Telegraph Capital stock on free offering from New York, and at 137 the price shows a drop of 6. The President-elect's recent fulminations against trusts has caused considerable uneasiness in Wall Street, and fairly substantial falls in American Rails were followed as a natural sequence by declines in other American issues of a trust character. West India and Panamas are more in favour, the price gaining ½; and with the approach of the time for the opening of the Panama Canal, it is expected that these shares will appreciate still further. They are, of course, a very speculative holding. Great Northern Telegraphs rose 10s.; Eastern Extensions are ¼ higher, allowing for the dividend; and Eastern Telegraph stock, also *ex*-dividend, is about ¼ up on balance. Direct United States Cable shares recovered their dividend deduction of 2s. 6d.

The Manufacturing division is inanimate. There has been a good rise in British Insulated and Helsby Cable shares, the Ordinary advancing to 8½, while Callenders are again ½ higher at 11½. One or two buying orders for British Westinghouse Preference had the effect of causing the price to harden to 12s. 6d. middle. A moment shares are better on the whole. In the Rubber market a trifling decline in the price of the raw stuff led to the leading speculative shares being put down a little, though for the purely investment descriptions the public demand has not slackened.

**American Telephone and Telegraph Co.**—According to the *Financial*, a special meeting of the stockholders will be held on the 30th inst., in New York, to consider and act upon the question of authorising the issue of convertible bonds.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 21st.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations Jan. 21st.	Rise + or Fall	Present Yield p.c.	
		1911.	1912.						1911.	1912.				
Bournemouth & Poole, Ord.	10	5 1/2	5 1/2	94-104	..	5 4 0	Kensington & Knightsbridge, Ord	5	9	81	74-84	..	5 10	
Do. 4 1/2 % Pref.	10	4 1/2	4 1/2	81-97	..	4 12 4	Do. 4 % Deb.	Stock	4	4	92-96	..	4 1 3	
Do. Second 5 % Pref.	10	6	6	96-104	..	5 11 8	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 1/2	4 1/2	79-80 1/2	..	5 12 6	
Do. 4 1/2 % Deb. Stock	Stock	5	4 1/2	96-98	..	1 11 10	London Electric, Ord.	..	8	2 1/2	14-2	..	3 15 0	
Brompton, Kensington, Ord.	5	10	9 1/2	84-94	+ 1/2	5 6 8	Do. 5 % Pref.	..	6	6	4-5 1/2	+ 1/2	5 14 1	
Do. 7 % Cum. Pref.	5	7	7	84-9	..	3 17 9	Do. 4 % First Mort. Deb.	..	Stock	4	4	80-92	+ 1/2	4 7 0
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95-96	..	4 1 8	Metropolitan	..	5	4	82-87	..	5 3 3	
Charing Cross, West End & City	5	5	5 1/2	48-54	..	4 17 7	Do. 4 1/2 % Cum. Pref.	..	5	4 1/2	14-4 1/2	+ 1/2	5 0 0	
Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2	43-48	- 1/2	4 12 4	Do. 4 1/2 % First Mort. Deb.	..	Stock	4 1/2	4 1/2	67-100	..	4 10 0
Do. "City Undertaking"	5	4 1/2	4 1/2	34-48	..	5 2 10	Do. 5 1/2 % Mort. Deb.	..	Stock	6 1/2	6 1/2	81-86	..	1 1 5
Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2	34-48	..	4 5 1	Midland Electric Corporation	..	100	4 1/2	4 1/2	98-101	+ 1/2	4 9 1
Chelsea, Ord.	100	4	4	93-94	..	4 17 7	4 1/2 % First Mort. Deb.	..	5	5	42-44	..	5 2 7	
Do. 4 1/2 % Deb.	Stock	10	4 1/2	42-54	..	4 10 11	Newcastle-on-Tyne 5 % Pref., Non-Cum.	..	100	5	5	99 1/2-102 1/2	..	4 17 7
Do. 5 % Pref.	10	8	8	16-18	..	4 9 0	North Metropolitan Power Supply, 5 % Mortgages (Red.)	..	10	8	6	92-101	..	5 11 7
Do. 8 % Cum. Pref.	10	8	6	12-13 1/2	..	4 3 4	Do. 7 % Pref.	..	5	7	7	64-67	..	4 16 7
Do. 5 % Deb.	Stock	5	5	116-120	..	4 8 3	Do. 8 1/2 % Deb.	..	5	2	..	12-14	..	1 0 3
Do. 4 1/2 % Second Deb.	100	4 1/2	4 1/2	100-102	..	4 8 3	Oxford	..	5	7 1/2	61	64-62	..	5 2 6
County of London, Ord.	10	6	4	11 1/2-11 1/2	..	5 1 1	St. James' and Pall Mall, Ord.	..	5	10	10	92-104	..	4 18 8
Do. 6 % Pref.	10	8	6	11 1/2-12	..	5 0 0	Do. 7 % Pref.	..	5	7	7	64-67	..	4 16 7
Do. 8 % Cum. Pref.	10	8	6	104-106	..	4 11 1	Do. 8 1/2 % Deb.	..	5	2	..	12-14	..	1 0 3
Do. 5 % Deb.	Stock	4 1/2	4 1/2	98-101	..	4 8 8	Smithfield Markets, Ord.	..	5	2	..	22-24	..	3 3 1
Do. 4 1/2 % Second Deb.	Stock	4 1/2	4 1/2	98-101	..	4 8 8	South London, Ord.	..	4	5	..	12-14	..	3 3 1
Edmundson's, Ord.	£3	Nil	..	..	..	Nil	Do. 5 % First Mort. Deb.	..	100	5	5	97-100	..	5 0 0
Do. 6 % Cum. Pref.	5	Nil	..	..	..	..	South Metropolitan, 7 % Pref.	..	1	7	7	12-14	..	5 9 5
Do. 6 % Non-Cum. Pref.	5	..	..	..	..	..	Do. 4 1/2 % First Deb. Stock	..	100	4 1/2	4 1/2	96-99	..	4 11 3
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	4 1/2	82-85 1/2	+ 1/2	5 15 7	Urban, Ord.	..	£3	Nil	..	..	..	..
Folkestone	5	6	6	42-54	..	4 17 7	Do. 5 % Cum. Pref.	..	5	2	..	22-24	..	3 3 1
Do. 5 % Cum. Pref.	5	6	6	42-54	..	4 17 7	Do. 4 1/2 % First Mort. Deb.	..	100	4 1/2	4 1/2	85-88	..	5 2 3
Do. 4 1/2 % First Deb.	100	4 1/2	4 1/2	90-92 1/2	..	4 17 10	Westminster, Ord.	..	5	10	9 1/2	64-92	..	5 6 8
Hove	5	9	8 1/2	73-8	..	4 12 6	Do. 4 1/2 % Cum. Pref.	..	5	4 1/2	4 1/2	42-54	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	8	8	54-58	..	5 6 8	Monterey Riv. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88-90 1/2	..	5 11	
Calcutta, Ord.	5	8 1/2	7 1/2	62-74	..	5 19 4	Montreal, Lt., H. and Power	\$100	8	9 1/2	297-242	..	3 14 5	
Do. 5 % Pref.	5	5	5	43-54	..	4 16 5	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$500	5	5 1/2	10-20	..	..	
Calgary Power, 1st Mort. Bds.	100	6	6	93-94	..	5 16 8	River Plate, Ord.	..	Stock	10	..	217-227	..	4 8
Canadian Gen. El. Com.	\$100	7	7	116-120	..	5 6 8	Do. 6 % Non-Cum. Pref.	..	Do.	8	6	106-111	..	5 5 3
Do. 7 % Pref.	\$100	7	7	120-124	..	5 19 0	Do. 5 % Deb. Stock	..	Do.	5	5	100-102	..	4 18 0
Cordoba Lt., Power and T., Ord.	1	8	5	83-84	..	5 6 8	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	4 1/2	4 1/2	98-100	..	4 10 0	
Do. 5 % Deb.	100	5	5	96-99	..	5 1 0	Shawinigan Water, Capital	\$100	5	5	153-154 1/2	+ 3/4	8 4 11	
Elec. Lt. and P. of Cochabamba, 8 % Bonds	100	8	8	83-85	..	6 6 4	Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	105 1/2-107 1/2	..	4 13 0	
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90-93	..	5 7 6	Do. 4 1/2 % Per. Deb.	..	Stock	4 1/2	4 1/2	100 1/2-102 1/2	..	4 7 10
Elec. Dev. Ontario, 5 % 1st Mort. Deb.	\$500	5	5	95 1/2-97 1/2	..	5 2 7	Toronto Power, 4 1/2 % Deb.	..	Do.	4 1/2	4 1/2	98 1/2-100 1/2	..	4 9 7
Kalgocri Elec. P. and Lt., Ord.	10	Nil	..	..	..	Nil	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91-94	..	5 6 5	
Do. 6 % Pref.	1	6	6	102-104	..	4 16 2	Victoria Falls Power, Pref.	1	11 1/2	17 1/2	15-1	..	..	
Kaminiatqua Power, 6 % G. B. S. Madras, Ord.	5	6	Nil	..	..	..	West Kootenay Power (and Lt.), 1st Mort. 6 % Gold	100	8	6	103 1/2-106 1/2	..	5 19 9	
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101-104	..	4 16 2								
Mexican El. Lt., 5 % 1st M. Bds.	5	5	5	85-87	..	5 15 0								
Mexican Lt. & Power, Common	\$100	4	4	82-86 1/2	- 1	4 13 0								
Do. 5 % Cum. Pref.	\$100	7	7	106-110	..	6 9 8								
Do. 5 % 1st Mort. Gold Bds.	5	5	5	96 1/2-98 1/2	..	5 1 6								

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4 1/2	7-7 1/2	..	6 0 0	Monte Video Telephone, Ord.	1	6	6 1/2	43-1 1/2	..	5 13 0		
Do. 5 % Deb. Red.	Stock	5	5	87-90	+ 1	5 1 1	Do. 5 % Pref.	..	5	5	90-101	..	5 18 6		
American Telep. & Teleg., Cap.	\$100	8	8 1/2	136-138	..	5 15 11	National Telephone Del.	..	Stock	8	..	90-101	- 4	..	
Do. Collat. Trust	\$100	4	4	91-93	- 1/2	4 6 0	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	97 1/2-98 1/2	..	4 11 2		
Anglo-American Telegraph	Stock	8	8	65 1/2-67 1/2	..	4 8 11	Oriental Telep. and Elec.	..	1	8	6 1/2	123-123 1/2	..	4 9 10	
Do. 6 % Pref.	..	Do.	8	6	110 1/2-113 1/2	..	5 6 7 7	Do. 6 % Cum. Pref.	..	1	6	6	123-123 1/2	..	4 18 6
Do. Def.	..	Do.	80	..	24 1/2-25 1/2	..	6 0 0	Do. 4 % Red. Deb.	..	Stock	4	4	87 1/2-89 1/2	..	4 8 6
Anglo-Portuguese Tel., 5 % } Reg. Deb. }	100	5	5	102-104	..	4 16 2	Pacific and European Tel., 4 % Guar. Deb.	..	Do.	4	4	97 1/2-99 1/2	- 1/2	4 0 5	
Chili Telephone	5	7	7	74-77	..	5 8 9	Reuter's	..	10	10	10 1/2	11 1/2-11 1/2	+ 1/2	8 12 0	
Commercial Cable, Stig. 4 % Deb.	Stock	4	4	80-82	..	4 17 7	Submarine Cables Trust	..	Cert.	6	6	127-180	..	4 12 4	
Cuba Telegraph	10	6	6 1/2	8-9	..	6 13 4	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	..	Stock	4 1/2	4 1/2	97-99	..	4 10 11	
Do. 10 % Pref.	..	Do.	10	10	16-17	..	5 17 8	United River Plate Telephone	..	5	8	..	..	..	
Direct Spanish Telegraph, Ord.	5	4	4	93-93 1/2	..	5 6 6	Do. 5 % Cum. Pref.	..	5	5	5	7 1/2-7 1/2	..	5 4 1	
Do. 10 % Cum. Pref.	5	10	10	64-7	..	7 2 10	Do. 6 % Cum. 2nd Pref.	..	10	6	6	94-10	..	4 7 11	
Direct United States Cable	10	5	4	64-72 1/2	+ 1/2	6 15 7	Do. 4 % Deb.	..	5	2 1/2	..	..	..		
Direct W. India Cables, 4 1/2 % Reg. Deb.	100	4 1/2	4 1/2	99-101	..	4 9 0	West Coast of America	..	100	4	4	95-98	..	4 1 8	
Eastern Telegraph, Ord. Stock	Stock	7	7 1/2	133-136 1/2	+ 1/2	5 2 11	Do. 4 % Deb.	..	Stock	4	4	94-96	..	4 3 4	
Do. 8 1/2 % Pref. Stock	..	Do.	8 1/2	8 1/2	78-80 1/2	..	4 7 6	Western India and Panama Telep.	..	10	2 1/2	..	..	..	
Do. 4 % Mort. Deb.	..	Do.	4	4	96-98	..	4 1 8	Do. 6 % Cum. 1st Pref.	..	10	6	6	10-10 1/2	..	5 14 3
Eastern Extension	10	7	7 1/2	118-123 1/2	+ 1/2	5 9 8	Do. 6 % Cum. 2nd Pref.	..	100	6	6	101-109	..	4 17 1	
Do. 4 % Deb.	..	Do.	4	4	96-98	..	4 1 8	Do. 5 % Deb.	..	100	6	6	101-109	..	4 17 1
East and B. Africa Tel., 4 % M. D. Mauritius Sub.	25	4	4	98-101	..	3 19 8	Western Telegraph, Ltd.	..	10	7	7 1/2	124-128	..	5 2 9	
Globe Telegraph and Trust	10	6	6 1/2	102-107	..	5 10 4	Do. 4 % Deb.	..	Stock	4	4	94-96	..	4 3 4	
Do. 5 % Pref. Stock	..	Do.	4	4	128-132	..	4 13 2	Western Union 4 1/2 % Fdg. Bonds	..	\$1000	4 1/2	4 1/2	97 1/2-100 1/2	..	4 10 0
Great Northern Telegraph	10	18	18	284-304	+ 1/2	5 18 0									
Indo-European Telegraph	25	18	18	264-284	..	5 11 1									
Mackay Companies Common	\$100	5	5	87-91	+ 2	6 9 11									
Do. 4 % Cum. Pref.	..	Do.	4	4	68-71	..	5 12 6								
Marseilles Wireless Telegraph	1	20	..	..	..	4 12 10									
Do. 7 % Cum. Partic. Pref.	1	17	..	..	..	4 10 8									

\* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 3s. in Funded Dividend Certs

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 21st.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 21st.	Rise + or Fall	Present Yield p.c.
Bath Trams, Pref. Ord. . . . .	1	Nil	111	..	5 8 1	Metropolitan Railway Consol. . . . .	100	15 11	591-64	+ 2	8 0 2
Do. 5% Pref. . . . .	1	5	11	..	6 8 1	Do. Surplus Lands . . . . .	100	25 2 1/2	61-63	..	4 6 0
Do. 4% Deb. . . . .	100	4 1/2	76-81	..	6 11 1	Do. 8 1/2% Deb. . . . .	100	8 1/2	86-88 x d	..	8 17 9
Brit. Elec. Trac. 6% Pref. . . . .	100	..	11-13	..	..	Do. 8 1/2% Pref. . . . .	100	8 1/2	85-87	..	4 0 6
Do. Do. Deferred . . . . .	100	..	6-7	..	..	Do. 8 1/2% Con. Pref. . . . .	100	8 1/2	94-85	..	4 1 6
Do. Do. 5% Cum. Pref. . . . .	100	6	87-90	..	6 13 4	Metropolitan District Ord. . . . .	Nil	Nil	40 1/2-41	- 1 1/2	Nil
Do. 7% Non-Cum. Pref. . . . .	100	..	38-41	..	..	Do. 6% Deb. . . . .	100	6	139-141	..	4 4 0
Do. 6% Perp. Deb. . . . .	100	6	92-95	..	6 2 2	Do. 4% Deb. . . . .	100	4	98-95	..	4 2 6
Do. 4 1/2% 2nd Deb. . . . .	100	4 1/2	77-81	..	5 7 2	Do. 4% Prior Lien . . . . .	100	4	99-101	..	3 19 8
Central London Railway, Ord. . . . .	100	8	82-84	..	3 11 5	Do. 4 1/2% First Pref. . . . .	100	4 1/2	89-91	..	4 18 11
Do. Pref. . . . .	100	4	81-85	..	4 14 2	Do. 8 1/2% Gtd. . . . .	100	8 1/2	76-78	..	4 9 9
Do. Del. . . . .	100	2	82-84	- 1	2 7 7	Metropolitan Elec. Trams, Ord. . . . .	1	5 5 1/2	1 1/2-1 1/2	..	Nil
Do. 4% Deb. . . . .	100	4	98-100	..	4 0 0	Do. Del. . . . .	1	Nil	1 1/2-1 1/2	..	Nil
City & South London, Ord. . . . .	100	12	113-115	+ 1	3 11 5	Do. 5% Pref. . . . .	1	5	94-92	..	5 14 3
Do. 6% Pref., 1891 . . . . .	100	6	109-111	..	4 10 1	Do. 4 1/2% Deb. . . . .	100	4 1/2	90-92	..	4 17 10
Do. Do. 1896 . . . . .	100	6	109-111	..	4 10 1	Do. 5% Deb. . . . .	100	5	94-97	..	5 8 1
Do. Do. 1901 . . . . .	100	6	109-111	..	4 10 1	Potteries, Ord. . . . .	1	8 1/2	..	..	..
Do. Do. 1903 . . . . .	100	6	109-111	..	4 10 1	Do. 5% Pref. . . . .	1	6	..	..	6 19 0
Do. 4% Deb. . . . .	100	4	98-100	..	4 0 0	Do. 4 1/2% Deb. . . . .	100	4 1/2	88-88	..	5 2 8
Dublin United Trams, 6% Pref. . . . .	10	6	12-13	..	4 12 4	South Metro. Trams, 6% Pref. . . . .	1	6	11-11 1/2	..	7 7 8
Great Northern & City, Pref. Ord	10	Nil	21-22	..	Nil	Do. 4% Deb. . . . .	100	4	85-70	..	6 11 4
Hastings Trams, 6% Pref. . . . .	1	6	61-62	..	8 6 8	Underground Elec. Railways	10	..	4 1/2-5 1/2	+ 1/2	Nil
Do. 4 1/2% Deb. . . . .	100	4 1/2	69-74	..	6 1 7	Do. "A" . . . . .	1/1-	..	..	+ 1/2	..
Isle of Thanet Trams, 5% Pref. . . . .	5	25	23-24	..	4 15 3	Do. 6% First Cum. Inc. Deb. . . . .	100	..	11 1/2-11 1/2	+ 1/2	5 5 9
Do. 4% Deb. . . . .	100	4	75-80	..	6 5 0	Do. 4 1/2% Bonds . . . . .	100	4 1/2	98-100	..	4 17 7
Lancashire United, 5% Deb. . . . .	100	6	74-80	..	6 5 0	Do. 6% Income . . . . .	100	1 1/2	94 1/2-95 1/2	- 1/2	Nil
London Elec. Railwys, 4% Deb. . . . .	100	4	95-97	..	4 2 6	Yorkshire (West Riding), Ord. . . . .	5	Nil	..	..	Nil
London United Trams, 5% Pref. . . . .	10	Nil	..	..	..	Do. 6% Pref. . . . .	5	8 1/2	2 1/2-3 1/2	..	4 12 4
Do. 4% Deb. . . . .	100	4	69-72	..	6 11 1	Do. 4 1/2% Deb. . . . .	100	4 1/2	77-81	..	6 8 5

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . . . .	5	5 1/2	4 1/2-5 1/2	..	5 7 4	La Plata Elec. Trms, Ord. . . . .	1	Nil	..	..	..
Do. 2nd Pref. . . . .	5	5 1/2	4 1/2-5 1/2	..	5 11 8	Do. Pref. . . . .	1	6	..	..	6 0 0
Do. 4% Deb. . . . .	100	4	92 1/2-94 1/2	..	4 4 8	Lisbon Elec. Trams, Ord. . . . .	1	6	61-61	..	4 6 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	98-100	..	4 10 0	Do. 6% Pref. . . . .	1	6	6-11	..	4 16 0
Do. 5% Deb. . . . .	100	5	98-100 1/2	..	4 19 6	Do. 5% Deb. . . . .	100	6	91-95	..	5 5 8
Auckland Trams, 6% Deb. . . . .	10	5	101-103	..	4 17 1	Madras Elec. Tr. (1904), Deb. . . . .	100	5	101-103	+ 1	4 17 1
Bombay Elec. S. & Trams, Pref. . . . .	100	6	114-121	..	4 18 0	Minnos Trams & Lt., 1st Deb. . . . .	100	5	87-90	..	6 11 1
Do. 4% Deb. . . . .	100	4	98-100	..	4 11 10	Manila Elec. R. and Lig., Bonds	1000	6	100 1/2-102 1/2	..	4 17 7
Do. 5% 2nd Deb. . . . .	100	5	97-99	..	5 1 0	Mexico Trams Com. . . . .	1000	7	110-112 x d	..	6 5 0
Brazilian Traction Light and Power } \$100	..	..	101-103	+ 3	..	Do. Gen. Con. 6% Bonds . . . . .	..	6	98-100	..	6 0 0
Brisbane Trams Inv., Ord. . . . .	5	8	62-72	..	5 8 6	Do. 6% Bonds . . . . .	100	6	101-103	..	5 16 6
Do. 5% Pref. . . . .	5	6	52-52	..	4 15 3	Para Elec. Riys. & Lt., Ord. . . . .	5	10	7 1/2-8	..	6 5 0
Do. 4% Deb. . . . .	100	4	98-102	..	4 8 3	Do. 6% Pref. . . . .	5	6	46-53	..	5 11 7
B. Columbia Elec. Ry., Def. . . . .	100	8	141-145	+ 2	5 10 4	Do. 5% 1st Deb. . . . .	5	6	98-100	..	5 0 0
Do. Pref. Ord. . . . .	100	6	120-124	+ 1	4 16 9	Perth (W.) Elec. Tr. Ord. . . . .	100	5	133-143	..	3 14 5
Do. 5% Pref. . . . .	100	5	105-108 x d	..	4 12 7	Do. 5% 1st Deb. . . . .	100	6	105-108	..	4 12 7
Do. 4 1/2% 1st Mort. Deb. . . . .	40	4 1/2	100-103	..	4 7 5	Rangoon El. Tr. & Sup., Pref. . . . .	5	6	52-54	..	5 0 0
Do. 4 1/2% Vanouver Deb. . . . .	100	4 1/2	101-103 x d	..	4 7 5	Do. 4 1/2% 1st Deb. . . . .	100	4 1/2	97-99	..	4 10 11
Do. 4 1/2% Con. Deb. . . . .	100	4 1/2	97-100	..	5 0 0	Riodes Janeiro Trams, 1st Mort. } ..	5	5	101-103	+ 1/2	4 17 1
Calcutta Trams, Ord. . . . .	5	7	53-54	..	5 12 0	Do. 5% Mort. Bonds . . . . .	100	6	96 1/2-98 1/2	..	5 1 6
Do. 6% Pref. . . . .	5	6	4 1/2-5 1/2	..	4 17 7	Sao Paulo Tram, Lt. and P. } ..	500	5	103 1/2-105 1/2	+ 1/2	4 14 9
Do. 4 1/2% Deb. . . . .	100	4 1/2	97-100	..	4 10 0	Singapore Trams, 5% Deb. . . . .	5	6	83-85	..	6 17 8
Cape Electric Trams . . . . .	1	25	..	..	..	Southern El. Tr. B.A., 5% Deb. . . . .	5	5	99-101	+ 2	4 19 0
City Buenos Aires Trams (1904)	5	5	5 1/2-5 1/2	..	4 8 0	Un. Elec. Trams Monte Video . . . . .	5	7	61-62	..	5 19 2
Do. 4% Deb. . . . .	100	6	97-100	..	6 5 0	Do. 6% Pref. . . . .	5	6	88-88	..	5 11 7
Colombo Elec. Tr. & Lt., 5% Deb. . . . .	100	6	93-97	..	6 2 1	Do. 5% 1st Deb. . . . .	100	6	99-102	..	4 18 0
Havana Elec. Ry., 5% Bonds \$1000	5	6	98-102 x 3	..	4 18 0	Winnipeg Elec. Ry., 4 1/2% Deb. . . . .	100	4 1/2	99 1/2-102 1/2	..	4 7 10
Kaigoordie Elec. Trams . . . . .	1	Nil	..	..	6 13 8						
Do. 5% A Deb. . . . .	100	6	83-88	..	..						
Do. 6% B Deb. . . . .	100	6	80-80	..	..						

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	6	..	..	8 0 0	Crompton & Co. . . . .	8	Nil	..	..	Nil
Do. 8% Pref. . . . .	1	6	..	..	7 7 8	Do. Deb. . . . .	100	6	58 1/2-56 1/2	..	9 1 10
Babcock & Wilcox . . . . .	1	25	14 1/2-15 1/2	..	4 14 0	Dick, Kerr . . . . .	1	6	8 1/2-8 1/2	..	8 17 2
Do. Pref. . . . .	1	6	13-14	..	4 0 0	Do. Pref. . . . .	1	6	..	..	4 11 10
British Aluminium, Ord. . . . .	1	Nil	..	..	..	Do. Deb. . . . .	100	4 1/2	95-98	..	Nil
Do. 6% Con. Pref. . . . .	1	Nil	..	..	..	Edison & Swan, A, 28 paid	5	Nil	..	..	Nil
Do. 5% Prior Lien Debts. . . . .	100	5	90-93	+ 1	5 7 6	Do. fully paid . . . . .	5	Nil	..	..	Nil
Do. Deb. Sck. . . . .	100	6	86-89	..	5 12 4	Do. 4% Deb. . . . .	100	4	64-68	..	6 17 8
B.I. & Helsby Cables . . . . .	5	10	8-8 1/2	+ 2	5 17 8	Do. 5% Second Deb. . . . .	100	5	72-75	..	6 18 4
Do. Pref. . . . .	5	6	62-62 1/2	..	4 14 1	Do. 6% Pref. . . . .	2	2 1/2	33-34	..	7 1 4
Do. Deb. . . . .	100	4 1/2	102-104	..	4 6 7	Do. Pref. . . . .	2	7	13-14	..	7 0 0
British Thomson-Houston, Deb. . . . .	100	4 1/2	94-96	..	4 19 9	Greenwood & Batley, Pref. . . . .	10	7	7 1/2-8	..	8 5 8
British Westinghouse, Pref. . . . .	8	Nil	..	..	..	Do. Deb. . . . .	100	6	92-94	..	6 4 2
Do. Deb. . . . .	100	4	58-61	..	6 11 2	General Electric, Pref. . . . .	10	5	93-103	..	..
Do. 6% Prior Lien . . . . .	100	6	100-103	..	5 15 6	Do. Deb. . . . .	100	4	90-95	..	4 4 8
Browitt, Lindley, Ord. . . . .	1	..	27-29	..	Nil	Henley's, Ord. . . . .	5	17	122-123	..	6 8 0
Do. Pref. . . . .	1	..	4/6-6/6	..	Nil	Do. Pref. . . . .	5	4 1/2	44-45	..	4 7 10
Brush, Do. Pref. . . . .	2	Nil	..	..	..	Do. Deb. . . . .	100	4 1/2	101-103	..	4 7 5
Do. 5% Prior Lien Deb. . . . .	100	5	73-78	..	8 8 2	India-Rubber, G. & T. . . . .	10	..	10-11	..	6 16 4
Do. 4 1/2% Deb. . . . .	100	4 1/2	47-52	..	8 13 2	Do. Pref. . . . .	10	6	92-104	..	4 17 7
Do. 4 1/2% Second Deb. . . . .	100	4 1/2	28-32	..	11 4 4	Telegraph Construction . . . . .	19	17 1/2	64-66	..	5 13 0
Callender's Cable . . . . .	5	15	103-114	+ 2	6 10 5	Do. Deb. . . . .	100	4	85 1/2-95 1/2	..	4 1 8
Do. Pref. . . . .	5	6	42-64	..	4 17 7	Willans & Robinson . . . . .	1	Nil	..	..	Nil
Do. Deb. . . . .	100	4 1/2	97-100	..	4 10 0	Do. Pref. . . . .	5	Nil	..	..	Nil
Casner-Kellner . . . . .	1	20	2 1/2-8 1/2	..	5 5 0	Do. Deb. . . . .	100	4	67-59	..	6 15 7
Do. Deb. . . . .	100	4 1/2	100-109	..	4 2 7						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

## CONTROL OF THREE-PHASE VARIABLE SPEED A.C. MOTORS.

THREE-PHASE alternate-current motors are now used in many industrial applications in which some degree of speed regulation is desirable. Such regulation is specially necessary for economy in the case of motors driving pit fans. At the time of opening the pit, the volume of air required for ventilation may be only 40-70 per cent. of the volume ultimately needed. Assuming that the initial requirements are as high as 70 per cent. of the final maximum value, the power required during the earlier stages is only 35-40 per cent. of that required for maximum delivery. It is obviously important that the speed reduction be obtained as efficiently as possible. According to the special conditions of the case, the fan may run at reduced output for one, two, three or more years, hence any system which improves the running efficiency at reduced speed easily recovers the heaviest additional capital outlay which is likely to be involved.

The most obvious method (to the electrical engineer) of controlling the speed of a three-phase slip-ring motor, is to insert more or less external resistance in the rotor circuit. To the mechanical engineer, the most obvious means of controlling the fan delivery is to throttle the inlet passage. Both of these methods are inefficient and involve large dead losses, but of the two the former is far preferable.

In the ELECTRICAL REVIEW, August 23rd, 1912, pp. 285-286, particulars were given of the efficiency of the simple cascade system in connection with pit fan motor control, and it was shown that this system offers considerable advantages as regards efficiency and power factor. The data given below compare throttle and simple resistance control with the Scherbius system in operating a 650-H.P., 2,000-volt, 50 cycles, three-phase motor driving a Rateau fan of present and ultimate capacity, 5,600 and 8,000 cb. m. per min. respectively. The general principle of the Scherbius system is well known. In the present case, the main three-phase slip-ring motor is provided with speed regulation between 150 and 220 R.P.M., and drives the ventilating fan at corresponding speeds ranging from 325 to 475 R.P.M. Speed control is obtained by varying the excitation of an alternating-current commutator motor connected to the main motor rotor, thus applying variable back E.M.F. to the latter. When the speed of the main motor is less than normal (here 485 R.P.M.) slip energy is transferred to the commutator motor which drives an induction generator feeding energy back to the supply mains. The necessary hand and automatic switchgear is provided for starting and controlling purposes; this need not be considered in the present connection, but a full description is to be found in "Gluckauf," 48 pp. 1,668 *et seq.*

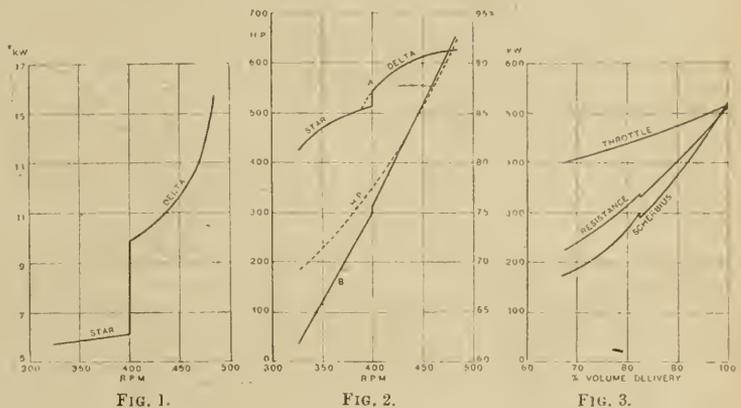
A centrifugal governor is mounted on the converter shaft and coupled to an isolating switch, so that energy supply is interrupted in the event of the converter racing, owing to any fault which prevents return of energy to the bus-bars. Special switchgear is provided to enable the stator coils of the main motor to be placed in "star" for low speeds and in "delta" for high speeds; as shown by fig. 2, this conversion considerably improves the overall efficiency at low speeds and improves the commutation of the converter motor by keeping the applied voltage at a low value.

By the use of a phase transformer and switchgear, the power factor of the main motor can be brought to unity or a leading current can be taken if desired (though efficiency is then somewhat sacrificed owing to the higher copper loss). For convenience and efficiency, it is desirable to place the whole equipment within as small a space as possible, but, if so desired, the main and auxiliary parts can be located in separate rooms.

The light losses in the present equipment at various speeds are shown in fig. 1, and the overall efficiency on load (at various speeds and hence volume outputs), is shown by Curve A, fig. 2. This curve clearly shows the gain in efficiency by star connection when running at low speeds (the decreased iron losses then more than compensating for the higher copper loss); at about 330 R.P.M., either connection yields the same efficiency (85.2 per cent.).

The considerable advantage in favour of the Scherbius system, as compared with simple rotor resistance regulation is shown by Curve B, fig. 2.

Fig. 3 compares the above two systems with throttle regulation. The curves for the Scherbius cascade converter system and simple resistance control are transferred from fig. 2 (taking account of the percentage volume output corresponding to various fan speeds). The power curve for the throttle regulation system is determined as follows: The volume of air delivered is, at constant R.P.M., proportional to the equivalent aperture, with which, therefore, varies the driving power so long as the fan efficiency is constant. Fig. 2 shows that the motor H.P. = 650 for a speed of 485 R.P.M., and, corresponding to a speed of 330 R.P.M. =  $\frac{330}{485} \times 650 = 442$  H.P. Taking into account the alteration in fan efficiency, the (power-volume) curve falls linearly from 650



to 495 H.P., and, accounting for motor efficiency, the actual (H.P.-volume) curve is as shown in fig. 3.

Throttle regulation is clearly very inefficient; resistance regulation is much more efficient, and the additional capital outlay required is only the difference in cost between the starter required under the throttle system and the resistance regulator required in the other case.

In this instance, the Scherbius system required a capital outlay nearly £750 higher than would be required by a simple resistance regulator. At first sight, this appears to be a serious matter, but if the fan runs continuously for 18 months at 70 per cent. of its rated volume output, the power saved is 53 kW., and, with electrical energy at 0.3d. per unit, the reduction in the total energy bill more than recoups the additional capital outlay in question.

**A Novel Electro-medical Outfit.**—According to a recent issue of the *Autocar*, Dr. Gamlen, of West Hartlepool, has had his car fitted to his own plans with an electric equipment whereby electrical current can be generated for a portable X-ray equipment. When it is desired to set up the equipment, the near side back wheel is jacked up and removed, and a spare wheel, which is carried minus its tire, is used as a belt pulley and coupled up to the pulley on a portable dynamo by a short flat belt. The dynamo is supported on a small table carried on the car, the table in question being fixed to the running board so as to maintain the tension of the belt drive. The rear mudguard of the car is made readily detachable, so that it shall not be damaged or get in the way of the belt. In addition to providing current for the X-ray equipment, this arrangement, by the aid of a special switchboard, enables various forms of electrical treatment to be administered, the car meanwhile being, of course, outside the patient's house. Plenty of cable is carried to enable the current to be taken to any convenient point.

**GRAPHS IN A CABLE-SHIP DRUM-ROOM:  
NOTES FOR JUNIOR ASSISTANTS.**

By EDWARD RAYMOND-BARKER.

(Continued from page 115.)

32. A more serviceable example of the graph method is shown in fig. 4.

Ordinates.—Cable circumference in inches.

Abscissæ.—Percentage of cable-length increase for any given cable drum (in this case,  $d_1$ ) due to addition of any cable circumference.

A curve, as shown in fig. 4, may be prepared for any given cable drum.

In fig. 4 dots are plottings for 3 in. to 9.5 in. cable circumferences. Crosses and circles are plottings from tabular records of two cable-laying expeditions.

33. Practical application of fig. 4.—Certain cable, in course of cable-diversion operations, was picked up, amounting to 7,585 revs. of drum  $d_1$ . Mean cable circumference



FIG. 4.

was found to be 4.4 in. In fig. 4, co-ordinates in dotted lines show that, in the case of this particular drum ( $d_1$ ) and cable 4.4 in. circumference, a further 2.075 per cent. must be added to the uncorrected length picked up.

34. By uncorrected drum-constant ( $d_1$ )—see fig. 3—cable picked up =  $7,585/344.15 = 21,838$  N.M.

$2,075$  per cent. of  $21,838 = 0,453$  N.M. (By slide rule.)

$21,838 + 0,453 = 22,291$  N.M., correct length picked up.

35. To check the above figures by the customary method:—(See 23).

$$\text{Corrected drum-constant} = \frac{73,044}{212.21 + 4.40} = 337.16;$$

$7,585/337.16 = 22,291$  N.M., correct length picked up.

Note:—Figs. 3 and 4, as printed, are on a scale about 1.75 of the original curve-sheets.

36. A useful table during the laying of a cable is one in terms of drum-revs. per min., and the equivalents in N.M. per hour for all cable types on board. In 24 there is an example of 1 corrected drum-rev. of 0.002941 N.M. This refers to cable of 2.60 in. circumference. Let us take a paying-out speed of 40 drum-revs. per min.  $\times$  60 min. = 7.06 N.M. per hour.

37. A quick way of compiling a table is to take—say—the above example, as follows:— $0.002941 \times 60 = 0.17648$  as a constant for a given type of cable.

Then  $0.17648 \times 30$  revs. per min. = 5.29 N.M. per hour,  
 $0.17648 \times 40$  revs. per min. = 7.06 N.M. per hour,  
and so on.

38. An alternative plan is to apply graphic methods by utilising the curve in fig. 4, which is that for drum  $d_1$ , with an uncorrected constant of 344.15, as shown in fig. 3.

Then  $1/344.15 = 0.0029058 \times 60 = 0.17435$ .

$0.17435 \times 40$  revs. per min. = 6.97 N.M. per hour uncorrected. The circumference of the cable in question is 2.60 in.: therefore, by curve in fig. 4, to 6.97 a further 1.225 per cent.—that is, 0.09 N.M.—has to be added, = 7.06 N.M. per hour, as in 37.

In this way a table may be compiled, in view of subsequent correction from curve in fig. 4, applicable to all cable types.

39. The following practical and comprehensive example deals with a length of cable made up of four different types: Shore End ( $AA_2$ ), Heavy Intermediate (E), Light Intermediate (B), and Deep Sea ( $D_1$ ).

During certain cable-laying operations the exact length paid out from shore up to a given time, say, 8 p.m. was required. The said length included three splices (sp.) uniting four different types of cable.

40. Data:—

Circumference of paying-out drum (see 19)	=	212.24 in.
„ „ cable type $AA_2$ (see 27)	=	6.775 „
„ „ „ „ E	=	4.680 „
„ „ „ „ B	=	3.564 „
„ „ „ „ $D_1$	=	2.600 „

41. The several drum-constants (see 23) therefore become:—

For type $AA_2$	=	333.50 revs. per N.M.
„ „ E	=	336.72 „ „ „
„ „ B	=	338.46 „ „ „
„ „ $D_1$	=	339.98 „ „ „

42. When sp.  $\frac{AA_2}{E}$  passed drum, indicator (see 17) showed 2,331 (+ .5) revs.

$2,331.5/333.50 = 6.991$  N.M. type  $AA_2$  paid out.

When sp. E/B passed, indicator gave 11,481.5 revs.

$11,481.5 - 2,331.5 = 9,150$  revs.

$9,150/336.72 = 27.175$  N.M. type E paid out.

When sp. B/ $D_1$  passed, indicator gave 16,618.5 revs.

$16,618.5 - 11,481.5 = 5,137$  revs.

$5,137/338.46 = 15.178$  N.M., type B, paid out.

At 8 p.m., drum-indicator gave 23,993.5 revs.

$23,993.5 - 16,618.5 = 7,375$  revs.

$7,375/339.98 = 21.692$  N.M., type  $D_1$ , paid out up to 8 p.m.

$$\text{Total paid out} \left\{ \begin{array}{l} \text{Type } AA_2, \quad 6.991 \text{ N.M.} \\ \text{„ E,} \quad 27.175 \text{ „} \\ \text{„ B,} \quad 15.178 \text{ „} \\ \text{„ } D_1, \quad 21.692 \text{ „} \end{array} \right\} = 71.036 \text{ N.M.}$$

43. The above is the customary routine. If, to the same example, we apply the graph method described in 32 . . . 34, figures will be as follows:—

**GRAPH METHOD.**

Drum-constant as it is per se, a real absolute invariable constant, uncorrected for any cable circumference =  $\frac{73,044 \text{ in.}}{212.24 \text{ m. circ.}} = 1 \text{ N.M.} = 344.15$  revs. per N.M.

Measurements from curve in fig. 4 show that to drum-indicator lengths of cable types:—

$AA_2$ circ.	6.775 in.	a correction of	3.19 %	must be added.
E „	4.680 „	„	2.21 %	„ „
B „	3.564 „	„	1.68 %	„ „
$D_1$ „	2.600 „	„	1.23 %	„ „

Applying graph values from fig. 4 to the above example (42):—

When sp.  $A_2/E$  passed, indicator = 2,331 (+ .5) revs.  
 $2,331.5/344.15 + 3.19$  per cent. =  $6.775 + 0.216 = 6.991$  N.M. ( $A_2$ ).

When sp.  $v/h$  passed, indicator =  $11,481.5 - 2,331.5 = 9,150$  revs.  $9,150/344.15 + 2.21$  per cent. =  $26.587 + 0.588 = 27.175$  N.M. (E).

When sp.  $w/d$ , passed, indicator =  $16,618.5 - 11,481.5 = 5,137$  revs.  $5,137/344.15 + 1.68$  per cent. =  $14.927 + 0.251 = 15.178$  N.M. (B).

At 8 p.m. indicator =  $23,993.5 - 16,618.5 = 7,375$  revs.  $7,375/344.15 + 1.23$  per cent. =  $21.429 + 0.263 = 21.692$  N.M. (D).

Total paid out up to 8 p.m. =  $71.036$  N.M.

N.B.—The foregoing percentage corrections are quickly applied with a slide rule.

lying may conveniently be ascertained by the paying out—simultaneously with the cable—of a fine steel wire absolutely taut, the speed rate of which is accurately given by a measuring wheel and counter. This method was first advocated in 1876 by the late Dr. Werner Siemens, but it did not come into general use until a comparatively recent date. The *taut-wire* device may best be described in the words (abridged) of its originator, from a paper read by him before the Society of Telegraph Engineers.

17. "To obtain precisely any desired slack, the only method will be to pay out, with the cable . . . a wire. . . . If this wire . . . be retained with sufficient brake power to be paid out without slack, and, therefore, with tension on the sea bottom, a counter will give the exact progress of

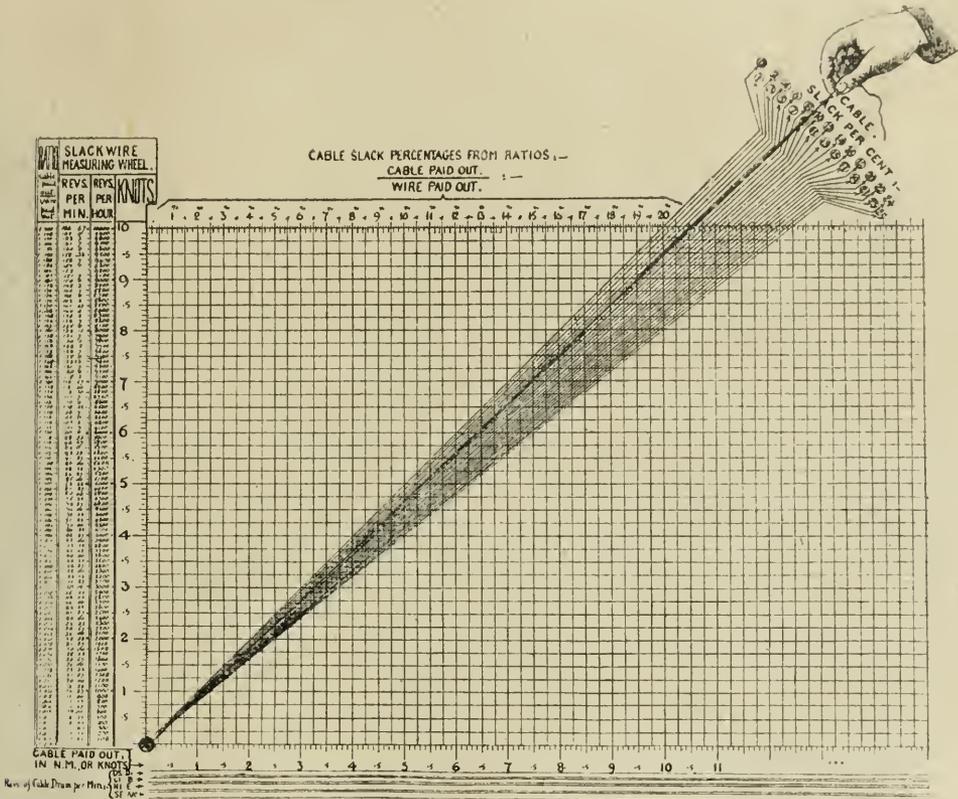


FIG. 5. (Reduced from 2 ft. 5 in. x 1 ft. 11 in.)

CABLE SLACK PER CENT.

44. One of the many important mechanical data in great request during cable-laying operations is that relating to the percentage of slack laid at any given time, or average slack for any given time period.

The amount of slack required varies with attendant conditions, having regard, chiefly, to the nature and configuration of the sea bottom over which the cable ship is passing.

There are various ways of estimating traversed distance (nautical miles) or speed rate (knots) over ground—i.e., an imaginary line representing the track of the ship from point to point.

45. Given the distance over ground, and the amount of cable actually paid out; or, given the speed (s) of the ship through the water, and that (c) at which the cable is actually paid out, a simple comparison affords the necessary

data for knowing slack per cent. (P), or  $P = 100 \frac{c - s}{s}$ . On

the other hand, given the speed (s) of the ship, and the percentage (P) of slack thought desirable, the speed at which the cable must leave the ship may be calculated, or  $c = s + Ps/100$ .

46. The ship's speed through the water during cable-

the vessel, even without the errors caused by currents; therefore the brake has only to be maintained under the pressure that will give any desired ratio between the velocities with which the cable and the wire are run out. . . ."

TAUT-WIRE GEAR IN PRACTICE.

48. In recent practice the taut-wire measuring wheel has been given a *circumference* which, allowing for the circumference (see 20 . . . 22) of the 0.032 in. diameter bright steel wire (S.W.G. No. 21) weight 16.74 lb. per N.M., will cause its every revolution when carrying the wire round the wheel's V-section periphery, to be equivalent to exactly one-thousandth of a nautical mile = 0.001 N.M. = 6.087 ft. = 73.044 in. of wire.

49. An equivalent of a speed-rate of one measuring-wheel rev. per min. of course would be  $0.001 \text{ N.M.} \times 60 = 0.060 \text{ N.M. per hour}$ . On this basis a convenient table may be compiled to include all values within likely limits. Example:—

- 100 revs. per min. = 6.00 N.M. per hour.
- 155 " " " = 9.30 " " "

50. Custom varies regarding the appellation of this contrivance which, sometimes, instead of being called the *taut-*

wire, receives the name of *slack wire*, from its use in leading to a knowledge of cable *slack* per cent. paid out.

#### CABLE SLACK PER CENT. GRAPHS.

51. The writer has devised a series of graphs illustrative of the whole question of the ratio between the two velocities, viz., of *taut-wire* and of *cable*.

52. Fig. 5, although unsuitable—as will further be explained—for final adoption in practice, shows the general principle of the cable-slack graph. Under the heading "*slack-wire measuring wheel*," a vertical scale graduated in knots (*i.e.*, N.M. per hour) stands parallel to equivalent slack-wire values in terms of *revs. per hour*, and *revs. per min.*

53. At right angles to the vertical scale lies a horizontal scale graduated in *cable* knots.

54. Parallel with the horizontal cable-distance or cable-speed scale, are spaces in which, on the occasion of each expedition, cable speeds may be pencilled in terms of *paying-out drum revs. per min.* for all the various types of cable on the ship. These pencilled drum-revs. per min. may be erased when done with. Drum-rev. spaces will be shown in more developed form in fig. 7.

55. From the *origin* of the vertical and the horizontal axes, straight-line "curves" are drawn diagonally across the diagram-sheet to figures in terms of cable-slack per cent., zero per cent. to 20 per cent.

56. *Taut-wire* and *cable* co-ordinates always intersect on, or close to, the corresponding diagonal line indicating *cable slack* per cent.

57. The diagonal line on which any *taut-wire* and *cable* co-ordinates intersect will, at its upper end, indicate *cable slack* per cent.

58. If the co-ordinates intersect *between* two diagonal lines, the decimal fraction to be added to the lower percentage may easily be appreciated.

59. A black thread—one end pinned at the point of origin, the other held taut in the operator's hand—on being brought to the intersection of *taut-wire* and *cable* co-ordinates, will be found to coincide with the diagonal line indicating *cable slack* per cent.

60. Conversely, if the thread be brought to the intersection of any *taut-wire* co-ordinate with any *slack per cent.* diagonal, that *cable* co-ordinate found to pass through the same intersection will, at its lower end, indicate the *cable speed* necessary to bring about the required *slack per cent.*

Note : Practical examples will be given from later graphs.

61. Fig. 5 includes a supplementary vertical column of ratios *cable/wire* paid out.

A horizontal line, extended from any given ratio, abuts on the *zero* diagonal line at a point from which a vertical line, at its upper end, will indicate *cable slack* per cent.

62. Fig. 5 sufficiently indicates general principles, but is weak in regard to practical requirements, inasmuch as, where the diagonal straight-line curves approach to and converge at their common *origin*, they merge into a useless blur.

(To be continued.)

## PROCEEDINGS OF INSTITUTIONS.

### The Steam-Gas Turbine.

(Abstract of THE JAMES WATT LECTURE, 1913, delivered by DR. S. Z. DE FERRANTI, Past-President I.E.E., at Greenock, before the JAMES WATT CLUB, January 16th, 1913.)

I HAVE chosen the subject of "Prime Movers" for the lecture, and have done so for several reasons. James Watt was practically the inventor of what we know as prime movers. This subject is, I think, the most interesting problem in engineering. It is also a subject which is more than ever interesting to-day on account of the active competition existing between the various systems of power production, and lastly, I have chosen this subject because it is the one which interests me above all others. You have had shown to you what splendid results Watt achieved, and what an immense effect these achievements have had upon the world's progress. You have, however, I think, heard little of what these achievements cost James Watt, and of the enormous difficulties he had to overcome in order to bring about the utilisation of his inventions. When at last he got some measure of assistance, there were endless mechanical difficulties to overcome, as in those days engineering practice was of the crudest possible nature. I consider that one of the greatest things ever achieved by James Watt was his discovery of Matthew Boulton; if it had not been for the magnificent support extended to him by Matthew Boulton, I cannot conceive how his inventions could have resulted in anything but failure and complete despair.

The same sort of thing is going on to-day in many directions. I am also afraid that in this country the difficulties of inventors are very great, owing to the want of interest in anything new. Although I think we have plenty of inventors, we have very few Matthew Bouldons, and from the point of view of progress and development of the country, it is men such as he who are wanted to-day. It is generally believed that the immense development which has taken place in Germany is largely due to the intelligent use of her scientific men by the commercial community. In the United States there also appears to be a much better chance for the man who is desirous of developing new things, and this undoubtedly must help these countries to progress and keep ahead in the industrial struggle. It is vital to the progress of the country, in order that we should not fall behind our competitors, that great risks should be taken in the development of new ideas, and it would be a good thing for the country generally, if there were more keenness in this direction. I do not think that to-day this country is spending anything like enough in the development of new ideas.

In steam we have a power the whole of which is available for doing useful work. The power required for pumping the water into the boiler, which is the negative work of the cycle, is so small that it is almost negligible. Whatever the power given by the steam in the cylinder, less the friction of the engine it is available for doing useful work. It is, therefore, clear that however inefficient the engine may be, it will go round and do some useful work.

Although the Newcomen engine was in use before the days of Watt, it was exceedingly uneconomical, and his great work was the improvement of the efficiency of this engine to such an extent that it became useful and economical for general service. The greater part of the work done since his time has been in the same direction—viz., in a continual endeavour to improve the efficiency of conversion of the heat in the fuel into mechanical work.

With this object in view, higher steam pressures involving higher temperatures were introduced and compound engines, and later on triple expansion engines were developed to more effectively utilise the higher ranges of steam pressure. The work of Sir Charles Parsons in the invention and development of the rotary principle to the production of motive power by means of steam must ever be remembered as a great advance in the development of prime movers. The turbine, notwithstanding its very low efficiency as first constructed, was gradually improved until high-mechanical efficiencies of conversion have been reached. Especially is the turbine valuable in the production of large powers and in taking advantage of high degrees of vacuum.

Before, however, the modern turbine had been developed, another idea had been pursued with a view to simplifying the process of power generation, and, at the same time, getting a higher economy. Years ago an engine was invented and built by Lenoir, in which a charge of air and gas was sucked into the cylinder at atmospheric pressure and exploded. The piston speed in this engine was low, the ratio of expansion was low, and, needless to say, the economy was very poor. Still, it was a step in the direction of higher economy, inasmuch as by this system a higher temperature of working fluid was obtainable. Later on, Otto and Langen invented a gas engine, which was an improvement on the previous one as the pressure of explosion was higher and the ratio of expansion was greater. Both these engines, although of the explosion type, came under the heading of "low negative work," as the explosive charge was simply sucked into their cylinders, and was not compressed before firing.

The great move forward, which was next made, was that of compressing the charge of explosive mixture before firing, and so getting a high maximum temperature, a good ratio of expansion and, consequently, much improved economy. Engines of this type belong to a class of prime movers with "high negative work." In this form of engine the positive work of the explosion has to have deducted from it, not only the friction of the engine, but also the amount of work required to compress the charge which constitutes

**Credit and Security.**—A certain amount of ephemeral interest has been excited by the replies of Mr. J. P. Morgan in his examination before the so-called Money Trust Commission at Washington. Mr. Morgan is reported to have said that credit is based primarily upon character, and not upon money or property, otherwise collateral or collateral security. In another place he is alleged to state substantially his practice thus: "I always know the person to whom I lend, or something of him." "If I see there is a loan to Mr. Smith, and I do not like his character, I say, you call that loan right away" (which is very Yankee). "I would not have that loan in the box." "I would not have that loan."

There is nothing that is original in these statements. Naturally if a person has achieved an unenviable notoriety, in other words, whose character is bad, some people would possibly not entertain his proposals on any security; but premising that person to possess a character above suspicion, it is too much to say that his unimpeachable character alone would gain him his object without the production of substantial and the proper kind of collateral. At any rate, generally speaking, neither "Lombard Street" nor "Threadneedle Street" nor any other locality would look at such a proposal. In practice interest and security frequently regard character as a negligible trifle.

the negative work of the cycle. There is a further deduction, viz., that of the friction of the engine or of a separate pump whilst doing negative work. These deductions are very serious and would render this class of motor useless, were it not for the high mechanical efficiency of the parts used for carrying out the cycle.

In the gas engine the negative work is high, but not so high as to form a serious difficulty. In the more economical Diesel engine in which very high pressures are used, so as to get a high enough temperature to burn the oil as sprayed into the cylinder and give a high ratio of expansion, the negative work is a much more serious difficulty.

The development of the internal-combustion engine of high negative work, which was started before the birth of the modern steam turbine, has been vigorously pushed on over a period of years concurrently with the work done on the turbine, and now both are competing for premier place in furnishing the world's power.

It seems, according to present knowledge, to be clear that for small powers the internal-combustion reciprocating engine is in every way the best. At the other end of the scale the turbine is the only means of filling our requirements to-day. In between these two extremes there is a doubtful dividing line where either form of engine may best serve the purpose, according to the conditions of the particular case.

As the turbine gets bigger, so is it easier to construct, and it also becomes more economical. As the gas or oil engine gets bigger I need hardly remind you how the natural difficulties increase. On the other hand, as the turbine is reduced in power its economy falls off badly and it is difficult to make a satisfactory design. The internal combustion engine, on the contrary, becomes a most satisfactory and economical machine in small sizes, as witness the thousands of gas engines in use all over the world and the beautiful engines working on the Diesel cycle which are small enough to avoid water cooling of the pistons.

I think that this division of the means of power production by large and small units between the rotary and reciprocating machine is almost a natural law, and those who seek to evade it must either invent some new principle or court endless trouble, expense and failure.

To-day, with a complete disregard of the above principles, the advocates of the Diesel engine for marine propulsion are spending vast sums of money on its development, but even this usually all-powerful force may not prove enough to make a wrong principle right. The daily Press and also our well-informed technical journals tell us of all the wonderful successes of large oil engines in Germany and elsewhere, but I can assure you that few people have any conception of the failures and breakdowns which have occurred, and which are repeatedly occurring, with the big experimental engines that have been constructed. In Germany, especially, where so much has been done in this direction, they carefully avoid informing the foreigner on these points.

As I mentioned to you at the beginning of this lecture, the subject of prime movers is one in which I have always been most interested, and in following it my constant aim has been to increase the amount of work that can be usefully obtained from a given amount of fuel. It is, of course, well known that the higher the temperature of the working fluid the higher is the economy that can be obtained. High temperatures have, however, proved very difficult to work with, and as an instance of this, the low working temperatures of turbines for marine propulsion may be pointed out. Seeing, however, that the difficulties were mechanical and that great advantage could be derived if these troubles were overcome, I commenced experimenting some years ago, and have now after many failures, and the expenditure of much money and time, produced a turbine which at the highest temperatures, and with great and rapid variations of temperature, is quite free from mechanical troubles. Indeed, I believe that this turbine is perhaps the strongest from a mechanical point of view that has yet been produced. Moreover, contrary to what might have been expected with a high temperature machine, it runs with certainty with a blade end clearance that is so small that it is almost negligible from the point of view of leakage loss, and the fear of the possibility of stripping appears to have been effectively removed.

In this turbine I superheat the steam initially, and after the first expansion, and whilst it is still superheated, resuperheat it before it does its work in the second stage of the turbine. After this it is exhausted in a superheated condition through a regenerator to the condenser. The whole of the blading is electrically welded, so as to avoid the straining due to caulking at the high temperatures that are reached, and also the loosening that occurs due to the same cause. The blading is formed of mild steel with a thin coating of pure sheet-nickel electrically welded on to the surface. The blading is most accurately finished to shape by a process of step-by-step pressing under very heavy pressure.

The blading, the sections of which are very exact, is welded in position with the accuracy of the automatic machine that is used for the purpose, and every opportunity is thus given for realising the best results. Although the turbine is of the reaction type, no balance dummy is used. The whole of the end load is taken on a specially constructed thrust, thus saving steam leakage.

The steam is worked as a gas at high temperature throughout the turbine, and this, coupled with the many improvements above referred to, has given very good results.

The 5,000-h.p. machine, which has now been running for some time, when tested at a load of two-thirds full power, has given a shaft h.p. on 7 lb. of steam, which, if supplied by an oil-fired boiler superheater system of 85 per cent. efficiency, which has already been exceeded in central station practice, would consume less than 625 lb. of oil per shaft horse-power.

From many tests already made, it appears that when this turbine is run at full load under favourable conditions it will take less than 6 lb. of steam per shaft horse power, and that the system under the conditions named will have a thermal efficiency of over 21 per cent. corresponding to an oil consumption of about 55 lb. of oil per shaft horse-power. The tests are being proceeded with, but as the turbine is run continuously in supplying power to a large works with a constantly varying load, it is not easy to do what is necessary to enable tests to be carried out. So far as I can see, this system when applied on a large scale, will be capable of giving an overall thermal efficiency of 29 per cent.

When the advantages of the turbine system in the way of lightness, simplicity and certainty are borne in mind, and when they are compared with what is known of the complicated reciprocating oil engines now being introduced for marine purposes, the possibilities of the new system of high-temperature gas steam turbine become of great interest.

Steam as a practical motive power so brilliantly invented and applied by James Watt has had a long and most useful application in our civilisation, but it cannot be looked upon as the eventual solution of the power problem even for large powers. It can, however, be immensely improved in efficiency, and as it does not appear that there is any other system at present which will fill the same requirements, it is probable that it will still have an enormous application.

With a high-temperature steam turbine of large size generating electricity to supply power for all purposes on land one has the advantage of a machine of the highest efficiency which is not limited to oil for its fuel. It is probable that as improvements are made the whole of the coal used for firing these large units will be gasified, and the by-products recovered. When this result is brought about we shall have not only an ample and cheap supply of fertiliser for the land, but also a great quantity of the tar oils, which will form a suitable means of firing for naval purposes, and will relieve us from the necessity of purchasing fuel oil abroad and the risk and cost which this process involves. We will also have an ample supply of benzol for all our small motor requirements. This, I think, is the solution of the fuel problem for these motors rather than in the production of alcohol on a large scale from the land, as has lately been advocated. When we are supplied with ample quantities of fertiliser at a low cost, both the land and the labour involved for the production of alcohol will be much better occupied in other ways. After all, the great problem for this country is to so utilise the coal that we produce that we make it fill our every requirement. This, I have shown you, will be done in the not distant future.

The electric motor which gives its power in a rotary form, and which is supplied from very large power stations, is displacing all forms of small engine. It is, therefore, probable that in the future small prime movers will only be required to propel cars and boats, and that all stationary motors will be electric. The electric motor, with its one running part so easily and conveniently applied to all purposes, is a good illustration of the desirability, and even the necessity, of the rotary principle of engine. Reciprocating forms of engine will, no doubt, be used for a long time, but they can only be regarded as makeshifts, and so soon as an equally efficient machine for any particular purpose is developed, it must surely displace the reciprocating motor. No doubt, as knowledge increases, many forms of prime mover will be developed of higher and higher economy. It is difficult to predict the form of the prime mover of the future, but, in search of the highest economy, and with the limitations of temperature imposed by known materials, one is inclined to look to electricity converting the energy of the fuel at low temperatures, and giving its power in rotary form as the most likely eventual solution.

### The Design of Apparatus for Improving the Power Factor of Alternating-Current Systems.

By MILES WALKER, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, London, January 9th, 1913.)

THIS paper will be confined to a short statement of the principles involved and a description of the phase-advancer built by the British Westinghouse Co.

We may look at the cause of the lagging current in the following way:—The energy stored in any magnetic field consists of two factors—(a) the total flux; (b) the magneto-motive force driving that flux.

Now, the total flux when created at a certain frequency produces a certain back E.M.F. in each turn encircling it, and the magneto-motive force requires for its production a certain number of amperes-turns. Thus, from the two factors—flux and magneto-motive power—we arrive at certain factors necessary for the production of the alternating magnetic field at any given frequency. These factors are:—(1) Electromotive force per turn; (2) number of turns; (3) amperes per turn.

Grouping 1 and 2 together, we arrive again at two factors—volts and amperes—whose product represents the idle component of the power required to generate all the alternating fields in the distribution system.

The higher the frequency of the supply the greater will be the idle component of the power required to produce the alternating field. If the field can be produced by a rotating magnet (as, for instance, in a synchronous motor) excited by continuous current, the frequency of the current being zero, no idle component is necessary. Indeed, by supplying more continuous-current turns than

are necessary to produce the magnetic field in any particular machine, it is possible to create in the system a leading current, which will compensate for a lagging current in another part of the system. The field current in the magnet of an alternator may be said to have two functions:—

1. To produce the magnetic field which generates the electromotive force in the alternator itself.
2. To supply an additional magneto-motive force, which by means of a wattless current is communicated to all the machines in the system that have not got continuous-current excitation themselves.

If we are to reduce the wattless current we must either use machinery requiring weak magnetic fields, or we must provide independent means of magnetising the fields. A modern transformer does not take a large wattless component in proportion to its output, because, though the total flux generated may be great, the magneto-motive force required to produce that flux is very small. An induction motor, however, having necessarily an air-gap and coils of considerable magnetic leakage, has in it a magnetic field which requires a wattless component of 25 to 30 per cent. of the kilovolt-ampere rating of the motor. For this reason the induction motor is the main cause of low power-factors in our alternating-current systems.

If now the magnetising current of an induction motor can be supplied at the frequency of the slip (say, one cycle per second), instead of at the frequency of supply (say, 50 cycles per second), the wattless magnetising kilovolt-amperes are very much reduced.

In 1895, M. Leblanc proposed to supply the magnetising current to the rotors of induction motors and generators by means of special exciters, which consisted of commutating alternating-current generators whose magnets were excited by the rotor currents.

The main objection to the method, as described in Leblanc's early patent, is that it requires two or three exciters, and as the currents to be dealt with would in general be large, the cost of these exciters becomes excessive. Leblanc has described an exciter which embodies in one machine all phases, and is of a very simple nature. This is illustrated in figs. 1 and 2, which show two-pole armatures, one arranged for two-phase and one for three-phase.

The armature is made like an ordinary drum-wound continuous-current armature. It is surrounded by a simple ring of laminations, having inwardly projecting poles, but without any field windings. The notches in the field are to aid commutation. If such an armature, as illustrated in fig. 1, be provided with four brushes, placed at 90° to one another on the commutator and connected to the four slip-rings of a two-phase rotor of an induction motor, and is run at a speed which is high as compared with the frequency in the rotor circuits, it will have the effect of producing leading currents in the rotor. The beauty of this exciter is that the armature currents themselves excite the field, and produce a flux in the armature which is in such a phase as to generate an E.M.F. in each circuit, exactly at right angles to the current carried by that circuit. For, at the instant when the maximum current is going into the armature by brush A<sub>1</sub> and out at brush A<sub>2</sub>, the armature will be magnetised with one pole at the top and another pole at the bottom, so that no E.M.F. is generated in phase A, but a

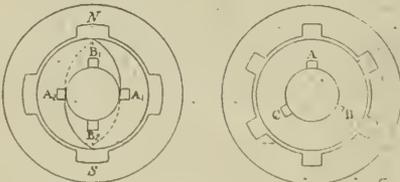


FIG. 1.—LEBLANC'S TWO-PHASE EXCITER. FIG. 2.—LEBLANC'S THREE-PHASE EXCITER.

maximum E.M.F. is generated in phase B. Thus we see that the E.M.F. in any phase is always at right-angles to the current in that phase. The question whether the E.M.F. leads or lags behind the current depends only on the direction of rotation. Such an exciter can be built for three phases, as illustrated in fig. 2, and would be much cheaper to build than three separate exciters. By proper design, and by using carbon brushes, the commutation can be made sufficiently good; but in view of the fact that the rotors of induction motors of large power usually carry very heavy currents, the commutator of such an exciter, say, for a 1,000-H.P. motor, would be of considerable dimensions.

A. Scherbius, in a recent communication, gave an illustration of a phase advancer of this type made by Messrs. Brown, Boveri & Co., capable of bringing to unity power-factor a 600-H.P. motor. This machine is illustrated in fig. 3. The overall dimensions of this set are 50 in. x 22 in. x 25 in., and its weight 750 lb. The ccs  $\phi$  curves of a 400-H.P. 32-cycle motor running at 160 R.P.M. both with and without the advancer are given in fig. 4.

It will be recognised that the stationary iron frames in figs. 1 and 2 are not really necessary, except in so far as they may reduce the magnetic reluctance of the magnetic circuit when an open slot-winding is used on the armature. If a winding with closed slots is used, the magnetic circuit may lie wholly within the armature. While the armature rotates, the field remains stationary as long as a continuous current is supplied to one set of brushes. If currents slowly alternating, such as those from a rotor winding, are supplied, the field slowly revolves in space while the rapidly revolving armature conductors cut across this field and generate the necessary

leading electromotive forces. An exciter of this kind, having no external field, has been made by Messrs. Brown, Boveri & Co. The use of the external frame, however, seems to possess several advantages; it enables open slots to be used on the armature, and by fixing the position of the field independently of the currents carried by the armature, enables the commutation to be performed in a thoroughly satisfactory manner.

It should be pointed out that the main reason why the phase-advancer has a fair chance of commercial success is that it is a machine of small output in comparison with the amount of change of wattless load which it is capable of effecting when used in conjunction with an induction motor of suitable size. A phase-advancer of only 30 K.V.A. capacity is capable of changing the power-factor of a 1,300-K.V.A. motor from 0.88 lagging to 0.95 leading. That is to say, the motor instead of requiring to be fed with lagging wattless current to the amount of 600 K.V.A. will relieve the generators supplying the system of a wattless load of 400 K.V.A., making a total change in the wattless power of 1,000 K.V.A. to the good. The reason is that the phase-advancer stands in the same relation to an induction motor as an exciter does to a synchronous motor. An exciter of comparatively small capacity can over-excite a synchronous motor so as to make it supply a wattless load 50 times as great, measured in K.V.A., as the rating of the exciter. Now, if for some mechanical work a large induction motor must be employed, the extra cost of making that motor run at unity, or even at a leading, power-factor is not very great. It is merely a question as to the cost of an advancer whose rated output is some 3 to 6 per cent. of the rating of the motor, and the cost of a three-phase double-throw switch for putting it in and out.

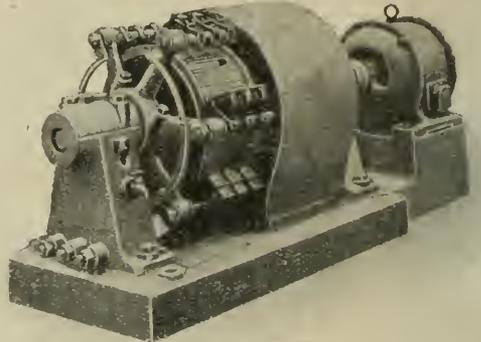


FIG. 3.—SCHERBIUS PHASE-ADVANCER.

The armature may either be of the open-circuit star type or of the closed-circuit type. Both kinds of armature commutate well. The first (fig. 5) is suitable when the current to be collected on the commutator is very great and the voltage to be generated is small, say not more than 15 volts. It enables a very wide brush (extending

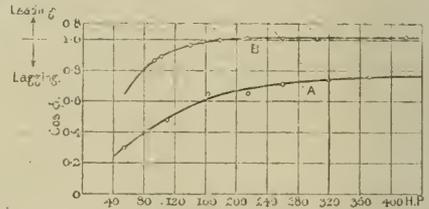


FIG. 4.—POWER-FACTOR CURVE OF A 400-H.P. MOTOR: A, WITHOUT THE PHASE-ADVANCER; B, WITH THE ADVANCER IN CIRCUIT.

over 07 of the pole pitch) to be used. The second type (fig. 6) is suitable when the current is not very great and the voltage is higher. The illustration given in fig. 11 relates to a machine with a closed armature winding. The design is identical with that of some smaller machines of 6-K.V.A. rating now running in commercial service, but the dimensions shown are suitable for an advancer of 30-K.V.A. output.

The cases that will be found most suitable for the addition of phase-advancers to induction motors are those where the motors are intended to run continuously in one direction throughout the greater part of the day. If a motor is intended to be started and stopped frequently, or reversed, then it is not suitable.

Let us suppose that we wish to design a phase-advancer to be direct-connected to an 800-H.P. induction motor driving a continuous-current generator. If the motor has already been built, it is necessary to inquire whether its rotor is provided with a winding brought out to slip-rings; and if so, whether the slip-rings and brush gear are designed to carry the full-load current continuously. One could adapt a phase-advancer to almost any normal rotor winding (except, of course, a short-circuited winding); but if the

current is very high and the voltage low, the cost of the advancer will be greater than where the current is fairly small and the voltage higher.

Suppose that the rotor has a three-phase star-connected winding having a stand-still pressure of 800 volts per phase. The working current (that is to say, the current in phase with the voltage) will then be about 255 amperes, which can be collected on a comparatively small collector. To find the rotor current necessary to

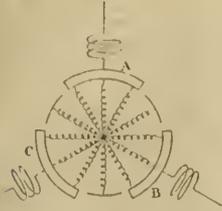


FIG. 5.—DIAGRAM OF OPEN-CIRCUIT ARMATURE WITH SEVERAL BRANCHES IN PARALLEL UNDER WIDE BRUSH BELONGING TO EACH PHASE.

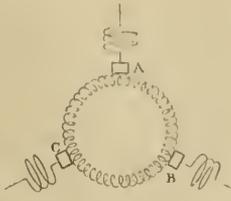


FIG. 6.—CLOSED-CIRCUIT ARMATURE FORMING A MESH CONNECTION BETWEEN THE PHASES.

make the motor run at 0.95 leading power factor, proceed as follows:—

Set off a vertical line representing 255 amperes, as shown in fig. 7. The power factor of an 800-H.P. 50-cycle motor running at 490 revs. per minute might be about 0.88, so that without the advancer one would have a lagging current equal to 47 per cent. of the working current. If the advancer caused the rotor to take a leading current of 47 per cent. (that is, 120 amperes), the power factor at the stator terminals would be nearly unity. If now it is desired to make the power factor at the stator terminals 0.95 leading, we must supply to the rotor an additional 31 per cent. of leading current, making 200 amperes wattless in all. Adding as

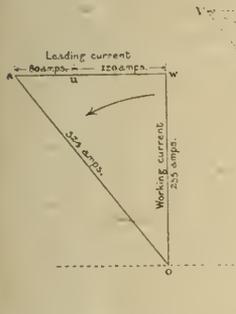


FIG. 7.—CONSTRUCTION FOR FINDING VALUE OF ROTOR CURRENT REQUIRED TO PRODUCE A GIVEN LEADING POWER FACTOR.

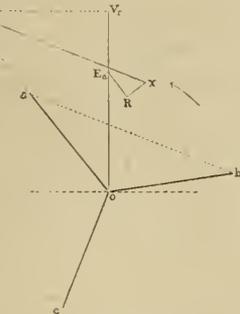


FIG. 8.—CONSTRUCTION FOR FINDING THE VOLTAGE REQUIRED TO BE GENERATED BY ADVANCER.

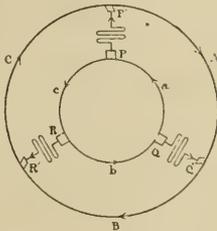


FIG. 9.—DIAGRAM OF CONNECTIONS. Mesh-connected phase-advancer armature *a, b, c*, field connections *E, Q* and *R*, and mesh-connected rotor *A, B, C* of induction motor.

vectors the 200 amperes wattless to the 255 amperes working current, we get 324 amperes per phase for the rotor when running under these conditions. This is the current for which the advancer must be designed. If we had made the rotor with a voltage per phase of 400, we should have had 650 amperes, which would have made a somewhat more expensive, though perfectly possible, phase-advancer.

Next as to the voltage to be generated by the advancer. As the armature of the advancer is to be mesh connected, it is simpler to take the voltage across the slip-rings than the voltage per phase of the star winding. Indeed, as the motor would work the same whether it were mesh connected or star connected, we may, if we like, consider it mesh connected, as we have done in fig. 9. If the normal slip of the motor at full load be 1.45 per cent., the E.M.F. generated by the slip will be 20 volts measured between rings. Lay off, as in fig. 8, the vertical line  $o E_a$  to represent this voltage generated by the slip in phase A. In fig. 7 we have found the angle by which the current must lead on this voltage, so we can set off the line  $o a$  to represent the current in phase A (see fig. 9). Similarly,  $o b$  and  $o c$  represent the currents in the other phases. We should allow about 6 volts for pressure drop in brushes and in the resistance of the advancer. This will be represented by  $E_a R$  in phase with  $o a$ . Then there will be some reactive drop in the field coils of the advancer. We may provisionally allow 5 volts for this, and after the machine is calculated we can make a check calculation to see if it is enough. This is represented by  $R X$ . There is no reactive drop in the armature because the compensating winding wipes out its field. We see that if we add a voltage  $x V$ , parallel to  $b a$ , we shall get a resultant voltage  $o V$  in phase with  $o a$ , and this is what we want. If, therefore, we excite the advancer with a current which is in phase with the sum of  $o a$  and  $-o b$  (shown by the dotted line  $b a$ ), we can make the current lead by the right amount. The voltage to be generated by the advancer is therefore

given by  $x V$ , which, when scaled off, gives us 33 volts. It will be seen that the projection of  $o V$  on the vertical line gives us  $o V$ , which is greater than  $o E_a$ . If this voltage  $o V$ , is greater than is necessary to drive the working current through the rotor circuit, the only effect will be that the slip of the rotor will be reduced until we get the right working current for the load. If it should come out that  $o V$ , is not sufficient to drive the working current, then the slip of the motor will be increased.

From fig. 8 it appears that with 33 volts generated by the advancer the slip will be slightly reduced. We thus arrive at the rating of the advancer, namely, 33 volts between terminals and 324 amperes per phase.

It will be found that the series-wound advancer will have more suitable characteristics for the case in hand than a shunt-wound advancer. With a series excitation the amount of leading current taken from the line increases with the load, so that the power factor of the motor remains more nearly constant than where the excitation of the advancer remains constant. We will therefore decide upon a series winding. When the voltage to be generated is of the order of 30 volts or higher, and the current is reasonably low, as in this case, the best kind of armature is that with a closed winding, just like an ordinary continuous-current armature.

Theoretically, three salient poles (equivalent to two magnetic poles) are quite enough for a machine of the rating required in this case, but a machine of six poles (equivalent to four poles magnetically) is more likely to fit in with standard frames and standard punchings. This will give us six brush arms, two in parallel in each phase. There will be 162 amperes per brush arm, and  $162 \div 1.73 = 94$  amperes per conductor.

As the speed of the main motor in this case is quite high, 490 R.P.M., it is quite a good plan to couple the advancer directly to it, just as one would an exciter to a high-speed synchronous motor.

If we take a large  $D^2 L$  constant of  $9.5 \times 10^6$  ch. cm. it will not be excessive, though very ample. A diameter of 46 cm. is suitable for a speed of 49 R.P.M., and the length of iron may be 18 cm.

The easiest way of designing a phase-advancer of this type is to proceed as if it were a continuous-current machine whose voltage is 1.41 times greater than the virtual voltage called for in the specification. The armature need not differ in any particular from a continuous-current armature. The field winding will be provided with series exciting coils and compensating windings connected to the various phases in the manner described below.

The main points to look to, that are not found in a continuous-current design, are:—

1. The machine though having six salient poles is a four-pole machine magnetically, and we must remember this when fixing the dimensions of the iron behind the slots.

2. The voltage to be generated as a continuous-current machine is 1.41 times greater than the virtual voltage called for.

3. The fluxes in the salient poles which constitute magnetically a pole-pair are  $120^\circ$  apart in phase, so that the voltage generated in an armature coil which lies partly under one pole and partly under another is only 0.86 of the voltage that would be generated if the two poles were carrying the maximum flux at the same time.

4. It is necessary to arrange the series winding on each pole so as to cause the flux to lead, by the right amount, ahead of the current carried by the armature conductors passing under the pole.

5. It is desirable to arrange the compensating winding so that its effect is equal and opposite to the armature winding adjacent to it, and for this purpose it is necessary to have regard to the phases of the currents in the armature and field.

6. It is desirable to provide a commutating flux which shall be proportional to, and in phase with, the current to be commutated.

We begin, then, just as we would on a continuous-current generator. The voltage to be generated is  $33 \times 1.41 = 46.5$  volts. There are six ways through the armature, each carrying 94 amperes. If we choose 72 slots with four conductors per slot we get 288 conductors, and these multiplied by 94 give us 27,000 amperes-wires, a fairly easy current-rating for an armature 46 cm. in diameter.

If we denote the area of the cylindrical working face of the armature by  $A_p$ , and the maximum flux density in the gap by  $B$ , then we may take the magnetic-loading as proportional to  $A_p B$ . If we have a pole arc equal to 0.72 of the pole pitch, then as there are 48 conductors in series and the speed is 82 revs. per second—

$$46.5 \times 10^6 = 0.72 \times 82 \times 48 \times A_p B \times 0.866.$$

Observe the multiplier 0.866, which comes into the equation on account of the circumstance mentioned in paragraph 3, above.

Thus we arrive at the magnetic-loading  $A_p B = 0.189 \times 10^3$ . If we work the iron in the teeth at 18,500 lines per sq. cm., we shall require a total mean cross-section of all the teeth of 1,020 sq. cm. Our conductors, to carry normally 94 amperes and 25 per cent. overload, may be made 0.23 by 1.27 cm. Four of these will require slots about  $0.77 \times 3.7$  cm. To provide room for 72 slots and give the necessary cross-section to the teeth we shall require a net length of iron of 16.4 cm. Allowing 11 per cent. for paper on the punchings and 0.6 cm. for a ventilating duct, we arrive at a gross length of iron of 19 cm. The rest of the calculation of the armature is the same as for a continuous-current machine, except in the matter of commutation, which we will consider later.

We must now consider how we are to wind the field poles so as

to give to the excitation its proper phase. The first point to note is that the six armature circuits are connected in mesh, while the leads from the brush-holders are connected in star.

In fig. 9 we have a diagram of connections as they would be if the machine had only three brushes. Obviously this diagram applies equally well to the machine with six brushes where brushes at opposite ends of a diameter are in parallel with one another. The inner circle of fig. 9 represents the closed winding of the armature of the advancer. The small letters *a, b, c* show the three phases mesh connected. Three brushes—*p, q* and *r*—bear on the commutator and convey the currents to the outer circle, *A, B, C*, which represents the winding of the rotor of the induction motor taken as mesh connected. The arrowheads show the direction along each conductor which is taken as positive for the purpose of our clock-diagram, fig. 8. *P, Q* and *R* are in star, and it is only in series with them that we can connect the series exciting coils. The voltage in phase *A* of the rotor is the voltage we would measure by connecting a voltmeter to the collecting brushes *p'* and *q'*. In order to make the current in this phase lead, it is necessary to generate a leading electromotive force in the part *a* of the armature circuit. From fig. 8 we found that a suitable E.M.F. to inject into phase *A* was the E.M.F. *NV*, which is in phase with  $(a - b)$ . From fig. 9 we see that the current in *q* is  $(b - a)$ , so that  $-q$  is  $(a - b)$ . We will, therefore, excite the poles under which coils *a* are passing with  $-q$ . The span of the armature coils is almost a pole pitch, so that the coils in phase *a* will be passing under two adjacent poles, which we will call pole *p''* and pole *q''*. Now, it is not convenient to use only the conductor *q* to excite *p''* and *q''*, because we have to arrange for return paths and also for a compensating winding, and we want to make a fairly simple mechanical arrangement of the coils. We, therefore, take advantage of the known fact that currents  $p + q + r = 0$ ; therefore,  $q = -p - r$ . Let us make an arrangement of exciting windings and compensating windings

countershaft in the mill where it is used, or it may be directly connected to an independent motor.

The most important consideration of the design of the phase-advancer is the obtaining of good commutation. It is chiefly for this purpose that the field frame and winding described in this paper are provided. Where, in a continuous-current generator, the voltage between the bars is small, the commutation can generally be forced by the resistance of the carbon brushes; but it is very much more desirable to provide a commutating E.M.F. which shall at all times be proportional to the current to be commutated. In the machine here described this result has been effected by giving each armature coil a span of somewhat less than the full pitch, and arranging the positions of the brushes so that one of the limbs of each coil is moving in the fringing field of a pole excited by a current which is at all times proportional to the current under commutation. The currents in the two branches of the armature, *a* and  $-c$ , which combine to form *p*, are out of phase with one another, and are not directly under control of the commutating flux; but the rate of change of the current in the coil under commutation ought at all times to be proportional to *p*. Now the pole *p''* (fig. 10) is excited so that the fringing field in which the left-hand limb of the coil *a* is moving is at all time proportional to *p*. By making the coil with a short throw, the right-hand limb can be taken out of the influence of the pole *q''*. The exact position for the brushes is, of course, obtained by trial; in practice it is found that the commutation is perfect. The alternation of the current in the armature and field causes a harmful E.M.F. to be set up in each coil under commutation; but as the frequency is so very low (say one cycle per second), this E.M.F. is not sufficiently great to create any disturbance. In the machine under consideration it only amounts to one-sixth of a volt.

In a certain mill in the North of England there is a 250-kw. generator which on account of the low power factor of the motors connected to it is somewhat overloaded. As it would be a rather

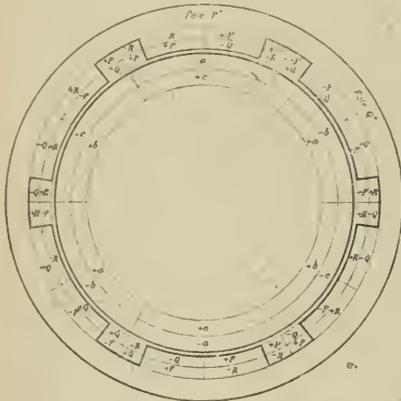


FIG. 10.—SHOWING RELATIONS OF EXCITING WINDINGS AND COMPENSATING WINDINGS TO ARMATURE WINDINGS.

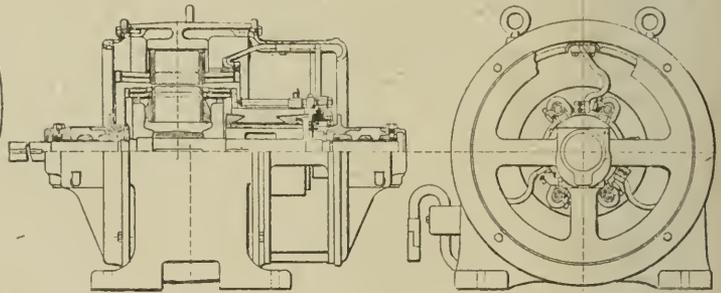


FIG. 11.—PART SECTIONAL ELEVATION OF PHASE-ADVANCER.

like that indicated in fig. 10. There the exciting conductors which pass between poles *p''* and *q''* are  $+q, +q, -p, -r$ . That is to say, they are equivalent to  $3q$ . The question whether the excitation  $+q$  gives a forward or a backward E.M.F. in a coil depends upon the direction of rotation, and also upon the question whether the armature is wound right-handedly or left-handedly. It will be seen that this arrangement of conductors lends itself to form mechanically a simple barrel winding. The conductors lie in two layers, and all the end connectors of one layer are bent to the right, and all the end connectors of the other layer are bent to the left.

The letters in fig. 10 which are placed on the salient poles represent the compensating windings. It is easy to prove that these are in direct opposition of phase to the currents in the armature under the pole. For instance, take the pole *p''*. The compensating winding on this is,  $+p + p - r - q$ , or  $+3p$ . Now the armature coils which lie under *p''* are *c* and  $-a$ , and we know that  $a - c = +p$ . Moreover, the 16 conductors in the pole face carrying the currents *p, q, r* are equivalent to 12 conductors carrying the *p* current. Opposite the pole *p''* are 12 armature slots each carrying  $-2a$  and  $2c$ . When we remember that there are two paths in parallel per phase in the armature we see that the currents in these 12 slots are exactly balanced magnetically by the 12 *p* currents in the compensating winding.

In practice it will be found unnecessary to adjust the speed exactly, because the particular power-factor at which the motor runs is not a matter of importance. It is not usually necessary to make any provision for the adjustment of the power-factor during running; it is sufficient that the motor shall take a leading current from the line at all loads. If it should be necessary to adjust the power-factor, this can be done either by changing the speed of the advancer or by diverting some of the field current from the series coils.

In cases where the speed of the motor is not great, it is more economical to belt the advancer to it so as to obtain a higher speed. In other cases the advancer may be run from any convenient

costly undertaking to install a new generator, the alternative proposition was put forward of connecting a phase-advancer in circuit with the rotor of a certain 140-H.P. motor in the mill. It was seen that this at least would help matters, although the capacity of the motor and its phase-advancer were not great enough to bring the power factor up to unity. A 5-k.v.a. advancer was installed, with the result shown by the following figures:—

TOTAL LOAD ON MILL.				
	Amperes per phase.	Volts.		Power factor.
Advancer cut out ...	325	440		0.70 lagging
Advancer connected in ...	240	440		0.92 lagging
MOTOR LOAD ONLY.				
Advancer out ...	105	440		0.74 lagging
Advancer in ...	97	440		0.96 leading

Whenever the advancer was switched in the volts of the generator rose from 440 to 470. The figures in the above table were taken after the rheostat had been adjusted to make the voltage normal.

Another case that might be quoted is that of three 400-H.P. motors installed for pumping water for the Port of London. As the speed of the motors is low the normal power factor at full load is only 0.55. These machines have been fitted with phase-advancers, with the result that they run on a slightly leading power factor.

The table on page 158 gives the result of tests upon a 750-H.P. motor running under various conditions with and without a phase-advancer.

In the case of readings 1 and 2, the voltage was maintained constant by hand regulation. The rise of voltage between readings 3 and 4 is due to the phase-advancer yielding a leading magnetising current. It will be seen that when the first reading was taken

the phase-advancer was not running, and the power factor of the motor was then 0'6 lagging. The next two readings show that with the aid of the phase-advancer the power factor has been brought up to unity, whilst in the case of some of the lower readings, with the aid of the phase-advancer, the power factor has been changed to 0'5 leading.

Reading.	Volts.	kW.	Power factor.	Remarks.
1	1,840	280	86 % lagging	Phase-advancer not running
2	1,840	300	Unity	Phase-advancer running
3	2,200	375	Unity	Phase-advancer running
4	2,600	375	80 % leading	Phase-advancer running (increased speed)
5	2,000	20	50 % leading	Phase-advancer running (speed as before)
6	2,600	312	40 % leading	Phase-advancer running (increased speed)
7	2,560	20	5 % leading	Phase-advancer running (speed as before)

The motor on which these experiments were tried formed part of a motor-generator set, and it was therefore possible to make it run as an induction generator by speeding up the continuous-current machine. When this was done the terminals of the phase-advancer were reversed so as to give the right rotation phases relatively to the rotor winding. It was found that the induction generator could be run so as to supply a lagging wattless load, the magnetisation of the motor being carried out by means of the rotor current. In another case a phase-advancer was connected to the rotor winding of a 750-H.P. motor driving a rolling mill. The load on this mill was very unsteady, and for considerable intervals of time was so light that the motor was running on an extremely low power factor. The effect of the phase-advancer was to make this induction motor take a small leading current at all loads. Before the installation of the advancer the whole works took a load of about 1,000 K.V.A. at 0.64 power factor; when the advancer was started up this was changed to 800 K.V.A. at 0.8 power factor. In cases where generators are overloaded and it is not desirable to install large machines, a considerable advantage can sometimes be obtained by the use of a phase-advancer in conjunction with a large motor on the system.

variable reactance  $X_z$  in each leg. Adjustable condensers  $c$  and  $c'$  are adapted to be varied equally with condensers  $D$  and  $D'$  respectively, the latter being included in closed oscillation circuit, each of which forms a shunt to condensers  $L$  and  $Y$  respectively. These circuits are adapted to be tuned in resonance with the absorbing loop, and, therefore, oscillate in the oscillation frequency of the received waves.

The variable inductances  $L$  and  $L'$  respectively included in each shunt circuit, form the primaries of a transformer the secondary  $G, G'$  of which forms part of a detector circuit which is thus responsive to any oscillation frequency in either shunt circuit through the

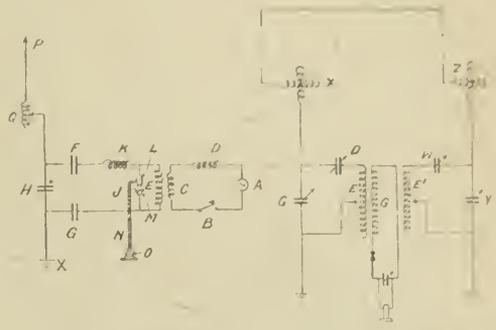


FIG. 1.—WIRELESS TRANSMITTER.

FIG. 2.—WIRELESS RECEIVER.

medium of the inductive coupling, but swings in its own time period, which is determined by the adjustment of its condenser, at a rate which corresponds to the group frequency, and not to the oscillation frequency of the received waves.

In an alternative form, one closed oscillating shunt circuit only is shown, to which the detector circuit is inductively coupled, as in fig. 2.—*Australian Mining Standard*.

### AUSTRALIAN WIRELESS TELEGRAPHY.

The Commonwealth Commissioner of Patents on October 15th, 1912, granted letters patent to Mr. J. G. Balsillie, the Commonwealth wireless expert, with respect to his system of wireless telegraphy, which is assigned to the use of the Postmaster-General.

The description and drawings of the transmitter and receiver, as published in the Australian Official Journal of Patents, are as follows:—

A transmitting system, in which tuned primary and charging circuits energise an exciting circuit, which, in turn, delivers unidirectional impulses or kicks to an electrostatically-coupled radiator circuit.

The exciting circuit is characterised by being provided with more than two condensers, one of which is common to the radiator circuit.

The unidirectional impulses are obtained from the exciting circuit by the use of an air-blast gap, working with a pressure of 100-105 lb. per sq. in.

In fig. 1 the primary circuit, consisting of the alternator A, key B, primary C of step-up transformer, and reactance  $D_1$  is inductively coupled to, and in tune with, the charging circuit, consisting of the transformer secondary E, reactance K, and condensers F, G and H.

The exciter circuit comprises the rectifying discharge gap J (consisting of nozzle and plate electrodes L and M), the reactance K, and condensers F, G and H, it being essential that the condensers F and G are arranged symmetrically, one in each connection of the exciting circuit to the radiator circuit.

The radiator circuit consists of the antenna P, variable inductance Q, condenser H, and earth X.

In operation, the constants of the exciting circuit are so adjusted that it has no distinctive frequency of its own, in order that the radiator may freely oscillate in its own time period.

In an alternative form, a rearrangement of the condensers is shown, permitting the omission of the variable inductance Q.

In an absorber of the looped type, fig. 2, the extremities of which are connected to earth, one or both legs include a variable condenser, around which is shunted a closed oscillation circuit, tuned to the oscillation frequency of the received waves, and provided with a variable inductance, forming the primary of a transformer. The secondary of this transformer is included in a detector circuit, adapted to be tuned to the group frequency of the received waves.

The receiver may thus be tuned to receive from any particular transmitter, working on the two-tone principle, and emitting two distinct wave trains of different frequencies, but having a certain predetermined group frequency. The circuit is formed with a

**Telephones in Rural Districts.**—It will be remembered that, under the present farm telephone system, several persons in rural districts are enabled to share a single telephone line, running through an estate or district, at considerably reduced rates. This party-line system, of course, destroys privacy of communication, but has rendered an important service to agriculturists and others by providing full telephone benefits in other respects at a rate which is, at least, proportioned to some extent to the less urgent need for telephone service in these districts. Though a farmer has not the same kind of need for a telephone as a city man, the value per call is probably greater to him, owing to the greater distances involved and the absence of other rapid means of communication.

In rural areas, the commercial advantages of telephone facilities are great; market fluctuations can be followed, and sales and purchases effected, but it is in commercial transactions that the lack of privacy of the party-line system is really most serious. Socially—where distances between neighbours are great, and other means of communication practically impossible in inclement weather—the telephone comes as a great boon. In at least one case, the tedium of an isolated farmhouse has been relieved by the transmission of gramophone songs and music from the house of a neighbouring subscriber. Finally, the ability to summon prompt assistance in case of fire, accident or other emergency cannot be over-estimated, and must save many lives and much property in the course of a year.

The Western Electric Co. have lately introduced an economical telephone system, suitable for use on large and small estates and holdings, whereby a line is run round the estate, starting at the manor house or office, where a public telephone set is installed side by side with the local or "home" instrument. The occupier of every holding, and the various estate employes, can call any other station in the local circuit, a simple ringing code being arranged to discriminate between the calls intended for one station and these for another. Under the present Post Office regulations, private telephone circuits may not be directly connected to the public telephone system, but arrangements can easily be made to retransmit messages from stations connected only to private telephone lines at a central station connected to the public network, as well as to the party-line, and hence provided with two instruments.

An interesting installation on this system has lately been erected on Messrs. Farrow's general produce farm, near Spalding, Lincs., and various parts of the equipment are illustrated in our contemporary, the *Fruit Grower, Fruiterer and Florist*. Ten stations, including the central office, on this farm (which is considerably over 1,000 acres in extent) are connected by 19 miles of local circuit carried on crossoted poles varying from 45 to 22 ft. in height. All the telephones are of the magneto-ringing type, and have powerful five-magnet generators. Wall sets are used except in the central office, where a table set is used for convenience, the ringing-magneto and call bell being arranged in a separate box.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

318. "Blow magnet for arc lamps." KÖSTING & MATHEWSEN AKT.-GES. (Convention date, May 11th, 1912, Germany.) January 6th. (Complete.)
331. "Processes of electric welding." G. GNOCCHETTI. January 6th.
333. "Sparking plugs." J. H. RUMMARKEN. January 6th.
356. "Electric welding." L. M. WATERHOUSE. January 6th.
411. "Disinfecting apparatus for telephones and the like." L. BLOCK. January 6th. (Complete.)
415. "Manufacture of quartz articles." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 6th. (Complete.)
444. "Resonating relays." H. VON KRAMER and G. KAPP. (Addition to 10,566, 1911, and 6,969, 1912.) January 7th.
453. "Hoisting gear, winches or the like, operated by electric motors." D. WILSON. January 7th.
465. "Magnetometers, compasses, and the like." R. W. PAUL. January 7th.
605. "Connections between wires and cables of small diameter." A. FODOR. January 7th. (Complete.)
608. "Means for improving the illuminating effect of electric and gas lamps." W. J. BEVILLE. January 7th.
620. "Guide attachment to trolley poles of electrically-propelled vehicles." J. HILL. January 8th.
634. "Electric ceiling roses." J. P. SMITH. January 8th.
576. "Means for and methods of increasing the frequency of alternating currents." A. M. TAYLOR. January 8th.
584. "Arrangements for compounding alternating-current machinery." SIEMENS BROS. DYNAMO WORKS, LTD., and W. MARREN. January 8th.
608. "Automatic single-pole electric switch." W. E. GORTON. (Convention date, May 16th, 1912, United States.) January 8th. (Complete.)
609. "Disinfecting apparatus for telephones and the like." L. BLOCK. January 8th. (Complete.)
622. "Vapour electric current rectifying apparatus." F. CONRAD. (Convention date, January 10th, 1912, United States.) January 8th. (Complete.)
633. "Wireless transmission of energy." A. ROLF. January 9th.
647. "Primary batteries." H. E. FRY. January 9th.
654. "Electrical signal system in connection with tramway single lines with loops, or any electric traction, either along the public thoroughfare, in mines, or on permanent railways." E. LAWTON. January 9th.
672. "Connection of motors of electric trams or other rail carriages to prevent side swing." I. BULFIN. January 9th.
657. "Apparatus for controlling synchronous motion electrically from a distance." SIEMENS-SCHUCKERT WERKE. (Convention date, August 2nd, 1912, Germany.) January 9th. (Complete.)
735. "Means for collectively actuating and controlling alternating-current motors." J. L. ROUTIN. January 9th. (Complete.)
736. "Radiating system for signalling by electric waves from aeroplanes." RIGOLD-GES. m.B.H. (Convention date, February 24th, 1912, Germany.) January 9th. (Complete.)
745. "Starting and regulating devices for electric motors." A. H. GUMSTED and L. BOOTHMAN. January 9th.
749. "Improvements in and in means for use in electroplating." H. B. SANKEY. January 10th.
763. "Electrical terminals." J. W. RECORD. January 10th.
764. "Electrical switches." W. C. HORNE. January 10th.
770. "Storage battery plates." W. M. McDUGALL. January 10th. (Complete.)
785. "Method of telegraphy by low voltage currents converted by an induction coil into high voltage currents and a double current key for making momentary contacts." R. P. McDUGALL. January 10th.
788. "Method of and means for effecting the efficient transmission of electric signalling impulses through conduction wires and cables." A. WILLIAMS. January 10th. (Complete.)
790. "Motors for use chiefly in connection with telegraph transmitters." J. S. WITHERS. (K. C. Cox, Norfolk Island.) January 10th.
791. "Automatic telegraph transmitters." J. S. WITHERS. (K. C. Cox, Norfolk Island.) January 10th.
792. "Electric measuring instruments." H. ARON ELEKTRICITÄTZAHLER-FABRIK G.M.B.H. (Convention date, August 25th, 1912, Germany.) January 10th. (Complete.)
798. "Arc lamps." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 10th.
800. "Accumulator containers." H. HUNTE. January 10th.
802. "Means for generating alternating electric currents." G. MARCONI. January 10th.
809. "Wireless telegraphy and telephony." S. G. BROWN. January 10th.
818. "Selecting devices for telephone circuits." SIEMENS BROS. & CO., LTD., and T. FETTERBERG. January 10th.
829. "Dry galvanic cells." J. A. E. ACHENBACH. January 10th. (Complete.)
853. "Control of electric motors and dynamos." T. & J. JACKSON, LTD., and J. JACKSON. January 11th.
866. "Electric furnaces for fixing nitrogen from the air." G. HARKER and E. K. SCOTT. January 11th. (Complete.)
882. "Electricity meters." W. LAWSON. January 11th.
883. "Time-limit devices for circuit-breakers and the like." J. ROOTHJAN and FERANTI, LTD. January 11th.
886. "Electrical resistances." O. L. PRARD. January 11th.
896. "Carbon feed mechanism for electric arc lamps." CROMPTON & CO., LTD., and C. CROMPTON. January 11th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911

- WALL PLEGS OR OTHER COMPOUNDS FOR ELECTRICAL PURPOSES. V. C. H. GIBSON. 28,877. December 21st. (Cognate application, 12,969 of 1912.)
- CONTROLLEERS FOR ELECTRIC MOTORS. P. S. TURNER. 29,138. December 27th.
- MAGNETIC SEPARATORS. FRIED. KRUPP AKT. GRUBENWERK. 29,224. December 28th. (January 12th, 1911.)
- PORTABLE ELECTRIC BATTERY LAMPS. Edmondson's Electricity Corporation Ltd., J. S. Highfield and F. E. Gripper. 29,309. December 29th.

1912.

- DYNAMO-ELECTRIC GENERATORS. British Thomson-Houston Co. and E. Garton. 4,529. February 22nd.
- MARINERS' COMPASSES. L. W. P. Chetwynd. 4,761. February 26th.
- INSULATING FISH-PLATE FOR RAILWAY OR TRAMWAY RAILS. C. J. Cooke and A. H. JOHNSON. 6,717. March 19th.
- ELECTRICALLY-OPERATED AUTOMATIC PIANO AND LINE PLAYERS. J. T. Sibley. 7,963. March 26th.
- TURBINE DYNAMO PLANT. Warwick Machinery Co. (1908). (General Electric Co.) 7,497. March 27th.
- VAPOUR-ELECTRIC DEVICES. British Thomson-Houston Co. (General Electric Co.) 7,775. March 30th.
- STARTING SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. J. D. Bell. 9,139. April 18th. (Cognate application, 16,763 of 1912.)
- TERMINALS FOR ELECTRIC BATTERIES. H. Lucas and G. H. Jackson. 9,278. April 19th.
- STATION INDICATING DEVICE FOR USE ON VEHICLES. D. J. Cooke and C. Schcock. 9,360. April 20th.
- AUTOMATIC BLOCK SIGNALING SYSTEMS FOR RAILWAYS. A. E. White. (Catsdon.) 10,908. April 26th.
- SPEED REGULATION OF ASYNCHRONOUS MOTORS. Bergmann Elektrizitäts Werke Akt.-Ges. 12,434. May 22nd. (May 22nd, 1911.)
- EXCESS CONSUMPTION METER FOR ELECTRIC CIRCUITS. E. Schuppisser. 18,002. June 10th. (June 10th, 1911.)
- COMBINATION ELECTRIC LAMP BULB AND DIFFUSER. E. L. Frenot. 18,766. June 12th.
- ELECTRIC SWITCHES. E. B. METIARD. 14,752. June 24th. (June 13rd, 1911.)
- RESPONSIVE DEVICE FOR APPARATUS FOR PRODUCING RÖNTGEN RAYS. H. BAUER. 16,171. June 28th.
- TELEPHONES. E. Ramdohr. 16,241. July 11th.
- PRODUCTION AND WIRELESS TRANSMISSION OF ELECTRICAL OSCILLATIONS. H. HEINICKE and M. JASPER. 18,632. August 14th. (Divided application on 28,861 of 1911. December 16th.)
- IONIZING CURRENT DISTRIBUTORS FOR INTERNAL-COMBUSTION MOTORS. Siemens und Halske Akt.-Ges. 19,069. August 20th. (August 26th, 1911.)
- ELECTRIC WIRE TERMINAL PLUGS. C. E. MOWER. 23,764. October 15th.
- PLUG FOR ELECTRICAL PIVOT CONTACTS. H. STOLZ and Compagnie Elektrizitäts Ges. 23,877. October 18th. (October 20th, 1911.)
- DEVICES FOR ADJUSTING THE LENGTH OF THE SPARE GAPS BETWEEN ELECTRODES. O. INFAY. (Compagnie Generale Radiotelegraphique.) 26,467. November 18th.
- ILLUMINATED SIGNS FOR USE WITH ARC LAMPS. W. J. BEVILLE. 229. January 3rd.
- SYSTEMS OF ELECTRIC DISTRIBUTION. British Thomson-Houston Co. and A. P. YOUNG. 627. January 6th.
- ELECTRICAL MEANS FOR CONTROLLING ELECTRICALLY-DRIVEN APPARATUS. H. T. HOLMES and Automatic Advertising Co. 1,569. January 19th.
- BLACKLEADING MACHINES FOR THE USE OF ELECTROTYPE. R. HOE & CO. and F. G. LOUGE. 1,968. January 24th.
- DRYING OF ARTICLES MOULDED FROM CLAY, OR OTHER WET MATERIAL, MORE ESPECIALLY INTENDED FOR USE IN CONNECTION WITH THE DRYING OF MULTIPLE CHANNEL CONDUITS FOR ELECTRICAL CONDUCTORS. R. LAWTON. 2,348. January 29th.
- ELECTRIC SWITCHES. M. J. RAILING and J. STRACHAN. 4,577. February, 23rd.
- TROLLEY COLLECTORS FOR ELECTRICALLY-DRIVEN TRAMCARS OR ROAD MOTOR VEHICLES. E. P. B. EATON. 5,468. March 5th.
- MAGNETS USED WITH INTERNAL-COMBUSTION ENGINES. E. E. BENTALL and G. C. BINGHAM. 6,639. March 6th.
- DEVICE FOR ATTACHING OVERHEAD LINE WIRES TO INSULATORS. G. R. PATON. 5,636. March 6th.
- AUTOMATIC SPARK TIMING MECHANISM FOR INTERNAL-COMBUSTION ENGINES. T. TOWNSON. 6,077. March 11th.
- SWITCHES COMBINED WITH PLUG TERMINALS FOR ELECTRIC CIRCUITS. W. E. WATSON. 6,673. March 18th.
- ELECTRICAL INDICATING APPARATUS. Soc. Contraud G. Oatnier, Gil et Cie. 7,780. March 30th. (April 1st, 1911.)
- ELECTRIC ADVERTISING APPLIANCES. J. MEYER & Neuheiten Verwerthungs Ges. 12,133. May 22nd.
- ELECTRO-MAGNETIC BRAKES. A. THODE & CO. 18,440. August 10th. (August 10th, 1911.)
- APPARATUS FOR AUTOMATICALLY OPERATING GAS OR ELECTRIC LAMPS. C. R. OLIVER. 23,993. October 21st. (Addition to 23,769 of 1911.)

**A Technical Explanation.**—One of the leading Canadian daily newspapers was describing the cause of a street car tie-up which had occurred the day before. The reporter remarked that he interviewed an expert, and in all seriousness he gave the following account of the interruption of service on the transmission line:—"If there is an electric storm in the neighbourhood of the wires, the current on the wire is protected by rotary converters, which transform the alternating current to a direct one. Sometimes the transformers are thrown out of service, and have to be started up again, causing a delay in the systems fed by the power. When this happens, the current is stepped down and out." The moral is: Be careful what you believe when you read the daily newspaper—no matter what a power it wields in the land.

**Electrometallurgy in Norway.**—A company, under the name of "Aktieselskabet Hybinettes Udenlandske Nickel-patenter," has recently been formed at Kristiania with a capital of £5,556, for the purpose of selling foreign patents of Engineer F. Hybinette for the production of nickel by electrolysis from nickel-copper matte, which have been acquired by the company from the inventor. As may be remembered, the Norwegian rights of the above-mentioned method have been acquired by the Kristiansand Electrical Nickel Refining Works, which have already employed the process at their works at Kristiansand for a couple of years, with great success.

At the same time a similar company has been formed at Kristiania under the name of "Aktieselskabet Hybinettes Udenlandske Kobberpatenter," with a capital of £1,177, for the purpose of selling the foreign patent rights of Engineer Hybinette for the electrolytic production of copper from copper ore and from roasted copper ore and pyrites. This process has also been commercially exploited in Norway. It may, however, be mentioned that it deals only with those ores in which the percentage of nickel does not exceed that of copper.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

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## ELECTRICAL REVIEW.

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## THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

THE Association is to be congratulated upon the success which attended its annual dinner on Friday last, when Lord Amthill for the first time presided over its proceedings, and the chairman of the Council, Mr. A. Bruce Anderson, with commendable restraint, defined its aims and felicitated the members upon its achievements. The Association, he said, had attained a position in which it must be heard, and on every occasion when it had had to speak, it had been heard with courtesy and consideration. That the Association should occupy an influential position in the affairs of the electrical industry is greatly to be desired, and no one will be found to cavil at the tone of the chairman's speech, which indicated that success was due to grafting the spirit of alliance on the old spirit of self-reliance. The latter in past time has, perhaps, been somewhat too prominent in our industry; individualism has been carried to extremes, with a lamentable lack of foresight, and the consequences of cut-throat competition have been painfully brought home to many firms, the innocent suffering with the guilty.

The times, apparently, are changed; co-operation was the key-note of the gathering, and the text of every speech. Seeing that we have for years, in season and out of season, urged upon our readers the imperative necessity of combination and co-operation in order to rescue the electrical industry from the dangers towards which it was drifting, we may be permitted to claim no small share in bringing about the new order of things, and we rejoice to see our precepts translated into action, and our policy adopted with enthusiasm.

Judging from the report of the Council on the results of the first year's operations, which we reproduce elsewhere in this issue, excellent progress has already been made towards organising the industry and harmonising its apparently discordant elements. The relations between vendors and purchasers of plant have been vigorously taken in hand, and the work of evolving a model set of conditions of contract, with the co-operation of the I.E.E. and the I.M.E.A., is far advanced. In this respect also we led the way, having conducted for some years a critical examination of specifications for public works, with especial reference to the onerous conditions of contract prescribed by the legal advisers of municipal authorities. The unnecessary waste of time and money involved in the practice of cross-tendering, which also has been condemned in our columns, has been tackled by the Association, and an agreement has been reached whereby tenderers, it is hoped, will be relieved of all this trouble and annoyance.

The revision of standards for electrical machinery is urgently needed, and the Association has made good progress in this direction; while this matter is on the table we trust the Council will give serious consideration to the report of Mr. Hamilton Wickes, which we recently published, with a view to establishing a Laboratory dealing with the whole question of standardising and testing electrical accessories.

One of the most delicate matters which have been dealt with is the relationship between the Association and the Electrical Contractors' Association, and we trust that in this case also satisfactory results will be derived from the negotiations which are now in progress.

The suggestion of Mr. Duddell that efforts should be made to co-operate with other important bodies is a valuable one, and we hope it will bear fruit. Co-operation is,

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION

In the Press.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

undoubtedly, the right policy—the only policy that affords hope for the future of the British electrical industry, which has had its hard times, and deserves a term of prosperity. In spite of the “boom,” it is a fact that prices still rule low, much lower than they ought to be, though work is plentiful, and by sincere and genuine co-operation this can be remedied. But is the policy of the Association always and wholly co-operative? Has there been no endeavour to apply pressure, to resort to attempted compulsion without so much as a preliminary hint at co-operation, in any of its activities? But, perhaps, that to which we refer was simply the work of a sub-committee. While we congratulate the Association on the good work it has done, and is doing, and heartily approve the creed which it professes, we trust that it will sedulously adhere to the principles of action which its leaders have so earnestly enunciated.

Our friends in the United States are taking the question of standards very seriously. A Joint Committee of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers last month resolved to recommend to the said Societies the use of the myriawatt as a unit of thermal or mechanical power, to be used exclusively in connection with boilers, producers, turbines and engines, in lieu of the term “boiler-horse-power,” from which it is said to differ by only 2 per cent. We are informed that this is an important event, being the first piece of joint standardisation work accomplished between two of the American engineering Societies, and affording a simple and satisfactory method of rating the input and output of turbo-generators in terms of the international watt. We are gravely told that “instead of rating the output of a turbo-generator in kilowatts, and the input in boiler-horse-power or other heat units as at present, it becomes very convenient to rate the electric output in kilowatts and the steam input in myriawatts, because the myriawatt is approximately the same as the boiler-horse-power, while it is also exactly 10 kw. By this means the long existing incongruity of stating the input and output in different and disconnected units of power will be eliminated.” Now, we cannot refrain from pointing out that to “standardise” the myriawatt, which is simply a recognised decimal multiple of the standard watt, is as superfluous as to standardise the number 10—or 10,000. It is not standardisation at all. What the conference really did was to agree to abolish the “boiler-horse-power,” a term which has been disused and obsolete in this country for years and years. For the benefit of our readers we may state that, according to an American handbook, it represents an evaporation of 30 lb. of water per hour from 70° F. to steam at 70 lb. pressure: we are sure that American engineers will be well rid of this clumsy unit. What we cannot understand, however, is why, in the name of common sense, they want to measure the input by a unit ten times that used for the output. Surely the kilowatt is good enough for both ends of the machine. Have our cousins lost their traditional sense of humour?

In accordance with our usual custom towards the end of January, we publish elsewhere in this issue a graphic record of the more important features of British electrical export and import business during the year just ended. The various trade curves which we reproduce are based on the monthly statistics which have formed an exclusive feature of this journal for some years past.

In view of the steady expansion of British overseas electrical trade which has occurred in recent years, there can be

no doubt that information as to the approximate extent and character of requirements of the different markets of the world is extremely useful to the exporter, and this information can be obtained from our monthly statistics.

It is probable, however, that the detailed particulars from which the latter are compiled contain much information of value to particular firms, which it is impossible for us to publish, and to meet cases such as these, we shall have pleasure in allowing those interested to examine these details on application to us.

### Copper.

THE fall in the price of standard has naturally aroused considerable interest, affecting, as it does, not only actual dealers but many important industries, which are influenced by the price in making quotations. Discussed in the *Financier* for January 17th, two theories are quoted, held by “bears” and “bulls” respectively. The bear theory is that the American producers have, in the aggregate, increased the output so substantially that consumption has been overtaken, and stocks have consequently accumulated. Also that, in consequence of enormous electrical schemes in prospect in the States, more low-grade mines have been opened, which help to increase the output. This party also is apprehensive of the effect of further restrictive legislation in future.

The “bulls” have it that, while the producers may be holding stocks, merchants and consumers keep practically none, and that the same conditions prevail in Europe. It is also believed that the political outlook in Europe is less gloomy than is represented. A revival of trade on more settled conditions would force the consumer into the market and cause a smart recovery in price.

Uncertainty, as pointed out by the writer of the *Financier* article, is the disturbing cause on both sides of the Atlantic. Until the want of confidence is overcome, the demand will not be inclined to increase, while production is likely to proceed with regularity. It is anticipated in New York that the price may further come down to about 16 cents, corresponding to about £73 10s. per ton. There is said, however, to be a strong group ready to act in co-operation to prevent anything like a “slump.”

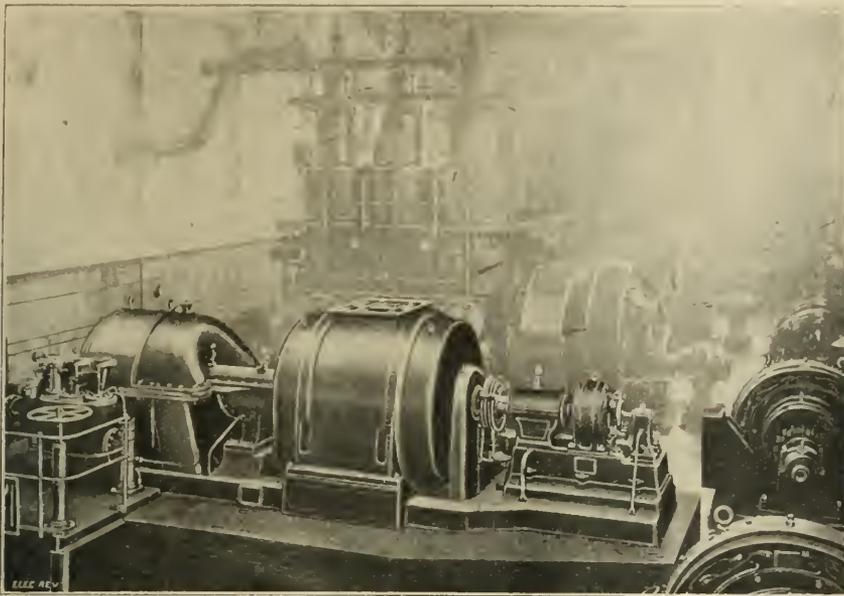
Messrs. James Lewis & Son's *résumé* of the situation in 1912, quoted by the *Financial News* of January 17th, is well worth studying in connection with the present situation. They say:—“During the first half of the past year standard copper fell from £63 per ton for cash, the value at the close of 1911, to £60 17s. 6d. on January 29th, wire bars selling at £65 5s. With a rapidly-increasing consumption and diminished supplies, large purchases were made by consumers and speculators, and prices steadily advanced until £80 was paid for cash and £80 15s. for three months' prompt standard on June 20th—the highest point of the year—wire bars selling at 17½ cents per pound, or £82 per ton c.i.f. On July 1st European stocks and those held by American refiners had decreased 40,238 tons (from 100,593 tons on January 1st, to 60,455 tons), the increase in European and U.S. consumption being respectively 31,166, and 25,509 tons, or 56,675 tons together. After July 1st, stocks steadily increased from 60,455 to 82,055 tons, production having overtaken consumption, and the policy of the leading American refiners of maintaining their selling price for electrolytic copper at 17½ cents per lb., although cash standard fell to £71 13s. 9d. in August, and rose to £79 15s. in September, being sustained by large purchases believed to have been on American account, caused manufacturers to hold as little copper as possible, and to buy only for their immediate requirements, thus throwing the onus of carrying the increasing stocks on the American refiners. The year ended with cash standard quoted at £76 12s. 6d., and high conductivity wire bars £82 per ton. Production in the U.S. has increased 70,973 tons, or over 14½ per cent., against a decrease of 1,069 tons in 1911.” General deductions are that the price is still one favouring increased production. As any favourable influence tending to lessen the uncertainty of the political outlook would be followed by a marked trade revival, it will be to the interest of consumers that this increase should continue.

Electrical  
Exports and  
Imports during  
1912.

### THE BLACKBURN EXTENSIONS.

IN our last issue we referred briefly to the new plant which has recently been installed by the Blackburn electricity department, chiefly in order to meet the demand for industrial power in the town.

The plant previously in use consisted of 15 d.c. engine-



NEW WESTINGHOUSE TURBINE PLANT AT THE BLACKBURN ELECTRICITY WORKS.

driven generators and a motor-generator for supplying alternating current.

The new plant includes two Westinghouse turbo-alternator sets generating three-phase current at 6,000/6,600 volts and 50 cycles, remote controlled switchgear, and two rotary converters with the necessary transformers, by the same makers, to link up the alternating and direct-current supplies.

The turbines are of the impulse type, running on steam at 180 lb. pressure and 160° F. superheat, and at a speed of 3,000 R.P.M.

One turbo-alternator is already completed, and has been on load, but not officially tested, while the second one will be completed on the arrival of the alternator early in February.

Each set is capable of giving 2,000 kw. under continuous working conditions. In addition to the usual fittings, &c., a small automatic steam-driven oil pump is provided for flushing the bearings before starting up, a Lea recorder is also provided for each set, and a Triplex Fournier recorder for giving temperatures of condensing water inlet and outlet, together with the extraction water.

The condensers, fixed directly under the turbine, are of the Leblanc type, each with its own Leblanc air pump driven by a vertical turbine which exhausts into the low-pressure end of the main turbine.

The steam supply to the auxiliary turbine is arranged for starting up from the main platform of the turbine, so that it is not necessary in case of emergency to go down into the basement to start up the condenser.

The rotors of the alternators are of the cylindrical type with Miles Walker's patent compensated windings and fans attached for ventilating purposes which draw the air, by means of ducts, from filters fixed outside the engine room through the windings of the machine, the warm air being then, by means of a plate placed on the top or bottom of the alternator casting, exhausted either upwards into the engine room or downwards into the basement.

The water for the condensers can be taken either from a tank over the boiler house, direct from the reservoir, or from

a cooling tower capable of dealing with 200,000 gallons per hour, which is in course of erection.

The two rotary converters, of 800 kw. capacity each, have been fixed adjoining the turbines, while the transformers, one for each machine, rated at 880 K.V.A., 6,600/160 volts, and of the oil-insulated, self-cooling type, are located in the basement below the rotaries.

The transformers are connected star to double star, for operation in connection with the rotaries, which are six-phase machines, running at 600 R.P.M. with a booster and exciter mounted on the same shaft. The rotaries are started up from the d.c. bus-bars and can be run inverted for supplying the A.C. load when the turbines are shut down.

The extra-high-tension control switchboard is fixed in the main switch-room, and is of the electrically operated remote-control desk type, equipped with the usual indicating lamps, instruments, &c.; it is divided into nine panels made up of two turbo panels, two rotary converter panels, four feeder and one bus-bar coupling panels. Two rotary converter direct-current control boards are also fixed in the main

feeder and one bus-bar coupling panels. Two rotary converter direct-current control boards are also fixed in the main

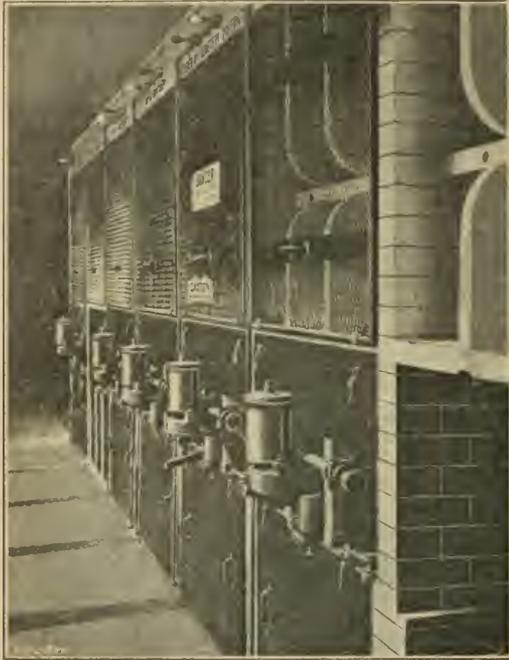


REMOTE CONTROL BOARD FOR THE E.H.T. SWITCHGEAR.

switchroom, on which are fixed throw-over switches for supplying the lighting or traction bus bars.

The extra-high-tension switchgear is built up in brick

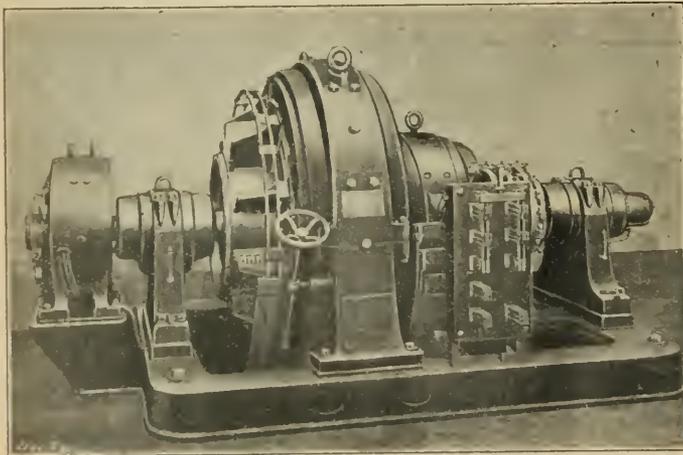
cubicles in a special room in another building situated about 60 yards from a control desk. The oil switches are of the three-pole type, with solenoid operating gear, and are interlocked with the doors of the cubicles. Already four feeders have been laid to two mills situated a mile and a half, and half a mile distant respectively, from the works, the demand



WESTINGHOUSE OIL-BREAK SWITCHGEAR.

from which will ultimately exceed 1,000 kw., and arrangements are now well in hand for further extensions to supply another 1,000 kw. demanded by several engineering concerns.

The extensions carried out have been designed, and the installation of the plant carried out to the specification and under the supervision of the borough electrical engineer (Mr. P. Wheelwright), to whom we are indebted for these



800 KW. ROTARY CONVERTER PLANT AT BLACKBURN.

notes. The new plant completes the equipment of the present generating station, as the limit of the supply of water for condensing purposes has been reached, and in the very near future another generating station will have to be built where coal can be delivered by rail or canal, and better provision for water is possible.

The whole of electrical machinery, condensers, pumps, switchgear, &c., has been supplied by the British Westinghouse Co., and the cooling tower is being built by the Davenport Engineering Co. The pumps for the latter are being supplied by the Rees Roturbo Co., and the water piping by the Stanton Ironworks Co., the work of laying the latter being carried out by the electricity department.

## MISTAKES IN TENDERS.

[FROM OUR LEGAL CONTRIBUTOR.]

WHEN preparing the tender for the carrying-out of a large contract, it is by no means difficult for the engineer to make a mistake in his figures. He often has to work against time, and he is bound to entrust some of the detail work to subordinates. Finally, he may have been misled as to the prices at which he can obtain materials.

If a mistake is made, and the tender is accepted, has the contractor any remedy? Of course, if the offer has not been accepted, he may withdraw it; so if he made a tender by post overnight and discovered an error in the morning, he might withdraw the offer by a second letter. In such a case, the withdrawal would be good, unless a letter of acceptance had been written and posted before the letter of withdrawal was received.

As mistakes are not usually discovered until a much later stage, it becomes necessary to consider in what circumstances they can be put right.

It is clear law that if a mistake is unilateral, that is to say, a mistake made by the party tendering, and not known to the person who invited the tender, the contractor cannot escape liability.

For instance, in a Scotch case heard not long since the defender offered to execute work for the pursuers for the lump sum of £859. His offer was accepted. He afterwards found that owing to an error in calculation made by his son, the offer was £326 less than it should have been. In an action for damages for breach of contract, the defender having contended that this mistake released him from his contract, the Court held that he was not released—the mistake having arisen through no fault of the pursuers—and that the pursuers were entitled to damages.

In another case, a tender for the supply of granite to the plaintiffs contained the words, "weather and other circumstances permitting." These words were struck out by the plaintiff's clerk, and the defendant was informed of the fact. No reply having been received from him for several days, the contract was sealed. Delays having occurred owing to bad weather, the plaintiffs sued for breach of contract. It was held that they were entitled to recover.

In another case (*Johnson v. Islington Union*, 1909, 73, J.P. 172) the facts were as follows. The plaintiff saw an advertisement in a newspaper, inviting tenders for the supply of certain goods required by a Board of Guardians. He tendered on a printed form supplied by the Guardians for the supply of a certain disinfectant manufactured by him. The tender was accompanied by a sample of the disinfectant labelled "Anite," which was delivered to an official of the defendants. On the printed tender the defendants had asked for a tender for "Heydozone," and the plaintiff omitted to alter the word "Heydozone" into the word "Anite" on the tender, so as to make the tender agree with the label on the sample delivered. The defendants accepted the tender of the plaintiff for the supply of "Heydozone." It was held on the facts that the plaintiff had failed to show that the minds of the two contracting parties were not *ad idem*, or that the defendants had misled

him in any way, and that consequently the contract was binding upon him.

Where, however, there is a mistake in a tender which being the result of a mutual error has the effect to prevent the contract carrying out the real intention of the parties, the court will intervene to rectify the contract. For instance, in *Neill v. Midland Railway*, 17 W.R. 871, a railway company advertised for tenders, and issued a form of tender and schedule of quantities. The builder signed a contract in 1866 to execute the works required at the prices set forth in his tender and schedule of quantities. The specification for the erection of the building was annexed to this contract. The builder made mistakes in filling up the schedule. In 1868 he discovered them, and filed a bill in equity to have them rectified, alleging knowledge of the mistake by the defendants' engineer, and he obtained rectification.

In *Collin v. Dublin County Council* (1908) Ir. R. 503, the plaintiffs, the building contractors, tendered to the defendants for the building of an asylum. The defendants, deeming the cost too high, directed their quantity surveyors to prepare bills of reductions, showing reduced works and reduced prices. Owing to a reference letter being displaced, there was a error in the total cost as appearing from the bills of reductions, the total sum being put at £830 less than the correct figure. The plaintiffs, in the mistaken belief that the aggregate cost of the reduced works was as stated in the reduced bills of quantities, tendered for one bulk sum and their tender was accepted by the defendants, and the works completed. It was held, in an action for rectification, that the mistake could be rectified to carry out the real intention of the parties.

These few cases serve to illustrate the necessity for taking the utmost care in getting out the figures on which to base a tender. Of course, a mistake may sometimes occur to the benefit of the contractor; but this is unlikely, for the person inviting tenders is able to check the figures of the successful tenderer with those of the other contractors who have made quotations.

Another point to which attention should be directed in preparing the figures for the final tender is the valuation of "prime cost" and "provisional items." A prime cost item is one upon which, on the face of it, the contractor is not to make any profit. A provisional item is one which may at any moment be withdrawn from the control of the contractor altogether. So far as prime cost items are concerned, it may be that the contractor will find it possible to add something to his total in order to enable him to make a profit.

With regard to extras and omission, it is prudent to have words inserted in the contract which will prevent the employer from withdrawing from the contractor more than a certain percentage of the whole work. Thus, he may be invited to omit the most valuable part of the whole work, and make what profit he can on the rest.

### Hydro-electric Scheme for New York State, U.S.A.—

In the *Electrical World* for January 4th particulars are given of an important scheme for the utilisation of the natural resources of the State of New York, based on an article by Mr. A. H. Perkins in the *Engineering Magazine*. At present the power plants of the State aggregate four million H.P., of which 2,200,000 is developed in electricity works, 1,200,000 in private steam power plants, and 700,000 from water power for manufacturing industries. At the present rate of growth the power required will increase to five million H.P. in 1915, and over seven millions in 1920. Of the steam plants, 2½ million H.P. could be replaced by water power, and at an estimated diversity factor of 50 per cent. the latter need only be of 1¼ million H.P. The proposed high-pressure distribution system would be connected with nine hydro-electric stations, aggregating 1,669,000 H.P., with steam auxiliary plant of 809,000 H.P. and a peak load rating of 2,153,000 H.P.

It is estimated that the scheme will halve the cost of house lighting and of motive power, saving \$15,000,000 annually to electric consumers in 10 of the principal cities, and conserving 20 million tons of coal per annum. The similar scheme in operation in Ontario serves 30 cities with 300 miles of high-pressure lines, and has halved the cost of electricity; 99 per cent. of the houses in Ottawa are electrically lighted, compared with one in 35 in New York City. The rate for continuous power supply in Ottawa is \$22.50 per H.P. per annum, and in Toronto the city pays \$18.50 and sells at \$28 per H.P. per annum for 10 hours daily. Nearly all the private supply companies in Ontario are said to have profited by the competition and to have enlarged their business.

## CORRESPONDENCE.

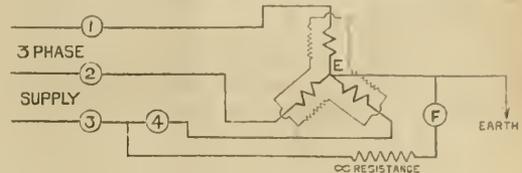
Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

### Earthing the Neutral.

Since Mr. Kenelm Edgemont's letter in your issue of the 10th inst., I have confirmed the experimental tests taken in the laboratory and enclose you diagram S.D. 146.

It will be observed from these readings that the neutral point is anchored, or very nearly so. The ammeters used on these tests are commercial instruments, and the readings are correct within a small percentage.

TRANS. 3.50 K.V.A. RATIO 205 TO 11,200. DELTA-CONNECTED ON E.H.T. SIDE AND STAR ON L.T. SIDE AS SHOWN IN SKETCH.



CURRENT READINGS.					PRESSURE READINGS.					
1	2	3	4	F	1&2	1&3	2&3	1&E	2&E	3&E
14	14.75	13.5	13.75	0	382	384	386	219	222	221
10	31.5	39	19	54	380	374	371	216.5	213.5	213

The reading of 54 amps. is the maximum that can continuously flow through the earthing transformer, which is sufficient to operate the patent earthing device controlling the trip coils on the automatic oil-break switches.

An earth developed on the E.H.T. system on two recent occasions, and in each case the fault was isolated, proving that the arrangement is satisfactory.

S. E. Fedden.

Electric Supply Department, Sheffield,  
January 23rd, 1913.

### Testing the Continuity of Earth Conductors.

In the Home Office Rules Relating to the Use of Electricity in Mines, Rule 8 on earthing says, "Where cables are provided with metallic coverings, such metallic coverings may be used as a means of connection to the earthing system. All conductors of an earthing system shall have a conductivity at all parts and at all joints at least equal to 50 per cent. of that of the largest conductor used solely for the supply of apparatus a part of which it is desired to earth"; and Rule 14 (c), "That the electrician shall be responsible for the fulfilment of the following duties: (1) The testing of earthing conductors and metallic coverings for continuity."

Up the present time I have not been able to find any practical and ready method of testing the continuity of earth conductors, and should be pleased to know if any other colliery electrician has met with the same difficulty, or has any suggestion to make as to a convenient method of fulfilling the requirements of the Act.

Continuity.

### The Chances in England.

In going over the advertisements in the *ELECTRICAL REVIEW* of a recent issue, I was afforded considerable amusement by two plums offered to those out of a job, or desirous of improving their knowledge and finances.

I refer to the mechanical engineer required by the City of Bradford, and the resident electrical engineer required by the Borough of Todmorden. Those who inserted the advertisements offer the pay of a common labourer—a labourer is worth that, anyway, if he is a good one. A first-class Board of Trade certificate is worth £3 per week in England, and, in addition, experience with steam turbines is necessary to land the job. Fine!

In the other case, for a trifle less money, the lucky man is expected to be a fully qualified electrical engineer, and, presumably, familiar with destructor plants. He stays at

the pleasure of the Council—an excellent way to put it—and must devote his whole time to the service of the Corporation. What a great opportunity for someone!

Goodness! what prospects there are in my native land to entice a man back home!

I often wonder why some of the good men in England stand for such treatment. I almost believe the mechanical engineer who was "lucky" enough to secure that Bradford appointment would do his fellow engineers a good service if he wrecked the whole plant.

English.

Newark, N.J., U.S.A.

#### Tariffs for Electricity Supply.

Those of your readers who are concerned with the manufacture and sale of electrical heating and cooking apparatus will be interested to hear of an alteration in our tariff that came into force with the new year. To cater for the heating and cooking business, we now offer the following alternatives:—

1. Domestic Supplies for All Purposes.—A fixed charge per quarter of 8d. in the £ of the rateable value of the premises, plus a running charge per "kelvin" of 1½d. in winter and 1d. in summer.

2. Heating and Cooking, if Separately Metered.—A flat rate per "kelvin" supplied of 1½d. in winter and 1d. in summer.

Applications from lighting consumers are coming in freely for transfer to the assessment tariff, and there is a brisk inquiry for auxiliary domestic apparatus.

With regard to such goods, will manufacturers bear with me if I insist on the importance of two details:—

(a) The heating element must be replaceable easily, and at small cost.

(b) The connector and flexible cord must be able to withstand kitchen handling.

Item (a) has been successfully provided for in some utensils, but the problem involved in item (b) has not, so far as I am aware, been solved, except at a cost comparable with the price of the main article.

The Harrow Electric Light and Power Co., Ltd.  
B. HORSLEY, Engineer and Manager.

Harrow, January 27th, 1913.

#### The I.E.E. Discussions.

Although the above is not a new topic by any means, I should like, once again, to call attention to the fact that at many of the meetings proper scope is not allowed for discussion, and that the Institution cannot fail to be a loser through this.

I take it as granted that the main object of the Institution meetings is to allow those well qualified to discuss papers contributed to do so before an audience of members sufficiently interested in the subject matter of the paper to come and hear it discussed. The reading of the paper by the author is quite secondary in importance; he merely reads an abstract, probably indicating what he considers the most important parts. This being so, is it a reasonable thing to apply the closure to a discussion at 9.25 p.m., as was done at the meeting on Thursday evening, the 23rd inst.? In this instance the chairman, immediately he had called on all those who had sent in their names beforehand as wishing to take part in the discussion, said he had several written communications which he would not read, but would now call on the author to reply, which he did.

Now I, for one, wished particularly to take part in this discussion, and, by the foregoing procedure, was absolutely debarred from doing so. It is small consolation that I can send in a written communication; that is all very well in its way, but one can bring home one's arguments by speech in a way in which they cannot be brought home in cold print, and bring more of them.

If a reasonable time is not allowed at the meetings for open discussion, and if we are to be satisfied by sending in a written contribution, what is the use of the meetings? I submit that to stop the discussion of an important paper at

such an hour as 9.25 p.m. is unreasonable. I wonder how many members would consider they had had value for their money if they went to a theatre and found the entertainment winding up at 9.25 p.m. instead of, say, 11.25 p.m.?—not that I am advocating the extension of Institution discussions to the latter hour. The whole proceedings on Thursday evening were over at 9.40 p.m.; for members of a learned Institution we seem to be very easily satisfied indeed with discussion.

I need not enumerate the causes which sometimes prevent a member from sending in his name beforehand, but I may point out that, in the discussion by those who have sent in their names, openings are sometimes given to other members who could utilise those openings for the profit of those members and the meeting generally, and I do think that it should be made a rule that, provided the members who have intimated their desire to the secretary to take part in the discussion, have finished at a reasonable hour, the chairman should invite further contributions to the discussion from the audience. An hour is a totally inadequate time to allow for the discussion of a paper of the interest and scope of Mr. Whysall's.

Battery.

London, January 27th, 1913.

#### The Association of Electrical Station Engineers.

As a central-station man myself, I must confess my surprise at finding a *confrère* who does not religiously peruse the "Situations Vacant" columns of the REVIEW weekly. Nevertheless, in reply to "Central Station Engineer" and any others who may have overlooked the advertisements at the end of the above-mentioned column for the past few weeks, the Hon. Secretary of the Association is:—

Mr. W. J. Ebben,  
7, Vernon Road,  
Stratford, E.

to whom all requests for application forms, provisional rules, &c., should be sent. Also, in case the advertisement in last week's issue has also been overlooked by anyone desirous of attending the general meeting on Thursday next, February 6th, it is to be held at the office of Harmer Rooke & Co., 69, Fleet Street, E.C., at 7 p.m.

We hope to see a very much larger attendance this time than on the 16th inst., and it would be as well that any items that anyone desires to put on the agenda should be forwarded to the Hon. Secretary without delay. Prospective members in the provinces should especially take note of this, and they have my assurance that all such suggestions, &c., will have full and fair discussion.

As to the grades to be included in the membership of the A.E.S.E., it would seem that those mentioned in the following list would about cover the various positions, in whose interests the Association has been formed, viz.:—

Station superintendent.	Repairs and construction engineers.
Mains superintendent.	Boiler house engineers.
Engineers-in-charge.	Switchboard attendants.
Sub-station assistants.	Meter-room assistants.
Mains assistants.	Draughtsmen.
	Outside Traction Assistants.

As regards those in-charge of works or private plants, it would greatly depend upon the particular qualifications of the applicant, as these gentlemen range from highly-trained engineers down to gardeners, stable hands, &c., so that it will be necessary for the permanent Committee (when elected) to decide each individual case upon its own merits.

As reference to the report of our meeting in last week's REVIEW will show, the A.E.S.E. will provide also for a social and recreative side, for at present this has offered the only solution of the difficulty in getting members to become acquainted with each other, so as to render it possible for an open election of officers to be made.

Before I conclude, I notice that "Unity is Strength" is under a slight misapprehension as to the failure of a previous attempt to form a similar association. This was engineered by an individual (not a station man) who had a very real interest in largely adding to the membership of a society whose

jects certainly did not in the slightest degree coincide with our own, under the hazy suggestion that should we care to become members of the said society (annual sub. two guineas, I believe) they might be disposed to consider the advisability of championing our cause, but no promise or undertaking to do so was given.

We want everyone who is interested in the A.E.S.E. to turn up on Thursday next week, when it is hoped that a great deal of good solid business will be got through.

Finally, I should like to remark that the unanimity of the first meeting was very encouraging indeed, and augurs well for the successful future of the A.E.S.E.

Chas. F. Wade,

*Acting hon. chairman.*

London, N., January 27th, 1913.

Having become interested in the correspondence *re* the above, I should like to endorse the remarks made in the letter signed "Unity is Strength" *re* "the inclusion of all grades who are connected with the running and maintenance of electrical plant."

I am at present responsible to the directors of a large manufacturing concern for the efficient working of a large plant amounting to several thousand H.P., and comprising steam, gas and electrical machinery, including intricate plant for special manufacturing purposes, also for the compilation of statistics of power and costs, &c., all requiring skilled attention; if, therefore, the Association of Electrical Station Engineers is going to include men of my status in its ranks, I will gladly give it my support.

Unit.

#### Village Lighting.

I am thoroughly surprised at the supercilious and self-satisfied tone pervading "Willesden's" letter in your last issue. It, at all events, does not give one the impression of a desire to get at the real facts. If "Willesden" throws doubt on Mr. Wardale's "second-hand" information, he may possibly accept my statements, which are first-hand, though I have my doubts, from his attitude. Still, your readers can form their own opinion.

In my own case, the population is less than 1,000, and the plant capacity less even than 10 kw. All the available customers in the village are not yet secured, although I am steadily and surely approaching this condition of things. I have connected premises ranging from a little sweet shop with three lights and 1d. slot meter to a brewery with 72 lights, and both pay a flat rate of 8d. a unit. What is significant is that when people who had electric light have moved into other houses in the village without it, they have invariably asked us to wire the new house. I think this will fairly prove that 8d. per unit is not considered too much by our customers.

Now as to remuneration. When I wrote in October last (ELEC. REV., Vol. 71, p. 646) we had 500 lights; now we have 557. With 500 lights the output per annum was 5,000 units approximately. This, at 3d. per unit, brought me £62. My actual running time for the year was 1,312 hours, less than 3¼ per day; but we may say 4¼ to allow for time making small adjustments and repairs. So I had the greater part of the day for other work. House wiring in 1912 brought me, as payment for labour, £21; work on mains and services about £6. That is £89 so far. Total time on house wiring and services, &c., was 540 hours—call it an average of 1½ hours per day. So that my total time working for the village lighting syndicate was 5¼ hours per day, and pay, £89 for the year.

In addition to this I put in three country house installations of from 25 to 45 lights. As two of these were 30 miles from home, I put a wireman on the interior wiring, and went over and installed the dynamo, battery and switch-board myself. Average profit on each, after paying wireman, practically £20, making another £60. Each of these jobs took about a month over all, start to finish. Total earnings so far, £149.

I regret I have not a complete record of my earnings from other sources, such as visits to obstinate oil engines on

farms, occasional fees for examining and reporting on second-hand machinery, &c.

But the above will perhaps give a fair idea of what may be expected from a small installation. Of course, in 1913 the output will be much more than 5,000 units, and the pay accordingly; from present prospects I should say at least 6,000, making about £75 for running plant. And I anticipate that the running hours will little exceed the 3¼ hours per day mentioned, if at all, as during 1912 I have run a good deal of the time on part load, the maximum load never having reached the output of the dynamo alone, to say nothing of drawing from the storage battery while the engine was running. I have gone into the earnings of the man in charge at some length. "Willesden" can form his own opinion of the position compared to the assistant engineer's post mentioned. Frankly, I don't know which is the better. But these figures are absolutely correct in an actual case of a smaller plant than his 10-kw. example.

I have given the customer's view and my own position. Now for the owners of the plant. This plant did not cost £500. After paying for fuel, oil, rent, wages and repairs, this particular installation had a surplus for the last financial year of 16 per cent. on the capital. I rather think we could put a fair amount into the sinking fund out of that, and still have a fair dividend. As we shall in the present year sell a deal more current, adding only to mains and services, and not to generating plant, a higher gross profit is inevitable, apart from a serious accident. If "Willesden" thinks we have a jerry plant for our outlay, I can only point out that we are in our fourth year, and have never had a single interruption of supply. We shall probably reduce the price later on, but only to-day a customer told me that he had tested a 10-c.p. lamp with his penny slot-meter and got 11 hours' light for his penny. He wasn't grumbling.

The above are first-hand facts, proof of which I will lay before "Willesden" if he wants it. Your readers must form their own opinions on "Willesden's" airy generalities, and on the figures obtained in actual working.

"Willesden" mentions a plant of 10 kw.—maximum capacity, I suppose. From observations at my own switch-board, a maximum load of 10 kw. would mean, in a village of this type, an annual output of 12,000 units. I should put the cost of plant at £700. Running expenses—fuel, oil, water—1½d. per unit (it costs us less). Repairs ¼d. per unit. Wages of attendant, say, 2d. per unit, giving him practically £2 per week for less than half of the day. Rent, in a country village, practically negligible. Total running costs, 3¼d. per unit. The above are obviously rough figures, but are reasonably near for present purposes. Put the selling price at 7d. Then the gross profit, 12,000 units at 3¼d., is £162 odd. Let "Willesden" descend to figures, and show where the miscalculations are. If people can pay 5s. 6d. and 6s. 8d. per thousand for gas, as they do in small towns in the country, these being actual figures for towns not far from here, they will pay 7d. a unit for electricity. I had been discussing the question of village lighting, before I launched into it, with electrical engineers of fair standing, and in many cases they were politely sceptical, and in others almost as bad as "Willesden." They would probably have put in the three-wire system, underground mains, and elaborate balancers, boosters and duplicate plant. Then before long someone else would have put in the bailiffs.

Little Man.

#### The Case of the Sub-Man.

If "Motor-Generator" will only accept advice and information from his equals or superiors, if he has any in his own mind, he will lose sight of one of the most useful sources of information it is possible to find—the practical workman; call him tradesman or what you like. If his experience has been anything like mine, he will have found that equals and superiors are more often than not unable to give him any useful information, and those that are able are more often than not "too busy" or openly unwilling. "If I tell you, you'll know as much as I do" appears to be their motto.

But I have always found the men to whom "Motor-Generator" refers as tradesmen, willing to give of their best both in time and trouble to explain anything they can

Not so with the shiftman, however: quite the contrary, except in a few isolated cases.

I had the whole gamut of actions in an engine room full of engines and turbines explained to me by a driver, who never even called me "Bill": he didn't call me anything. When he wanted to explain a particular thing he caught hold of my arm, and, so to speak, put my nose right on the thing under discussion. But I owe that man a debt which increases rather than diminishes as time goes on.

With Mr. Sullivan's idea of examinations I most thoroughly agree: it is, to my mind, the only way to remedy things.

"Switchboard's" trouble is mine also, as he says, "qualifications should count for something," and it does not look fair to any man with an impartial eye that "shiftmen," who are really "trained men," not crammed men that "Wireman" speaks of, but men with good practical knowledge and theory to back it up, should be paid an equivalent wage for a 56-hour week, to what men, such as floor cleaners and under-stokers are receiving for a 48 and 50-hour week, and very little more than labourers.

This is what we want to remedy; not the "Hey, Bill is this right?" There is not a man in the large power-house at which I am employed who is addressed as "sir," from the head shift engineer downwards; and few even as "Mr." We are all known by nicknames, and many of us are addressed by wiremen, fitters, cleaners, &c., by those.

Let us drop cavil and snobbery—it is doing our cause more harm than good; also the badly veiled advertising of Mr. Potter; and if our society is formed, let us go solid for an examination for all "shift-men," such as Mr. Sullivan speaks of.

Being a "shift-man" no more makes a man a gentleman than it ensures his fitness for the position he holds.

Balancer.

It is most interesting to read the letters from sub-men and others. But surely they are free agents, and free men. So, if they are dissatisfied and underpaid according to their own valuation of their ability, why not offer it to that section of the trade who require such ability, and always appreciate quality and find it remunerative to pay for qualified practical men?

Looking at the subject as an outsider, while sympathising with them, to some extent, most of the writers miss the practical and most vital point, namely, the commercial value of the individual to the station or firm by which he is employed. Although we as workers may not like it, each year as it passes proves, most unmistakably, that the labour given to the employer is considered from a strictly commercial standpoint, and this principle will increase in weight as time advances. But when does the everyday workman ask himself the question, if he, commercially, is worth more to his employer than he is at present receiving? Provided he is satisfied that he is worth more, and he fails to secure the same in the central station, why not come out of it, and place his ability, or "assumed ability," to the test in the open market? Then he will soon feel his feet, and his salary or wage its commercial level, accordingly.

But if he desires to succeed, he must know his trade "through and through," even "wiring," the modern steam engine, boiler, and all the auxiliaries which go to make up the complement of a modern up-to-date private installation, and how to manage and run it economically. Then he will have no need even to join a society to bolster up a fictitious wage, which he naturally places above the competitive value. This experience will most probably be to his advantage by disabusing him of his present inflated idea of his value.

The first and second sections of the letter signed by "Unity is Strength," are worth more than a passing glance. Here we find a contented electrician, in the sense that his estimate of his commercial and financial value is satisfactory to himself and his employer. The particular cause of so much discontent and complaint from a certain class to-day, is that workers put a much higher value upon their ability, relative to the work they are doing for the firm or station they are engaged by, consequently dissatisfaction and disappointment are the result, and instead of taking advantage of their opportunity and coming into the open market

of competition, they seek out a way to compel their present employers to pay them according to their own and their advisers' valuation, irrespective of the fact, that there must be two sides to this contract and two contracting parties, whose interests are diametrically opposite, except that one desires value for money, the other, money for their value.

However, this is the experience of the writer and his advice is qualify, and again qualify. Come out into the open market, do not live financially above your social status and all your grievances will disappear, and your interest in yourself, coupled with your interest in your employer, will be eminently satisfactory and financially gratifying to both.

Agreeably Satisfied.

I read with great interest the letters *re* shiftmen in last week's REVIEW, and I am sorry to say that some of the nasty things said are true, but as a branch secretary of the Electrical Trades Union, I must take objection to a remark of "Switchboard's." He says, "Apparently the sole idea of the Electrical Trades Union is to grind all down to a common level of efficiency, or rather inefficiency." I take it, by his use of the word apparently, he is not quite sure of what he says, so if he reads this letter, it might help him to see more clearly than the word "apparently" implies. The objects of the E.T.U. are as follows:—

To teach a man that a £4 suit and veins flowing with blue (*i.e.*, vulgar term for dirty) blood, does not earn wealth. To help those inefficient men to become efficient.

To grind all wages below the standard rate up to the standard rate.

Also to be ready to fight as a Trade Union when they see words or phrases such as apparently, as and when required, &c., and to append their name to anything they write.

E. S. Burslem.

Liverpool, January 21st, 1913.

## THE HOUSEHOLD BATTERY.

[COMMUNICATED.]

The household battery (by which the writer refers to the couple of primary cells connected in series which are usually employed for operating bells and indicators in private houses) is individually a very humble unit; but yet, when viewed in the light of the enormous number used, and of the fact that the majority of people find them indispensable, their collective importance becomes very great. Perhaps one of the most common household troubles is the failure of the electric bells, and the cause of such failure will amply repay a little investigation.

It may safely be said that, in the majority of cases, the trouble is due to a defective condition of the battery; and it is further safe to say that the defective condition is usually due to the fact that the battery was put to work, in the first instance, whilst in an improper condition. Assuming that the cells are of the wet Leclanché type (and this is the only common type of cell from which prolonged service may be expected), the mistake is commonly made of putting such a quantity of sal-ammoniac in the jars that the solution is not only saturated, but there is a large quantity of excess crystals.

The result of this is that "creeping" takes place, and the terminals are attacked and the connections rendered faulty. It will be found that 2½ oz. of sal-ammoniac is quite sufficient to charge a No. 2, or quart size, battery. Another fruitful source of trouble is the use of zincs which have not been thoroughly amalgamated. However commercially pure the zinc may be, there is bound to be local action unless this point is attended to.

The use of lead caps on the carbon plates is a mistake which is still made by some manufacturers, as these are soon attacked and eaten away. Carbon-capped plates are perfectly satisfactory and should always be selected.

If proper attention is paid to these points, and the battery is set up in a dry position, it will last for years with the occasional addition of water to make good the loss by evaporation.

## PROCEEDINGS OF INSTITUTIONS.

## Tramway Feeding Networks.

THE paper on this subject by MESSRS. J. G. and R. G. CUNLIFFE, of which an abstract was given in our issues of January 3rd and 10th, 1913, was read before the BIRMINGHAM SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS, on December 11th, 1912.

MR. A. P. TROTTER said that scientific experts had argued that because 1 ampere would dissolve 13 lb. of iron in a year, under laboratory conditions, the same action would go on in the case of tramways. If this were the case, the ends of all the tramway rails which were positive to the earth, must have corroded, but no such corrosion had been observed. Fortunately cases of electrolysis in this country were very rare. It was generally acknowledged that this was due to the Board of Trade Regulations, and to the carefulness with which they were generally observed. It was generally recognised among tramway engineers that these Regulations had not hitherto impeded tramway development, and that they had protected pipes from electrolysis to an extent which was not anticipated. The rule that pipes must not approach nearer than 3 ft. to the rails was well intentioned, but excavation was not made to a depth of 3 ft. in building a tramway, and the owners of old gas and water pipes seldom knew the position of them. The only cases of electrolysis that he had known had been at a distance of less than 2 ft. from tramway rails. The suggestion that poles should not be bonded to the rails, either for guard-wire earthing, or to avoid live poles where gas lamps were fixed to them was a good one, but it came too late. It appeared that the use of bare copper negative feeders bonded together, and at many places to the track, was a serious obstacle to the use of boosters in Chicago, and accounted for the proposal to increase the number and size of sub-stations in that city. This was evidently the wrong method, and the copper was not well leaded with current. The authors recommended that each booster should be excited from the feeders serving the same area, but engineers had found that it was difficult in some cases to divide the districts in that manner. Some six years ago he began to look into the elementary principles of the design of negative feeders, and had worked out a number of cases.

MR. E. B. WEDMORE said that, in a paper contributed to the Institution *Proceedings* of 1902, he produced some data bearing on electrolysis. The further evidence indicated that the fall of potential in the immediate neighbourhood of the track was greater than he estimated. This called for some revision of his estimate of the average specific resistance of the earth, and the data now indicated this to be in the neighbourhood of 50 ohms per yard cube. This revision did not appreciably affect the considerations on electrolytic effect of the leakage current. He had attempted to estimate the resistance of the relative paths through the ground and the pipe. The two paths were from the track through the general body of earth and from the track through the pipe, the latter path including a path through the earth from the track to the pipe and from the pipe to the track. His figures indicated that, in the case of iron pipes, the earth was practically a short-circuit to the pipe, but, in the case of lead pipes or of pipes having a low internal resistance throughout, the resistance of the path through the pipe was low enough to require careful consideration. With a view to bringing out the important features, he had made an estimate bearing on the length of life of the pipe under average conditions, and had assumed corrosion taking place to the depth of  $\frac{1}{16}$ th in. uniformly over the surface of the pipe. His calculations applied to pipes lying parallel to the track, and not more than 3 ft. from the rails over the greater part of their length. He had taken an extreme case where the voltage drop was 2 volts per 1,000 ft. of rail, which was twice the limit set by the Chicago rules. With the voltages they were discussing, the evidence was that the electrolysis would correspond, on the average, to only 5 per cent. of that calculated on the assumption that the whole of the observed current flow was electrolytic in effect. Even with 7 volts drop, there was not  $1\frac{1}{2}$  volts difference between the pipe and general body of earth at either end of the pipe, and in considering the effect on short lengths of pipe, the voltage available was some small fraction of 1 volt. Thus, probably, the calculations erred a great deal on the safe side in the case of short pipes. In the case of 6-in. iron pipe 5,000 ft. long, it was estimated that it would take 400,000 years to cause the amount of corrosion he had postulated. This figure was based on the line resistance. An estimate based on the surface resistance would indicate a figure of 600 years. In the case of a similar pipe 500 ft. long, the line resistance gave a corresponding limit, and the surface resistance a limit of about 6,000 years. In the case of lead pipes, the figures were very different. In the case of a 2-in. lead pipe 5,000 ft. long, the estimate based on the data in his 1902 paper was 160 years. The data given by Messrs. Cunliffe indicated a much higher figure, the estimate running between 400 and 1,600 years, based on the line resistance of the pipe. In the case of a pipe 500 ft. long, the line resistance gave a similar limit on the assumed potential gradient, and the surface resistance now gave a limit in the neighbourhood of 160 years. Safety lay in keeping the pipe away from the rail, and the life rapidly increased as the distance exceeded 3 ft. Regulations covering the maximum voltage drop in the rail were all that was required.

DR. KAPP, referring to the calculations of the last speaker, drew attention to the fact that they were made on the supposition that the action was uniform over the whole surface. In reality there was not this uniformity, and the electrolytic attack was concentrated at a few points, with the result that the pipes became pitted, and at certain points holes might be eaten through the pipe. He had himself seen a large amount of old gas piping rendered useless by such pitting and perforation in Hamburg. With negative feeders and boosters properly installed no electrolysis need be feared. He could

not agree with the authors that the use of negative boosters increased capital outlay and working costs. He thought the reverse was usually the case. By the insertion of resistance in a short feeder the ohmic loss in the feeder was artificially increased to that unavoidable in the longest feeder. This extra loss must be more than the losses occurring in boosters, since these would only be put on to the longest feeders, whilst the shorter feeders would have no more than their natural ohmic loss.

MR. GROVES said that in 1905, in connection with the Birmingham tramway system, the alternatives of sub-stations and negative boosters were considered; the necessity for providing local supply for power and lighting in widely-separated districts determined that the former scheme would be the most suitable, consequently no great difficulty had been experienced in conforming to regulations. There was no doubt that with negative boosters and plenty of pilots a very flexible system could be designed, and the track sectioned as desired, but commercial considerations would not permit the universal adoption of this electrically ideal method of controlling vagabond currents. The restriction to 7 volts between any two points required some qualification on a long route consisting of several negative sections, the potential might rise in a series of small steps until it exceeds 7 volts, although the conditions would be quite satisfactory in respect to the safety of pipes.

MR. A. M. TAYLOR said that the authors' statement that the addition of sub-stations for the purpose of splitting up the track into smaller areas was unconomical, was no doubt intended to apply to the case where the traction and lighting systems of a town were quite distinct. Where they were combined under one management, as at Birmingham, the additional sub-stations were desirable for the lighting scheme. In the case of Birmingham, he had gone very carefully into the use of negative boosters, in order to see whether it was at all possible by their use to feed the whole tramway system direct from one generating station, and had found that some 20 negative boosters would have been necessary. It was then found that the requisite number of rotary converter sub-stations for the traction requirements (without boosters) suited also the lighting requirements, and the combined scheme was adopted. It must be borne in mind that the authors' paper dealt with specially heavy traffic conditions only.

## The Design of Apparatus for Improving the Power Factor of Alternating-Current Systems.

THE paper on this subject by PROF. MILES WALKER, which was abstracted in our issue of January 24th, 1913, was discussed by the INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM LOCAL SECTION) on January 8th, and in London on January 9th.

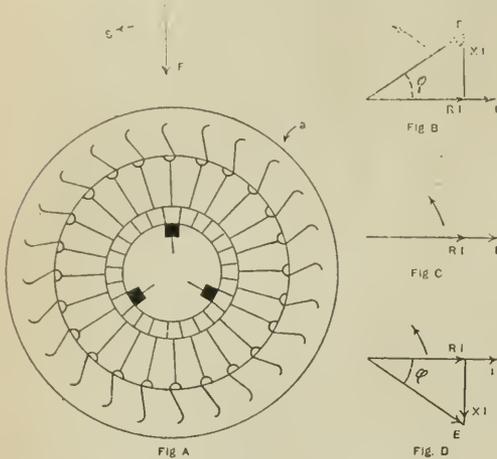
## DISCUSSION AT BIRMINGHAM.

DR. KAPP said that the so-called practical engineer seemed to think that anything which was highly scientific was generally also highly unsatisfactory as a commercial proposition. The author had given a few examples showing the vast improvement resulting in the power factor of a system by the addition of his phase-advancer, but he had omitted to draw attention to the fundamental proposition that a motor with a phase-advancer need not be dearer than one without. By using a phase-advancer they were able to do with a smaller motor in all cases where the short-time peak and not the heating was the determining factor. Since the motor was smaller, it did not work underloaded, and therefore with reduced efficiency, and the buyer would find that the saving on his bill for current would represent a high dividend on the outlay for the phase-advancer. It was to the advantage of the power companies to encourage the customer by an extra discount if he took his current at or near unity power factor. Prof. Arno, of Milan, had devised a special meter which would automatically discriminate between bad and good customers in this respect, so that all customers were treated alike. At full load the input into the motor was the same whether a phase-advancer was used or not; some power was, of course, required to keep the phase-advancer going, but some waste of power was saved in the motor; and the two approximately balanced. The author had referred to a phase-advancer made by the speaker, to which he had given the name "Vibrator." The idea of producing a leading E.M.F. by the free swing of an alternating-current conductor in a magnetic field was not new; Mr. Swinburne many years ago had suggested this kind of mechanical condenser to improve the power factor, not of a motor, but of a whole network. The suggestion was impossible of practical application, because the E.M.F. was exceedingly small with the usual frequency of supply. If, however, they had to deal with the rotor current of a non-synchronous motor, they got frequencies of 1 or 2 per second, and then the idea of a mechanical condenser became quite practicable, provided that they did not let a conductor alone swing as suggested by Swinburne and M. Leblanc, but a complete electromagnet. In his vibrator the electromagnet was a drum armature of special proportions, and the A.C. was passed through it by brushes. Since the armature swung freely, it could not permanently take up energy; hence the induced E.M.F., and the current which produced the swing must be in quadrature. The reversal of motion must, therefore, take place when the current passed through crest value. This meant that a growing current retarded the motion and a declining current accelerated it. When the motion was retarded, mechanical energy was converted into electrical energy, which was transferred to the circuit, and when the motion was accelerated energy was given by the circuit to the swinging system. Thus, the circuit lost energy during the time that the current passed from crest value to zero, and it received energy during the time that the current approached crest value. Thus, both the decline and the growth of the current were promoted, which was only another way of saying that the current phase was advanced by the injection of a leading E.M.F. The com-

mutating conditions were very favourable. The frequency of commutation was with a swinging armature very much lower than with an armature which must be driven at high speed. Moreover, the maximum frequency of commutation occurred when the current passed through zero. When the current had crest value the armature stood still. At an intermediate point there was both current and frequency of commutation, but both were less than their maxima. Hence the resistance voltage was low, a fraction of a volt only. The result was a perfectly sparkless commutation, even if solid copper were used for the brush contact. A vibrator to his design had been built at the Sandycroft works, and tested a week ago in connection with a 60-h.p. cascade motor of the type invented by Mr. Hunt. It had two pairs of tappings in each of its three secondary circuits, but as the vibrator had only three armatures, one pair of tappings

winding were fixed in space. Hence, when the ring was driven at the speed  $s$  R.P.S. in the direction in which  $F$  revolved, the relative motion of the field  $F$  and the winding became zero, and this was equivalent to the disappearance of the self-induction effect. The vector diagram of the phase E.M.F.  $E$  at the brushes and the current  $i$  fed into the brushes became as shown in fig. C, i.e., the current was now in phase with the E.M.F. If the ring were driven at a higher speed than  $s$  R.P.S., the  $XI$  component of fig. B became reversed in sign, and the vector diagram was now as shown in fig. D, i.e., the current was leading on the E.M.F. The angle of lead might be adjusted by adjusting the speed at which the apparatus was driven.

MR. N. SHUTTLEWORTH said Prof. Walker's fig. 8 did not agree with his view of the case. They might assume that the phase-advancer had no resistance or reactance, in which case the point  $x$  would coincide with the point  $E_a$ . He understood that  $O E_a$  represented the resistance drop of the full-load watt current in the main rotor; if then they drew a horizontal line from  $E_a$  to cut  $O a$  in  $Q$ , they would have  $E_a Q$  as the ideal voltage to inject, since it represented the resistance drop of the wattless current required. This voltage was at right angles to the rotor voltage, which was



FIGS. A, B, C AND D.

in each circuit had to be joined by equivalent resistances, so that the motor did not work under the best possible conditions. Notwithstanding this drawback, they obtained a power factor of 0.82 at quarter load, rising to 0.93 at full load, and when the motor was supplied at reduced pressure (400 volts, instead of 500 volts), the power factor rose to 0.98 at half load. When driven at 5 per cent. above synchronism, the machine returned 35 per cent. of its normal input to the line with a power factor of 0.94.

DR. T. F. WALL said the action of the Scherbius type of phase-advancer might be explained as follows:—The apparatus might be represented as shown in fig. A, in which  $a$  was a ring of iron provided with holes in which a winding was arranged, in a manner similar to that of a ring-wound armature of a D.C. machine with embedded active conductors. (In practice the winding was drum, but a ring winding was easier to illustrate in a diagram.) The ring and commutator were fixed on a shaft which might be driven. Three brushes were provided on the commutator, displaced relatively to one another by 120 electrical degrees, and these brushes received the currents of slip frequency from the secondary of the induction motor. If the ring were stationary it acted like a three-phase choking coil, the currents producing a field  $F$ , which revolved in

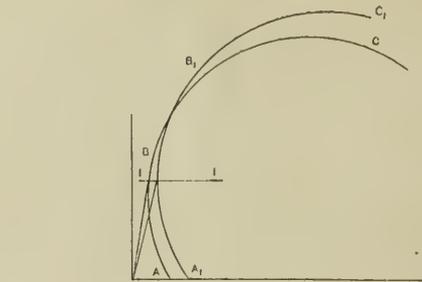


FIG. G.

variable according to the slip, hence it would control the wattless current entirely; in other words, they must not introduce a horizontal component greater than  $E_a Q$  when full-load watt current was flowing, otherwise they would have a larger wattless current than was desired. They might now represent the phase of the advancer E.M.F. by drawing from  $E_a$  a line parallel to  $a b$ , and by cutting this in  $r$  with a vertical from  $Q$ , it was clear that the magnitude  $E_a r$  had the correct horizontal component for producing the wattless current necessary, and the other component  $Q r$  would be immediately neutralised by a speeding-up of the main motor. It would seem, therefore, that  $E_a P$  was the correct magnitude for this particular phase to introduce. For any other phase relation it was simply necessary to draw from  $E_a$  a line representing the phase to cut the vertical through  $Q$ . According to Prof. Walker's diagram the required magnitude was obtained by the phase line cutting  $O a$ . Prof. Walker referred to the provision of a commutating flux in phase with and proportional to the current to be commutated; there was no further mention of this, and the commutating flux provided was not in the desired phase. In spite of this, the machine would commutate sparklessly, for the reason that the reactance voltage of commutation was only of the order of '5 to '6 volt.

MR. G. SHEARING gave the results of tests made on a Scherbius three-phase induction motor of 25 H.P., 50 frequency, and 450 volts, having a synchronous speed of 1,000 R.P.M. The motor was the primary and the phase-advancer was fixed on one end of the rotor shaft. The advancer itself was a three-phase commutator dynamo with no stator field, the exciting flux being produced by the armature itself. The stator terminals were connected to three brushes on the commutator; in this way, the necessary leading E.M.F. was injected into the secondary winding. Tests were made at 505 and 460 volts. In one test at 505 volts the advancer was cut out, in the other, the advancer was in circuit as well as in the test at 460 volts. The relation between the power factor and kilowatt input were

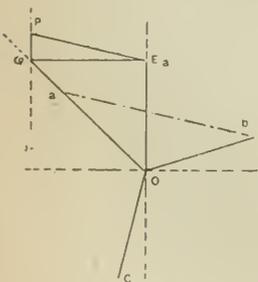


FIG. E.

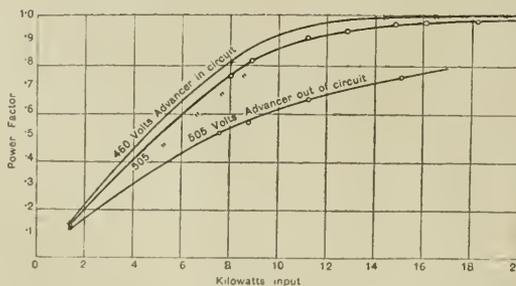


FIG. F.

space at a speed of  $s$  R.P.S. corresponding to the frequency of the currents supplied to the brushes. The vector diagram for the phase E.M.F.  $E$  at the brushes, and the current  $i$  fed to the brushes would be as shown in fig. B, in which  $R I$  was the component to overcome resistance, and  $X I$  was the component to overcome the E.M.F. produced by the revolving field  $F$  (i.e., the E.M.F. of self-induction). Supposing the apparatus were driven in the same direction as that in which the field  $F$  revolved, the speed of rotation of  $F$  in space was independent of the speed of rotation of the ring, because the points at which the currents were led into the

shown by the curves, fig. F, and the conclusions to be made from the test were very favourable to the use of phase-advancers. The motor was very light for the output. Its net weight was 798 lb., giving 14.5 kg. per horse-power for the rated load. From the maker's figures he found that as a rough average value for a motor of the same output, frequency and speed, but with no advancer, and a power factor from 86 per cent. to 88 per cent., the weight was from 14 to 15 kg. per horse-power. Thus the decrease in weight of the motor resulting from the use of the advancer compensated for the increase due to the weight of the

advancer itself. Without an advancer to secure a high power-factor, the air-gap had to be very small. With its use the air-gap need not be so small, and the mechanical difficulties associated with a small air-gap disappeared. For these reasons the cost of the motor and phase-advancer should not necessarily be greater than that of a motor with no advancer. The efficiency of the motor was 92 per cent. at full load. The additional losses due to brush and ohmic resistance of the advancer were thus small, and the gain resulting from the reduction of the current for a given output was far greater than the additional losses. There was no sparking at the brushes at full load when the stator current was about 80 amperes. The magnitude of the leading E.M.F. was at full load 5.4 volts, at half-load 4.9 volts, and with motor running light 3 volts, showing the tendency to saturation of the magnetic circuit of the advancer. The power factors obtained were less at the higher voltage. This followed from the circle diagram assuming, as an approximation, that the current diagram was a circle. A B C, fig. G, was the current circle for the lower voltage, and A' B' C' that for the higher voltage. For a given input as represented by the height of the horizontal line I, the phase angle was greater for the higher voltage over the working range of the motor. The greatest improvement in the power factor was at the higher loads. When lightly loaded the power factor was somewhat low, and the advantages of the advancer would be increased if, by some means, the power factor could be made higher at light loads with no additional complications. The greater part of the decrease of the leading E.M.F. of the advancer took place between no-load and about one-third full load. For these loads the E.M.F. was approximately proportioned to the current and the power factor decreased considerably.

## DISCUSSION IN LONDON.

DR. KAPP, in opening the discussion, said the author, in his new design, had used a mesh-coupled machine, and he believed it could be built so as to obviate any sparking, a matter which he had doubted when the author read his last paper on the subject. He felt that the author had not said as much as he might have done as regarded the commercial use of the phase-advancer; the motor with the phase-advancer would give a greater torque than without, which was equivalent to a saving in capital on a new machine to meet a slight increase of load. The efficiency would be improved at all times, representing a continuous saving in cost of energy. He also thought it would be cheaper to build an "iron" machine with a phase-advancer than a copper one without it, and that the cost of the advancer should not hinder its adoption. The right place for it was on the consumer's premises, but it was possible that the supply authorities disliked putting their plant on another man's premises. Possibly if the consumer were tempted by a discount, he might be induced to put the phase-advancer in himself. There was a difference in principle between the author's rotary machine and his (the speaker's) vibrating machine and the latter could not tackle a motor with a very bad slip so well as the author's phase-advancer. The effect of the latter was simply proportional to current, while the former depended on slip, and was adapted for motors which were much under loaded. The phase-advancer would be of great importance in electric traction, especially in such a place as Italy, where coal was dear. There was close on 200,000 H.P. of three-phase motors in locomotives at work there.

MR. W. H. PATCHELL thought the phase-advancer was commercially practicable and it should be put on the consumers' premises. The Scherbius machine had been largely used for fan driving, and the author's arrangement would be valuable in colliery work.

MR. H. W. ASHTON made a comparison between the use of condensers and the phase-advancer, taking the cost of installing the former to deal with 1,000 K.V.A. of wattless current at 50 periods to be £2,800. He assumed that the phase-advancer cost £250, and that its use would involve an extra loss of 25 K.W., and assuming capital charges at 6½ per cent., and energy at £4 per K.W. plus 4d. per unit, he found that at 100 per cent. load factor the condenser would cost £249, and the phase-advancer £489; at 25 per cent. load factor, £206 and £211 respectively; and at 20 per cent. load factor, £203 and £193 respectively, showing a saving in favour of the condenser for anything over 25 per cent. load factor. No doubt the higher first cost of the condenser, and the fact that engineers were unfamiliar with it, accounted for its non-use.

DR. S. P. SMITH said while the idea was ingenious, he thought it wrong to charge against the induction-motor its one vice, in view of its many virtues. As a designer, he could not see how an installation, consisting of an induction-motor and commutating polyphase motor, could be put into unskilled hands on the consumer's premises, and he further considered that if the station engineer wanted his power factor improving he should do it himself, as he had several means at his disposal. In certain systems the phase-advancer might be the only alternative, but generally he did not agree with its use.

PROF. MILES WALKER, in replying, said he thought that in the case of large machines, the total loss when using the phase-advancer, would be less than without it. The important thing was that a smaller motor could be built and worked at a higher rate with the same frequency. The main reason for correcting power factor was on account of the mains cost, which quite overbalanced the cost of machinery. He was glad to hear of the progress of the condenser, but the price mentioned seemed low; he had heard of a quotation of £5 per K.V.A. The condenser had its advantages, as it could be put direct on the mains, but he disagreed that the losses in the phase-advancer would be as high as stated by Mr. Ashton, and this greatly reduced his figure. The phase-advancer was independent of the motor, and could be shut off without affecting it; it was even better in this way than the exciter of the

synchronous motor. If there was such an objection to the extra machine, why did not people scrap the exciter in that case? The synchronous motor could be run all right direct from the mains without the exciter, and would give a power factor of about .72, but nobody did this.

MR. ASHTON writes to say that the cost of suitable condensers, including switches, is now less than mentioned by him, being about £1.9 per K.V.A.

## Electric Winding Engines.

By A. E. DU PASQUIER.

(Abstract of paper read before the SOUTH WALES INSTITUTE OF ENGINEERS, September, 1912.)

In this paper the author discussed not the relative advantages of steam and electricity, but the principles governing the type of winder for particular conditions, and the influence of drum profile on the results obtained. He pointed out that there was a general trend towards electric driving, and the makers of steam winders were with one accord making their designs more suitable for electrical operation. The tendency was strengthened by the growth of the large power companies, which he regarded with favour as being to the advantage of the consumers rather than to install their own generating plant. A close estimate of the load factor was of the first importance; the smaller it was, the less chance had the local generating plant. Where coke-ovens were used, the use of local plant, however, was essential to economy, provided that the surplus energy could be disposed of by co-operation with a supply company, as in many cases on the North-East Coast.

Comparing A.C. and D.C. winders, the author stated that in the case of the former, speed regulation was effected by inserting resistance in the rotor circuit, a wasteful method, while with D.C. the Ward-Leonard system was always used; the latter showed an economy of energy per wind, but the A.C. winder cost 20 per cent. less, and if the intervals between winds were prolonged, the saving was lost. Regenerative braking was practicable with the Ward-Leonard control, but this had little effect on the total consumption. The equalising effect on the load of a cylindro-conical drum was very marked. The introduction of improved double-helical gearing had benefited the A.C. motor, by enabling it to run at speeds at which high efficiencies and power factors were attainable. The accelerating and retardation periods should be so arranged that the accelerating torque turns will be as nearly as possible equal to the product of the static moment by the number of revolutions made by the drum in the decelerating period. "Equalising" was to be avoided if possible. Valuable assistance could be obtained from a drum with a special profile, and from the use of a tail rope. Table I gives a comparison of the results obtainable with an A.C. motor under various conditions, without equalising:—

TABLE I.

Drum.	Drum speed, R.P.M.	Motor H.P.	Motor speed, R.P.M.	Units per wind.	Accelerating peak.	Price ratio.
Cy-Con. 8' 6"-13' 0" ...	50	480	290	4.8	720	1.1
Cy-Con. 8' 6"-13' 6" ...	50	460	50	4.8	700	1.55
Cylindrical 12' 0" ...	50	750	290	5.6	1,730	1.1
*Cylindrical 12' 6" ...	45	480	290	4.75	900	1.0
Cylindrical 12' 0" ...	50	730	50	5.5	1,630	1.68
*Cylindrical 12' 0" ...	50	465	50	4.6	870	1.68

\* Tail rope 10 lb. per ft.

## Details of Winder.

Depth of shaft ...	...	...	...	...	1,050 ft.
Load ...	...	...	...	...	3 tons
Number of decks per cage ...	...	...	...	...	3
Weight of each cage and chains ...	...	...	...	...	80 cwt.
Number of tubs per deck ...	...	...	...	...	2
Weight of each tub ...	...	...	...	...	6 cwt.
Circumference of rope ...	...	...	...	...	5½ in.
Weight per yard ...	...	...	...	...	14 lb.
Winding time ...	...	...	...	...	47 sec.
Decking time ...	...	...	...	...	30 sec.
Output per hour ...	...	...	...	...	140 tons

A hoist of this nature would be quite impossible operated from the ordinary colliery generating station, or small power company, and under such conditions of supply the colliery company would have to adopt an equalised system at a cost of about 50 per cent. more.

With the uniform turning moment of the electric motor tail-ropes gave no trouble; they were in use in some of the Rand mines, with shafts 4,000 ft. deep.

Nowadays, the author said, the maximum peak load affected feeder drop more than generator regulation, and it was often better to spend money on additional feeders than on equalisers, except where the colliery was at a considerable distance from the power station. On the Rand, with thousands of H.P. of electric winding plant in use, there were no equalisers. In any case, there was no need to attempt to get perfect equalisation—a peak of 15 per cent. above the mean demand was permissible. The fly-wheels should be run as fast as possible—peripheral speeds of 100-120 m. per sec. were now quite common—and provided with an excess speed safety cut-off. As the wheels had to be solid castings, not over 12 ft. 6 in. in diameter, on account of transport difficulties, the maximum speed of the motor-generator was thus approximately fixed. Bearing

pressures up to 200 lb. per sq. in. of projected area were satisfactory, with forced lubrication from a tank, at 10 to 15 lb. per sq. in., oil pumps returning the oil to the tank through a cooler. An oil-failure alarm should be provided. The equaliser should be designed for a maximum slip of 12½ to 15 per cent., and should be capable of completing one wind in case of failure of the supply; the fly-wheel should be situated at one end of the set, with a coupling permitting it to be disconnected without shutting-down the plant. A brake for stopping the wheel quickly was necessary.

The Westinghouse equaliser for A.C. winders was in parallel with the load, instead of in series with it, and this involved much smaller losses; the slip could be increased to 30 per cent., enabling a smaller wheel to do the same work, and the equaliser set could be completely shut down without interfering with the winding. In the event of growth of the power station to such an extent that equalising was no longer necessary, the whole of the losses inseparable from the use of such sets could thus be cut out. Table II gave a comparison of the systems considered, the figures being for a complete winding cycle, including decking (see under Table I).

Comparing A.C. and D.C. winding, the author gave preference to the former for simplicity, first cost, maintenance and space occupied, and to the latter for regulation, control and braking, while, in respect of reliability, efficiency, power factor and equalising, there was, on the whole, no great difference between the systems.

The author dealt at some length with the question of drum profile, and commended the practice of lapping the ropes on the drum (winding in two layers), which had been in use on the Rand, for some time. He stated that, as the depth of shaft increased, the load also should be increased; for a depth of 500 yd., the economical lower limit seemed to be 3 tons with a 50-second wind, raising about 200 tons per hour. Drums should be kept as light and small as possible. Drums of unnecessarily large diameter were often used; the ratio of drum diameter to rope diameter might be as low as 41:1, and of drum diameter to the diameter of the individual wires 1,000:1. Small diameter of drum reduced the statical

would generate 10 units, leaving an equivalent of 20 units per wind for the steam winder. The Pengam electric winder dealing with similar loads, 60-sec. winds, at 730 yds. took an average of 24 units per wind, but, in the former case, condensation losses between winds were not included, and, in the latter, which included losses in the Ilgner converter, transmission losses were not allowed for.

MR. FOX TALLIS thought that the question of transmission had influenced the adoption of the electric winder rather than any economy over steam winding, and that such winders were generally found at new pits.

MR. W. A. CHAMEN, speaking from the Power Co.'s point of view, urged that the colliery proprietor would benefit by a public supply of energy, costing no more than he could produce it at for himself and freeing a large amount of his capital for other purposes. He further pointed to the advantageous influence of diversity factor on the Power Co.'s supply, the maximum load on which might be only half the total H.P. connected, while a small local station for a colliery would get scarcely any benefit in this direction.

MR. HUGH BRAMWELL dealt with the matter of winding ropes, and mentioned that the electric winder, owing to its even acceleration, was very much less severe on the rope, and that a reduced factor of safety was possible, and Mr. F. ANSLOW in a communication, discussed the question of geared motors, holding that there must be considerable advantage for them to replace the direct-coupled drive. He had had satisfactory gearing in use for purposes comparable with winding.

### THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION (INCORPORATED).

TABLE II.

	Price ratio.	Units per wind.	Average power factor.	No load losses during night.	Weight of fly-wheel, tons.	R.P.M. of fly-wheel.	Average demand from line, H.P.	Max. demand from line, H.P.	Heating capacity of motor, H.P.
A.C.	1.00	4.52	0.8	Nil	Nil	—	520	1,040	550
A.C. equalised	1.45	3.22	0.9	Nil	4.5	800/560	600	750	550
D.C.				33 units per hour					
D.C. equalised	1.65	4.66	0.92		7.5	800/680	525	620	540

moment and the first cost, increased the drum speed, and, with scroll drums, greatly assisted in equalising the winding diagram without unduly increasing the inertia. The author submitted that with modern conditions, using electric winding engines, a factor of safety of 10 for the ropes was no longer necessary; at the De Beers mines a factor of safety, omitting bending and acceleration stresses of 5.2 was employed, and allowing for these stresses, the actual factor of safety was 2.33. The use of the Thury high-pressure D.C. system in the case of three small winders was mentioned. The effect of suitably designing the profile of the drum on the winding diagram was fully dealt with in the paper, with the aid of numerous diagrams.

The discussion on this paper (on December 19th, 1912) was reported in the *Iron and Coal Trades Review*, to which we are indebted also for the foregoing abstract.

MR. B. J. DAY considered that the high power required for the large outputs of present-day pits was in favour of the modern steam winder, which, for purposes of comparison with the electric winder, must be considered in conjunction with the exhaust steam turbine. MR. W. C. MOUNTAIN communicated similar views to the meeting. MR. W. TRIMMER, however, disagreed, pointing out that, in South Africa, electric winding was displacing the steam winding where heavy loads had to be hoisted from great depths. He further gave his opinion that in South Wales the steam winder would be displaced by the electric winder, when power supply on an adequate scale was available.

MR. GEO. HANN thought that, if a fresh start could be made in the South Wales area, it would be agreed that the most efficient arrangement would be central power stations and electrically equipped collieries. Under present conditions, with existing steam plant, however, mixed-pressure turbine-driven generators supplying auxiliary plant, was a possibly good solution of the problem. Assuming a modern installation of this kind, power from outside would not have to exceed in cost 3d. per unit—a price which had not yet been reached.

He favoured the electric winder, providing the conditions were favourable to its use, but careful investigations of its cost compared with the steam winder were required.

As an example, he mentioned that the Penallta steam winder consumed 450 lb. steam per wind, calculated from the indicator; load 6 tons, depth 750 yds., time of wind 50 secs. This quantity of steam used in a live steam turbine plant, at 15 lb. per kw.-hour, would generate 30 units; while the same amount of exhaust steam used in an exhaust turbine plant at the rate of 45 lb. per kw.-hour

ON Friday last the annual dinner of the "Beams" was held at the Savoy Hotel; the chair was occupied by the Lt. Hon. Lord Amptill, G.C.S.I., President of the Association, and there were present about 300 guests, including members of the Association, central-station engineers, consulting engineers and contractors, as well as many distinguished guests.

After the loyal toasts, Mr. Samuel Insull, President of the Commonwealth Edison Co., Chicago, proposed "The British Electrical and Allied Manufacturers' Association." First remarking that he knew but few of the audience, though born in London, he said that one of the great obstacles to the progress of electrical business in this country was the lack of co-operation between electrical men in general and between the manufacturers of electrical apparatus and the suppliers of electrical energy in particular. The results achieved in the United States and Canada were, to a large extent, due to the closest co-operation between manufacturers and suppliers, and while the Association was formed more especially to look after the interests of the former, if it was to accomplish its purpose, it must also take care of the interests of the users of electrical apparatus. Undertakings and combinations were useless unless they were reasonable—so reasonable as to safeguard the interests of the user as well as of the maker. Nothing would add so greatly to the prosperity of the electricity supply business of the United Kingdom as a greater appreciation on the part of those engaged in it of the true mission before them. In London alone, 200,000 H.P. was awaiting the attention of the electricity supply authorities. In the County of London, with a population of 7½ millions, 750 million units a year were manufactured for all purposes; in Chicago, a population of 2½ millions in 1912 consumed 800 million units. The conditions of life and purchasing power in the two places were the same, yet there was this great difference in consumption per capita. His message was that, if they wished to see their great industry prosper, the main thing necessary was the massing of the production and of the distribution of energy. The pursuit of that policy would bring prosperity to the Association.

Responding, Mr. A. Bruce Anderson, chairman of the Council, first apologised for the length of his speech last year, which he ascribed to inexperience and enthusiasm. As for the aspirations of the Association, in the words of "The Road Mender," all they asked was "leave to serve." They wished to carry their fellow men, light them, heat them, cook for them, and help them out of this world, if justice so decreed; to do this the world over, but especially where their own flag flew. The Association had achieved a position in which they expected to be heard—and so long as they spoke truly, they must be heard. Whenever they had found it necessary to speak, either on behalf of individual members or of the Association as a whole, they had invariably been received with courtesy and consideration. That position had been achieved by a reasonable growth of that spirit of alliance which they had grafted on to, without impairing, their old spirit of self-reliance; by the careful deliberations of the council and committees, and by the ability and tact of their secretary, Mr. Dunlop. During the year they had obtained the services of Lord Amptill as president of the Association; they regarded his presidency as a high honour, and a clear indication to their friends of the reasonableness of their desires and of the purity of their intentions. As the visitors by their presence recognised the importance of the Association, so the latter would recognise and endeavour to fulfil their obligations.

Proposing "British Industry," Mr. L. W. Evans, M.P., referred to the prosperity of trade the world over, and said that the mainsprings

of British industry were capital and brains. It was an excellent thing for British capital to go abroad provided that enough remained to develop home industries; the surplus capital only should go abroad, and so long as there was reasonable co-operation between those who found the capital and those who supplied material, British industry was benefited. There must be closer co-operation between them—that was where they were weakest. The Rand power scheme a few years ago was a notable example; the money was found not in London, but in Germany, and the Germans got the work. The necessity of closer co-operation had brought that Association into existence, and every where they saw the increasing effect of combination. In Lord Amptill, who had had wide experience and occupied great positions, they had secured an ideal president.

Lord Amptill, in his reply, said he was a casual labourer in various branches of public work, and he could sympathise with those who did not share in the advantages due to the unquestioned boom in trade. They might well be proud of the achievements of British Industry in the past and thankful to Providence that these blessings had been showered on the nation. Their most urgent need was to see that all classes shared in their good fortune. Could they disregard the efforts of their rivals and go on in the same old way? Often in business a complete change of methods was necessary. Cobden thought we should always be the workshop of the world, but other nations had become workshops, and as they did not copy our methods as Cobden expected, we should adapt ourselves to their methods. Our Parliament ought to be attending to these matters—the things they were busy with at present would not help industry. Our prosperity had had a deteriorating effect on political life; they must look not to the politicians but to the people of this country. The people looked after themselves by Trade Unionism, a system of co-operation to protect their interests; why not extend the system to the nation—why not have a Federation of Trade Unions of the Empire? How could they reconcile the system of protection of Labour with Free Trade in goods? Foreign manufacturers could protect themselves; British manufacturers should be able to compete with them, not for their own sakes, but for the sake of the workmen. They were not in need of it at present, but must look to the future. He congratulated them on the wonderful success of the industry; by the skill of the workmen and the courage and devotion of the employers they had recovered their lost ground and pulled up level with their competitors. But they must not forget the 12 millions of people on the verge of starvation—the white slave traffic—the discontent of labour—the unmanly decadence which held back their citizens from preparing themselves to defend their great heritage—and the humiliating outbreaks of feminism. There was nothing like work to inculcate the spirit of duty and discipline and to bring about the social reform that was so necessary. What was wanted above everything else was far-sighted promotion of British industry.

Dr. S. Z. de Ferranti, vice-president, proposed "Kindred Institutions and Our Guests." He said that a few years ago to have called the Institution of Electrical Engineers a "kindred institution" would have been very difficult, but now they could go very much closer to the idea, because the Association existed for the protection of the members and their interests, and the I.E.E. was not only a scientific institution, but had also taken up the idea of protecting and supporting its members. The presence of Sir N. J. Moore was a sign of the times and of their desire; they wanted him to help them on with the great work they had to do—to promote the applications of electricity throughout the Empire. Mr. Ineull was a great benefactor to the industry, as he had shown them in Chicago the wonderful results that could be attained in the supply of electricity to the community by skilful organisation. Mr. Evans had shown the desirability of capital, when going abroad, conferring benefits upon British industry; but, in the case he mentioned, the Germans got the English to find the money, while they got the work.

Mr. W. Duddell, President I.E.E., responded, and in pointing out that the toast included many other institutions besides the I.E.E., said that no country had more institutions per cap. than this; it would be a great thing if they could devise some scheme of co-operation between these bodies. It was not good either for the manufacturer or the consumer that goods should be sold at unremunerative prices, nor was it good for the institutions to work without co-operation.

Sir N. J. Moore, Agent-General for Western Australia, also replying to the toast, said there was an undoubted commercial link with the Dominions beyond the seas; they never forgot that industry was the lifeblood of commerce, and the Dominions were doing all they could to see that the British manufacturer had a look-in. Three-quarters of the trade of the three Dominions south of the line came to England; one of them was spending £50 per cap. on British goods. What was wanted besides capital and brains was labour, without which they could not develop their vast territories. Out of 12 millions' worth of imports, over 8 millions came from the United Kingdom, only £1,100,000 from Germany, and 2½ millions from the United States. All parties in Australia were in favour of preference and compulsory service. The preferential tariff applied to more than half their imports. Between 1906, when preference was introduced, and 1910, the electrical imports from the United Kingdom had increased by 58 per cent. There was a strong commercial tie between the United Kingdom and the Dominions, largely due to the preferential tariff. Melbourne had placed orders for three millions; New Zealand was calling for tenders for electrical plant of 20,000 H.P. Never was there a stronger sentiment of universal patriotism. All the Dominions were preparing to share in Imperial defence—they were as proud of the Empire as the native Britons. Nothing short of national military preparation sufficed nowadays, and the British people should consider closely

the reasons which led 15 millions of their brothers to adopt this Imperial policy.

Mr. H. Hirst, vice-president, proposed "The Health of the Chairman," remarking that Lord Amptill was the distinguished son of a distinguished father, and had inscribed his name on the roll of Empire-builders. With Lord Carson, Lord Roberts and Viscount Milner, he had been relegated to the position of a casual labourer, in the debating society called the House of Lords. The ship of State was in the hands of windy orators; it was now in smooth waters, but what would happen in time of trouble? The manufacturers also had been drifting, but Lord Amptill was willing to help them, and in their wider aims he would be a safe guide. He must preach the great difference between commerce and industry; commerce led to internationalism, manufacture to nationalism. It was peculiar that every society had some honour thrust upon it, but no one cared for the manufacturer—he was left to himself. They must alter this state of things, and must organise, not trusts, but some system of universal co-operation, so that they could appear abroad as a coherent unit, not as at present a negligible quantity. Lord Amptill would lead the way to success in this.

The Chairman briefly responded to the toast, expressing his appreciation of Mr. Hirst's remarks. The health of Mr. Bruce Anderson was also honoured, though, as he pointed out in reply, his name had already been coupled with a toast.

During the evening a short but excellent programme was performed by Miss Carrie Tubb, Mr. Herbert Heyner and Mr. Ernest Hastings.

We have received the following summary of the report of the Council (Session 1912), which was submitted at the annual meeting held in the afternoon of the same day:—

The Council, in their confidential report issued to members (which covered the first year of working under the reconstituted Association), recalled the main object for which the Association was originally established—namely, the fostering and protection of the industry by means of co-operative action.

It had appeared to them at the outset that a subject which most urgently called for co-operative action was that of getting agreement between members as to the adoption of a set of equitable conditions to govern, as far as possible, the relations between vendors and purchasers of large plant. That work, therefore, became the first line of action, and was energetically put in hand last January.

A moment's consideration of the mere scope of the various interests represented in the Association made plain the extreme difficulty and complexity of that work. All large contracts contained about 40 important clauses, each dealing with a different subject-matter and bristling with contentious points. Fortunately, a text on which to work was at the disposal of the Association, viz., the "Model General Conditions of Contract," published by the Institution of Electrical Engineers. This text, originally drafted, as it is stated, by a firm of consulting engineers, had undergone amendment from time to time as circumstances seemed to its producers to require, and the industry at large owed those gentlemen a debt of gratitude for something in the absence of which the Association would have been confronted at the outset by a serious difficulty.

Even the briefest *résumé* of the work done upon this text by the Revising Committee of the Association would have to deal with an immense mass of matter thrown off first as between the Revising Committee and the members of the Association, and, secondly, as between that Committee and the other two representative bodies chiefly concerned, viz., the Institution of Electrical Engineers and the Incorporated Municipal Electrical Association.

The Council were able to announce, as a result, that at the end of the year just closed, the text of the general conditions of contract most commonly in use by engineering purchasers throughout the country had been very thoroughly amended in line with the requirements of the manufacturers; and they hoped that agreement on that text was within a short distance of being reached as between the Association and the kindred bodies.

That this result had been attained in so short a time was due partly to the unflagging energy of the Revising Committee, partly to the courtesy and assistance extended to the Association at all times by the cognate institutions concerned; and, to some extent, it should be said, to the clear earnest of its intentions which the Association afforded all and sundry by printing and forthwith putting into use, amongst such members as cared to adopt it, a text, limited to certain vital clauses common to all large contracts, as soon as the Revising Committee had settled the same. Printed copies of that short text, of which about 4,000 had been distributed, might be had by any member on application to the secretary; and copies of the complete text would similarly be available at a later date. Neither was to be regarded as final.

Members of the Association manufacturing prime movers and generating plant had long laboured under the cumbersome and wasteful procedure known as cross-tendering, whereby sub-contractors always tendered to a main contractor, and he again to the purchaser. A remedy for that had been devised and was embodied in the agreements between members known as cross-tendering agreements, under which their signatories, whether main or sub-contractors, now made separate tenders direct to the purchaser without cognisance of each other's prices, thus, in a very simple and certain way, not only avoiding temptations to cut prices, but obviating fruitless expenditure of much time and trouble.

A Committee dealing with the revision of standards for electrical machinery commenced work last February. Its terms of reference were to consider what extensions and modifications were necessary

to the Engineering Standards Committee's Report No. 36 on British Standards for Electrical Machinery, so as to make this a recognised text-book for British engineers and manufacturers corresponding to the standardisation rules respectively issued by the American Institution of Electrical Engineers and the Verband Deutscher Electrotechniker.

As a result, the following sections of the proposed rules, viz.:—II, Standard Pressures and Frequencies; III, High-Potential Tests; IV, Classification of Machines; V, Rating; VI, Overloads; and VII, Heating, were now completed, and would shortly be presented to the Engineering Standards Committee.

The Association was represented on the various Sub-Committees of the Engineering Standards Committee and on the International Electrotechnical Commission, three of the Special Committees of which had met recently in Zürich on the subjects, respectively, of "Symbols," "Rating of Electrical Machinery," and "Prime Movers."

Another Committee of the Association which had made satisfactory progress, was that dealing with electrical accessories. Acting upon the recommendation of the Panel of the Engineering Standards Committee dealing with electrical accessories, a joint conference had been held under the chairmanship of Mr. C. H. Wordingham, consisting of members of the Panel and members of the Association. The outcome was that recommendations had been made which would, in due course, be presented to the Electrical Accessories Section of the Engineering Standards Committee.

The recent important activities of the Houses of Parliament as they affected the Association were well known. The National Insurance Act of 1911, particularly Part 2 relating to unemployment insurance, threw a considerable amount of work upon the Association, and the secretary attended on several occasions before, and otherwise communicated with, the Empire, and argued cases on behalf of members, securing in several instances the exclusion of certain branches of the industry.

A new Railway Bill was proposed by the Government during the year, but was dropped in favour of a short one-clause Bill which was now receiving attention.

A Bill to obtain further powers, and to extend the present powers of municipalities under the Electric Lighting Acts was promoted by the Incorporated Municipal Electrical Association, which, it was hoped, might be passed in a form agreeable to the conflicting interests.

During the past 12 months the Association's patronage and assistance had been invoked in respect of many exhibitions promoted either by local authorities or private enterprise. As members were aware, a standing rule of the Association was that members could not exhibit except on conditions very advantageous to themselves, and this rule was enforced in regard to all such exhibitions, with the exception of the forthcoming Ideal Home Exhibition and those held at Islington, Earl's Court (Shakespeare Exhibition), Glasgow and Newcastle, limited, however, to members who supplied heating, cooking and lighting apparatus, for the purpose of displays of smoke-abatement electrical appliances.

Arrangements were on foot for the formation of a Joint Exhibition Committee composed of representatives of the Association, of the Incorporated Municipal Electrical Association, and of the supply companies. The terms of reference to that Committee would be to consider whether, and, if so, by what means, agreement could be reached as to the Association's attitude towards proposals for holding exhibitions, and the nature of such exhibitions, having regard in particular to the question of avoiding overlapping throughout the country.

The railway companies had made, during the year, certain alterations in their rates, and prescriptions as to method of packing goods, which affected a large number of members. Switchgear and electric-heating stoves had both come in for punishment last year. A deputation of the Association, in respect of the carriage of switchgear, would shortly visit the Railway Clearing House, the carriage of electric heating-stoves having already been the subject of a visit of a deputation. It was expected that the points of difficulty in both cases would shortly be satisfactorily settled.

As members were aware, the Electrical Contractors' Association was one which took care of the interests of that increasing body of trading contractors who acted as intermediaries between members of the Association, the manufacturers of apparatus and appliances, and private customers. Many such contractors were in a large way of business, and several of them even manufactured lines of their own, while, on the other hand, several members of the Association confined themselves solely to selling. Distinct lines of cleavage were not, therefore, easily drawn, and this might account, to some extent, for the difficulty which had apparently been experienced in the past in arriving at a complete understanding between the two Associations, the respective members of which were so necessary to each other. A Joint Committee composed of members of the Association and the Contractors' Association was now, however, discussing a set of rules to govern the relations to one another of the respective members of the two Associations.

During the year the Publicity Committee held frequent conferences with the Electricity Supply Companies' Publicity Committee with a view to devising a scheme, and a scheme was finally devised and put before the Council, for an extensive campaign of Press and other advertising. That scheme, while it had many merits, appeared of somewhat too ambitious a character for the Council's sanction, and was, therefore, rejected.

Towards the close of the year, unfortunately too near the close for effective action, the Publicity Committee had under consideration questions raised as to the usefulness of the existing trade directories covering the branches of the industry represented in the Association. Recommendations made were a little confusing to the proprietors of these works, and action was left to members'

discretion. The subject would be dealt with sufficiently early this year to admit of promise of agreement between the Association and those gentlemen.

The Electrical Trades' Benevolent Institution, a body worthy of support, had benefited by a contribution from the Association of the sum of £250.

The number of sectional meetings held during the year was 135. The number of members on the register of the Association at the close of the year was 109, being an increase of 14 on the number on the register at the close of 1911.

Under Article 17 of the Articles of Association five members of the Council retired as from the date of the annual general meeting, and, being eligible, offered themselves for re-election.

Under Article 25 the members of the General Committee retired, and, being eligible, offered themselves for re-election.

Mr. T. Trimmell, of 123, Cannon Street, London, had been invited to become industrial solicitor to the Association (in addition to the Parliamentary solicitors, Messrs Bircham & Co.), and, having accepted the invitation, his appointment was confirmed.

Messrs. Price, Waterhouse & Co., the auditors of the Association, retired under Article 53, and, being eligible, offered themselves for re-election.

## LEGAL.

### MARCONI CO.'S RUSSIAN EXTENSIONS.

MR. JUSTICE SCRUTTON, sitting as Commercial Judge in the King's Bench Division on Friday last, delivered his reserved judgment in an action brought by the Marconi Wireless Telegraph Co., Ltd., against Goukasoff and another for breach of contract, arising out of negotiations between the English Marconi Co. and a Russian company, which, for the purposes of the action, was referred to as the Russian Telegraph and Telephone Co.

Mr. Shearman, K.C., with Mr. Stuart Bevan, were for the plaintiffs, and Mr. Cavell Salter, K.C., M.P., with Mr. W. S. Hogg, represented the defendants.

MR. SHEARMAN, in opening the case, said that the point in dispute turned mainly upon the construction of a document relating to the contract between the parties. The plaintiff company desiring to extend their operations to foreign countries, including Russia, and thinking that combination was better than opposition, approached the Russian Telegraph and Telephone Co., which was working wireless patents invented by Eisenstein. Negotiations were begun in 1910 for working with the company or buying it out entirely, and a scheme was suggested by which the plaintiff company was to purchase sufficient shares to secure a controlling interest in the Russian company. Capt. Adrian Simpson, acting under the instructions of Mr. Godfrey Isaacs, the managing director of the Marconi Co., went over to St. Petersburg and commenced negotiations with Mr. Tischenko, under whose control were the majority of the Russian company's shares. Mr. Tischenko, on October 16th, came over to England and completed the transaction. All the documents were handed over as against cash. The document which was the cause of the dispute, was signed by Tischenko, and said:—"P. O. Goukasoff & Co., represented by myself, hereby bind themselves by every means to promote the success of the Russian company, and not to take part, directly or indirectly, in any other similar companies in Russia. At the same time, they hereby bind themselves, in the event of their wishing to sell the shares of the Russian company belonging to them of the nominal value of 340,000 roubles, to give to the English company a preferential right to purchase all those shares on the same conditions, and at the same rate, as may be offered for those shares by other persons or institutions." The whole object of the plaintiff company was to obtain complete control over the Russian company, and they did not want those shares to get into the hands of other people, who, as in this matter, were holding them for the purpose of trying to persuade and squeeze the plaintiff company to buy them at a prodigious price. In order that they might not be put at the mercy of Stock Exchange manipulation by outside purchasers, they stipulated that if Tischenko got an offer for the shares from anyone else, before selling them he was to give the plaintiffs an option of taking them. What happened was that Tischenko negotiated for the sale of the shares. He said he wanted capital for other purposes. They were offered to the plaintiffs on the Stock Exchange at a low rate, and Mr. Godfrey Isaacs made a low bid for them of 220,000 roubles. He was, however, not successful. He (counsel) thought the facts would turn out as follows: Somebody desirous of speculating in the shares approached the owners and made a substantial bid for them. Tischenko offered the shares to Capt. Simpson late one night in St. Petersburg at what was called 10 per cent. under par, and gave him only 36 hours in which to decide. The moment that was refused, Tischenko conceived himself at liberty to sell the shares to someone else, although the offer he made to the plaintiffs did not represent any valid offer that had been made to him. He sold them to other persons, who were now demanding a large premium if plaintiffs wanted to buy them. The plaintiffs submitted that Tischenko had bound himself down by the document. They did not know who had bought the shares, but they were held by a broker named Barch, against whom there was a second action. All plaintiffs knew was that a two-man company had been registered to deal with the shares, and they were now being offered to the plaintiffs at 800 roubles for every 100-rouble share. They

had obviously been bought for the specific purpose of putting pressure on plaintiffs to buy them, which was one of the things they were seeking to prevent. He submitted that what had taken place amounted to a breach of contract. He did not, however, suggest that Tischenko was not a perfectly honourable man. Plaintiffs did not want to spend any more money at the present, but they desired to prevent the shares getting into the hands of a hostile group. In Russia, a great many things could only be done by a company if there was a 75 per cent. majority, and plaintiffs only held 60 per cent. of the shares. Plaintiffs claimed damages for breach of contract, said counsel, and the usual measure of damages would be what the plaintiffs would have to pay in the market for the shares, but there were hardly any shares to be had.

MR. GODFREY CHARLES ISAACS, the managing director of the Marconi Co., said that negotiations in 1910 came to nothing, but in September, 1911, Mr. Tischenko saw him in London, when further negotiations took place. He, Mr. Tischenko, suggested writing the letter of October 16th, giving plaintiffs' company a preferential right to purchase the 3,400 shares. The first offer submitted to him in respect of those shares was from Solomon and Co., stockbrokers, on September 27th, 1912. They first telephoned to him saying they had a large block of Russian shares to offer, and a correspondence took place on the subject. At the beginning of April, 1912, he purchased 700 shares at 100 roubles each, and others were offered afterwards. If he had been able to secure defendants' shares it would have given his company just over 75 per cent. of the shares of the Russian company, sufficient for the control of it.

In cross-examination, he said that as early as October 13th Tischenko had agreed to give the plaintiffs a preferential right to purchase the shares, although his letter of the 14th made no reference to the option. He was given to understand that Tischenko was doing things separately. He did not remember having had shares offered to him before February 20th, but he wrote to Capt. Simpson on that date stating that he had been approached by a firm of stockbrokers with an offer of 3,200 shares then held by Tischenko, and he, witness, had offered 220,000 roubles for them which had not been accepted. They were offered by the stockbrokers at par, which was 320,000 roubles. The shares were offered about March 4th for 280,000 roubles, but he declined them. The Russian company owed the plaintiffs a good deal. The business of the Russian company was so large that the plaintiff company had to advance considerable sums of money to finance it. Its business was entirely with the Russian Government, and with every order they had to pay 25 per cent. deposit for the fulfilment of the order. The payments from the Russian Government were often very long delayed. Plaintiff company were creditors of the Russian company for £20,000, and £40,000 in Russian bonds had been lent to them.

CAPTAIN ADRIAN FRANCIS HUGH SIMPSON, managing director of the Russian Wireless Co., said that he was previously engaged by the English Marconi Co. in Russia, and that while there he had negotiated with Tischenko. He and Mr. Isaacs afterwards saw Tischenko in London, when further negotiations took place with regard to the option, but eventually he heard from others that Tischenko would not give him the option. His company had been purchasing all the shares they could at reasonable prices.

In cross-examination, the witness said that he held a power of Attorney in Russia from the Marconi Co. When he, on March 5th, saw Mr. Tischenko, he reminded him of the engagement as to the option. Mr. Tischenko made a verbal offer and asked witness to telegraph to London, saying that he would be prepared to sell his shares at par, less 10 per cent. Later in the day he repeated the offer in writing. Witness agreed that on March 14th, Mr. Tischenko was informed by him that his company would be willing to take the shares at 90 per cent., but on the following day he heard that the shares had been sold.

MR. SALTER said that the offer was made too late.

MR. GEORGE TISCHENKO, called for the defence, stated that he was managing partner in the firm of Goukassoff & Co., and was chairman of the Russian company. The option was not mentioned until nearly everything in connection with the arrangement had been settled, but when Mr. Isaacs asked him to give the option he said he would do so with pleasure. When Capt. Simpson reminded him while at St. Petersburg of the document, he had forgotten it, although he had often spoken of selling his shares at the board meetings. Capt. Simpson knew of the offers he had received for the shares. Capt. Simpson afterwards bargained on behalf of the Marconi Co. for the shares, but nothing was agreed, and he was compelled to sell to the broker, Baruch, for 288,000 roubles. He did not know who the buyers were, and he wanted the money immediately for business purposes.

In cross-examination by MR. SHEARMAN, Witness stated that he did not know who had got the shares or whether Mr. Baruch was the holder of them himself.

COUNSEL having addressed the Court on the evidence,

HIS LORDSHIP said that his difficulty was that he did not know who had got the shares now. In reserving judgment his Lordship added that it was obvious that there would be judgment against the defendants for damages, but if before Friday morning, when he proposed to give judgment, sufficient shares could be got under the control of the plaintiff company it might make a difference.

There was a second action by the Marconi Co. against Mr. Baruch, against whom damages were claimed on the ground that he had induced Goukassoff to break the contract with the plaintiffs, the question being whether at the time he completed the sale, he knew of the option given by Goukassoff & Co. to the plaintiffs.

The Defendant having given evidence to the effect that he knew nothing of the option before the completion of the sale,

MR. SHEARMAN said he could carry the case no further.

HIS LORDSHIP accordingly gave judgment for the defendant.

HIS LORDSHIP in giving judgment in the case against Messrs. Goukassoff & Tischenko, said that, in the first place, the defendants pleaded that there had been no consideration for the agreement under which they undertook to make an offer of the shares to the plaintiffs before selling them to anyone else, at the price which the other buyer offered; but he had come to the conclusion upon the whole of the documents that there was consideration. The defendants, in the second place, contended the meaning of the agreement, and said that it was merely an offer to the Marconi Co. of the shares before selling them to another person, but he did not so read the document. The object of the agreement was that they should give the Marconi Co. the option of taking the shares at the same rate as others offered for them. In his view, the defendants were entitled to sell, but they must have a *bona-fide* offer from a buyer, and before selling must offer the shares to the Marconi Co. as offered by the other person, and must allow a reasonable time for acceptance. The Marconi Co. were not bound to buy unless they were informed of an outside offer, and they were therefore entitled to damages, and having regard to the position of the Russian company he assessed the damages at £6,000, for which sum he gave judgment, with costs.

#### THE GRAETZIN LAMP AGENCY.—JUDGMENT.

MR JUSTICE SCRUTTON, sitting as Commercial Judge in the King's Bench Division on January 24th, gave judgment in the action of Braunstein v. Graetz, in which the plaintiff, Mr. Bernard Braunstein, a manufacturer's agent, of Carthusian Street, London, claimed damages from Mr. Max Graetz, the patentee of the Graetzin lamps, trading in Berlin as Ehrich & Graetz, for breach of agreement of agency for the sale of electric and gas lamps and fittings.

HIS LORDSHIP, in giving judgment, said that the plaintiff had for some years carried on business in London as agent for the sale of electric and gas lamps and fittings, and had for some time been acting as agent for the defendant in this country under an agreement which stipulated that he was to have the sole agency for a period of years. In December, 1908, the defendant arranged with the plaintiff to take up the sole agency for his lamps and fittings upon an agreement which provided that if he was able to sell £5,000 worth of the Graetzin lamps within a year, the agency would be extended for another year, and if in the second year he was able to sell £10,000 worth, he was to have the exclusive right for a further period of five years. The business was very successful, and the plaintiff became entitled to the longer period of agency. In the first year of the contract, a large order was given by the Welsbach Co., in which they offered to sell 500,000 lamps on condition that no other firm in the United Kingdom should be supplied with the lamps at less than 5 per cent. above the price at which they were supplied to the Welsbach Co. The Welsbach Co. exceeded their amount in the first year of the agreement, and in the second year they agreed to purchase 500,000 lamps to be marked with the Welsbach name. The plaintiff agreed to this, and the turnover again exceeded the order. For various reasons the Welsbach orders were discontinued, and subsequently, with the plaintiff's consent, an agreement was entered into with Krupka & Jacoby, under which they were to take a fixed amount of the goods. The plaintiff's agreement was affected by the arrangement, but it was compensated for by an arrangement with regard to the sale to other persons. It appeared that early in 1912, Krupka & Jacoby's sales hardly reached the minimum for the first year, and without the knowledge or consent of the plaintiff, an agreement was entered into by the defendant with Krupka & Jacoby for the whole of the electric lamp business, leaving the plaintiff with only the gas business, the agency for which terminated in January of this year. By the agreement with Krupka & Jacoby, a company was to be formed, and it was contemplated that that company should deal with both branches of the defendant's business. Krupka & Jacoby were to be the managing directors of the company for a period of five years. The plaintiff was not told of that agreement, although letters were passing between him and the defendant relative to the business. He did not know what was being done until June, 1912, when the defendant wrote to Krupka & Jacoby, stating that defendant was cancelling the agreement with them as from July, 1912. He (Mr. Justice Scrutton) had considerable doubts as to the *bona fides* of the letter, which was not shown to the plaintiff until some time afterwards. The plaintiff had, in the meantime, been asking for new price lists, and he did not receive, until August 26th, the information that the defendant had arranged with Krupka & Jacoby to give them the exclusive sale of the goods, and asking him not to obtain further orders. His Lordship then, at considerable length, dealt with the bearing of the German and English law upon the question of agency, it having been pleaded by the defendant that under the German law the plaintiff could not recover, as there was in German law no such thing as sole agency. He said that upon the authorities, and the evidence, he came to the conclusion that as the contract was made in Berlin, and the goods were supplied from Berlin, although the agency was carried out in England it came within the German law. The interpretation of the contract was governed by the German law, and the idea of an agency for the exclusive sale of goods was almost unknown in German law. Another point of importance was that when agents and principals disagreed as to the interpretation of a contract, the agent could not, under the German law, bring an action without having first obtained a declaration, and the agent, according to the expert evidence, could not complain of trading by other agents within his area. He found that the second agreement was a breach of the plaintiff's rights so far as it

excluded plaintiff's action as agent in his district. He (the Judge) would have held, under the English law, that the defendant had no right to cancel the contract, and that Krupka & Jacoby had no right to make the contract without plaintiff's consent, and he would have given judgment for the plaintiff on the claim, and assessed the damages at £2,300. He held, however, that, by German law, the plaintiff was not entitled to damages, but he was entitled to a declaration that the contract was a subsisting contract. The plaintiff was not entitled, under the German law, to an exclusive right of sale in Great Britain and Ireland, but he was entitled to a commission of 5 per cent. on all goods sold in his district. The defendant was not entitled to exclude plaintiff from carrying on business in his district or to prevent him from taking orders. With regard to costs, his Lordship said that, although plaintiff had failed to do damages, he was entitled to a declaration, and he would have half the taxed costs.

The form in which the judgment should be entered was left for future discussion.

EDINBURGH TRAMWAY GUARD CASE.

THE First Division of the Court of Session has refused a Bill of Exceptions, applied the verdict, and found defenders entitled to expenses in the case in which a lady sued the Edinburgh and District Tramways Co. for damages for personal injuries. When Lord Hunter and a jury tried the case in June last, the jury returned a verdict for defenders. The pursuer's case was that she took up a position in order to get clear of a cable car, but that when the car was halfway past her the lower part of her skirt was caught by the vertical stay on the car. As a result of her injuries, her left leg had to be amputated. She maintained that if there had been side guards on the car the accident would have been avoided. Defenders denied that the side guards were necessary, and stated that the pursuer in a preoccupied manner walked against the side of the car, with the result that she was thrown down. Lord Hunter charged the jury to the effect that if they came to be of opinion that the pursuer's carelessness contributed to the accident, they must return a verdict for defenders, and that the question as to their opinion with reference to the propriety of having side-guards or not was immaterial. His Lordship refused the request of pursuer's counsel to give the direction that even if there was carelessness the company could be held liable if the jury were of opinion that reasonable care on their part would have prevented the accident, and it was to decide this point that the case came before the First Division. The Lord President said that he was of opinion that Lord Hunter had rightly refused the direction, as he thought it would have been either a wrong direction, or, at least, a misleading one. Supposing the case was that the pursuer was standing, not in the tramway line, but in the vicinity of it, and that she had by no fault of her own been violently thrown on the tramway lines through the fault of somebody else coming up behind her, or through the pressure of the crowd or something of that sort, and she had been run over, that would have raised the question whether the tramway company should have had a side guard. The other Judges concurred.

ELLIS v. OSRAM LAMP WORKS, LTD.

WITH reference to the report of this case in our last issue, Mr. F. Samuelson, of 71A, Queen Victoria Street, E.C., writes as follows:—

"As solicitor to the defendants in the above action, I beg to point out an inaccuracy which occurs in the report published in your last issue. In such report it is stated that the counterclaim (which was in respect of dilapidations to the premises) was dismissed without costs. As a matter of fact this counterclaim was not dismissed, the sum of £7 was awarded to the defendants in respect thereof, but no costs were allowed in respect of the counterclaim. May I ask you to be good enough to insert this correction in your next issue?"

**Breach of Electricity Regulations.**—At Leigh, on Monday, the Howebridge Spinning Co. pleaded guilty to a breach of Clause 13 of the electricity regulations of the Factory and Workshops Act of 1901. Mr. J. Owner, H.M. Inspector of Factories, said that a man named Heaketh was using a portable electric lamp when he received a shock. There was a danger when handling the apparatus, whilst standing on a wet floor, of electricity passing through the man's body and causing death. The apparatus in the case was liable to become charged with electricity at a pressure of 130 volts, which was sufficient to cause death. Defendants were fined £5 and costs.

**The Radium Institute.**—The first report of the work carried out at the Institute up to December 31st, 1912, deals with the results of 578 cases treated by radium or its emanation; 39 received prophylactic irradiation only; 53 were apparently cured; 28 were cured; 245 were improved; 70 were not improved; 88 abandoned treatment; and 55 are dead. The cases treated were in no instance selected. Many of the patients had exhausted all the known resources of medicine and surgery, their condition being almost hopeless.

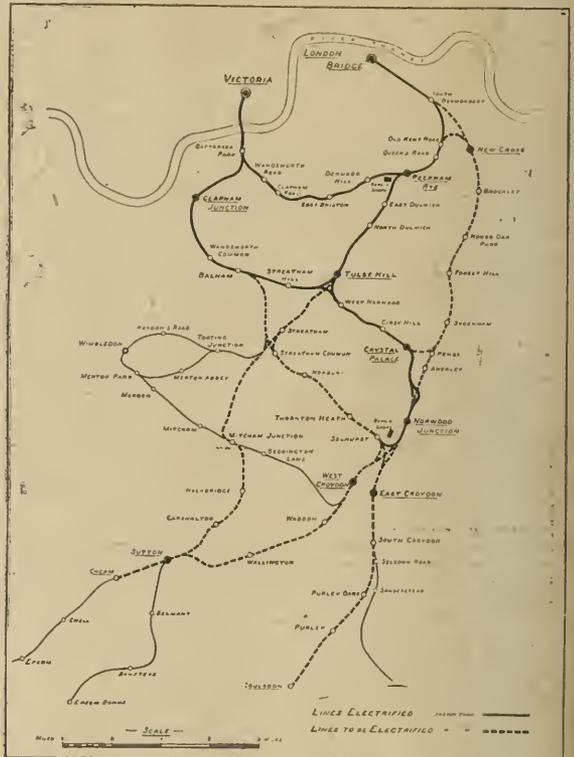
THE L.B. AND S.C. RAILWAY ELECTRIFICATION.

THE Board of Directors of the Brighton Railway stated in the half-yearly report that they had decided to proceed with the electrical equipment of the whole of their suburban system comprised within the area extending from London to Croydon, Purley, and Coulsdon, and from London and Sutton to Cheam, and that active steps were being taken towards the execution of the work.

The board arrived at this decision after careful investigation of the conditions governing the suburban traffic, in view, more especially of the excellent results obtained from the limited electric service now running, and of the steady growth of the competition for this traffic by other means of transport.

The present electric service has been operated electrically for over three years on the single-phase system with every satisfaction.

As is well known, the introduction of electric traction on the South London line resulted in the number of passengers not only being brought back to that originally carried by steam before the competition of electric tramways first started, but in an increase of about 2,000,000 passengers, making a total of about 10,000,000 per annum, with a corresponding increase in revenue.



PLAN SHOWING THE ROUTES WHICH IT IS PROPOSED TO ELECTRIFY.

Little or no alteration in the fares was made when electric traction was introduced, so that the increase in receipts was practically proportional to the increase in passengers carried.

On the Victoria-Crystal Palace line competition had not been felt so severely, in consequence of the distances being longer and of the tramway and motor-omnibus services not having been so extensively run in this region as in the area served by the South London line. At the same time the increase in traffic during the first 18 months of service has been most remarkable, and there is no doubt that before deciding on the larger scheme the directors must have satisfied themselves as regards the increase in traffic brought about by electrification.

The sections to be electrified comprise four tracks between Balham and Croydon and Bricklayers' Arms (just north of New Cross) and Croydon; three tracks between London Bridge and Bricklayers' Arms; four tracks from Croydon to Purley, the remaining sections being two-track roads.

The electrification so far carried out, including all sidings, expressed in miles of single track, at the present moment amounts to 70 miles. The section now proposed to be electrified, reduced to single track and including sidings, amounts to nearly 150 miles, thus bringing up the total electrification to 220 miles which will constitute by far the largest electrification ever undertaken by a railway company in this country.

The present rolling stock, as far as the electrical equipment is concerned, consists of 50 motor coaches, and in round figures another 200 motor coaches will be required to operate the extensions.

It is interesting to note that the supply of electricity from the London Electric Supply Corporation has proved so satisfactory, that it is intended to purchase all the electricity required for operating the suburban system from this company, which will mean the installation of additional plant of something like 40,000 to 50,000 kw., thus making the company's plant at Deptford, including its present equipment, one of the largest in this country.

The principal reasons which influenced the Brighton Co. to adopt the single-phase system, were the necessity, in their opinion, of not having a third rail, and their opinion that in the near future it would be necessary to extend the electrification as far as Brighton and Eastbourne.

As regards the first reason, it is interesting to note that this seems to appeal to every railway, as well as that the overhead system is going to be adopted in connection with continuous-current traction. This is the more interesting, as it was the overhead construction which was attacked by the opponents of the single-phase system.

As regards the question of long-distance electrification, all authorities are practically agreed that in that case the single-phase system possesses the greatest advantages.

The decision of the Brighton Co. to extend this electrification and their satisfaction with the single-phase system only confirms the experience of the Prussian Government and of the New York, New Haven Railway in America.

The whole of this extensive work is expected to be completed within four years, the plans and details being complete, so that the actual work can be started at once.

It is greatly to the credit of the Brighton Co.'s directors that they have now decided to adopt the forward policy, and proceed with one of the largest schemes of electric traction at present proposed in this country.

## BUSINESS NOTES.

**Consular Notes.—Brazil.**—An American Consular report states that the Brazilian Government has decided to erect wireless telegraph stations in Rio Grande do Sul, Santa Catharina, Sao Thome, Cruzeiro do Sul, Senna Madureira, Rio Branco, Sao Luiz de Caçeras and Porto Mustinho. Steps are being taken to organise a general scheme of radio-telegraphy, both on the coast and in the interior.

**Norway.**—The American Consul at Christiania reports that Det Norske Nitridaktieselskab, which was formed in Christiania recently with a capital of £550,000 fully subscribed, to produce sulphate of ammonia from the atmosphere, will adopt the method of the Austrian engineer, Dr. Serpek. The invention has been developed by a French company, Société Generale des Nitrures, and the patent right for Norway has been acquired by the Norske Aktieselskab for Elektrokemisk Industri. The new company has been started jointly by French and Norwegian interests. Construction of the mill was to begin immediately after the formation of the company, and production was anticipated to start in the autumn of 1914. At first 10,000 H.P. will be used, to be increased later to 25,000 H.P. The power will be supplied by the Aktieselskab Arendals Fossekompagni. The annual output is calculated to exceed 40,000 tons of sulphate of ammonia.

This Consol also reports that the new wireless telegraph station opened on September 1st at Rundemanden, near Bergen, is the third large Norwegian Government station; a fourth will probably be established at Tryvandskjoen, near Christiania. Norway has also a number of smaller establishments doing excellent work. The Government's first land wireless stations were the two built in Lofoten in 1905 and 1906, which since their establishment have been among the busiest in the world, successfully sending and receiving some 6,000 telegrams a month. In 1905 the navy, after equipping its ships with wireless apparatus, established two stations, the Tjomo and the Flekkero, and operated them until a couple of years ago, when they were transferred to the Telegraph Board. In the autumn of 1910 the Våro station at Lofoten was opened, and there are now five coast stations in operation besides the three large stations. The first steps towards building the Rundemanden station were made in 1909, when a joint commission of military and telegraph experts examined the districts around Bergen with the view of establishing a large station for the west coast. Rundemanden was selected chiefly for military reasons, being within the circle protected by the fortifications of Bergen. Some years ago the American company, which is mining coal at Spitzbergen, applied to the Norwegian Government for a concession to build a wireless telegraph station on the island and keep up connection with an establishment on the coast of Norway. It being against the principles of the general director of the telegraph of Norway, Mr. Heftye, to recommend this kind of concession, he proposed instead that the Norwegian Government should build a station at Spitzbergen and one at Ingo, in Finmarken, and thus supply the necessary connection with the far Arctic Island. This proposition was acted upon by the Government, and £12,000 appropriated therefor. The purpose of the coast stations is partly to connect the ships within their district with the shore, and partly to keep a watch over these ships in case of any emergency, and see that help is brought. Life and property have already in innumerable cases been saved by these means. The Lofoten stations, besides these functions, also do the work of ordinary telegraph stations. The large stations would also be of great importance in case of war. The time of service at Våro, Rost and

Sorvaagen is all day at Tjomo, Flekkero, Ingo and Rundemanden day and night; at Spitzbergen day and night in summer all day in winter. The system used is the one of Gesellschaft für Drahtlose Telegraphie, Berlin, the Telefunken system, and the different stations are equipped with the types of this system that were the newest at the time the stations were established.

**Japan.**—The American Consul at Nagasaki reports that the electric light, power, and tramway undertakings, had an unprecedented boom in his district in 1911, some 41 different electric projects, including five tramways, having been inaugurated in Kyushu and Okinawa-ken, of which 25 have begun work.

Fukuoka Prefecture in the northern central part of Kyushu leads in electric companies with eight working, and five in course of construction; Oita Prefecture has five working, and three under construction; Nagasaki Prefecture three working, and two under construction; Kagoshima two working, and three under construction; Saga two working, and two under construction; Miyazaki three working, and one under construction; and Kumamoto and Okinawa, each one working. The Island of Kyushu is well adapted to electric development, having many streams capable of being utilised for water power, and extensive coal-mining areas with cheap fuel for steam power. The Hakata Electric Light and Tramway Co., of Hakata, in Fukuoka Prefecture, has been in operation a little more than one year, and is quite successful, having declared a dividend of 12 per cent. for 1911. The Nagasaki Electric Lighting Co. has made some improvement in its plant and will enlarge it considerably to meet the increased demand for light and power which the old plant is too small to supply. A dividend of 8 per cent. was declared for 1911.

**Uruguay.**—The American Consul at Monte Video reports that although small electric street signs of American make have been used in Uruguay for several years, these were until recently confined to signs capable of one reading only. On January 20th 1912, the first large electric changing display sign was opened for service with a capacity for 40 advertisements, each visible every seven minutes. It was manufactured in New Jersey at a cost, delivered in Monte Video, of £620, the cost of placing in position being additional. The annual operating expenses will aggregate £1,400. The sign is patronised by many of the leading local houses and newspapers and by a number from other countries. It is situated at the western side of the Plaza Independencia, through which thousands of people pass during the day and night, doubtless the best site in Monte Video. It is operated by Publicidad, a well-organised advertising concern here, which also places "ads" in the various newspapers, periodicals, street cars, and billboards throughout this Republic, also supplying, free of cost, information relative to where advertising should be placed to produce the best results. This sign is the property of a young Uruguayan, who spent two years in the United States making studies of the best American novelties to introduce into his native country. This venture has succeeded so well that he is now planning to erect similar signs, but of greater capacity, in the cities of Buenos Ayres and Rosario (Argentina), Rio de Janeiro and Sao Paulo (Brazil), and Santiago and Valparaiso (Chile).

**B.T.H. Movements.**—Some months ago, in order to cope with the rapid growth of their business in Mazda lamps, the BRITISH THOMSON-HOUSTON CO., LTD., acquired a plot of land at Willesden, and were erecting a large up-to-date lamp factory at this point. This building has now been completed, and we are advised by the British Thomson-Houston Co., that, in order to relieve the pressure on the Rugby labour market for male labour, it has been decided to remove the switchboard department from Rugby and install it at Willesden, and to furnish the additional facilities required for the manufacture of Mazda lamps, at Rugby, in the space which the removal of the switchboard department will now provide. The British Thomson-Houston Co. anticipate that this change in plan will effect economies in lamp manufacture, will provide largely increased lamp manufacturing capacity, by reason of the concentration at Rugby, and, in addition to providing employment for female labour in Rugby, will actually improve the situation as regards the supply of male labour in the other departments of the Rugby factories.

**Ten Months under Water.**—MESSRS. CROMPTON AND CO., LTD., send us the following translation of an extract from a letter received from one of their customers in Tangiers, which affords interesting evidence of the quality of their machines. The machine in question formed part of a consignment to their Bombay office on the ill-fated *Delhi*:—

"I have to-day bought an electric motor of your make, which was taken out of the steamer *Delhi*, which was lost on this coast about a year ago. The electric motor in question has been under water for about 10 months, and in spite of this, I have been able to have it cleaned and dried perfectly well in a stove, which has meant altogether about three hours' work, and immediately after this, I put it on load—it ran absolutely well, as if it had only just come out of the workshops."

**Book Notices.**—*Lockwood's Builder's and Contractor's Price Book*, 1913. Edited by F. T. W. Miller. London: Crosby Lockwood and Son. Price 4s.—The rise in wages and in cost of materials naturally has affected this useful annual, though it is stated that the cost of building is not materially greater, being kept down by improved methods of production and by competition. The electric lighting section has been revised and extended by Mr. A. P. Haslam, M.I.E.E., and may therefore be depended upon to be correct; it includes not only prices of materials and apparatus, but also a variety of estimates of cost of electric lighting installations and running costs, with other information useful to the builder.

The *Telefunken Zeitung* for December, 1912, contains articles relating to the International Radiotelegraphic Conference of last summer, and the International Time Conference which met in Paris in October. Other articles relate to Telefunken apparatus for land and sea stations, military wireless, and the development of the system in Russia, the United States, New Zealand, &c.

The Adams Manufacturing Co., Ltd., of Bedford, have just brought out a second edition of their book, entitled "Electric Control of Printing Machinery." It contains a great deal of useful matter acquired during some years of practical experience, and it is divided up into some seventeen chapters. Since the last edition the contents have not only been brought up-to-date, but a number of new chapters have been added, containing descriptions of apparatus subsequently introduced. General considerations, notes on the essential features of a good control gear, "inching" devices, speed regulation, motor-starting switches, regulators, stopping devices, overload preventers, press controllers, are among the subjects handled, and most of the apparatus mentioned is illustrated.

"Spon's Architects' and Builders' Pocket Price Book and Diary." 1913. London: E. & F. N. Spon, Ltd. Price 2s. 6d. net.

"Atti della Associazione Elettrotecnica Italiana." January 15th, 1913. Milan: Stucchi, Ceretti & Cie.

"Transactions of the Concrete Institute." Vol. IV, part III. December, 1912. London: The Institute.

The *Journal of the Tramways and Light Railways Association* for January contains a full list of members.

"Journal of the Franklin Institute." Vol. CLXXV, No. 1. January, 1913. Philadelphia, Pa.: The Institute. Price 50 cents.

"Proceedings of the Physical Society of London." Vol. XXIV, part VI, October 15th, 1912. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"Abstract Bulletin of the Physical Laboratory of the National Electric Lamp Association." Vol. I, No. 1. January, 1913. Cleveland, Ohio: The Association.

"Examinations in Science and Technology, 1912." London: Wyman & Sons, Ltd. Price 9d.

"Design of Polyphase Generators and Motors." By H. M. Hobart. 1913. London: Hill Publishing Co., Ltd. Price 12s. 6d. net.

"Aziende Municipalizzate: Tramvie Urbane; Distribuzione di Energia Elettrica." 1912. Modena: Blondi e Parmeggiani.

**Calendars and Diaries.**—THE WHITE ELECTRICAL INSTRUMENT CO., of 2 and 4, Gloucester Street, Clerkenwell, E.C., have issued a small and handy-sized celluloid pocket calendar for carrying in pocket books or purses. Already they have satisfied innumerable applications for them, and an additional supply is now available for all who write to the above address.

MESSRS. MCKLURE & WHITFIELD, of Mersey Dynamo Works, Adwood, Stockport, have issued their useful pocket note-book and diary for the current year as usual. Illustrated particulars and prices of their Mersey multipolar type generators and motors of 70 kv. and upwards, and other plant, are given in the opening pages, and there is also an insurance coupon.

**Electrical Works' Sale.**—The recent sale of the works of MESSRS. ERNEST SCOTT & MOUNTAIN, together with portions of the plant, as reported in our columns, was carried out by Messrs. Wheatley Kirk, Price & Co., who also conducted a six days' auction of the other machinery and contents of the works.

**Catalogues and Lists.**—MESSRS. JAMES GORDON AND CO., 81-83, Knightbridge Street, London, E.C.—New catalogue of between 60 and 70 pages, containing excellent half-tone illustrations and line diagrams, together with descriptive particulars of complete plant for the development of water-power, including turbines (vertical and horizontal shaft and Francis types), Pelton wheels, governors, pipe lines, &c. The plants illustrated are those in Khabul (Afghanistan), Dryden (Ontario), Ocean Falls (B.C.), Cauvery Falls (India) and Glenanne (Armagh). A number of useful and detailed tables concerning power, efficiency tests, dimensions, &c., are given.

MESSRS. HIGGS BROS., Dynamo Works, Sherbourne Road, Balsall Heath, Birmingham.—Preliminary four-page list containing brief descriptive and tabulated particulars of their shunt and series motors—semi-enclosed and enclosed-ventilated—which they have recently put upon the market. Messrs. Higgs have been manufacturing for the last eight months, during which time they have supplied upwards of 200 machines, and the only ones that have been returned are two which were broken by a railway company.

MESSRS. POPE'S ELECTRIC LAMP CO., LTD., Hythe Road, Willesden, London, N.W.—Folder, giving prices of "Elasta" wire filament lamps, also a picture blotter-card. Copies will be sent on application.

MESSRS. GENT & CO., LTD., Faraday Works, Leicester.—New catalogue of 52 pages (Book 5) in which are given very full particulars, with illustrations, and, in some cases, prices, of their "Pulsynetic" system of electric impulse clocks. "Pulsynetic" is the new name now adopted and registered for the system, which hitherto has been known as the "B.P." Considerable improvements have lately been carried out in the system, notably the increase in the sensibility of the movement, so that only one cell is now required for every three clocks in the installation. Among the new features in the list is the C24 impulse "Underground" clock, a pattern introduced for workshop use—interior and exterior. The impulse movements are in air-tight cast-iron cases for wet positions and where destructive fumes are present. The faces are part of the casting and are painted white, with black raised chapters. This clock is fitted with a water-tight flexible connection for fitting to screwed tubing. Another feature in the list is the Universal programme ringer, which enables a set of bells to be rung at any time during

the day or night, and the programme can be altered simply and as often as required. It is simply connected in series with the clock circuit. The firm's astronomical observatory clock, which has already been fitted in six well-known observatories throughout the world, has recently been ordered by the Hong-Kong Observatory. Contractors are invited to write for copies of this catalogue.

THE SCHNEEWINDT ELECTRIC CO., 40 and 41, Staniforth Street, Birmingham.—Illustrated list, giving prices and full particulars of "Stangerotherm" electric heat carpets and mats.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—New 40-page pamphlet (No. 201) containing brief notes, together with illustrations and prices, relating to cheap domestic telephones ("Parlyphones" and "Twencen" instruments), battery ringing telephones, magneto ringing ditto, "Primax" automatic interphones, and various "Sterling" accessories.

**Sentence on Dealer.**—For reselling 90 lb. of copper wire belonging to the Scottish Electric Power Co., a general dealer has been sentenced to 14 days' imprisonment by Sheriff Mitchell at Stirling.

**Liquidation.**—HEAT ECONOMISERS, LTD.—This company is winding up voluntarily, with Mr. H. St. J. Hodges, 20, Copthall Avenue, E.C., as liquidator. A meeting of creditors is called for February 8th.

**Bankruptcy Proceedings.**—W. LONGDON & V. G. COBB (Longdon & Cobb) electrical engineers, Nottingham.—First meeting, February 6th; public examination, February 14th; both at Nottingham.

A. E. MARTIN, Birmingham.—First and final dividend 11½d. in the £, payable February 3rd, at 191, Corporation Street, Birmingham.

F. HASTINGS MEDHURST (deceased), engineer, 13, Victoria Street, S.W.—Last day for receipt of proofs for dividend, February 8th. Trustees: F. S. Saloman, 1-2, Bucklersbury, E.C.; and F. W. Pixley, 58, Coleman Street, E.C.

**Patents Restored.**—Notices appear in the *London Gazette* ordering the restoration of the following letters patent:—

E. J. DOBBINS.—"Improvements in light distributors for windows and the like." No. 8,461 of 1907.

S. G. BROWN.—"Improvements in electric telegraphy." No. 7,471 of 1900.

**Screw Caps for Radiator Lamps.**—Referring to the remarks by Mr. Allen, engineer and manager to the electricity department of Loughborough, in our issue of January 17th, under the heading of "Screw Caps for Radiator Lamps," the WESTINGHOUSE Co. inform us that they recognised the troubles attending the use of bayonet caps on such lamps years ago, and in their own make of luminous radiators they use exclusively screw cap lamps with suitable holders. They have found this type of cap much superior to the ordinary bayonet cap.

**Trade Announcements.**—We are asked to state that some time ago Mr. Wm. Yorath Lewis was appointed managing director of the BRITISH "NICLAUSSE" BOILER CO., LTD., Tottil Street, Westminster, S.W. The company have recently installed a large boiler at Messrs. Siemens Bros.' works at Stafford, and are taking steps to construct their boilers and mechanical stokers (in accordance with the most modern designs and standards of Messrs. J. & A. Niclausse, of Paris) in this country.

MESSRS. ACBERT, GRENIER & CO., of 68A, Lincoln's Inn Fields, W.C., will in future carry on their English business under the title of "The General Cable Manufacturing Co." The address and telephone number remain the same, until larger and more convenient premises can be found.

Owing to the large increase in the sales of Osram lamps since their manufacture with drawn-wire filaments, the GENERAL ELECTRIC CO., LTD., have found it necessary to provide additional facilities for handling orders. A larger space at their head office, 67, Queen Victoria Street, E.C., is now devoted to the sale of Osrams; the counter room has been doubled, and the new counter, which is adjacent to the old one, has been specially reserved for supplying high C.P. and fancy Osrams, battery lamps, &c. At their Osram Stores in Union Street additional premises have been taken and set aside for stock accommodation. A stock of Osram lamps, twice as large as that carried heretofore, is now constantly on hand.

MESSRS. W. DICKINSON & CO., of The Broadway, Bexley Heath, have taken offices at 130, Queen Victoria Street, E.C., to facilitate the handling of their manufactures, comprising small motors, switchboards, &c. Mr. L. M. Lawlor, for some years on the staff of Messrs. Dick, Kerr & Co., Ltd., will be in charge of their London office.

THE SELSON ENGINEERING CO., LTD., 85, Queen Victoria Street, London, E.C., state that their name was wrongly omitted from the Telephone Directory, and they will be glad if readers will take note that their numbers are as before: "Bank, 341," and "Central, 11779."

MESSRS. IMESON, FINCH & CO. (1912), LTD., of Stockton-on-Tees, have taken over the manufacture of White's patent controller finger, and are at present supplying same to H.M. Dockyards and many of the large works and tramway systems in Great Britain and abroad.

MESSRS. SAVILLE & WALTON, electrical engineers and contractors, have opened a branch business at 37, St. Mary Street, Cardiff.

THE LANGDON DAVIES MOTOR CO. have installed an additional telephone service ("City 3388") in their office in Cannon Street, E.C.

The sale of patent adaptable earthing clips will in future be continued under the style of HANN & INGLE at the same address, 13, Albert Place, Bridge Street, Manchester.

**For Sale.**—The Aberdeen Corporation electricity department has for disposal two 200-kw. Willans-Mavor & Coulson D.C. generating sets, with spare armature, one surface condenser, and one Edwards air pump; and the Salford Corporation one 800-kw. Browett, Lindley-Mather & Platt D.C. generating set. See our advertisement pages in this issue.

## LIGHTING and POWER NOTES.

**Aberdeen.**—The extension of the Corporation generating plant, at an estimated cost of £15,510, proposed in a report by the electrical engineer, has been agreed to by the T.C.

**Alnwick.**—At a meeting of the U.D.C. on January 24th, the engineers to the new water scheme reported that they had gone into the three schemes of pumping, the estimated costs respectively being: Pumping by town's gas, £472; by suction gas, £315; and by electricity, £337; and they recommended the adoption of the latter scheme. The report was approved subject to the necessary consents.

**Ayr.**—The T.C. has increased the charge for private lighting from 3½d. to 4d. per unit, and for public lighting from 2d. to 2½. The rate for heating and cooking is to be 1d. per unit, and meter rent, instead of 1½d. The sum at the credit of the reserve account at May 15th last was £4,000.

**Bedford.**—The T.C. has decided to apply to the L.G.B. for a loan of £1,800 for electrical lighting services for the next three years. Public lighting extensions by electricity are to be carried out at an estimated cost of £259.

**Beahill.**—The electrical engineer has been instructed to prepare specifications and obtain tenders for a new switchboard.

**Bexley.**—The U.D.C. has referred to its electrical engineer for consideration and report, an offer by Woolwich B.C., which is considering a scheme for the extension of its generating station, to supply electricity in bulk to the Council at the actual cost of generation, plus a small profit to be agreed upon. It was intimated by Woolwich that it estimated that energy so supplied could be retailed in the Council's district at about 1½d. per unit.

**Blackburn.**—As indicated in our last week's issue the Mayor (Alderman Crossley) set in motion at the electricity works on the 24th inst. the first of two turbo-alternators of 2,000 kw. capacity, which has been installed along with two 800-kw. rotary converters to meet the requirements of heavy power consumers. This is the last extension possible at the existing works. The supply to a few more electrically-driven mills in the town will render necessary a new generating station, estimated to cost £150,000. The new plant is described elsewhere in our pages.

**Blackpool.**—At a meeting of the Corporation Tramways Committee on January 23rd, there was general agreement with the engineer's extensive scheme for autumn illuminations for the whole length of the Promenade and adjoining squares and open spaces, in connection with the season extension scheme. The cost will be shared between the Tramways, Electricity, Markets and Street Lighting Committees. The electricity department will supply the current free.

In order to deal more effectually with the large volumes of water in times of flood, the Highways Committee has decided to install two electrically-driven pumps at the sewage chambers in Manchester Square, as mentioned in our "Contracts" column.

**Burton-on-Trent.**—The B. of G. has referred to the Building Committee a proposal by the borough electrical engineer, that the electric light should be installed at the workhouse.

**Canada.**—An application has been made for a grant to develop a water-power site on the Cheakamus River, a few miles south of Green Lake, a short distance from the proposed route of the Pacific Great Eastern Railway line. It is proposed to divert the water through a tunnel about one mile in length, having a fall of 100 to 150 ft., with a flow of 10,000 cu. ft. of water per second. A power plant is to be erected in connection with the project, and the estimated cost of the works is about £400,000. An application has appeared in the "Provincial Gazette" requesting the right to construct a dam across the Fraser River, in British Columbia, at a point about 2½ miles above Yale, in a narrow canyon at that place. The storage area will be about 5,000 acres, and the H.P. derived, 100,000. The applicant, the International Railway and Development Co., it is stated, has at present about £1,000,000 available and can, if necessary, secure several times that amount for further development.

**Carlisle.**—The tramway company has accepted the offer of the T.C. to light the centre tramway poles by electricity, at a fixed annual charge of £80.

**Dungarvan.**—The Urban Council has decided to light the town with electricity, if it is able to procure the funds necessary for doing so. It has now decided to ask the L.G.B. for sanction to enable it to negotiate a loan of £2,000 for the purpose of carrying out the work.

**Edinburgh.**—The Corporation Electric Lighting Committee is to be asked to consider and report as to revising the minimum charges for current, for power and lighting.

The Council, after discussion, has agreed to strike out the clause in the provisional order dealing with the power sought by the Corporation to provide and repair electric motor fittings.

**Erith.**—The U.D.C. has been approached by the Woolwich T.C. with reference to the supply of current in bulk on terms similar to those mentioned in the case of Bexley. The Council has decided to reply that it is prepared to favourably consider a definite offer for a bulk supply at a firm rate per unit, and all other essential terms upon which the supply will be given. In the meantime, the Council has deferred consideration for the proposed extensions to the generating station at Erith.

The engineer has reported that as far as the present station is concerned, the only extension he can recommend is that a 750-kw. reciprocating set should be installed in place of three existing small sets, the boiler plant remaining as at present. He further advises that the time has arrived for considering a new riverside station.

**Godmanchester.**—The T.C. has decided not to entertain an offer from the Cambridge Electric Supply Co. to install the electric light in the borough in conjunction with a scheme for the neighbouring borough of Huntingdon. The proposal of the company was that the two Corporations should jointly obtain a prov. order to distribute current which could be obtained in bulk from the company.

**Goole (Yorks.).**—The town is shortly to have a supply of electricity, as the Electrical Distribution of Yorkshire, Ltd., proposes putting into force the powers which it obtained last year to supply current for power and lighting purposes. It proposes obtaining current from a plant installed at Thorne Colliery, and a preliminary canvass of residents at Goole who might be prospective customers has yielded a very satisfactory result.

**Halifax.**—The B. of G. has decided to engage an electrical engineer to report upon the cost of producing the electricity at the hospital.

**Hastingsden.**—The T.C., on the recommendation of the Electricity Committee, has reduced meter rents by from 50 to 25 per cent. Works using electrical power throughout, are to be allowed to use 5 per cent. of their consumption for works lighting. For lighting consumers, the minimum payment of 5s. per quarter has been abolished, and there is to be a minimum now of £1 per year. It was reported to the T.C. that the Committee had reason to be satisfied with the progress the electricity undertaking had made.

**Hastings.**—At the weekly meeting of the Hastings Board of Guardians, the clerk brought up a report showing the relative cost of gas and electric light. The electric light was installed at the workhouse buildings in December, 1911. For the year 1911 the total cost for gas amounted to £285. In 1912, £168 was paid to the Corporation for electricity after allowing for renewals, &c., and gas for cooking purposes cost £24 10s., making a total of £193, thus showing a net saving of £92 since the adoption of the electric light.

**Hove.**—The T.C. has decided to drop those clauses of the Parliamentary Bill in reference to the purchase of the electric lighting undertaking, which refer to supply to outside areas. One reason suggested is the desirability of getting rid of the opposition of the Brighton Corporation.

**Hoylake.**—The electrical engineer, at the monthly meeting on January 22nd, was instructed to prepare the specification for a new switchboard at the generating station, for which tenders are to be invited. The cost of these improvements is to be charged to the revenue account of the electricity undertaking.

**Leeds.**—The electricity authorities have decided to supply current to the Low Moor Iron Co. for use at the Osmondthorpe Colliery, at a fixed charge of £850 per annum, plus 4½d. per unit. Mr. C. N. Heford has been temporarily appointed to fill the post of engineer to the Electricity Department, in place of Mr. Harold Dickinson.

**Liverpool.**—The Select Vestry has decided to install at the Highfield Infirmary an electric lighting and power system. Gas lighting at the institution costs £564 per annum, in addition to which the engine for laundry power costs £266, making a total of £830. It is estimated that electricity can be generated at 1d. per unit, and that the cost of the supply required for the institution and laundry would be about £342 per annum. For the necessary plant and appliances it is estimated that £2,194 will be required.

**London.**—**MARYLEBONE.**—With regard to the Council's decision to take a bulk supply from the Metropolitan Electric Supply Co., Ltd., the Electric Supply Committee has decided to pay the company £408 as out-of-pocket expenses in fixing converting plant, &c., also to enter into an agreement with the company accepting its offer to supply current in bulk upon the condition that the Council has the call of 500 kw., and to pay at the rate of £500 per annum and 3d. per unit therefor, such payment only to be made in the event of 12 hours' notice being given that a supply is required.

**Manchester.**—The City Council has now adopted the report of the Trading Profits Special Committee, which recommended that the Electricity Committee should contribute in aid of the city rate 1 per cent.; the Tramways Committee, 5 per cent.; the Gas Committee, 1½ per cent.; and the Markets Committee, 2 per cent.; the percentage contribution in all cases to be based upon the

capital expended. The Committee recommended the adoption of the scheme for a period of three years, but an amendment was carried by the Council limiting the time of operation of the scheme to 12 months.

**Manchuria.**—The electric light service of the South Manchuria Railway at the end of last June served 30,294 lamps. The lamps most in demand were those of 5, 10, 16 and 25 c.p., the 16-c.p. lamp being in most common use. The arc lamps for street lighting purposes now number 112.

**New Zealand.**—According to the *Mining and Engineering Review*, Mr. F. Black, of Wellington, submitted to the Christchurch Council his report on the proposed purchase of bulk electricity from the Lake Coleridge power scheme. The report is favourable to the acceptance of the New Zealand Government's terms, as, under existing circumstances, it would be impossible for the Council to generate the required quantity of energy at as low a figure as that offered. The capital cost of the transforming plant, mains, meters, &c., necessary to satisfy the requirements is estimated by Mr. Black at £123,888, to which he adds 12½ per cent. for engineering and contingencies, making a total of £139,373. The City Council Electricity Committee recommends that a loan of £120,000 be raised to provide for necessary plant required.

**Penistone (Yorks.).**—The District Education Committee has decided to approach the West Riding County Education Committee with a view to electricity being used as the illuminant in the new school at Silkstone.

**Peterborough.**—The L.G.B. has given consent to the borrowing by the T.C. of £1,000 for the extension of mains.

**Pocklington (Yorks.).**—A largely attended and enthusiastic meeting of ratepayers was held last week for the purpose of urging forward a proposal to provide the township with electricity for lighting and power. The keen desire in this direction shown by the ratepayers, has encouraged Messrs. Crompton & Co. to offer to carry out the work if a suitable agreement can be arrived at with the local authority. It was stated that the provision of electricity would improve the town's lighting, and save £70 a year in that direction alone. A resolution urging the Urban Council to move in the matter was passed unanimously.

**Plymouth.**—The Parks Committee of the T.C. has adopted a scheme by the electrical engineer for electrical illuminations at Hoove Park, at an estimated cost of £300.

**Rawtenstall.**—At the T.C. meeting last Thursday some discussion took place regarding the proposal of the Lighting Committee to apply for sanction to a loan of £800 for the work of electric lighting in Bank Street, Haslingden Road, and along Baeup Road to Thrutch. Councillor Schofield said he thought it was the intention at the outset to borrow £2,000 and complete the work in the Crawshawbooth and Lumb valleys as well. Ald. Crabtree thought the intention was to deal with that later. Eventually the proposal was approved.

**Salford.**—The annual report of the Lighting and Cleansing Committee states that 100 electric arc lamps, each of 1,000 nominal c.p., are used for lighting several important street junctions and thoroughfares. The Electricity Committee charges £14 10s. per lamp per year, which includes the supply, erection, cleaning, and maintenance of the lamps, and also carboning and current.

**Shaldon (Devon).**—At a ratepayers' meeting on January 24th, it was decided by a majority of votes to ask the Council to adopt electricity for public lighting, in preference to gas or oil.

**South Africa.**—The Cape Town Corporation, having taken over the electric lighting of Claremont, Rondebosch and Mowbray, announces a further reduction of charges, making the price of the current from New Year less than half that in force 12 months ago. This is regarded as an example of the benefits to be derived from the projected unification of the municipalities.

**Stafford.**—The T.C. has reduced the price of current for lighting the outside of premises from 5d. to 3d. per unit.

Premises in Greengate Street are to be leased for 21 years, at an annual rental of £150, for use as showrooms and offices.

**Stalybridge.**—The Joint Tramways Board has resolved that the engineer be instructed to get out plans, &c., for extensions, and obtain prices for rotary converters for Hyde sub-station and the generating station.

**Stroud (Glos.).**—The R.D.C. has agreed to waive any objection it might have to the proposed electric lighting scheme for the district on condition that the promoters consent to protective clauses.

**Swanage.**—Messrs. Purves, of Exeter, have informed the U.D.C. that the County of Dorset Electric Supply Co. will shortly commence the erection of electricity works in the town, and anticipated that current would be available for public and private lighting in May. The Council has decided to interview Mr. H. W. Purves on the question of public lighting.

**Westhoughton (near Bolton).**—In the new weaving shed being erected for Messrs. Taylor & Martley, Ltd., mention of which was made in our issue of January 17th last, 400 "Schorch" single-rod v. loom motors are to be installed.

**Whitstable.**—The U.D.C. on January 21st further discussed the electric light scheme prepared by Mr. Campbell. Mr. W. Camburn moved that in accordance with a minute passed in September, 1898, the Council should themselves apply to the B. of T. for a prov. order. Mr. Harrison seconded, but the motion was lost by seven votes to four. Mr. A. A. Kemp gave notice that at the next meeting he should propose the rescinding of the minute of September, 1898, and move that the Council consider the establishment of an electric light system for the town, subject to the necessary arrangements, guarantees and agreements being entered into with the promoters of the scheme.

**Willensden.**—Before giving a definite recommendation with regard to improving the gas lighting of the district, the Lighting Committee has decided to obtain tenders from the electricity department (1) for the lighting of all side streets in the parish, and (2) for those streets in which mains are already laid. The Committee also proposes to submit both systems of lighting to photometric tests by an independent expert. The offer of the electricity department to substitute all-night lighting of the arc lamps, at present lighted for half the night, with incandescent lamps, for £110, has been accepted. The question of gradually superseding the existing arc lamps, and providing flame arc lamps in lieu thereof, is under consideration.

## TRAMWAY and RAILWAY NOTES.

**Bradford.**—The Tramways Committee has decided to have 100 electric tramcars fitted with a new device invented by two Leeds men for preventing loss of life by persons being run over by the cars. The new idea consists of a couple of bars at the side of the cars stretching from the front "gate" which will have the effect of preventing anyone who is struck by a car from slipping underneath. This new contrivance works in conjunction with the Tidswell guard, which was invented by a Bradford man.

**Brighton Railway Electrification.**—Elsewhere in this issue we refer to the latest decision of the directors of the Brighton Co. to proceed immediately with the electrification of most of the remaining suburban routes south of the Thames, and extending as far as Coulsdon, Cheam, &c.

**Chesterfield.**—A poll taken on Monday on the question of the Corporation Bill seeking powers to install a system of railless cars in the borough and district resulted in a majority of 522 in favour, the figures being:—For the Bill, 905; against, 383.

**Continental Notes.**—GERMANY.—The Government of Saxony has decided to establish without delay a number of electric motor-coach lines on the same system as adopted in Bavaria, without awaiting the sanction of funds in the next Budget estimates of the Diet. It is also proposed to consider the question of converting the State railways to electric traction, and a scheme for this purpose is to be submitted to the Diet.

TURKEY.—According to the *Pall Mall Gazette*, the first act of the new Government in the industrial domain has been to grant a concession to a German group, for an underground railway in Constantinople from Bayazid, in Stamboul, to Chichli, the farthest outlying quarter of Pera. The line will run under the Golden Horn.

**East Ham.**—The Electric Lighting and Tramways Committee states that it has considered a report of the engineer and manager in connection with the suggested leasing of the Barking tramways situate between the boundaries of the districts of East Ham and Barking, and the supply of electricity to Barking Council in bulk. The Committee has decided that the leasing be agreed to on the following basis:—That the Corporation supplies the necessary cars and staff required for all through running and local services, and that for all service purposes the section shall be considered as part of the East Ham system, also that the whole of the revenue received, after deducting East Ham's working costs, be paid to Barking Council, and that should these arrangements be completed an offer be made to the Barking Council for the purchase of three cars only; the lease to be for a period of not less than three years, determinable thereafter on six months' notice by either side; that an offer be made to supply power to the Barking Council for traction purposes, metered at the boundary, at a charge of 1 25d. per unit net for all power supplied, sufficient to operate the section of track above referred to; the agreement to be for a period of 12 months and thereafter quarterly; not to entertain the question of giving a bulk supply.

**Folkestone.**—The General Purposes Committee of the T.C. has decided to oppose the Bill of the Tramway Co. for a railless traction system, and to hold the company to its original agreement.

**Halifax.**—Having made an agreement with Brighouse Corporation by which Bradford and Huddersfield were to be excluded from that borough with regard to tramways, unless with the permission of the Halifax Corporation, the latter submitted a Bill embodying this agreement and other matters to a poll of Halifax ratepayers on Saturday. Part of the bargain with Brighouse was that Halifax should extend its tramways from the centre of Brighouse to Rastrick and pay over £4,000 for necessary street improvements. The tramway borrowing powers asked for in the Bill

amounted to, roughly, £200,000, and £45,000 was included for an important street widening in Halifax. The result of the poll was that 6,031 persons voted against the Bill, and 1,921 in favour. The Bill will accordingly be withdrawn.

**Hythe (Kent).**—At a meeting of the T.C. General Purposes Committee on January 20th, it was decided to support the proposed system of railless traction, on condition that the promoters pay £100 towards the lighting of the route and £1,000 towards the cost of adapting the route to the system, and that they will undertake to carry out the scheme within two years of the passing of the Bill.

**Leeds.**—The people of the Wharfedale towns and villages have received with very mixed feelings the news that the Corporation has dropped from its Parliamentary Bill the proposals for running railless cars through the valley. At Otley the abandonment of the proposal is felt with keen regret, but at Burley, Ben Rhydding and Ilkley the decision has caused satisfaction.

**London.**—THE PICCADILLY TUBE COLLISION REPORT.—The B. of T. report dealing with the collision which occurred between an entering and a stationary train at the Caledonian Road Station of the Piccadilly Tube, in September last, has now been issued. The accident was difficult of explanation in view of the automatic signalling arrangements used on the tube railways. The first train was delayed by motor troubles for between two and three minutes, and the second train ran past the signals and collided with the standing train, while travelling at 18 or 20 miles an hour.

Sir H. A. Yorke, who conducted the inquiry, has come to the conclusion that the driver of the second train, in view of its coasting down the incline between Holford Road and Caledonian Road Stations, sat down and moved the reversing handles to the neutral position so as to render it unnecessary for him to keep his hand on the controller (dead man's) handle, to enable him to take his ease at greater convenience.

The fact that the brake-handle was found in the release position appears to indicate that the driver never applied his brake at all, and was paying no attention to his duties until the collision occurred. The evidence as to the brakes being applied was conflicting, and it was agreed that the train was running at the speed usual for a non-stopping train. If the signals failed, the failure was of brief duration, judging by the evidence of the driver of the train, which followed the above one minute behind it.

There remains the question of the train stop, which ought, if the signals were at danger, to have automatically applied the brakes. On this point, Sir H. A. Yorke finds that the trip and isolating cocks on the train were in their correct positions, but that the train stop was defective, and this probably caused it to be sluggish in movement, and prevented it from assuming the upright position with sufficient rapidity to catch the trip cock under the train, and stop the latter. The railway authorities are now engaged in improving the position of the signal mechanism, but in any case Sir H. A. Yorke agrees that automatic signalling combined with train stops may be regarded as the safest system which can be adopted on such lines as the one concerned.

[We may add that the signalling system adopted on this and other tube lines was fully described in our pages several years ago.]

**L.C.C.**—Owing to a cable burn-out at the Greenwich tramways generating station on Monday evening, some 1,200 of the Council's cars were held up for half an hour. A somewhat similar occurrence stopped the tramway service at Ashton-under-Lyne on Thursday evening last week.

**WOOLWICH.**—The B.C. has decided to lodge a petition against the L.C.C. (Tramways, Trolley Vehicles and Improvements) Bill, as regards the paragraph giving power to the Council to run trolley vehicles between the tramway termini at Lee Green and High Street, Eltham.

**North Wales.**—It is reported that after hearing the views of a deputation from the promoters of the proposed new railway to Trefrew and Llanrwst, a Committee of the Carnarvonshire County Council has decided to recommend a contribution of £20,000 towards the project.

**Persia.**—According to the *Standard*, a London syndicate has recently been formed with a view to providing electric tramways and lighting in the city of Baghdad.

**Siberia.**—It is reported from Vladivostok that a scheme is at present under consideration for the construction of an electric tramway in the town of Blagowestchensk.

**Southampton.**—The tramways manager has submitted a report to his Committee in which he strongly advises it to provide meters on the cars for the purpose of checking waste of energy, and in connection therewith to inaugurate a bonus system.

**Stirling.**—As a result of a decision come to at last week's T.C. meeting, the Corporation Lighting Committee is to consider and report as to how an electric or other improved tramway service can be secured for the town and district, to be carried on either as a municipal undertaking or by a company. In the course of the discussion, it was stated that, at one time, a provisional arrangement had been come to between the National Electric Construction Co., the T.C., and the existing tramway company, but that they failed to come to terms with the County Council regarding the roads. The Merchants' Association is strongly supporting the movement for electrifying the tramways.

**Stockport.**—Delivery has now been made of the first railless car to be used on the Offerton route, and the second car was due to arrive this week. After the necessary trial runs and B. of T. inspection, the cars will be available for public use.

**Walthamstow.**—It has been decided to take no action upon the question of the advisability of hiring tramcars from the Leyton undertaking. An appeal is to be made to the West Ham Union Assessment Committee against the proposal to increase the assessment of the electric light and tramways undertakings.

**Wood Green.**—The assessment of the properties of the Metropolitan Electric Tramways in the district has been reduced from £9,300 gross and £3,800 rateable to £8,558 gross and £2,530 rateable. A petition is to be presented against the M.E.T. (Railless Traction) Bill which enables the company to run railless trolley vehicles within the district.

## TELEGRAPH and TELEPHONE NOTES.

**Germany.**—A wireless station is in course of construction by the men of the Telegraph Battalion on the flying ground at Johannisthal, near Berlin, for the exchange of messages with the marine airship L.T. The range of the station is between 300 and 400 km.

**Imperial Wireless System.**—On Wednesday last week the Select Committee inquiring into the Marconi agreement had before it Mr. W. R. Lawson, a writer on financial and economic questions. The witness criticised adversely the agreement on the grounds that it would tie the hands of the Post Office, and would put a stop to British progress in long-distance communication, as all competitors would be driven out of the field. The Government, he said, had very indefinite ideas as to what they were really purchasing from the company, and the State had been indirectly associated with a huge Stock Exchange gamble. The 10 per cent. royalty alone condemned the agreement as a business transaction. In addition to the heavy royalty, the Government would have to take all the risks and bear the cost of military protection, as well as the charges for collection and distribution of telegrams, &c. It was doubtful whether the business would bear more than 2 or 3 per cent. in addition to the necessary expenditure, and the Marconi Co. might draw a large income while the Post Office made a heavy deficit; the company could buy up new inventions and thus maintain its grip on the system. He contrasted the favour shown to the Marconi Co. with the treatment accorded by the Post Office to the cable companies and the National Telephone Co. While the Post Office dictated terms to the Telephone Co., the Marconi Co. appeared to have dictated terms to the Post Office. The cost of the system and the royalties were trifles compared with the effect of the negotiations on the Stock Exchange. In July, 1908, with the number of Marconi shares at 394,190, the price on the Exchange was 6s. 9d.; in December, 1912, with 750,000 shares, the price was £4 10s., and in April, 1912, when there were 500,000 shares, the price was £9 15s.; the total market value of the preference and ordinary shares, together making £750,000, was £7,062,500. Whereas the Post Office representatives said the agreement was forced upon them, the Post Office was really the master of the situation, and the Imperial wireless system was a matter of life and death to the company.

On the following day Mr. Lawson again gave evidence. He alleged that the company was not in a position in 1910 to carry out the proposal which it then laid before the Government, to establish long-distance communication at its own cost, and said that commercial opinion in the country did not regard wireless telegraphy as urgent.

On Monday Mr. Marconi was invited to state his reasons for wishing to withdraw from the agreement. He said that the only efficient way of doing so, in his opinion, was by giving evidence in reply to all that had been said. It would not be right for him to split up what he had to say, and he preferred to reserve his statement until he had an opportunity of going into the whole case. Much had been said that could have been contradicted, and he thought the time had come when it was essential that he should make his statement. The chairman announced that Mr. Marconi would be heard in full, probably at the end of the journalistic evidence.

Sir Alex. King, recalled, said the Postmaster-General did not think it right to reply to the company's letter until the Committee had had an opportunity of expressing its views on the matter. The Postmaster-General asked him to point out that if it were found that the Marconi system was the only one that could safely be employed, and the Government were still unable to carry out the work, it would be difficult to resist a demand for higher terms if a fresh contract had to be negotiated with the company. He could not accept responsibility for the delay which had occurred since he laid the agreement before Parliament. In the opinion of the witness, the bargain was a very good one, and he could not help feeling that Mr. Marconi had not been well treated. He and his system had been attacked, and although he was the wireless expert of the age, he had not yet been given an opportunity of refuting the statements that had been made. The Government had everything to gain and nothing to lose by holding the company to the contract. He understood that in addition to the Norwegian contract, the company had entered into a contract with the Argentine Government for communication

with Africa. The Marconi Co. had informed the Postmaster-General that they were making arrangements which would necessitate alteration of the proposed sites and the wave lengths of the Imperial stations.

The Committee sat again on Wednesday, when Mr. Lawson was further cross-examined.

Answering questions in the House of Commons, Mr. Samuel stated that he could not pledge the Government not to reply to the letter of the Marconi Co. asking to be released from the agreement until the Select Committee communicated with him. Any observations that the Committee might make would be taken into consideration.

In accordance with the recommendation of the Select Committee of the House of Commons on the Marconi Contract, the Postmaster-General has appointed a Committee "to report on the merits of the existing systems of long-distance wireless telegraphy, and in particular as to their capacity for continuous communication over the distances required by the Imperial chain." The Committee will consist of:—

Mr. Justice Parker (chairman).

Mr. W. Duddell, F.R.S., President of the Institution of Electrical Engineers.

Mr. R. T. Glazebrook, C.B., F.R.S., Director of the National Physical Laboratory, Past President of the Institution of Electrical Engineers.

Sir Alexander Kennedy, F.R.S., Past President of the Institutions of Mechanical and of Civil Engineers.

Mr. James Swinburne, F.R.S., Past President of the Institution of Electrical Engineers.

They have been requested, as desired by the Select Committee, in view of the urgency of the question, to report as soon as possible, and in any case within three months from the present date.

**Norway.**—Experiments have lately been made to open up telephonic communication between the most northerly point of the kingdom, *i.e.*, the Saltema district, and the most southerly part, the Egner-Holmström high-pressure telephone being made use of. The results have shown that, up to a distance of 1,500 km., the telephone messages are clearly audible.—*Zeitschrift für Schwachstromtechnik*.

**Russia.**—The Department of Posts and Telegraphs has decided to connect Moscow and Riza by a telephone system during the course of the present year. Branch lines will establish communication with Libau and Windau.—*Board of Trade Journal*.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdeen.**—February 10th. One 3,000-kw. turbo-alternator, with surface condenser and air pump, for the Corporation. See "Official Notices" January 24th.

**Ashton-under-Lyne.**—February 19th. H.T. switchgear, water softening plant, steam, exhaust and feed pipes, tanks, &c., for the Corporation. See "Official Notices" to-day.

**Australia.**—VICTORIA.—February 21st. Four 1,500-kw. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

WESTERN AUSTRALIA.—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" January 10th.

February 27th.—Buildings and boiler-house equipment, turbo-alternators and rotary converters, for a Government power station at Perth. See "Official Notices" January 24th.

SYDNEY.—March 17th. Motors for the City Corporation.

SOUTH AUSTRALIA.—March 5th. One section of a commutator switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

**Beckenham.**—February 10th. Arc lamp carbons (flame) and electrical house cut-outs and service boxes, for the U.D.C. The Offices, Beckenham.

**Belfast.**—February 5th. Electric lamps, carbons, wire, batteries, &c., for a year, for the Midland Railway Co. Northern Counties Committee (form No. 27). Mr. Ellis, Stores Superintendent, York Road Station, Belfast.

February 24th.—Stores and materials for one or three years, for the City electricity department. See "Official Notices" to-day.

**Birkenhead.**—February 11th. Continuous-current electricity meters and house service fuse boxes, for the Corporation. See "Official Notices" January 24th.

**Blackburn.**—February 15th. Materials for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

**Bolton.**—February 13th. Turbo-alternators with condensing plant, water-tube boilers, economisers, switchgear and steam feed pumps, for the Corporation. See "Official Notices" January 24th.

**Bootle.**—February 12th. Steam coal and slack for three or six months, for the Corporation electric light station.—Borough Electrical Engineer, Pine Grove.

**Bridlington.**—February 8th. One 600-kw. turbo-generator, with switchboard and pipework extensions, for the Corporation. See "Official Notices" January 24th.

**Bristol.**—February 14th. Arc lamp carbons, joint, junction and fuse boxes, A.C. wattmeters, and D.C. mercury type ampere-hour meters, for the City Electricity Department. See "Official Notices" to-day.

**Canada.**—MOOSE JAW.—February 10th. One 1,500-kw. steam turbine and generator, for the City of Moose Jaw, Sask. See "Official Notices" January 10th.

REGINA.—February 24th. Supply of materials for a street railway at Regina, Sask., including 2,140 tons of steel rails, with bolts and nuts, angle bars, &c.; 9,690 copper rail bonds; 21 miles of hard drawn trolley wire, 16 miles of stranded copper wire, and 10 miles of soft drawn iron wire: insulators, hangers, brackets, &c.; 20,000 barrels of Portland cement. Copies of the specifications, &c., from H. Doughty, Superintendent, Regina Municipal Railway, Regina. It is expected that copies will shortly be received at the Commercial Intelligence Branch of the Board of Trade, where they will be available for inspection by manufacturers in the United Kingdom.—*Board of Trade Journal*.

**Cardiff.**—February 14th. One steel chimney, with mechanical draught plant, for the Corporation. See "Official Notices" to-day.

**China.**—February 10th. Six 625-k.v.a. three-phase oil-cooled transformers, for the Shanghai Municipal Council. See "Official Notices" January 24th.

**Colchester.**—February 10th. Duplicate motor-driven air-compressor plant, with pipework, cables, switchgear, &c., for the Committee of Visitors, Essex and Colchester Asylums. See "Official Notices" January 24th.

February 15th.—Rubber and fibre insulating materials, cables, electrical fittings (lighting), electrical equipment (cars), overhead equipment, car fittings, &c., for the Corporation tramways department. Mr. R. C. Bullough, General Manager and Engineer, Magdalen Street.

**Constantine.**—January 1st, 1914. The contract with the local gas company expiring in 1920. The Mayor is prepared to receive offers from individuals or companies prepared to provide a public and private lighting service either by gas or electricity, together or separately, in separate tenders or jointly. For further particulars see this column last week.

**Croydon.**—February 4th. General stores and goods for a year, for the Corporation tramways department. Tramways Manager, Thornton Heath.

**Darlington.**—February 17th. One 1,000-kw. steam turbo-alternator, one 750-kw. and one 250-kw. rotary converter, and one water-tube boiler, for the Corporation. See "Official Notices" to-day.

**Dublin.**—February 13th. Water-tube boilers, economisers, pumps, conveying plant, pipework, &c., also boiler seatings and flue work, for the Corporation Electricity Supply Committee. See "Official Notices" January 24th.

**Egypt.**—March 31st. Section des Municipalités invites tenders for electric light installation at Damietta. For further particulars see this column last week.

**Fleetwood.**—February 14th. One 500-kw. mixed-pressure turbine and continuous-current dynamo, with condensing plant, and one water-tube boiler, superheater and brickwork, for the U.D.C. See "Official Notices" January 24th.

**France.**—PARIS.—March 5th. The Administration of the Chemins de Fer de l'Etat is prepared to receive tenders for the supply of five travelling cranes with electric equipment for the railway erection shops at Batignolles. Particulars from the Bureau du Service Electrique (1st division), 43, Rue de Rome, Paris.

**Germany.**—DORTMUND.—The T.C. having decided to expend £119,000 on the improvement and extensions of its electric power station and tramway system, orders for electric rolling stock and equipment may be shortly expected.

**Grimby.**—February 11th. One 1,000-kw. mixed-pressure turbine and continuous-current dynamo, with condensing plant, for the Corporation. See "Official Notices" January 24th.

**Halifax.**—February 17th. Stores and materials for a year, for the Corporation electricity department. See "Official Notices" to-day.

**Hoylake and West Kirby.**—January 31st. High-tension single-phase switchgear (eight panels) and one 50-k.v.a. single-phase transformer, for the U.D.C. See "Official Notices" January 17th.

**Hyde.**—February 5th. The Corporation is inviting tenders for the electric lighting of the Public Baths extension. Specifications and forms from the architect, Mr. J. H. Fletcher, 16 Oldham Street, Hyde.

**India.**—February 18th. High and low-tension switchboards, for the Bombay, Baroda and Central India Railway. See "Official Notices" to-day.

**Keighley.**—February 8th. Electrician's work for a year, for the Keighley and Bingley Joint Hospital Board. Mr. J. N. Clarkson, Clerk, North Street, Keighley.

**Leeds.**—February 19th. Coal and general stores for a year, for the Corporation electric lighting department. See "Official Notices" January 21th.

February 17th.—The City Tramways Committee invites tenders for electrical sundries and engineers' furnishings and other goods for the tramways during the 12 months ended March 31st, 1914, and also for the reconstruction of certain portions of tramway track, in respect of which tenders may be for six, nine or 12 months. General Manager, Tramway Offices, City Square, Leeds.

**London.**—February 4th. The Metropolitan Water Board is inviting tenders for Sec. 25, electric lamps and accessories, for one year. Specifications and forms of tender from the Clerk of the Board, Savoy Court, Strand, W.C.

**Hammersmith.**—February 5th. General stores for a year, for the B.C. electricity department. See "Official Notices" Jan. 24th.

**H.M. Office of Works.**—February 5th. Main switches, main fuses, switch fuse and fuse boards, for three years. See "Official Notices" January 21th.

**Bermundsey.**—February 17th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" January 21th.

**L.C.C.**—February 11th. The tramways department is inviting tenders for 584 tons of special section mild steel bars for magnetic brake shoes. Specifications and form from Mr. A. L. C. Fell, Chief Officer of Tramways, 62, Finsbury Pavement, E.C.

The Highways Committee is to invite tenders from selected firms for additional water-condensing pipes, &c., required in connection with the alteration of the plant at the Greenwich generating station. Tenders are to be invited from selected firms for metallic filament lamps for electric cars.

February 25th.—Electric wiring of the Camberwell and Cressy Road car-sheds. See "Official Notices" to-day.

**Manchester.**—February 18th. General stores for a year, for the Corporation tramways department. See "Official Notices" to-day.

**Nelson.**—February 3rd. One traction battery, one automatic reversible booster and switchgear, one D.C. motor-generator and switchgear, for the Electricity and Tramways Committee. See "Official Notices" January 10th.

**Prague.**—February 28th. Tenders are invited for the supply of machine tools, with electric equipment, to the Bohemian Northern Railway. Particulars (enclosing 2d.) from the Direktion der Böhmisches Nordbahn, Abteilung IV, Prag.

**Salford.**—February 3rd. Rotary converters for the Corporation. See "Official Notices" January 21th.

**Sheffield.**—February 5th. General stores for two years, for the City Electricity Supply Department. See "Official Notices" January 17th.

February 8th.—The Corporation Tramways Committee is inviting tenders for 1,000 tons of steel tramway rails. Specifications, &c., £2 2s. (returnable), from Mr. W. J. Hadfield, Surveyor of Highways, Town Hall.

**South Shields.**—February 17th. Uniforms, for the Corporation tramways department. See "Official Notices" to day.

**Spain.**—Tenders have just been invited by the municipal authorities of Ledesma (province of Salamanca) for the concession for the electric lighting of the town during a period of 10 years.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

**Warrington.**—February 3rd. We are asked to state that a misprint occurred in the notice of last week. Specifications for the electric light installation at Public Baths are to be applied for at the office of the Borough Surveyor (Mr. A. M. Ker), Town Hall, Warrington. Drawings can be inspected, and further particulars obtained, at the office of Mr. F. V. L. Mathias, the borough electrical and tramways engineer, Electricity Works, Warrington.

## CLOSED.

**Bristol.**—The Docks Committee has accepted the tender of Messrs. Siemens Bros. & Co., Ltd., for the supply of flexible crane cable.

**Belgium.**—La Société de Ateliers de Constructions Electriques de Charleroi has submitted the lowest tender to the Belgian Post and Telegraph authorities for the supply and erection of two new telephone cables between Brussels and Antwerp, and a new line between Suherbeek and Dieghem.

**Bexhill.**—The tender of Messrs. Myers, Rose & Co. for the supply of 1,000 tons of coal for the electricity works, at 29s. per ton (Shipley or Tibshelf peas), has been accepted by the Council.

**Blackpool.**—The Highways Committee has accepted the tender of Messrs. Mather & Platt, Ltd., for the supply of two electrically-driven pumps.

The T.C. has placed an order with Messrs. Halley's Industrial Motors, Ltd., of Yoker, for the supply of a petrol motor tower wagon for service in connection with the maintenance of the electric tramway overhead conductors.

**Bury.**—The Tramways Committee has placed a contract with the United Electric Car Co. for the supply of four new car bodies, and a contract with Messrs. Dick, Kerr & Co., Ltd., for a pair of 40-h.p. motors.

**Great Yarmouth.**—The B. of G. has accepted the tender of Mr. J. Lamb, of Bridge Foot, Southtown, for electric light at the new receiving home, at £29 19s. 9d. There were six tenders, the highest being £18.

**Keighley.**—Messrs. Clough, Smith & Co., Ltd., have secured from the Trackless Trolley, Ltd., the contract for the overhead equipment on the over-running system for the Ingrow to Haworth section of the Keighley Corporation's trackless system.

**London.**—PADDINGTON.—The Guardians have accepted the quotation of Messrs. Drake & Gorham, for a supply of 0-ram electric lamps.

**WOOD GREEN.**—The tender of the Private Telephone Co. has been accepted by the U.D.C. for installing 21 Sterling inter-communicating telephones at the Town Hall, at £63 4s. plus £6 5s. for lead-covered cable and a maintenance charge of £5 per annum.

**WOLWICH.**—The T.C. has accepted the tender of Messrs. Kirk and Randall for steel work for the electricity engine house at £1,486.

**Preston.**—The Tramways Committee has recommended the acceptance of the tender of Messrs. Dick, Kerr & Co., Ltd., for 50 to 60 tons of rails for relaying a portion of Church Street track, at the rate of £7 17s. 9d. per ton, exclusive of royalties.

**Pekin.**—Messrs. Pritchett & Gold, Ltd., have received an order for a battery of 120 cells, 600 ampere-hour capacity, for the Pekin Legation.

**West Ham.**—The British Westinghouse Co.'s contract with the T.C. for supplies of transformers is to be extended for a further period of 12 months. In regard to this matter the Council's electrical engineer states that the prices of transformers of the sizes used have increased from 3 per cent. to 5 per cent., and by the end of March the increase would be much more than this, and it would be to the advantage of the Council to accept the offer made by the Westinghouse Co.

## FORTHCOMING EVENTS.

**The Electrical Engineers' Ball.**—Friday, January 31st. At 9 p.m. Hotel Cecil, London.

**North-East Coast Institution of Engineers and Shipbuilders (Graduate Section).**—Saturday, February 1st. At 7.15 p.m. At Bolbec Hall, Newcastle. Paper on "Pipe Design," by Mr. J. Dickinson.

**Society of Engineers.**—Monday, February 3rd. At 7.30 p.m. At the I.E.E. Paper on "The Bus, Tram Controversy, and other Aspects of the London Traffic Problem," by Mr. W. Yorath Lewis.

**Royal Society of Arts.**—Monday, February 3rd. At 8 p.m. Cantor lecture on "Liquid Fuel," by Prof. V. B. Lewes. (Lecture III.)  
Wednesday, February 5th.—At 8 p.m. Paper on "The Economic and Hygienic Value of Good Illumination," by Mr. L. Gaster.

**Institution of Electrical Engineers (Newcastle Section).**—Monday, February 3rd. At 7.30 p.m. At the Armatrong College, Newcastle. Author's reply to discussion on "Electric Resistance Welding," and demonstration of butt welding.

(Glasgow Students' Section).—Tuesday, February 4th. At 8 p.m. At the Royal Technical College, Glasgow. Paper on "Electrical Estimates and Opportunities," by Mr. N. C. Woodin.

(Manchester Students' Section).—Tuesday, February 4th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Winding of Electrical Machinery," by Mr. A. T. Robertson.

(Students' Section).—Wednesday, February 5th. At 7.45 p.m. At the I.E.E. Paper on "Low and Mixed-Pressure Turbine Plant," by Mr. C. H. Goulden.

**Chemical Society.**—Thursday, February 6th. At 8.30 p.m. At Burlington House, W. Papers on "The Presence of Helium in a Gas from the Interior of an X-ray Bulb," by Sir Wm. Ramsay; "The Presence of Neon in Hydrogen after the Passage of the Electric Discharge through the Latter at Low Pressures," by Messrs. J. N. Collie and H. Patterson; and other papers.

**Royal Institution.**—Thursday, February 6th. At 8 p.m. Lecture on "Recent Research on the Gas Engine," by Prof. B. Hopkinson. (Lecture II.)  
Saturday, February 8th.—At 3 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture I.)

**Association of Mining Electrical Engineers.**—Friday, February 7th. At 8 p.m. At the I.E.E., Embankment, W.C. Paper on "Cables for the Shafts of Mines," by Mr. E. K. Scott.

**Association of Engineers-in-Charge.**—Saturday, February 8th. At 8.15 p.m. At the I.E.E., Embankment, W.C. Paper on "Cables for the Shafts of Mines," by Mr. E. K. Scott.

**Association of Engineers-in-Charge.**—Saturday, February 8th. At 8.15 p.m. At the I.E.E., Embankment, W.C. Paper on "Cables for the Shafts of Mines," by Mr. E. K. Scott.

**Bride's Institute, E.C. Social Dance.**

**Dance.**—To-morrow, Saturday evening, the Ostram and Robertson Social and Athletic Club will hold a plain, fancy and evening dress dance at the Brook Green Works, Hammersmith.

**Dancing from 7 o'clock to 12 o'clock.**

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, February 25d.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.  
 Tuesday, February 26th.—"B" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.  
 Thursday, February 28th.—"C" Company. Company training, 7 to 10 p.m.  
 Friday, February 29th.—"D" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.  
 Saturday, February 30th.—"E" Company. Week-end run at Fort Coalhouse, East Tilbury. Parade at Fenchurch Street Station at 3 p.m., for train leaving at 3.25 p.m. for Low Street. Dress:—Service dress, puttees and greatcoats. No arms will be taken.  
 Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,  
For Officer commanding L.E.E.

### NOTES.

**The "Point Fives."**—We are informed that a meeting of the 3d. a unit men has been held in London under the chairmanship of Mr. Cooke, of Linton, and that a set of rules has been adopted for an Association to be called the "Point Fives." No one interested in electricity supply work will disagree with the underlying objects of this new Association, and we cannot wish it greater success than that its ostensible purpose, *i.e.*, the development of the use of electricity for domestic purposes, shall be so fully attained in the near future as to render its individual existence no longer necessary. The Association is to meet four times a year, one occasion being at the I.M.E.A. Convention, and the next meeting is at Bradford.

Mr. Cooke stated that in order to promote the more rapid and extensive use of electrical energy for cooking purposes, the Society was very badly in need of a compact, reliable and low-priced complete cooking outfit which would meet the requirements of the average family of six to eight persons. Although there were several cooking outfits on the market, there did not appear to be any uniformity of opinion among the manufacturers as to what the public really required, nor did they appear to realise the large sale they could obtain if the price of this class of apparatus was such as would bring it within the reach of the middle-class consumer. He therefore believed that the suggestion made by Mr. Rowley Hill at the last meeting was the only solution of the present difficulty, *viz.*, to standardise this apparatus as soon as possible. He suggested that the Society should adopt a standard specification for a complete cooking outfit, and arrange with the manufacturers for the purchase of a certain quantity over a given period. After this complete outfit had been standardised, the Society could then turn its attention to the standardisation of other articles for cooking and heating. He submitted a draft specification as a nucleus around which the Society might, with the co-operation of the manufacturers, develop something practical.

**Annual Dinner.**—The employees of Blackpool electricity and tramways department had their second annual dinner at the Winter Gardens, on January 23rd. About 140 attended. Mr. C. Furness, electrical engineer and tramways manager, presided, and was supported by several members of the Corporation. The chairman submitted the toast of the "Mayor and Corporation," and said that the department had had a record year, which could not have been achieved without the co-operation of each of the employees, who were all links in the municipal chain. It was of no use for the Committee to pass resolutions for the general manager to carry out unless every man in the department believed they were right and proper and carried them out to the best of his ability. They all tried their best without any tyranny on the part of the general manager or the staff. Councillor W. G. Bean, in proposing the health of the employees, commented with pride on the fact that last year 13,000,000 passengers were carried on the Blackpool Corporation cars, and that there had only been one accident. He also alluded to the work of the electricity department. Mr. J. Appleton, of the electricity department, acknowledged the compliment.

**Parliamentary Notes.**—TIDWORTH AND BULFORD CAMPS (ELECTRIC INSTALLATION).—In the House of Commons on January 22nd, Mr. Touche asked the Secretary of State for War if the specifications for the electrical installation at Tidworth and Bulford camps were prepared by a private firm; and, if so, would he mention the name of the firm and say why they were not prepared by the War Office electrical department. Mr. H. Baker replied that the specifications in question were prepared by Messrs Kennedy & Jenkin in conjunction with the War Office electrical staff. This staff, which was mainly employed on electric lighting for defence purposes, was not large enough completely to supervise extensive new installations such as the Tidworth and Bulford scheme. Mr. Touche then asked at what place the Armorduct cable, selected for the army camps at Tidworth and Bulford, would be inspected by representatives of the War Office. Mr. Baker replied that Messrs. Kennedy & Jenkin would inspect the cable at the works

of Messrs. Lynen & Co., Eschweiler, near Aix-la-Chapelle. Mr. Touche further asked the Secretary of State for War if his attention had been called to an advertisement circulated by the Armorduct Manufacturing Co., setting forth that the Armorduct cable had been selected by the contractors to the War Office for the army camps at Tidworth and Bulford, requiring approximately 300 miles; was this cable manufactured by Lynen & Co., Eschweiler, Germany; would he say who were the contractors who were providing the cable; and were all the competing contractors given an opportunity of quoting for German cable, or were they, or any of them, asked to tender for best quality English cable. Mr. Baker said that nothing was known at the War Office of the advertisement mentioned. The cable was manufactured by the company referred to. The contractors were Messrs. G. E. Taylor & Co. All competing contractors were given the same opportunity to quote for any cable complying with the British Standards Committee Report No. 7, of 1910. Mr. Touche asked if attention had been drawn to an advertisement in the papers to this effect:—"Is Armorduct cable good enough for you? It is good enough for His Majesty's War Office." He asked if the hon. member considered it desirable that the War Office should thus be used for the purpose of advertising the goods of foreign competitors. Mr. Baker said he had heard nothing of the advertisement, but could assure Mr. Touche that the cable was fully up to their requirements.

**Aluminium in 1912.**—The report for 1912 of the Berlin metal firm of M. Levy & Co. recalls, among other matters, the fact that the Neuhausen Aluminium Co., the French aluminium companies which had previously combined among themselves, the two English companies and the Norwegian works formed an international syndicate, which will work hand in hand with the Canadian and United States companies. It is of some interest to learn that the large stocks which were held at the close of 1911 have been entirely consumed by the works which produce domestic and fancy articles, the electricity companies and the airship works and the motor-car industry. During the final quarter of 1912 the motor-car works in the United States in particular imported large quantities of aluminium from Europe, whereas up to a short time previously American metal was being delivered in Europe. The prices of aluminium rose in accordance with the development of the market from £50 per ton in the autumn of 1911 to £70 in June, 1912, and further advanced by the close of the year to £85 and up to £90. As the stocks are completely exhausted, the report states that prices favourable to makers can be reckoned on in the present year also.

**Callender's Hospital Fund.**—With the close of the year 1912 the Callender's Hospital and Distress Fund completed its first decade. At the general meeting, held on January 25th at the Belvedere Works, Mr. A. R. Kibblewhite presiding, the tenth annual report and accounts were presented and unanimously approved. The penny weekly subscriptions realised £276, which is better by £57 than in 1911, and there were donations of about £70, including £50 from the company, £5 5s. from Mr. T. O. Callender, and £2 2s. each from seven others. The report details the various ways in which the money was distributed, £251 going to hospitals and infirmaries; this is the highest sum on record to go in this direction, and is an increase of £33 on the 1911 figure. Some £52 was granted to 37 cases needing financial assistance, while spectacles and surgical appliances were provided to a large number of members, and numerous hospital, convalescent home and nursing home tickets were given out. It is interesting to record that during the 10 years the fund has distributed among hospitals and members money and assistance in the above forms to the excellent total of £2,886, and has issued 2,668 letters. Those responsible for the conduct of this admirable fund are to be congratulated upon such splendid achievements.

**Admiralty Electrical Engineers.**—The Admiralty has notified the authorities at Plymouth that in future electrical engineers and assistant electrical engineers are to be borne on the established list, pensionable scales of salary being substituted for the non-pensionable salaries at present payable. Electrical engineers, highest grade, are to receive salaries of £450, rising by annual increments of £20 to £650, with an official residence, or an allowance of £50 to £75 in lieu thereof. Electrical engineers, lower grades, are to receive salaries of £300, rising by £15 increments to £400, with an official residence, or an allowance of £50 in lieu. First assistant electrical engineers are to receive £250 to £350 a year, and second assistant electrical engineers £200 to £250 a year. The pensionable scales are to apply to all future entrants, but officials now serving are to be given the option of being placed on the pensionable scales. They will enter these scales from the date of obtaining the necessary Civil Service certificate at the salaries they would have been receiving if they had served in the pensionable capacity throughout on the above scales, plus the proportion of increment earned on these scales up to the dates of their certificates. They will not be allowed to count their previous service for pension. With reference to the petitions of electrical engineers asking for an increase of pay, the Admiralty states that it is not prepared to make any alterations in the scales other than those indicated above.

**More Wireless.**—A correspondent anticipates a slump in copper and a sharp rise in the timber and tin-cann trade as a result of some "wonderfully clever work" by scientific members of the Hampshire House Club, Hammersmith—at least, if the *Daily Mirror* account in Friday's issue is correct. This informs us that "they have no expensive apparatus, but have made delicate instruments, like electric bells and galvanometers, out of old tin-boxes and tin-cans." Perhaps they mean *tin* and *tin* like

**Old Centralians.**—The fifteenth annual dinner of the above Association will be held on Saturday, February 15th, at the Trocadero Restaurant, Piccadilly Circus, W. The chair will be taken at 7.30 p.m. by Sir John Wolfe-Barry, K.C.B., F.R.S., the President of the Old Centralians. The annual general meeting is arranged to precede the dinner, and will commence at 6.45 p.m. Further information and tickets (price 6s. 6d.) can be obtained from Mr. G. W. Tripp, A.C.G.I., 4, Fairfield Road, Charlton, Kent. "Old Centralians" is the name of the Association formerly known as Central Technical College Old Students' Association, the change being made when the College became the City and Guilds (Engineering) College, and it is hoped that the new name will serve as an effective link with the past.

**Electrical Trades Union.**—The Fulham Branch of this Union is holding the fourth of its winter lectures on Monday next, February 3rd, at 9.30 p.m., at the Red Lion Hotel, Waltham Green, when Mr. Andrew Clark, of the Anti-Socialist Union, will be the lecturer. A welcome will be extended to anybody engaged in the trade.

**Electrical Fatality.**—At the Wandsworth Town Hall on Monday, Mr. S. Ingleby Oddie held an inquiry regarding the death of William Laming, aged 32, a labourer, who was killed by an electric shock. The deceased was in the employ of Messrs. Bentley & Lock, contractors, who are carrying out sewerage work in Mandrake Road, where the fatality occurred. Deceased left a widow and four little children.

The deceased and other men were working at excavations in Mandrake Road, and earth was hoisted up by an electric crane from the tunnelling. The deceased was found dead, after he had been heard to exclaim "Oh!" at the bottom of the shaft.

The driver of the crane, William James, said that he had no gauge to show him when there was a short circuit. He had never known the hook to become electrified. The strength of the electricity was 200 volts. The wire rope of the crane was not insulated, but witness knew of no defect in the machinery. The first witness knew about the deceased being found was when the banksmen told him to switch off the current. At the time witness suggested that the man had received an electric shock.

Dr. R. S. Trevor, pathologist at St. George's Hospital, who made a post-mortem examination, deposed that he found no marks of injury on any part of the body, but at the root of the neck on the left side he discovered a small oval pink mark on the skin. In the centre of this were numerous minute pin-point darker spots of hæmorrhage. Internally all the organs in the body were perfectly healthy—there were no signs of disease at all, and so far as the examination itself was concerned, it did not reveal the cause of death. There was no mark on the sole of the foot and no signs of burning on the feet and clothing. The only important sign was on the neck, and that was very superficial. He did not die from the effects of bad air, or through disease. He formed the opinion that he received a shock at the side of the neck where the pink mark was. It would correspond with the height of the hook of the crane, and as it was in the region of the great vessels of the neck, it would have been quite sufficient to produce immediate death. He concluded that death was due to an electric shock. There would be a sudden stoppage of the heart.

Heart failure following an electric shock?—Yes.  
Would 200 volts be sufficient?—I think so, if received over the great vessels of the neck. The boots and clothing were damp. There is a case recorded of the death of a man who received 225 volts by touching an ordinary electric lamp. He, too, was wearing damp boots.

Damp boots would make the conduction more active?—Yes, more especially as the hands were wet, deceased having worked in a damp tunnel.

The mark you found on the neck was the result of the contact?—It is impossible to say, but it occurred to me it might be. It is quite common, in cases of electric shock, to find no marks. [The witness handed the Coroner the book in which the case he had cited was recorded.]

Evidence of a technical nature was then given by Mr. Chas. A. Baker, M.I.E.E., principal assistant in the L.C.C. engineers' department and electrical inspector under certain Acts and orders. He made an examination of the crane with the object of finding out whether it was well earthed, and with the instruments at his disposal he came to the conclusion that a man could not get a shock from the wire. Had it been sufficiently earthed it would have been impossible for any man standing on the earth to receive a shock.

Then if you electrified the rope it would not give a man a shock if it were properly earthed?—No, sir.

When witness subsequently made an examination with more sensitive instruments, he found there was a slight resistance, sufficient to make it possible for a man to get a shock, but he thought it was improbable. He could not make out where the wire got the electricity from, although it might have come from the motor if there was a leakage. The man in the cabin of the crane could not receive a shock, unless he touched the switchboard. If there were defective insulation, there would be a permanent escape the whole time the motor was working. Of course it would vary, and would mean a serious figure to the meters: it would tend to blow the fuses.

How do you think this wire became temporarily electrified: I should have thought that it would have gone on permanently?—It would be intermittent with the motion of the crane. A jerk might cause it, and another might remove it.

Witness thought that the real safeguard would be to have an

earth plate connected with the cabin and machinery by means of a copper wire.

That would make it absolutely safe?—I think so.

Is it the duty of any council or the Board of Trade to inspect these cranes?—Not to my knowledge, sir.

Can anyone put up a crane without inspection?—Yes, with this voltage, but the Board of Trade varies the figure—low pressure, high pressure, &c. This came under the head of low pressure, such as is admitted into houses for private consumers—the public generally. It is considered reasonably safe.

That is to say, that because there is only one recorded case of death with such pressure, it is regarded as safe?—Yes.

Continuing, witness said that when the voltage was double the strength the supply companies had to satisfy the Board of Trade that their requirements had been met. Subject to that, one could use the electricity as he pleased—there would be nothing said as to the working.

In summing up, the Coroner described the case as a difficult one, but said it was not so complicated as he at first thought it would be. It was evident that the deceased did not die through inhaling poisonous gas, or there being a deficiency of oxygen. Dr. Trevor's opinion was his (the Coroner's), and he thought the jury must irresistibly come to the conclusion that the deceased died as the result of receiving an electric shock. The jury could not very well blame anyone for the fatality, for those in charge of the crane could not have been aware that the man was going to be killed. Now that a life had been lost the authorities might think it desirable that cranes, such as the one in question, should be inspected before workmen arrived, in order that they might not be put in a position of risk. Now that they had had experience of a sad case, he thought that in future precautions should be adopted by people in charge of machinery such as this.

After a short consultation in private, the jury returned a verdict that the deceased was accidentally killed by an electric shock, and added that "further precautions should be taken in future."

#### Municipal v. Private Ownership in Germany.

In a recent issue of the Swedish *Teknisk Tidsskrift*, an interesting paragraph appears regarding municipal electrical works in German cities, showing that municipal administration is not proving all that might be expected.

Electrical stations in the German cities are, as a rule, municipal property, and a great number of them have done very well in spite of the rather cumbrous administration which is associated with public or municipal working of an enterprise.

There are now, however, signs of a tendency to hand such works over to private enterprise, while retaining some sort of local control. The intention is to place the works under an administration which will manage their affairs in a more businesslike manner than municipal management will permit of. The electrical works at Brandenburg have recently been handed over to the A.E.G. for a period of 40 years, and it is thought that this arrangement, apart from the advantage which it has of removing some of the burdens from the municipal authorities, should also act as an incentive to the development of the town, as a private company would always be in a better position to meet the special requirements, and thus increase the use of electricity in general. Under the terms agreed, the A.E.G. will pay to the municipality a certain sum in cash at once, and afterwards a fixed sum per annum. The municipality will be entitled to a certain portion of the gross revenue and profits, while it further reserves the right to electrical energy for tramways and municipal buildings at reduced rates. The municipality also has the right of exercising a certain control over the working and the prices to be charged for energy. The electrical works at Brandenburg are valued at £60,000. A somewhat similar arrangement has been made between the town of Saarbrücken and the A.E.G. A new company has been formed in this case, and 70 per cent. of the shares are owned by the municipality, while the remaining 30 per cent. are in the hands of the A.E.G., which has undertaken the management on certain terms.

#### The Austrian Bergmann Co.

—A scheme is being promoted with a view to the amalgamation of the copper and brass departments of the Austrian Bergmann Co. of Bodenbach, and the Vienna brass rolling firm of Chaudoir & Co., by the formation of a new company, with a spare capital of £416,000. It is said that during the first complete year's working of the Bodenbach copper and brass departments it was possible for the company to secure one-third of the Austrian demand for brass in competition with the Austrian Brass Syndicate. This circumstance has proved to be very inconvenient to the syndicate, which has consequently threatened to collapse, but the proposed fusion of Bergmann and Chaudoir would remove one of the difficulties in connection with the renewal of the syndicate. The purely electrical departments of the Bodenbach works are to be converted into a joint stock company with the co-operation of the Anglo-Austrian Bank, whilst the German Bergmann group will have an interest in the new amalgamated copper and brass rolling mills.

#### Lamp-Making at the Cinematograph.

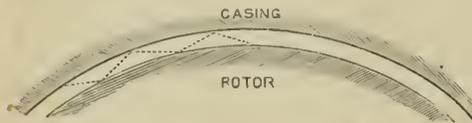
—We congratulate Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, upon having made arrangements with one of the largest film manufacturing firms in the world to produce cinema films showing the processes of manufacture of "Tantalum" and "Wotan" drawn-wire lamps, together with several other interesting features in connection with the science of electrical illumination. Arrangements have also been made for the exhibition of these films at the majority of first-class cinema theatres, and it is hoped by this means to increase the interest of the general public in the use of electricity as a lighting agent.

**Willesden Polytechnic Electrical Engineering Society.**—The eleventh annual dinner will be held on Saturday evening next, February 1st, at 7 p.m., at Reggiori's Restaurant, Chapel Street, W., the President, Mr. Frederick H. Taylor, A.M.I.E.E., in the chair.

**I.M.E.A. New President.**—Mr. C. E. C. Shawfield having resigned his position as President of the I.M.E.A., consequent on his accepting another appointment necessitating his leaving municipal employ at an early date, the Council has filled the vacancy by electing as President of the Association for the remainder of the term, *ie.*, until the annual Convention in June next, Mr. J. E. Edgcome, of Kingston-on-Thames, hon. treasurer and past president.

**The Cortesy Turbine.**—It is unwise to close one's eyes to new and apparently improbable inventions, because they are not based on familiar principles and proved mechanisms. For such is the Cortesy steam turbine, which is described somewhat vaguely in the *Standard*.

To begin with, the present types of turbine are not based on "shock tactics" as the *Standard* appears to think. The Cortesy turbine appears essentially to consist of a drum or series of drums rotating in a casing somewhat larger than itself. A narrow band of steam travels round this narrow space, and is supposed to cling round the rotor like a belt, and so drag it round. What really happens, if steam is regarded from the theory of molecular kinetics, is as shown in the figure annexed. Taking a single



molecule of steam projected into the narrow annular space between rotor and casing, it will follow a zigzag path and strike the rotor surface at an angle as shown, giving it a slight forward push at each impact.

Thus, just contrary to the *Standard's* dictum, this turbine *does* work by shock. And it does not work by the belt action fancifully supposed, for a belt does not slip, whereas the steam in this turbine acts wholly by slip velocity. It is, therefore, to be understood that the rotor will be turned by the impact of the steam molecules, and that if a sufficient circumferential area be thus lapped by a flat torrent of steam, the energy of the steam will be transferred more or less completely to the rotor. Presumably, the casing would be constructed so as to provide for expansion, and there would be many chambers in series. But the description is very vague indeed, and the mistake as to shock tactics throws doubts on it which are not laid to rest by the subsequent non-descriptive description so contradictory in what it appears to convey. There are no facts or figures given of value.

We would gladly welcome a bladeless turbine, and do not think the smooth rotor would refuse to rotate. What we fear is the very extended pulley surface to be exposed to the "clinging" belt of steam. As to efficiency, if it can be shown by tests that this turbine delivers its exhaust steam to the condenser at condenser pressure and condenser temperature, that is, not superheated, then it may be allowed that the turbine will be so far efficient, as the steam has lost heat by doing work.

**Municipal Electrical Trading at Edinburgh.**—Mr. Walter Finlay, secretary of the Electrical Contractors' Association of Scotland (Edinburgh Branch), writes as follows:—"I notice your paragraph referring to Edinburgh in your issue of 24th inst. Your paragraph correctly reports what took place at the special meeting of the Edinburgh Town Council called to consider the Bill, held on Tuesday, 14th inst., but I have to point out to you that the Bill is a very long one, embracing a great variety of subjects, and the electrical clause did not come on for consideration by the Council until a late hour, and there was a very small attendance.

"I understand that the clause at that meeting was amended to bring it in harmony with the model clause by a very small majority, and that the minority were in favour of deleting the clause entirely from the Bill. I have to point out, however, that at a meeting of the Town Council held on 21st inst., a motion was moved to disapprove of the minutes of the previous meeting so far as they approved of this clause in the draft provisional order, and that this motion in what was almost a full council was carried by a very large majority. The position of matters in Edinburgh, therefore, is that the Council have decided to have nothing whatever to do with municipal trading in electrical matters, and it is hoped by the trade that many other Corporations will follow the good example set by Edinburgh and leave well alone."

**Educational Note.**—The Engineering Department of the Manchester Municipal School of Technology is to be extended at a cost of £15,000, and re-equipped with modern machinery.

**Institution and Lecture Notes.**—ASSOCIATION OF MINING ELECTRICAL ENGINEERS (EAST OF SCOTLAND BRANCH).—At a meeting held at Dunfermline, on January 24th, Mr. David Beveridge, of Kelly, read a paper on "The Supervision of Electrical Cables Underground." The author said that there was difficulty in putting a cable in a deep shaft even where they had a clear space all the way down, but if they had to put the cable down the pumping space, where they would encounter wooden beams and steel girders lying across, it was

impossible to do the lowering there with guides. If, therefore, the cables were made and guaranteed to carry their own weight, without damaging them in any way, they would simply have to guide the end of the cable and brake it down. From practical experience he was of opinion that cables hung on trees, or near the ends of the crowns at the side of roadways, were in a much safer position than those suspended from the centre of the roadway. In such circumstances, when a fall took place, the crowns generally broke near the middle, and the half of the crown fell to the floor at one end, the other end commonly resting on the side of a roadway near the roof. The paper gave rise to an interesting discussion.

**ROYAL SOCIETY OF EDINBURGH.**—On Monday last week Dr. C. G. Knott read a paper on "Change of Electrical Resistance of Nickel subjected to Cross Magnetic Fields."

**SOCIETY OF ENGINEERS (INCORPORATED).**—The Council of the Society announces that arrangements are being made for holding the Fellowship Examination of the Society during the second week of June next. Intending candidates should apply to the Secretary of the Society, at 17, Victoria Street, Westminster, S.W., for full particulars. A paper is to be read before the Society on February 3rd by Mr. Yorath Lewis, at the Institution of Electrical Engineers, on "The 'Bus' r. Tram Controversy, and other Aspects of the London Traffic Problem."

**INSTITUTION OF ELECTRICAL ENGINEERS.**—The paper read before the I.E.E., in London on Thursday last week, on the "Use of a Large Battery in Central Station Supply," by Mr. F. H. Whyall, was read before the Manchester Section on Tuesday evening, the 28th inst. A long and varied discussion followed on each occasion, and the author replied. At the London meeting, the president, Mr. Duddell, announced that arrangements were in progress for the formation of a lending library, for the benefit of members who were unable to use the library at headquarters.

**INSTITUTION OF ELECTRICAL ENGINEERS (YORKSHIRE SECTION).**—A meeting was held at Sheffield, on Wednesday, when a lecture was given by Mr. Kenneth Cox on "Internal-Combustion Engines," and a discussion followed.

**THE CHADWICK TRUST.**—Three evening lectures on the "Hygiene of the Home" have been arranged under the Chadwick Trust. They will be given by Mr. H. Percy Boulois, M.Inst.C.E., in the library of the Royal Sanitary Institute, 90, Buckingham Palace Road, London, S.W., on Fridays, February 7th, 14th and 21st, at 8.15 p.m. The lectures will deal with the following phases of the subject:—(a) The Ideal Home; (b) Drainage and Sanitary Fittings; (c) Water, Ventilation, Heating, &c. The lectures are free, and any further information can be obtained from the secretary, Mrs. Aubrey Richardson, 8, Dartmouth Street, Westminster.

**MANCHESTER ASSOCIATION OF ENGINEERS.**—A paper on "Electric Lighting in Engineering Workshops" was read before the members on Saturday, by Mr. Haydn Harrison.

**NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.**—A Scholarship will be offered for competition among Graduates of the Institution in September next, tenable for two years, and of the annual value of £50. It will be awarded on the results of an examination held in Newcastle during September. Candidates must apply to the Secretary of the Institution before August 1st. Conditions for membership of the Graduate Section of the Institution may also be had from the Secretary.

**How to Quote Judiciously.**—Our contemporary, the *Gas World*, pays a well-deserved tribute to Dr. Ferranti's James Watt lecture, which we abstracted in our last issue, and draws attention to his remarks on the suitability of the internal-combustion engine for small powers, which it suggests will be useful "in maintaining the cause of the small town gas engine." It was naturally inconvenient, or would, at any rate, have been injudicious, to give equal prominence to the latter part of the lecture, which states that the electric motor is displacing all forms of small engine, and that in the future probably all stationary motors will be electric, reciprocating forms of engines being only makeshifts.

**Appointments Vacant.**—General assistant to the secretary (£150-£200), and library assistant (£150), for the I.E.E.; assistant engineer (£80) and fitter-driver (25s.), for the Severalls Asylum, Colchester. See our advertisement pages in this issue.

**L.C.C. Tramway System.**—On Monday night the L.C.C. tramway system was brought to a standstill owing to the breakdown of a feeder at Greenwich power station.

**Correction.**—Two slight errors have crept into the report on the concert of the Manchester Electro-Harmonic Society, on page 204. For "Canzetta" read "Canzonetta," for "Kuti" read "Kati."

## NEW COMPANIES REGISTERED.

**Isaacson & Brown, Ltd.** (126,606).—This company was registered on January 20th, with a capital of £1,000, in £1 shares, to carry on the business of electrical and mechanical engineers, manufacturers and workers of electricity, motive power and light, &c., and to adopt an agreement with A. W. Isaacson. The members (with one share each) are:—A. W. Isaacson, 43 and 44, Furnival Street, E.C.; electrician; C. W. M. Brown, 43 and 44, Furnival Street, E.C., electrician; J. C. Fisher, 24, Ribblesdale Road, Hornsey, N., clerk. Private company. The number of directors is not to be less than two or more than three; the first are A. W. Isaacson and C. W. M. Brown (both permanent managing directors), with power to appoint one other; qualification, £5; remuneration as fixed by the company. Registered office, 40 and 44, Furnival Street, Holborn, E.C.

**Coniston Electrolytic Copper Works, Ltd.** (126,747).—This company was registered on January 25th with a capital of £1,000 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—H. P. Adkin, 240, Canby Park Road, Kingston, clerk; F. Schofield, 28, Backwell Street, W. Clerk. Private company. The first directors are not named. Registered office, 14, Cockspur Street, W.W.

**Ardwick Electric Regulator Co., Ltd.** (126,500).—This company was registered on January 20th, with a capital of £1,000 in £1 shares, to acquire certain inventions relating to electric controller regulators and controllers for electrical purposes, to carry on the business of engineers, manufacturers of electrical implements and other machinery, and to adopt an agreement with S. Smith, A. J. G. Fleming and T. Guerin. The subscribers (with one share each) are:—T. Guerin, 6, Mayfield Road, Whalley Range, Manchester, metal merchant; A. J. G. Fleming, 8, Redstone Avenue, Victoria Park, Manchester, salesman; S. Smith, 13, Mildred Street, Broughton, Manchester, engineer. Private company. The number of directors is not to be less than two or more than five; the first are T. Guerin (chairman), A. J. G. Fleming and S. Smith (all permanent); qualification, 100 shares. Registered office, 62, Queen Street, Ardwick, Manchester.

**North British Diesel Engine Works, Ltd.** (126,722).—Registered January 24th, by the Colt, Innes and Roscoe, St. Benet Chambers, Church Street, E.C. Capital, £1,000,000 in 500,000 preference, and 500,000 ordinary shares of £1 each. Objects: To carry on the business of mechanical engineers, manufacturers and repairers of internal combustion engines and electrical, steam or oil engines, founders, smiths, machinists, boiler makers, general engineering contractors, builders, repairers, fitters and owners of steam and other ships and vessels, wet and dry dock and wharf owners, &c. The subscribers (with one share each) are:—T. H. Caselbourne, St. Helens, Everley Park Road, Winchmore Hill, N., cashier; W. Davies, 119, Turlough Road, W.W., superintendent; A. E. C. Greenwood, 53, Rectory Road, Walthamstow, accountant; L. Neville, 65, Windsor Road, Forest Gate, E., clerk; F. B. Liley, 3, Holland Road, N. Brixton, S.W., shorthand writer; C. A. Targett, 12, Wallwood Street, Burdett Road, E., clerk; L. B. Colt, 81, Benet Chambers, Church Street, E.C., solicitor. Private company. The first directors (to number not less than five or more than nine) are to be appointed by the signatories; qualification, £1,000; remuneration as fixed by the company. No notice of situation of registered office was filed with the original papers.

**British Telegraph Instrument Co., Ltd.** (126,746).—Registered January 25th by J. H. Webb, Walter House, Strand, W.C. Capital, £5,000 in £1 shares. Objects, to carry on the business of manufacturers of instruments and appliances for use in connection with wireless and other telegraphy and telephony, cablegraphy, &c., to acquire the business carried on by A. W. Ward and W. W. Drury, at 93 and 93A, Stanley Road, Teddington, and elsewhere, as the "British Telegraph and Electrical Manufacturers Co." The subscribers (with one share each) are:—A. W. Ward, 179, Clapham Road, S.W., chairman; J. H. Webb, Walter House, Strand, W.C., electrical engineer; C. B. Ward, 179, Clapham Road, S.W., engineer. Private company. The first directors (to number not less than three or more than five), are W. W. Drury, E. A. Poole, C. B. Ward and A. W. Ward. Registered office, 179, Clapham Road, S.W.

**Panama Electric Lighting, Power and Traction Co., Ltd.** (126,726).—This company was registered on January 21th, with a capital of £100 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—J. F. Crabb, 131, Stroud Green Road, N., clerk; C. E. Ellis, 57, Rodenburst Road, Clapham Park, S.W., clerk. Private company. The number of directors is not to be less than two or more than seven; the first are H. V. Saunders (chairman and managing director), and F. G. Bony, qualification, £1; remuneration, £10 per annum (chairman, £15). Registered office, 30, Coleman Street, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Electrical Name and Numerical Sign Co., Ltd.**—Particulars of £2,000 debentures, created November 6th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £1,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Hampshire Light Railways (Electric) Co., Ltd.**—Capital £1,000 in £10 shares. Return dated November 29th, 1912. All shares taken up £1,000 paid. Mortgages and charges: Nil.

**Hadley Trench and Wrockwardine Wood Lighting Co., Ltd.** (64,253). Particulars of £3,000 debentures, created by resolutions of August 15th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

A memorandum of satisfaction in full on January 6th, 1913, of two mortgages or charges, dated June 20th, 1901, securing £1,250, has been filed.

**Musselburgh and District Electric Light and Traction Co., Ltd.**—A memorandum of satisfaction to the extent of £500 on December 31st, 1912, of charges dated November 13th, 1905, and May 11th, 1909, and September 12th, 1911 (unregistered), securing £300,000, has been filed.

**Keynsham Electric Light and Power Co., Ltd.** (64,634).—Capital, £5,000 in £1 shares (3,000 pref). Return dated December 31st, 1912; all shares taken up; £5,000 considered as paid. Mortgages and charges: £2,980 without interest.

**Derbyshire and Nottinghamshire Electric Power Syndicate, Ltd.** (in liquidation).—A memorandum of satisfaction in full on December 8th, 1912, of mortgage or charge, dated January 20th, 1904, securing £15,000 and interest, has been filed.

**Longstreth's, Ltd.** (64,823).—Capital £3,000 in £1 shares. Return dated December 2nd, 1912. 3,775 shares taken up. £1 per share called up on 2,275. £2,340 paid, including £65 on 225 forfeited shares. £500 considered as paid. Mortgages and charges: £1,700. Resolution passed December 16th, confirmed January 13th, to change name to "Lithanoid, Ltd."

**Gosport and Alverstoke Electric Lighting Co., Ltd.** (82,693).—Capital £5,000 in £10 shares. Return dated November 29th, 1912; filed December 3rd, 1912. All shares taken up. £5,000 paid. Mortgages and charges: Nil.

**Indian Electric Supply and Traction Co., Ltd.**—Particulars of £75,000 debentures, created October 9th, 1912, and secured by trust deed dated January 1st, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £60,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and leasehold and other property in India, of such nature as to be capable of being specifically mortgaged under the laws of India. Trustees: Beaver Trust, Ltd., 1, Queen Victoria Street, E.C.

**Cordoba Light, Power and Traction Co., Ltd.** (69,649).—Present capital £1,000,000 in £1 shares. Original capital £600,000 in £1 shares, increased to £900,000 in £1 shares on July 7th, 1910, and to present amount on July 14th, 1911. Return dated December 18th, 1912. 600,000 shares taken up, £1 per share called up on 170,000. £170,100 paid. £129,000 considered as paid. 6,120 shares have since been allotted, payable in cash. Mortgages and charges £905,000.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—Luton T.C. has increased the salary of the electrical engineer, Mr. COOKE, from £150 per annum to a maximum of £600, by £50 a year forthwith, and two annual increments of £50 each.

Mr. J. M. DAWSON, charge engineer at the Hanley electricity works, who is leaving to become chief engineer to the Bethnal Green B.G., has been presented by his colleagues with a travelling bag, a case of pipes, and several technical books.

Out of over 100 applicants, Mr. FRED. RILEY, of Rawtenstall, was, at a special meeting of Todmorden Corporation, on January 23rd, appointed electrical engineer, at a salary of £150 per year.

Mr. WILLIAM INNES has resigned his position as assistant borough electrical engineer, Metropolitan Borough of Poplar, in order to take up a partnership with Messrs. W. T. Towler & Sons, engineers and boiler makers, Stratford, E., which firm will henceforth be known as Towler & Innes.

**General.**—Mr. LEE MURRAY, M.C.E. (Melb.), M.I.C.E., M.I.E.E., M.I.M.E., who recently retired from the position of general manager of Messrs. Bruce Peebles & Co., Ltd., engineers, Edinburgh, has started business on his own account at 10, Norfolk Street, Strand, London, W.C., as engineering representative (buying, inspecting, &c.) for firms and corporations in the Colonies and abroad.

The Times states that Mr. G. T. MILNE, who was recently appointed H.M. Trade Commissioner for Australia, is to sail early in February.

Mr. E. F. COX has resigned his position as burgh electrical engineer at Wishaw as from February 15th, and any further communication after that date will reach him, care of Cox & Danks, buffer makers, Wishaw. Mr. Cox has formed the firm of Cox & Danks with a view of putting down a forge for making general forgings, but more especially buffers for railway wagons, with which class of work he has been very familiar during the last five or six years.

**Obituary.**—The death of Mr. JAMES FERGUSON, electrical instrument maker and engineer, Pollokshaws, removes one who was associated with Lord Kelvin in the development of some of his chief discoveries. Mr. Ferguson, who was only 43 years of age, was first a pupil of and then assistant to the great scientist.

## CITY NOTES.

### Lisbon Electric Tramways, Ltd.

MR. L. BREITMEYER presided on Wednesday over an extraordinary general meeting of the above company, held at the offices, 1, London Wall Buildings, E.C.

The CHAIRMAN said that the object of the meeting was to obtain the approval of the shareholders to an alteration of the articles of association with regard to the remuneration paid to the directors. At present the articles provided for a sum of £500, but that amount had invariably been increased by the shareholders at the annual meeting. It was now proposed to alter Article 86, so as to provide that in future the directors' remuneration should be £2,500, and he felt sure the shareholders would have no hesitation in giving their sanction to a measure by which the directors would be paid adequately for their services. He concluded by moving the alteration of the article.

MR. P. TROQUET seconded the resolution, and it was unanimously agreed to.

**St. James' and Pall Mall Electric Light Co., Ltd.**—The directors recommend a balance dividend on the 7 per cent. preference shares, for the half-year ending December 31st, 1912, of 3s. 6d. per share, and 6s. per share on the ordinary shares, making, with the interim dividend paid thereon, a total distribution of 10 per cent.

**Prospectus.**—The Toronto Power Co., Ltd.—The list was to close on Wednesday in an issue of £616,438 4½ per cent. consolidated guaranteed debenture stock of this company, at 97 per cent. The stock is guaranteed, both as to principal and interest by the Toronto Railway Co.

**Central London Railway Co.**—The directors have declared the following dividends:—3 per cent. on the ordinary stock for the half-year, 4 per cent. on the preferred ordinary stock for the half-year, 2 per cent. on the deferred ordinary stocks for the year, carrying forward £27,218.

**Metropolitan District Railway Co.**

The directors' report that the expenditure on capital account during the half-year ended December, 1912, has been £25,009. The gross receipts on revenue account amounted to £346,655, being an increase of £23,840, as compared with the corresponding half of last year. The working expenses have amounted to £149,109, which shows a decrease of £3,546, but it must be borne in mind that in the corresponding half-year the charge for electric current included interest on the cost of the power-house, &c., whereas from January 1st, 1912, when the power-house undertaking was leased to this company and the London Electric Railway Co. jointly, the interest, by way of rent payable under the lease, appears in the net revenue account. After providing for interest and other charges and setting aside £10,000 as a reserve for renewals, the net revenue account shows a credit balance of £85,694, out of which the directors recommend that the following dividends for the half-year be declared and be payable on February 7th, viz. :— At the rate of £4 per cent. per annum on the 4 per cent. guaranteed stock ; at the rate of £4 10s. per cent. per annum on the 4½ per cent. first preference stock ; at the rate of £2 per cent. per annum on the 5 per cent. second preference stock. The following table gives a summary of comparative figures for the second halves of the years 1912 and 1911 :—

	Half-year Dec., 1912.	Half-year Dec., 1911.	Increase or decrease.	Or per cent.
Gross revenue .. ..	£346,655	£322,815	£23,840	7·49
Working expenditure ..	£149,109	£152,655	£3,546	—
Passengers, including workmen & season ticket holders' journeys ..	43,092,589	39,807,601	3,185,928	8·01
Passengers carried at workmen's fares ..	7,587,631	7,128,160	459,472	6·45
Passenger receipts ..	£327,236	£300,625	£26,611	8·85
Average receipt per passenger .. ..	1·82d.	1·81d.	0·01	0·55
Train mileage on District Railway .. ..	2,046,698	1,888,733	157,965	8·36
Car-mileage on District Railway .. ..	8,159,884	7,756,476	403,408	6·20

The traffic continues to show satisfactory increases, but owing to the higher price of fuel and increases in wages, the working expenses have increased. The company are constructing a fly-under junction at Earl's Court, which will, when completed, considerably improve the train working.

The following Bills will be submitted for the consideration of the proprietors at a special general meeting to follow the ordinary meeting, viz. :—

1. "A Bill to authorise the Metropolitan District Railway Co. to widen part of their Fulham extension railway, to confer further powers on the Wimbledon and Sutton Railway Co., and for other purposes."
2. "A Bill to extend the periods limited by the Wimbledon and Sutton Railway Act, 1910, for the compulsory purchase of lands for, and for the construction and completion of, the railways and works by that Act authorised ; to raise additional capital ; and for other purposes."

3. In future accounts will be submitted yearly, and one ordinary general meeting will be held in January or February in each year. Interim dividends will be declared in July or August. The directors have appointed Mr. C. S. Louch, accountant of the company in the place of Mr. Wm. Whittle, who retired on December 31st last, after being 42 years in the service of the company.

Half-year ending December 31st, 1912.

	On District Railway.		Total.	Total miles run by District trains, including joint and foreign lines.	Total for corresponding half-year of 1911.		
	District Company's trains.	Other companies' trains.					
Train-mileage ..	1,880,865	165,839	2,046,698	2,619,289	2,468,268		
Electric car-mileage ..	7,677,407	582,127	8,159,534	10,995,866	10,530,824		
Passengers.	Season tickets		Receipts.				
Half-year ended—	1st class.	2nd (estimated class. journeys).	Total.	1st class.	2nd class.	Season tickets.	Total.
June, 1911 ..	1,250,241	34,459,790	5,799,600	41,505,831	17,950	250,084	45,558,312,572
Dec., 1911 ..	1,683,513	33,273,850	5,589,698	39,897,661	15,139	242,318	43,168,990,695
June, 1912 ..	1,298,897	35,047,963	6,623,760	42,910,560	17,582	216,280	51,572,325,451
Dec., 1912 ..	1,194,391	35,499,910	6,438,948	43,692,589	16,042	261,023	50,115,627,296

The meeting is to be held to-day, Friday, at Westminster Palace Hotel.

**London Electric Railway Co.**

The directors' report for the half-year ending December 31st, 1912, states that the capital expenditure which was mainly on the new extensions, amounted to £279,322. The gross receipts on revenue account amounted to £376,710, being an increase of £10,520 on the receipts for the corresponding half of last year. The working expenses have amounted to £162,703, being a decrease of £8,238, but it must be borne in mind that in the corresponding half-year the charge for electric current included interest on the cost of the power house, &c., whereas from January 1st, 1912, when the power house undertaking was leased to the company and the Metropolitan District Railway Co. jointly, the interest by way of rent payable under the lease appears in the net revenue account. After providing for interest and rents, and reserving £7,500 for contingencies and renewals, there remains a balance of £113,220

available for dividends, and the directors recommend that a dividend at the rate of 4 per cent. per annum be declared on the 4 per cent. preference stock, and that a dividend at the rate of 1 per cent. per annum be declared on the ordinary shares, leaving a balance of £3,107 to be carried forward. The directors recommend that these dividends be payable on February 7th, 1913. The following table gives a summary of comparative figures for the corresponding half-years of 1912 and 1911 :—

	Half-year Dec., 1912.	Half-year Dec., 1911.	Increase or decrease.	Per cent.
Gross revenue .. ..	£376,710	£366,190	+ £10,520	+ 2·873
Working expenditure ..	£162,703	£170,941	- £8,238	-
Passenger receipts .. ..	£350,304	£342,451	+ £7,853	+ 2·293
Train-mileage .. ..	2,807,557	2,741,969	+ 65,588	+ 2·417
Car-mileage .. ..	9,472,887	9,121,677	+ 351,210	+ 3·830

The following table gives the number of passengers carried :—

Half-year ending—	Number, including season-ticket holders.	Receipts.
June, 1911 .. ..	62,548,384	£369,326
December, 1911 .. ..	48,666,842	£42,451
June, 1912 .. ..	51,691,661	£363,925
December, 1912 .. ..	49,190,925	£360,304

Satisfactory progress is being made with the construction of the Charing Cross and Paddington extensions. Work has also commenced on the Queen's Park extension and on the installation of escalators (or moving stairways) at Oxford Circus Station, for which contracts have been let since the last report. The company has sold during the half-year under review £235,056 of debenture stock, the proceeds of which are being used towards paying for the Golder's Green, Paddington and Charing Cross extensions.

The following Bills will be submitted for the consideration of the proprietors at a special general meeting after the ordinary meeting, viz. :— "A Bill to empower the London Electric Railway Co. to construct new railways and for other purposes." Powers are sought by this Bill to enable the company to construct junction railways at or near Euston Station to connect the company's Hampstead and Highgate lines with the City and South London Railway, and at Hammermith to connect the company's Great Northern, Piccadilly and Brompton Railway with the London and South-Western Railway Co.'s Kensington and Richmond line. Powers are also sought by the Bill to obtain running powers over the City and South London Railway. The additional capital sought by the Bill is £463,000 of preference stock and £463,000 borrowing powers. "A Bill for empowering the City and South London Railway Co. to enlarge their railway tunnels ; to raise further money ; and for other purposes." By this Bill power is sought by the City and South London Railway Co. for the enlargement of the tunnels of that company, and to wholly or partially stop or suspend the working of their railway during the construction of such enlargement. Power is also sought by the City and South London Railway Co. to enter into working or other agreements with this company. The London Electric Railway Act, 1912, which included amongst other things powers to consolidate the authorised Edgware and Hampstead Railway with that railway, received Royal Assent on August 7th, 1912. The Edgware and Hampstead Railway Co. has therefore become part of this undertaking. By the Railway Companies' (Accounts and Returns) Act, 1911, which came into operation on January 1st, 1913, the obligation upon the company to prepare half-yearly accounts and to hold an ordinary general meeting more than once a year is removed. The accounts, in future, will be made up yearly, and one ordinary general meeting only will be held in the month of January or February in each year. The directors, however, will declare interim dividends in the month of July or August.

	Half-year Dec., 1911.	Half-year Dec., 1912.
Train-mileage .. ..	2,741,969	2,807,557
Car-mileage .. ..	9,121,677	9,472,887

The meeting is to be held to-day (Friday) at Westminster Palace Hotel.

**Cape Electric Tramways, Ltd.**

An extraordinary general meeting of the shareholders of the above company was held on Wednesday, at the offices 1, London Wall Buildings, E.C., Mr. L. Breitmeyer presiding.

The CHAIRMAN moved the following resolution :—

"That the company's articles of association be altered by deleting Article 81 and substituting therefor the following :—"81. The board shall be entitled as from July 1st, 1912, to receive by way of remuneration in each year at the rate of £200 for each director, with an additional sum of £100 for the chairman and such further sums as may be voted by the members in general meeting. The division of all such remuneration between the directors shall be determined by resolution of the board from time to time."

He said that the meeting had been called simply for the purpose of dealing with the remuneration of the directors. As they would remember, the articles provided no fees, and hitherto it had been the custom for shareholders to vote the directors a sum at the annual meeting. At the meeting last November a discussion arose regarding the remuneration, and they would readily understand that that discussion was distasteful to him and his colleagues, and he was confident of their approval of the steps which were now being taken to settle the question once for all. The remuneration which they asked—£200 for each director, with £100 additional for the chairman—was not excessive, and they considered that they were fully entitled to it for the onerous work they were doing for the company. He might mention that they had received proxies for about 300,000 shares in favour of the resolution.

MR. DAVIS seconded the motion, and it was carried unanimously.

**Provincial Cinematograph Theatres, Ltd.**—A third interim dividend of 5 per cent. was paid on January 22nd, making a total of 15 per cent. for the nine months of the year ending January 31st, 1913.

**Gwynnes, Ltd.**—A petition for confirming the reduction of capital from £135,000 to £82,500 is to be heard in the Chancery Division on February 10th.

**Metropolitan Railway Co.**

For the half-year ended December, 1912, the directors report that the total receipts were £402,514, and the expenses £191,550, leaving a profit of £207,994. Compared with the corresponding half-year of 1911, the receipts show an increase of £5,561 and the expenses a decrease of £1,239. The net revenue account, after providing for the interest upon the debenture stocks and other fixed charges and placing £7,500 to the electrical renewal and depreciation fund, shows a balance of £171,778, which will permit of the payment of the dividends upon the preference stocks, and leave a balance of £66,037 available for dividend upon the ordinary stock. The directors recommend a dividend upon the ordinary stock for the past half-year at the rate of £1 15s. per cent. per annum, carrying forward £9,197.

The Surplus Lands Committee announce that the dividend on the surplus lands stock for the half-year will be at the rate of £2 15s. per cent. per annum.

The passenger traffic for short distances has again suffered severely from the competition of motor-omnibus services, but the longer distance traffic is steadily growing. The season-ticket business continues to show a satisfactory expansion, while the receipts from goods and mineral traffic exhibit appreciable progress. A resolution will be submitted at a special meeting immediately following the ordinary meeting with a view to the creation of the capital authorised by the Metropolitan Railway Act, 1912.

A Bill is being promoted in the ensuing session of Parliament for the transfer to and vesting in the company of the Great Northern and City Railway; for the construction of railways to connect the Great Northern and City Co.'s undertaking with the company's railway near Liverpool Street Station and with the Waterloo and City Railway at the Bank, and for other purposes.

A Bill has also been drafted by the Metropolitan District Railway Co., which includes, amongst other provisions, proposals for the acquisition of lands for the enlargement of Aldgate (East) Joint Station.

These Bills will be submitted for approval at a special (Wharnclyffe) meeting.

The work of replacing the electrical plant originally installed at Neasden by improved machines is now practically completed, and a substantial saving in the cost of the production of current is thereby being effected, notwithstanding the serious increase in the price of fuel. In order to provide for the increased service of through trains between the St. John's Wood line and the City, and the contemplated working of an electrical service over the East London line, it has been necessary to proceed with the laying of additional cables between Neasden and Moorgate Street and the installation of another rotary converter at Baker Street Sub-Station. The subways at Moorgate Street connecting this company's station with those of the City and South London and Great Northern and City Railways, were opened on September 2nd last, and have proved a great convenience to passengers. Facilities for the working of through trains between the St. John's Wood line and the City have been greatly increased by the opening of the double junction at Baker Street on November 4th last. The electrification of the East London Railway is rapidly approaching completion, and the through running of Metropolitan trains over that railway will be shortly resumed. Further contracts for the widening of the railway between Finchley Road and Wembley Park and for improvements at Finchley Road Station have been met, and substantial progress has been made with these works during the half-year. Contracts have been entered into for the construction of general offices at Baker Street, and also of a block of residential flats over the railway close to Regent's Park. In pursuance of an agreement with the Strand Hotel Co., Ltd., a contract will be entered into for the erection by this company of a large hotel on the building site which will be created over the new station at Baker Street, fronting Marylebone Road. Negotiations for the acquisition of the land for the railway to Watford, authorised by the company's Act of 1912, are proceeding.

The proprietors are aware that the position of the company in relation to proposals for a union of interests between the various transit companies in the metropolis has engaged the careful consideration of the directors for some time past. Having regard to all the circumstances, the directors have come to the conclusion that the interests of the company would best be served by maintaining a position of financial independence. An understanding has, however, been arrived at whereby this company and the Underground Electric Railways Co. will work in friendly co-operation in order to obviate unnecessary competition and to afford the fullest possible facilities to the public.

The National Insurance Act, 1911, came into operation on July 15th last, and imposes a substantial burden upon the revenues of the company. A certificate of exemption from the Act has, however, been granted by the Insurance Commissioners in favour of the members of the company's clerical staff who are contributing members of the Railway Clearing System Superannuation Fund; but in order that the full benefits of that fund, as set forth in the Railway Clearing System Superannuation Fund (Contributing Companies) Act, 1906, may be secured, a resolution will be submitted to the proprietors at a special meeting which will follow the Wharnclyffe meeting.

The directors regret to report the death on November 10th of their esteemed colleague and deputy-chairman, Lord Furness, and desire to place on record their appreciation of his valuable services to the company since his election to the board in 1901. Mr. Paul Speak has been appointed to the position of deputy chairman in his place.

The agreement with the Great Northern and City Co. for the acquisition of that company's undertaking provides for the election to the board of the company of two of its present directors, viz., the chairman (the Earl of Lauderdale) and Sir Clarendon Hyde. The vacancy on the board caused by the death of Lord Furness has been filled by the election of Sir Clarendon Hyde, and the proprietors will be asked to agree to a resolution to increase the number of directors from eight to nine in order to permit of the election of the Earl of Lauderdale to the board in the event of that portion of the company's Bill relating to the Great Northern and City Railway becoming law, and to make provision for the consequent additional remuneration of the directors.

Year.	Passengers.	Gross receipts.
1909	99,981,997	£896,881
1910	102,349,458	718,089
1911	101,620,653	720,745
1912	100,146,324	712,289

The figures given in the report practically complete a period of 50 years of the company's operations, the first section of the Metro-

politan Railway having been opened for traffic on January 10th, 1863. "In congratulating the proprietors of the railway on the attainment of its Jubilee, it is highly gratifying to record that during the half-century under review more than 3,500,000,000 passengers have been conveyed over the line, and that only on one occasion has a fatal accident occurred for which the company could be held in any way responsible." In future, the accounts will be made up in annual periods, but the directors are empowered to declare and pay an interim dividend for the first half of any year.

	Miles	
	Half-year ended Dec., 1911.	Dec., 1912.
Steam passenger trains	200,511	211,866
Electric "	1,709,667	1,760,047
Steam goods and mineral trains	97,407	98,684
Electric "	1,815	4,295
Total	2,102,510	2,108,576

**Blackpool and Fleetwood Tramroad Co.**—For the half-year ended December the amount of profit available for distribution to the shareholders is £14,027. The directors propose to pay a dividend for the six months at the rate of 9 per cent. per annum, which will absorb £6,750; to place £3,500 to depreciation; to place £750 to the general reserve account, and carry the balance forward.

**Dundee, Broughty Ferry, and District Tramways Co.**—The directors announce an interim dividend on the preference shares at 6 per cent. per annum.

**Singapore Electric Tramways Co., Ltd.**—A petition to the Courts, for confirming the reduction of capital from £400,000 to £100,000, is to be heard on February 4th.

**Yorkshire (West Riding) Electric Tramways, Ltd.**—The directors, in their report for the year ended December, 1912, state that after providing for all expenses, including repairs, maintenance, and debenture interest, the operations resulted in a net income of £20,106, which has been appropriated as follows:—To dividend on 6 per cent. cumulative preference shares, at 3 per cent. per annum, less income-tax, £4,531; to depreciation, renewals, reserve fund in lieu of accident insurance, and general reserve fund accounts, £7,329. £6,243 is written off preliminary expenses account.

**Parsons Marine Steam Turbine Co., Ltd.**—The directors have declared an interim dividend of 5 per cent. for the half-year to December 31st.

**Smithfield Markets Electric Supply Co., Ltd.**—The directors have declared a dividend of 2 per cent. on the ordinary shares for the year to December 31st, carrying forward £954.

**STOCKS AND SHARES.**

Tuesday Evening.

EVERY market in the Stock Exchange is under the influence of the foreign political situation, which has forced business to a standstill, and depressed prices from Consols downwards. The unrest abroad is supplemented by unsettlement at home, and, by a whimsical turn of the political wheel, the Suffragettes have been able to command more serious attention this week than they have done through the carrying out of all their freakish operations in times past.

Markets in electrical railway stocks are quiet to dull. The declaration of the usual dividends on the Central London Trio had no effect upon prices, because it was agreed that the announcement was of academic interest only, having regard to the fact that the proprietors of the company have agreed to throw in their lot with the Underground Electric group. Metropolitan's were the Stock Exchange tip just before the announcement of the dividend, and when the figures quoted here last week were announced, the price ran up to 54 bid, from which it has quietly dwindled since. On balance this week, the stock is 1½ down. Districts also have gone back after being a good market, and Underground Electric Railway shares, though they touched 5½ buyers the other day, eased off later to 4½. The "A" shares of the company at 15s. are ½ down, but the Income bonds, the dividend on which is expected to be declared this week, gained a point. Anticipation looks for the full 6 per cent. on the bonds.

Activity has been stimulated in the shares of the New Central Omnibus Company, a concern which has a close working agreement with the London General Omnibus Company, and from 35s. the price was run up to 45s.

The decision of the London and Brighton Railway to electrify nearly 200 miles more of their line has imparted quiet strength to the shares of the London Electric Supply Corporation. The prices of the Ordinary and Preference are firm at 1½ and 5½, respectively. According to a Stock Exchange statement, the Brighton Railway is thoroughly well satisfied with the source of its supply, and there seems to be little chance at present of the company branching out into an electric power business of its own, while it is further said that the London Electric is capable of supplying all the current which the Brighton Railway will need for the proposed extension.

Edmundsons and Urbans are a better market, and Edmundson's Preference have responded in price. The market in City of London shares has become very dry again, business being only fitful, and pointing in no particular direction for long at a time. For the best-class shares there is a fair demand.

Questions connected with Electricity Supply shares naturally arose out of the National Telephone award, and although the positions of the companies and the National Telephone are radically different, it is only natural that shareholders should be inquiring whether they are likely to be treated in the same way as those in the National Telephone undertaking. It may mean that the boards of some of the Electric Lighting concerns will consider the advisability of changing their policy, and either distributing profits well up to the hilt, or else seeing to it that their reserves are, as far as possible, in actual cash, which can be distributed to their proprietors at any time. Prices in the market, however, suffered in no way in consequence of the Telephone award.

Demand for shares in the electrical manufacturing companies is associated with the idea that the latter are doing extremely well just now. In this case, and in that, one hears of books being full of orders for another year or so, and evidently those who are in the know are also not averse to buying a few shares in the companies most interested. British Westinghouse shares retain their rise of last week. Electric Constructions are better, and other issues in this department are, as a whole, easier to sell than they are to buy just at present. Crompton Debentures gained 1/2, Callenders are 1/4 higher, British Thomson-Houston Debenture is 1 up, British Aluminium Ordinary and Babcock Ordinary are both 1/4 to the good.

Report has it that Edison & Swan Company may shortly lay before its shareholders a scheme of reorganising its capital, and a great deal of interest attaches to the way in which this will be done. If the £2 per share uncalled liability on the "A" shares is called up, we should think that the first Debenture-holders would have something to say, since this liability forms part of their security. At the same time, it would be better for all concerned in the company to have its finances placed upon a thoroughly sound basis; but the difficulties that there must be in the way of effecting equitable arrangements to all classes of the company can be well imagined. The First Debenture stock has fallen 4 points this week.

One of the excitements of the past few days has been a sudden descent in the price of Georgia Electric Light and Power shares, which from 52 slumped to 42. The reason for the drop was an extraordinary one. The previous advance had been brought about largely by the circulation of figures from the Company's office in London, showing that the Georgia Company would be in a position to pay 4 or 5 per cent. on its common shares, in respect of the present financial year. Later, however, it was discovered that certain of the statistics were inaccurate. Upon this came the slump already mentioned, and the incident has flung an atmosphere of doubt over all the undertakings connected with the Latin-Canadian group. The mistake appears to have been a purely accidental one in the London office, and to have had no official recognition from New York; but the bad impression created will take some time to dissipate, and it is peculiarly unfortunate that it should have occurred at the time when several other utility company issues were in immediate prospect. After the fall a mild recovery ensued to 43 1/2.

The Latin-Canadian group, as a whole, is somewhat upset by the Georgia incident, in addition to which there has been flatness in Mexican issues generally. Shawinigans fell 2, though the bonds are 1/2 up. Mexican Light and Power remain very steady, nor have Mexico Tramways moved. Montereyes lost a point. On the other hand, Montreal Light, Heat and Power Common gained 6, and Royal Electric of Montreal 1/2 per cent. Debenture put on 2 bonds. Electric Development of Ontario bonds are 1/2 higher, in connection with the issue this week of \$3,000,000 4 1/2 per cent. guaranteed Debenture stock at 97 by the Toronto Power Company and the Toronto Railway Company. The prospectus of this newcomer appeared at a moment none too opportune for fresh appeals to the investor, but the stock can be regarded as a good investment of its kind, though it is offered at a price very little less than the quotation for the existing Debenture stock, which is 98. The Company's 4 1/2 per cent. Debenture stock (1918) stands at 99 1/2. The rest of the electric tramways, railways and power group is steady. Anglo-Argentine Debentures show an improving tendency, and West Kootenay gold bonds are a little better. Victoria Falls Power Preference lost 1/2.

National Telephone Deferred stock continues to provide plenty of scope for speculation. On balance, the movement is decidedly retrograde, the stock having lost another 5 points this week. The market revises its estimates almost from day to day; and as the stock goes lower, so are the calculations modified. Marconis, on the other hand, have been on the up grade, regaining most of the fall of last week. Opinion in the House still adheres to the idea that, in proposing the nullification of the agreement with the Government, the Marconi Company has made an excellent move. Certainly one of the unexpected developments has been increased speculation in the shares. Canadian, American and Spanish Marconis are moving in sympathy with the fluctuations in the parent shares, and, of the trio, the Canadians are the most animated.

The Telegraph market is very quiet, West India and Panama and Anglo-American Deferred both went back a little. Except for these movements, there are no changes worth mentioning. Reuters rose to 11 1/2, the high yield again attracting purchasers. There are no movements to be recorded in any of the Eastern stocks and shares.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, January 29th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	57.	..
a " Nitric .. .. .. "	22 1/2.	..
a " Oxalic .. .. .. "	23 1/2.	..
a " Sulphuric .. .. .. "	5/5	..
a Ammoniac Sal .. .. .. "	42 1/2.	..
a Ammonia, Murate (large crystal) per ton	£29 10	..
a Bleaching powder .. .. .. "	£6 10	..
a Bisulphide of Carbon .. .. .. "	£15	..
a Borax .. .. .. "	£16 10	..
a Copper Sulphate .. .. .. "	£25 10	..
a Lead, Nitrate .. .. .. "	£29 10	..
a " White Sugar .. .. .. "	£27 10	..
a " Peroxide .. .. .. "	2/6	..
a Methylated Spirit .. .. .. per gal.	9 1/2.	..
a Potassium, Bichromate, in casks per lb.	8 1/2.	..
a Potash, Caustic (88/90 %) .. .. per ton	£22 10	..
a " Chlorate .. .. .. "	3/4.	..
a " Perchlorate .. .. .. "	4 1/2.	..
a Potassium, Cyanide (98/100 %) .. .. (for mining purposes only)	7 1/2.	..
a Shellac .. .. .. .. per cwt.	72/6	..
a Sulphate of Magnesia .. .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. .. .. "	£6 10	..
a " Recovered .. .. .. "	£5 10	..
a " Lamp .. .. .. "	4/5	..
a Soda, Caustic (white 70/75 %) .. .. "	£10 6	..
a " Chlorate .. .. .. "	8 1/2.	..
a " Crystals .. .. .. "	£8 6	..
a Sodium Bichromate, casks .. .. per lb.	8d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£93	£2 dec.
b " Wire, in ton lots .. .. .. "	£112	..
b " Sheet, in ton lots .. .. .. "	£120	..
b Babbitt's metal ingots .. .. .. "	£38 to £41 5	..
c Brass (rolled metal 2" to 12" basis) per lb.	9 1/2.	..
c " Tube (braced) .. .. .. "	10 1/2.	3d. inc.
c " " (solid drawn) .. .. .. "	9 1/2.	3d. inc.
c " Wire, basis .. .. .. "	8 1/2.	..
c Copper Tubes (braced) .. .. .. "	11 1/2.	..
c " " (solid drawn) .. .. .. "	11 1/2.	..
g " Bars (best selected) .. .. .. per ton	£32	..
g " Sheet .. .. .. .. "	£32	..
g " Rod .. .. .. .. "	£32	..
g " (Electrolytic) Bars .. .. .. "	£76	£4 dec.
d " Sheets .. .. .. .. "	£33	£4 dec.
d " Rods .. .. .. .. "	£31	£4 dec.
d " H.C. Wire per lb.	9 1/2.	3d. dec.
f Ebonite Rod .. .. .. .. "	6/8	..
f " Sheet .. .. .. .. "	4/9	..
n German Silver Wire .. .. .. "	1/10	..
h Gutta-percha, fine .. .. .. "	7/ to 8/	..
h India-rubber, Para fine .. .. .. "	4/7 1/2	..
l Iron Pig (Cleveland warrants) .. per ton	65/3	3d. inc.
l " Wire, galv. No. 3, P.O. qual. .. "	£14	9 1/2. dec.
g Lead, English Pig .. .. .. "	£18 5 to £18 10	..
m Manganin Wire No. 28 .. .. .. per lb.	6/6	..
g Mercury .. .. .. .. "	£7 8 6	..
e Mica (in original cases) small .. per lb.	8d. to 9d.	..
c " " medium .. .. .. "	8 1/2 to 6 1/2	..
c " " large .. .. .. "	7 1/2 to 11 1/2	..
o Nickel, sheet, wire, &c. .. .. "	3/6 to 4 6 nom.	..
p Phosphor Bronze, plain castings .. "	1/2 to 1/4	..
p " " rolled bars & rods .. .. "	1/3	..
p " " rolled strip & sheet .. .. "	1/23	..
o Platinum .. .. .. .. "	185/-	..
d Silicon Bronze Wire .. .. .. per lb.	11 1/2.	..
Steel, Magnet, in bars .. .. .. per ton	£25	..
g Tin, Block (English) .. .. .. "	£23 10 to £23 10	..
n " Wire, Nos. 1 to 18 .. .. .. per lb.	2/9	..
p White Antifriction Metals .. per ton	£45 to £2.3)	..
z Zinc, Sn't (Vielite Montagne bnd.) .. "	£30	£1 12 6 dec.

Quotations supplied by—

- |  |                                  |
|--|----------------------------------|
| a G. Boor & Co.  | f Bolling & Lowe,                |
| b The British Aluminium Co., Ltd.                          | g Morris Ashby, Ltd.             |
| c Thos. Bolton & Sons, Ltd.                                | h Richard Johnson & Nephew, Ltd. |
| d Frederick Smith & Co.                                    | i W. T. Glover & Co., Ltd.       |
| e F. Wiggins & Sons.                                       | j P. Ormiston & Sons             |
| f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. | k Johnson, Matthey & Co., Ltd.   |
| g James & Shakespeare.                                     | l W. F. Dennis & Co.             |
| h Edward Till & Co.  |                                  |

Stock Exchange Notices.—The Committee have ordered the following to be quoted in the Official List:—Montreal Tramways Co.—\$10,445,000 First and Refunding Mortgage 5 per cent. 30-year Gold bonds (Nos. D 1 to 1,046 of \$500, and M 1 to 9,222, of \$1,000 each).

Westminster Electric Supply Corporation, Ltd.—The directors have declared a dividend at the rate of 11 per cent. per annum (less income-tax) for the half-year to December 31st, making 10 per cent. for the year.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a balance dividend for the year ending December 31st of 1s. 3d. per share (making 5 per cent. per annum). £4,500 is to be transferred to the general amortisation fund, and £92 carried forward.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 24th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 24th.	Rise or Fall	Present Yield p.c.		
Bournemouth & Poole, Ord.	10	5 1/2	51	94-104	..	5 4 9	Kensington & Knightsbridge, Ord	5	5 81	78-84	..	5 10 0	
Do. 4 1/2 % Pref.	10	4 1/2	4 1/2	82-97	..	4 12 4	Do. 4 % Deb.	5	4 4	92-96	..	4 4 8	
Do. Second 6 % Pref.	10	6	6	10-104	..	5 14 8	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 1/2	4 1/2	76-80 xd	..	5 12 6
Do. 4 1/2 % Deb. Stock	Stock	4 1/2	4 1/2	96-98	..	4 11 10	London Electric, Ord.	8	2 1/2	14-2	..	8 16 0	
Brompton & Kensington, Ord.	5	10	9 1/2	82-94	..	6 6 8	Do. 6 % Pref.	5	5 5	4 1/2-6 1/2	..	6 14 8	
Do. 7 % Cum. Pref.	5	7	7	84-9	..	5 17 9	Do. 4 % First Mort. Deb.	Stock	4 4	89-92	..	4 7 0	
Central Electric Supply, 4 % Guar. Deb.	100	4 4	4	95-98	..	4 1 8	Metropolitan	5	4 4	89-91	..	5 8 3	
Charing Cross, West End & City	5	5 5	5 1/2	42-54	..	4 17 7	Do. 4 1/2 % Cum. Pref.	5	4 1/2	44-44	..	5 0 0	
Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2	43-44	..	4 12 4	Do. 4 % First Mort. Deb.	Stock	4 1/2	97-100	..	4 10 0	
Do. "City Undertaking"	5	4 1/2	4 1/2	43-44	..	5 2 10	Do. 3 1/2 % Mort. Deb.	Stock	8 1/2	84-86	..	4 1 5	
Do. 4 1/2 % Cum. Pref.	100	4 4	4	92-94	..	4 5 1	Midland Electric Corporation	100	4 1/2	98-101	..	4 9 1	
Do. Do. 4 % Deb.	100	4 4	4	42-54	..	4 17 7	Newcastle-on-Tyne 5 % Pref.	5	5 5	44-44	..	6 2 7	
Obelisk, Ord.	5	5 5	5 1/2	96-99	..	4 10 11	Non-Cum.	5	5 5	44-44	..	6 2 7	
Do. 4 1/2 % Deb.	Stock	4 1/2	4 1/2	16-17 1/2	..	4 11 5	North Metropolitan Power Supply, 6 % Mortgages (Red.)	100	5 5	99 1/2-102 1/2	..	4 17 7	
City of London, Ord.	10	8 6 1/2	6 1/2	12-13 1/2	..	4 9 0	Notting Hill, 5 % Non-Cum. Pref.	10	8 6	92-102	..	5 11 7	
Do. 6 % Cum. Pref.	10	6 6	6	116-120	..	4 8 4	Oxford	5	7 1/2	84-84	..	5 9 6	
Do. 6 % Deb.	Stock	6 6	6	100-102	..	4 8 3	St. James' and Pall Mall, Ord.	5	10 10 1/2	94-10	..	5 0 0	
Do. 4 1/2 % Second Deb.	100	4 1/2	4 1/2	113-112	..	5 1 1	Do. 7 % Pref.	5	7 7	84-74	..	4 16 7	
County of London, Ord.	10	6 6	6	114-112	..	5 0 0	Do. 3 1/2 % Deb.	100	8 1/2	84-87	..	1 0 6	
Do. 6 % Pref.	10	6 6	6	104-106	..	4 8 11	Smithfield Markets, Ord.	5	2 2	14-14	..	8 3 1	
Do. 4 1/2 % Deb.	Stock	4 1/2	4 1/2	98-101	..	4 4 8	South London, Ord.	5	4 5	23-23	..	5 0 0	
Do. 4 1/2 % Second Deb.	100	4 1/2	4 1/2	13-14 1/2	..	Nil	Do. 6 % First Mort. Deb.	100	5 5	97-100	..	5 9 5	
Edmundson's, Ord.	13	5 1/2	5 1/2	43-44	..	4 8 4	South Metropolitan, 7 % Pref.	1	7 7	104-13	..	4 11 8	
Do. 6 % Cum. Pref.	5	Nil	8	82-86 xd	..	5 5 11	Do. 4 1/2 % First Deb. Stock	100	4 1/2	96-99	..	4 11 8	
Do. 6 % Non-Cum. Pref.	5	..	..	42-54	..	5 17 1	Urban, Ord.	5	23	Nil	..	..	
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	4 1/2	43-44	..	4 17 7	Do. 6 % Cum. Pref.	5	2 1	24-84	..	5 2 8	
Folkestone	5	5 5	5	80-92 xd	..	4 17 10	Do. 4 1/2 % First Mort. Deb.	100	4 1/2	85-86	..	6 6 8	
Do. 6 % Cum. Pref.	100	4 1/2	4 1/2	74-8	..	5 12 6	Westminster, Ord.	5	10 9	87-92	..	6 6 8	
Do. 4 1/2 % First Deb.	5	9 3 1/2	3 1/2	..	..	..	Do. 4 1/2 % Cum. Pref.	5	6 4 1/2	44-64	..	4 5 9	

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6 8	6	64-59	..	5 6 8	Monterey Riv. Light & Power, 6 % 1st Mort. Deb.	100	5 6	87-89 xd	-1	6 12
Calcutta, Ord.	5	8 1/2	7 1/2	68-74	..	5 19 4	Montreal, Lt., H. and Power	\$100	8 9 1/2	243-248	+6	8 12
Do. 5 % Pref.	5	6 6	6	4 1/2-5 1/2	..	4 16 5	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$500	5 6 1/2	10-20	..	..
Calgary Power, 1st Mort. Bds.	100	6 6	6	92-94	..	6 6 5	River Plate, Ord.	Stock	10	217-227	..	4 8
Canadian Gen. El. Com.	\$106	7 7	7	116-120	..	5 16 8	Do. 8 % Non-Cum. Pref.	Do.	8 6	106-111	..	5 6 8
Do. 7 % Pref.	\$107	7 7	7	120-124	..	5 13 0	Do. 5 % Deb. Stock	Do.	5 5	100-102	..	4 18 0
Do. 6 % Cum. Pref.	1	3 5	5	13-14	..	5 6 8	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	4 1/2	100-102	+2	4 8 3
Cordoba Lt., Power and T., Ord.	100	5 5	5	96-99	..	5 1 0	Shawinigan Water, Capital	\$100	6 5	143-152 xd	-2	3 5 9
Elec. Lt. and P. of Cochabamba, 5 % Bonds	100	6 6	6	93-95	..	6 6 4	Do. 5 % Con. 1st Mort. Bonds	\$500	6 6	106-108	+ 1/2	4 12 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5 5	5	90-93	..	5 7 6	Do. 4 1/2 % Per. Deb.	Stock	4 1/2	100 1/2-102 1/2	..	4 7 10
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5 5	5	96-98	+ 1/2	5 2 0	Toronto Power, 4 1/2 % Deb.	Do.	4 1/2	98 1/2-100 1/2	..	4 9 7
Kalgoorlie Elec. P. and L., Ord.	10 1/2	Nil	..	74-76	..	Nil	Veracruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5 5	91-94	..	5 6 5
Do. 6 % Pref.	10	6 6	6	102-104	..	9 16 2	Victoria Falls Power, Pref.	1	11 1/2	17 1/2	..	..
Kaministiquia Power, 5 % G. B. Madras, Ord.	\$500	5 5	5	113-114	..	4 10 2	West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6 6	104-106	+ 1/2	4 14 4
Melbourne, 6 % 1st Mort. Deb.	100	6 6	6	101-104	..	4 16 2						
Mexican El. Lt., 5 % 1st M. Bds.	5	5 5	5	84 1/2-86 1/2	..	5 16 7						
Mexican Lt. & Power, Common	\$100	4 4	4	82-86 xd	..	4 13 0						
Do. 7 % Cum. Pref.	\$100	7 7	7	105-109	-1	8 8 5						
Do. 6 % 1st Mort. Gold Bds.	5	6 5	5	96 1/2-99	..	5 1 6						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4 4 1/2	4 1/2	7-7 1/2	..	6 0 0	Monte Video Telephone, Ord.	1	6 6	1 1/2-1 1/2	..	5 18 0
Do. 5 % Deb. Red.	Stock	5 5	5	97 1/2-99 1/2	+ 1/2	5 0 6	Do. 5 % Pref.	1	5 5	6	..	5 14 3
American Teleg. & Teleg., Cap.	\$100	8 8 1/2	8 1/2	135-138	..	5 15 11	National Telephone Def.	Stock	6 6	94-96	+ 1/2	4 10 8
Do. Collat. Trust	\$100	4 4	4	91-93	..	4 6 0	New York Teleg., 4 1/2 % Gen. Bnds.	100	5 5	98 1/2-99 1/2	..	4 9 10
Anglo-American Telegraph	Stock	8 8	8	85 1/2-87 1/2 xd	..	6 7 7	Oriental Teleg. and Elec.	1	6 6	1 1/2-1 1/2	..	4 13 6
Do. 6 % Pref.	Do.	6 6	6	110-111 1/2 xd	..	6 0 8	Do. 6 % Cum. Pref.	1	6 6	88-89 xd	+ 1/2	4 8 11
Do. Del.	Do.	80 1/2	80 1/2	242-244 xd	- 1/2	6 7 7	Do. 4 % Red. Deb.	Stock	4 4	83-89 xd	..	4 8 11
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	6 5	5	102-104	..	4 16 2	Pacific and European Tel., 4 % Guar. Deb.	Do.	4 4	97 1/2-99 1/2	..	4 0 5
Chili Telephone	5	7 8	7 1/2	74-77 1/2	..	5 9 9	Rentier's	10	10 10 1/2	11 1/2-11 1/2	+ 1/2	8 10 2
Commercial Cable, 8 1/2 % Deb.	Stock	4 4	4	80-82	..	4 17 7	Submarine Cables, Trust	Cert.	8 8	127-130	..	4 12 4
Cuba Telegraph	10	6 6	6	73-82 xd	- 1/2	6 17 2	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	Stock	4 1/2	97-99	..	4 10 11
Do. 10 % Pref.	10	10 10	10	16-17	..	5 17 8	United River Plate Telephone	5	4 4	32-32	..	5 4 1
Direct Spanish Telegraph, Ord.	6	4 4 1/2	4 1/2	84-87	..	5 6 8	Do. 6 % Cum. Pref.	5	5 5	62-62	..	4 8 11
Do. 10 % Cum. Pref.	5	10 10	10	64-72	..	7 2 10	West Coast of America.	2 1/2	2 1/2	1 1/2-1 1/2	..	4 0 0
Direct United States Cable	10	5 5	5	96-98 xd	..	6 15 7	Do. 4 % Deb., 1 to 1,500 guas, by Bras. Sub. Tel.	100	4 4	95-98	..	4 1 8
Direct W. India Cable, 4 1/2 % Reg. Deb.	100	4 1/2	4 1/2	99-101	..	4 9 0	West India and Panama Telegraph	10	2 1/2	32-32	..	5 14 8
Eastern Telegraph, Ord. Stock	Stock	7 7 1/2	7 1/2	133-136 xd	..	5 2 11	Do. 6 % Cum. 1st Pref.	10	6 6	10-10 1/2	..	6 0 0
Do. 2 1/2 % Pref. Stock	Do.	8 8 1/2	8 1/2	78-80 xd	..	4 7 6	Do. 6 % Cum. 2nd Pref.	10	6 6	94-10	..	4 17 1
Do. 4 % Mort. Deb.	Do.	4 4	4	96-98	..	4 1 8	Do. 6 % Deb.	100	5 5	101-103	..	5 2 9
Eastern Extension	10	7 7 1/2	7 1/2	13-13 1/2 xd	..	6 3 8	Western Telegraph, Ltd.	10	7 7 1/2	94-96	..	4 3 4
Do. 4 % Deb.	Stock	4 4	4	96-98	..	4 1 8	Do. 4 % Deb.	Stock	4 4	94-96	..	4 3 4
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.)	25	4 4	4	98-101	..	3 19 8	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	97 1/2-100 1/2	..	4 10 0
Globe Telegraph and Trust	10	6 6 1/2	6 1/2	103-103 1/2	..	6 10 4						
Do. 5 % Pref.	10	6 6	6	122-123	..	4 13 3						
Great Northern Telegraph	10	18 18	18	28 1/2-30 1/2	..	5 18 0						
Indo-European Telegraph	25	13 13 1/2	13 1/2	56 1/2-58 1/2	..	6 11 1						
Mackay Companies Common	\$100	5 5	5	87-91	..	6 9 11						
Do. 4 % Cum. Pref.	\$100	4 4	4	68-71	..	6 12 8						
Morconi's Wireless Telegraph	1	20	..	48-48 1/2	+ 1/2	4 8 11						
Do. 7 % Cum. Pref.	1	17	..	39-39 1/2	+ 1/2	4 7 0						

\* Unless otherwise stated, all shares are fully paid. † Paid in deferred interest warrants. ‡ Interim Dividend. § In Funded Dividend Certs

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 28th.	Rise + or Fall	Present Yield p.o.	NAME.	Stock or Share.	Dividends for	Closing Quotations Jan. 28th.	Rise + or Fall	Present Yield p.o.
Bath Trams, Pref. Ord. . . . .	1	Nil	Nil	..	Nil	Metropolitan Railway Consol. . .	100	1 1/2	52 1/2-52 3/4	-1 1/2	8 1/2
Do. 5% Pref. . . . .	1	5	5	..	6 8 1	Do. Surplus Lands . . . . .	100	2 1/2	61-63	..	4 5 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	76-81	..	5 11 1	Do. 8 1/2% Deb. . . . .	100	8 1/2	86-88 x d	..	8 17 9
Brit. Elec. Trac., 8% Pref. . . . .	100	..	11-13	..	..	Do. 8 1/2% Pref. . . . .	100	8 1/2	85-87	..	4 0 6
Do. Do. Deferred . . . . .	100	..	..	..	..	Do. 8 1/2% Con. Pref. . . . .	100	8 1/2	84-85	..	4 1 5
Do. Do. 6% Cum. Prf. . . . .	100	6 6	67-90	..	6 13 4	Metropolitan District Ord. . . .	Nil	Nil	40-40 1/4	- 1/4	Nil
Do. Do. 7% Non-Cum. Prf. . . . .	100	..	87-100	-1	..	Do. 6% Deb. . . . .	100	6	189-141	..	4 4 0
Do. Do. 5 1/2% Perp. Deb. . . . .	100	5 5	91-95	-1	6 5 8	Do. 4% Deb. . . . .	100	4	93-95	..	4 2 6
Do. Do. 4 1/2% 2nd Deb. . . . .	100	4 1/2	77-81	..	5 7 2	Do. 4% Prior Lien . . . . .	100	4	99-101	..	8 19 8
Central London Railway, Ord. . . .	100	6 8 1/2	83-84	..	3 11 5	Do. 4 1/2% First Pref. . . . .	100	4 1/2	89-91	..	4 18 11
Do. Do. 1886 . . . . .	100	4 4	83-85	..	4 14 2	Do. 4% Gid. . . . .	100	4	76-75	..	4 9 3
Do. Def. . . . .	100	4 4	83-84	..	2 7 7	Metropolitan Elec. Trams, Ord. . .	1	6 5 1/2	11-1 1/2	..	5 1 1
Do. 4% Deb. . . . .	100	4 4	98-100	..	4 10 1	Do. 5% Pref. . . . .	1	5 5	..	..	5 14 3
City & South London, Ord. . . . .	100	12 1 1/2	87 1/2-88 3/4	..	8 11 5	Do. 4 1/2% Deb. . . . .	100	4 1/2	89-92	..	4 17 10
Do. 5% Pref., 1891 . . . . .	100	5 6	109-111	..	4 10 1	Do. 5% Deb. . . . .	100	5 6	94-97	..	5 3 1
Do. Do. 1886 . . . . .	100	5 6	109-111	..	4 10 1	Potteries, Ord. . . . .	1	5 5	..	..	6 10 0
Do. Do. 1891 . . . . .	100	5 6	109-111	..	4 10 1	Do. 5% Pref. . . . .	1	5 5	..	..	5 2 8
Do. Do. 1893 . . . . .	100	5 6	109-111	..	4 10 1	Do. 4 1/2% Deb. . . . .	100	4 1/2	85-88	..	7 7 8
Do. 4% Deb. . . . .	100	4 4	98-100	..	4 0 0	South Metro. Trams, 8% Pref. . .	1	6	..	..	5 14 4
Dublin Union Trams, 6% Pref. . . .	10	6	12-13	..	4 12 4	Do. 4% Deb. . . . .	100	4 4	85-79	..	5 14 4
Great Northern & City, Prf. Ord	10	Nil	25-22	..	Nil	Underground Elec. Railways	10	..	..	..	Nil
Heathings Trams, 6% Pref. . . . .	1	6 6 1/2	56-7 1/2	+ 3 1/2	7 7 8	Do. 4 1/2% Deb. . . . .	100	4 1/2	113-113 1/2	..	5 5 9
Do. Do. 1891 . . . . .	100	4 4	69-74	..	6 1 7	Do. 6% First Cum. Inc. Deb. . . .	100	..	113-113	..	5 5 9
Do. Do. 1893 . . . . .	100	5 5	74-93	..	4 15 8	Do. 4 1/2% Bonds . . . . .	100	4 1/2	98-100	..	4 10 0
Do. 4% Deb. . . . .	100	4 4	75-80	..	5 0 0	Do. 6% Income . . . . .	100	1 1/2	95 1/2-96 1/2	+ 1	..
Lancashire United, 5% Deb. . . . .	100	5 5	73-80	..	6 5 0	Yorkshire (West Riding), Ord. . .	5	Nil	..	..	Nil
London Elec. Railways, 4% Deb. . .	100	4 4	86-97	..	4 2 6	Do. 8% Pref. . . . .	5	8	79-83	..	4 12 4
London Union Trams, 5% Pref. . . .	10	Nil	..	..	..	Do. 4 1/2% Deb. . . . .	100	4 1/2	82-83	+ 2	5 8 5
Do. 4% Deb. . . . .	100	4 4	69-72	..	5 11 1						

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . . . .	5	5 1/2	42-54	..	5 7 4	La Plata Elec. Trms, Ord. . . . .	1	Nil	..	..	..
Do. 2nd Pref. . . . .	5	5 1/2	42-43 1/2	..	5 13 8	Do. Pref. . . . .	1	6	..	..	6 0 0
Do. 4% Deb. . . . .	100	4 4	98-95	+ 1/2	4 4 8	Lieboen Elec. Trams, Ord. . . . .	1	6 6 1/2	1-1 1/2	..	4 16 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	99-101	..	4 9 1	Do. 6% Pref. . . . .	100	6 6	91-95	..	4 16 0
Do. 5% Deb. . . . .	100	5 5	103-103 1/2	..	4 19 6	Do. 5% Deb. . . . .	100	5 5	91-95	..	5 5 8
Anokland Trams, 5% Deb. . . . .	100	5 5	101-103	..	4 17 1	Madras Elec. Tr. (1904), Deb. . . .	100	5 6	101-103	..	4 17 1
Bombay Elec. S. & Trams, Pref. . . .	10	6 6	113-122	..	4 18 0	Manaos Trams & Lt., 1st Deb. . . .	100	5 5	87-90	..	5 11 1
Do. 4 1/2% Deb. . . . .	100	4 1/2	96-98	..	4 11 10	Manille Elec. R. and Ltg., Bonds	10000	5 5	1004-1024	..	4 17 7
Do. 5% 2nd Deb. . . . .	100	5 5	97-99	..	5 1 0	Mexico Trams Com. . . . .	1000	7 7 1/2	113-113 x d	..	6 5 0
Brazilian Traction Light and Power	\$100	..	101-103	..	..	Do. Gen. Con. 5% Bonds . . . . .	100	6 5	97-99	-1	5 1 0
Brisbane Trams Invt., Ord. . . . .	5	8 8 1/2	62-72	..	5 8 6	Do. 5% Bonds . . . . .	100	6	100 1/2-102 1/2	..	5 17 1
Do. 5% Pref. . . . .	5	5	42-52	..	4 15 8	Para Elec. Rlys. & Lt., Ord. . . . .	5	10 10 1/2	74-8	..	6 5 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	99-102	..	4 8 3	Do. 5% Pref. . . . .	5	5	44-52	..	6 11 7
B. Columbia Elec. Rly., Def. . . . .	100	8	142-146	+ 1	5 9 7	Do. 5% 1st Deb. . . . .	100	5 5	98-100	..	5 0 0
Do. Pref. Ord. . . . .	100	6 6	122-126	+ 2	4 15 3	Perth (W.A.) Elec. Tr., Ord. . . . .	1	5 5 1/2	145-144	..	3 14 5
Do. 6% Pref. . . . .	100	5 5	105-108 x d	..	4 12 7	Do. 5% 1st Deb. . . . .	100	5 5	105-108	..	4 12 7
Do. 4 1/2% 1st Mort. Deb. . . . .	40	4 1/2	100-103	..	4 7 5	Rangoon El. Tr. & Snp., Pref. . . .	5	8	53-54	..	5 0 0
Do. 4 1/2% Vancouver Deb. . . . .	100	4 1/2	101-108 x d	..	4 7 5	Do. 4 1/2% 1st Deb. . . . .	100	4 1/2	97-99	..	4 10 11
Do. 4 1/2% Con. Deb. . . . .	100	4 1/2	97-100	..	4 5 0	Rio de Janeiro Trams, 1st Mort. } 6% Bonds	..	5 5	101-103	..	4 17 1
Calcutta Trams, Ord. . . . .	5	7 7 1/2	53-62	..	5 12 0	Do. 5% Mort. Bonds . . . . .	100	5 5	96 1/2-98 1/2	..	5 1 6
Do. 5% Pref. . . . .	5	5	43-57	..	4 10 0	Sao Paulo Tram, Lt. and P. } 5% Bonds	5000	5 5	103 1/2-105 1/2	..	4 14 8
Do. 4 1/2% Deb. . . . .	100	4 1/2	97-100	..	4 5 0	Singapore Trams, 5% Deb. . . . .	100	5 5	83-86	+ 1	5 16 8
Cape Electric Trams . . . . .	1	2 1/2	4-3	..	..	Southern El. Tr. B.A., 5% Deb. . . .	100	5 5	99-101	..	4 19 0
City Buenos Aires Trams (1904) . . .	5	5 5 1/2	97-100	..	4 8 0	Un. Elec. Trams Montevideo . . . .	5	7 6 1/2	52-54	..	5 19 2
Do. 4% Deb. . . . .	100	5 5	93-97	..	5 2 1	Do. 5% Pref. . . . .	5	6 6	44-48	..	5 11 7
Colombo Elec. Tr. & Lt., 5% Bonds	10000	5 5	99-103 x d	+ 1	4 17 1	Do. 5% 1st Deb. . . . .	100	5 5	99-102	..	4 18 0
Havana Elec. Rly., 5% Bonds . . . .	1	Nil	..	..	Nil	Winnipeg Elec. Rly., 4 1/2% Deb. . .	100	4 1/2	100-103	+ 1/2	4 7 5
Kaloorlie Elec. Trams . . . . .	1	6 5	83-88	..	5 13 8						
Do. 5% A Deb. . . . .	100	6 5	80-40	..	..						

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	6	..	..	8 0 0	Crompton & Co. . . . .	8	Nil	..	..	Nil
Do. 6% Pref. . . . .	1	8	..	..	7 7 8	Do. Deb. . . . .	100	5 5	65-67	+ 1 1/2	9 15 6
Babcock & Wilcox . . . . .	1	28 14 1/2	83-94	+ 1 1/2	4 0 0	Dick, Kerr . . . . .	1	6 6	..	..	..
Do. Pref. . . . .	1	8	13-14	..	4 0 0	Do. Pref. . . . .	1	6 6	..	..	8 17 2
British Aluminium, Ord. . . . .	1	Nil	..	..	..	Do. Deb. . . . .	100	4 1/2	95-96	..	4 11 10
Do. 6% Cum. Pref. . . . .	100	6 6	90-98	..	5 7 6	Edison & Swan, 4 1/2% paid	..	5	Nil	..	Nil
Do. 5% Prior Lien Deb. . . . .	100	6 6	86-89	..	5 12 4	Do. fully paid . . . . .	..	5	Nil	..	Nil
Do. Deb. Btk. . . . .	100	6 6	86-89	..	5 17 8	Do. 4% Deb. . . . .	100	4 4	80-84	- 4	6 5 0
B.I. & Helaby Cables . . . . .	5	10 8 1/2	81-83	..	4 14 1	Do. 6% Second Deb. . . . .	100	6 5	72-75	..	8 13 4
Do. Pref. . . . .	5	6	55-63	..	4 11 1	Electric Construction . . . . .	3	2 1/2	82 1/2-84	+ 1 1/2	6 18 4
Do. Deb. . . . .	100	4 1/2	102-104	..	4 5 7	Do. Pref. . . . .	2	7 7	74-8	..	7 0 0
British Thomson-Houston, Deb. . . .	100	4 1/2	95-97	..	4 12 9	Greenwood & Bailey, Pref. . . . .	10	7 7	74-8	..	8 5 8
British Westinghouse, Pref. . . . .	8	Nil	..	..	Nil	Do. Deb. . . . .	100	6 5	92-94	..	6 4 2
Do. Deb. . . . .	100	4 4	81-81	..	6 11 2	General Electric, Pref. . . . .	10	4 4	93-102	..	..
Do. 6% Prior Lien . . . . .	100	8 6	100-108	..	5 15 8	Do. Deb. . . . .	100	4 4	90-95	..	4 4 8
Browett, Lindley, Ord. . . . .	1	..	20-31	..	Nil	Henley's, Ord. . . . .	5	17 5 1/2	123-131	..	6 6 0
Do. Pref. . . . .	1	..	47-61	..	Nil	Do. Pref. . . . .	5	4 1/2	46-54	..	4 7 10
Brush, 7% Pref. . . . .	2	Nil	Nil	..	Nil	Do. Deb. . . . .	100	4 1/2	101-103	..	4 7 5
Do. 5% Prior Lien Deb. . . . .	100	5 5	78-78	..	8 8 2	Do. Deb. . . . .	10	10	10-11	..	6 16 4
Do. 4 1/2% Deb. . . . .	100	4 1/2	47-52	..	8 13 2	Do. Pref. . . . .	10	6	94-102	..	4 17 7
Do. 4 1/2% Second Deb. . . . .	100	4 1/2	28-32	..	14 1 4	Telegraph Construction . . . . .	12	17 1/2	51	..	5 13 0
Callender's Cable . . . . .	5	15 10 1/2	11-11 1/2	+ 1/2	6 7 8	Do. Deb. . . . .	100	4 4	86 1/2-96 1/2	..	4 1 8
Do. Pref. . . . .	5	5	44-50	..	4 10 0	Do. Pref. . . . .	5	Nil	..	..	Nil
Do. Deb. . . . .	100	4 1/2	97-100	..	4 7 7	Do. Pref. . . . .	5	Nil	..	..	Nil
Castner-Kellner . . . . .	1	20	81-94	..	5 5 0	Do. Deb. . . . .	100	4 4	67-69	..	6 15 7
Do. Deb. . . . .	100	4 1/2	106-109	..	4 2 7						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

NEW TYPE OF SINGLE-PHASE  
LOCOMOTIVE.

THE 1,500-H.P. single-phase locomotive recently constructed for the Chemin de Fer du Sud by the Ateliers de Construction Electric du Nord et de l'Est, possesses a number of interesting features, chief among which are: Axle drive without connecting rods; simplified voltage regulation; improved commutation; and automatic current regeneration.

The locomotive is of the 1-C-1 type, weighing 86 tons (18 tons on each driving axle, and 16 tons on each trailing axle). Two air-cooled transformers, each of 750 kw. capacity, are mounted near the ends of the locomotive and are connected in parallel to the collector bows. An induction regulator is mounted on the upper yoke of each transformer, so that the total iron weight, losses and space occupied are hardly greater than those of a simple

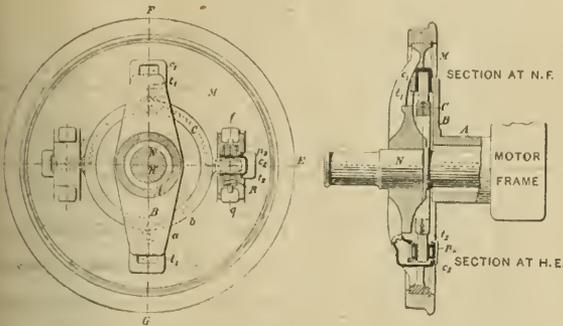


FIG. 1.

step-transformer for the same output; the copper weight is 18 per cent. greater, but chokers and other auxiliaries are eliminated. The transformer secondaries are in series with each other and their induction regulators, which provide continuous voltage regulation between 200 and 760 volts.

Three 500-H.P. motors are mounted perpendicularly over the respective driving axles, to which they are connected by gear wheels, and the elastic universal coupling described below. The motors are of the compensated series type, connected in series across the transformer secondaries. On starting they can be connected as repulsion motors without field weakening. Speed control is by voltage variation from the induction regulator, and regenerative action on down grades is obtained by separately exciting the main motors from the compressor motors.

Fig. 1 shows the ingenious coupling employed between the motor and driving wheel. The motors are fixed to the loco. frame, and their centre of gravity lies 1.8 m. above the rail level. No connecting rods or cranks are employed; each motor drives a hollow shaft through a 1:2.72 gearing. The hollow shaft is concentric with the driving axle, and is connected to it by a flexible coupling.

The circular coupling piece *c* is provided with four extensions, of which two  $t_1, t_2$  are free to turn and slide in the bronze shells  $c_1, c_2$  mounted in the arms *B* of the hollow shaft, and two  $t_3, t_4$  in the shells  $c_3, c_4$  held with some play in the track wheel flange. This arrangement permits a certain rotation of the hollow shaft round the driving axle and a certain inclination to its axis. The shells  $c_3, c_4$  can slide parallel to the axle in their bearings  $p_3, p_4$ , so that the coupling allows for side play. Finally, the bearings  $p_3, p_4$  are held between springs *B* in the wheel flange; these springs prevent shocks on starting the locomotive and damp oscillations in the driving torque. It is found that the lubrication of the coupling offers no special difficulties, and the mechanism operates satisfactorily at train speeds up to 80 km. per hour, and under most severe braking conditions.

The windings of the induction regulator and the compensation are so arranged that leakage is practically confined to coil end, slot, and zigzag leakage, and is very low. High power factor is thus secured.

The motor output is 500 H.P. at 450 R.P.M. under a terminal voltage of 230 volts. The efficiency, including gearing, is then 87 per cent., and the P.F. 93 per cent. At 400 H.P. output per motor, the efficiency is 88 per cent. and the power factor 95 per cent.

Complete compensation and good commutation are secured by two windings, 1, 2 (fig. 2a), of different sections and number of turns, connected in parallel and lying in the same slots. In this winding there flows a compensating current, proportional to the latter and independent of

speed. At constant load (and hence excitation) the voltage between commutator bars induced by the alternating field is constant and represented by the fine *A A* (fig. 2b). The pressure dynamically induced by the compensating current is proportional to the speed and is represented by *o n*. The difference between *A A* and *o n* gives a good commutation characteristic. The characteristic of an equivalent simple repulsion motor is given by the difference between *A A* and the parabola *o c*, and is much less satisfactory. On full starting current,  $o A = 3.5$  volts, and it becomes zero at a train speed of about 50 km. per hour. At low speeds, the repulsion connection yields best commutation. The windings 2 (fig. 2a), are now disconnected from 1 and placed in parallel, motor to motor; this arrangement constrains the motors to run at equal speed, and is an admirable substitute for coupling rods.

Current regeneration is rendered more difficult by the requirement that it shall be effected over a relatively wide current range. The single-phase Latour shunt motors driving the compressors are provided with auxiliary stator windings. The main winding is supplied at a pressure  $E_1$  (in phase with the supply pressure), from transformers. The auxiliary winding, in quadrature with the main winding, induces an alternating field in the main motor and a total E.M.F.  $E_2$  almost in phase with  $E_1$ . By a suitable setting of the induction regulator, the total secondary voltage  $E_3$  can be made equal to  $E_2$ , so that the circuit can be closed.

Directly it is attempted to return current to the network by lowering  $E_3$ , there arises serious phase displacement between current and pressure; referring to fig. 2c, the phase displacement is given by:  $\tan \phi = \omega L/w$ . To increase the power factor,  $E_2$  is displaced with regard to  $E_3$ , as shown to the right of fig. 2c, this being automatically effected by a transformer, the primary of which carries *J* and the secondary of which is connected to the compressor motor terminals. To compensate for the phase displacement produced by the watt-current required to drive the compressors and fans and to cover losses, a compensating transformer is provided and, finally, transformers and ohmic resistance serve to compound the compressor motors so that the latter operate at unity power factor at all times. The connections of these small transformers appear complicated, but their practical operation is very satisfactory. Regenerative braking is practised at speeds between 22 and 55 km. per hour; it occurs quite automatically the driver simply controlling the degree of braking by a lever

—E.T.Z.

AUSTRALIAN TRAMWAY COMPANIES  
AND THEIR EMPLOYÉS.—IX.

(Continued from Vol. 71, page 568.)

THE settlement of the Melbourne rates, which was given in our last article, seemed to pave the way to further arrangements, and the Court adjourned in the hope that other settlements by consent would be made. In several cases, however, agreements could not be arrived at, and, on September 23rd, the Court resumed its sittings, continuing them until October 15th, when a further adjournment took place till November 26th. The case commenced on March 4th, and has occupied the attention of the Court for nearly 90 days. The Judge has now stated that his decision, when arrived at, will be retrospective as from November 1st last. When the Court resumed on September 23rd, it was stated that complete settlements had been come to in the cases of Melbourne and Perth,

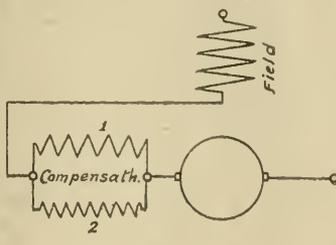


FIG. 2a.

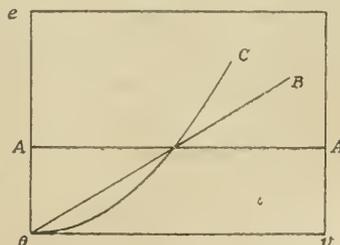


FIG. 2b.

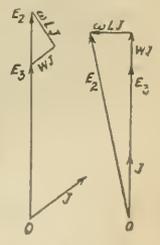


FIG. 2c.

and that agreements were practically complete with Ballarat, Bendigo, Hobart, Fremantle and Northcote.

At North Melbourne there was still trouble, the men not seeing their way to make the few concessions from the Melbourne terms rendered necessary by the company's financial position.

The case of Adelaide was then taken. The situation here is somewhat peculiar; in 1906 the South Australian Government bought up the interests of the horse car systems in Adelaide for £280,000. Next year a Trust was formed to carry on the working and to unify and electrify the systems. The Trust has in all incurred liabilities amounting to £1,500,000 to the Government, and is bound to repay this sum in 30 years. The Trust had to pay all its receipts to the treasurer, and after payment of all expenses and the provision of a 2 1/2 per cent. renewal fund, the balance went to the repayment of the loan. If this was not sufficient, the benefitting localities had to make up the difference from rates. It was shown that on the past year's working there was a deficiency of £15,000, due entirely

to sinking fund repayments. The position was that the fares in Adelaide were very high, and any addition to the pay-roll would practically have to be paid by the ratepayers. The Trust had already improved the conditions of its workers, but to a large extent its hands were tied. The Judge suggested wages on the Melbourne scale, but the Trust could not then see its way to grant them, or the men to accept them, as they considered that a motorman's work was more important than a gripman's. The question of the 1 minute wait at terminals was discussed, and it was stated that to increase it to 3 minutes would mean 23 additional cars in service, and an extra annual cost of £26,624. Mr. Goodman, the manager of the company, pointed out the difficulty of keeping working times within 8 hours per day, and stated that he thought that overtime rates should be reckoned after 9 hours' working.

Although the Trust could not see its way to definitely offer the Melbourne rates, a ballot of the men refused to accept them on the ground of the higher cost of living at Adelaide.

It was stated that the extra cost to the Trust of an agreement on these terms would be about £11,000 per year which would mean additional rates in the various townships of from 2d. to 4d. in the pound. It appeared that the sinking fund was about £41,000 per year, and that after paying all expenses and a small interest on the capital, there was a balance of £26,000 to go towards the sinking fund, leaving a deficiency of £15,000, as already stated. The Judge asked whether, under these circumstances, the Trust ought to want to pay low wages to its employes simply because it was under a liability to pay off a sinking fund. Had not the worker a prior claim on the net profit of working the system? Some interesting evidence on the cost of living and house rents was then given by Mr. Lightfoot, an officer of the Statistical Department, on the basis of last year's costs. Amongst other figures, he gave the following comparison of the relative cost of food, groceries and four-roomed houses in various parts of the Commonwealth:—Calling Melbourne 1,000, Sydney would be represented by 1,119, Newcastle 913, Broken Hill 1,108, Ballarat 841, Bendigo 833, Geelong 913, Brisbane 919, Rockhampton 930, Adelaide 1,117, Perth 1,177, Kalgoorlie 1,447, Hobart 1001, and Launceston 951. Rents would compare as follows:—Melbourne 1,000, Sydney 1,236, Geelong 863, Brisbane 802, and Hobart 818.

This concluded the evidence on behalf of the Adelaide Trust, and the case of Brisbane was next gone into. Mr. Frew, on behalf of the Brisbane Tramway Co., contended that there was no industrial dispute. The men's Union had lodged claims, but that did not constitute a dispute. The company thought that the troubles they had had with their workpeople had been due to the interested efforts of Mr. Prendergast and other officials of the Union, who had done their best to sow discontent against employers. The Judge pointed out the lack of any sympathetic tone in these remarks, and showed how, in his opinion, the company had taken up a too autocratic attitude, which had been the real cause of the trouble with the men.

The Judge then asked whether the company would undertake that in future there would be no preference shown to non-unionists over unionists. This was referred to the company at Brisbane, who replied by a counter inquiry as to whether an answer from them would mean that they accepted the jurisdiction of the Court. As the judge would not accept this as an answer, a further request for a direct reply was forwarded to the company at Brisbane.

A number of complaints were then made by Mr. Frew as to the manner in which the men's Union conducted their business, and the way in which they secured adhesions to their policy, but the judge remarked that this argument cut both ways, in view of the manner in which the company asked their employes to go to their solicitor's office to sign their own petitions. Mr. Frew then argued that the lower costs of living in Brisbane justified lower wages than in Melbourne, and took up the position that a motorman's duties were less arduous than a gripman's. The judge pointed out this was exactly opposite to the opinion held in Adelaide.

Before the conclusion of Mr. Frew's address, the Court adjourned. It was intimated that several of the other tramway authorities were ready with their employes to ask the judge to meet them and arrange a settlement. Mr. Justice Higgins intimated that he would appoint a time at the next sitting of the Court.

### HONG KONG UNIVERSITY.

PROF. C. A. M. SMITH has sent us a list of apparatus offered—the replies sent within a fortnight of his appeal to our readers. This we give below. He says that he is certain that this is merely a preliminary list, and he wants British manufacturers to support him thoroughly. He is almost pathetic concerning the recent telephone contract for the city of Canton (over £100,000). Canton is within 80 miles of Hong Kong,—yet a Continental firm got the order for the telephones. He begs Britishers not to let the Canton electric tramway scheme be captured by their trade rivals.

As for the University—there are visitors every day. There are 37 engineering students this year, and already there are indications of a further increase in numbers next year. We are glad to learn that the Councils of the British

Engineers' Association, and the Institutions of Electric and Mechanical Engineers have been asked to nominate members for the London Committee of the University of Hong Kong.

We understand that oil and gas engines up to 20 B.H.P., driving 110-volt d.c. dynamos, are wanted, and also electric motors and switchgear for use with machine tools. Later on we hope to publish a more complete list of apparatus presented. Meantime, Prof. Smith wishes to sincerely thank ourselves and another journal, also the British Engineering Association, which, he says, has more than justified its existence by its splendid co-operation with him.

### PRELIMINARY LIST OF APPARATUS PRESENTED BY BRITISH ENGINEERS.

1. Storage battery, 60 cells, 480 ampere-hours. (The Chlor Electrical Storage Co., Ltd., Manchester.)
2. Experimental steam engine, complete, with condensing plant. (Messrs. Marshalls, Ltd., Gainsborough.)
3. Ten B.H.P. vertical oil engine, coupled direct to d.c. 110-v. dynamo, mounted on base complete. (Messrs. L. Gardner & Sons Ltd., Patricroft, Manchester.)
4. Semi-Diesel oil engine. (Mr. Locke.)
5. Water-tube boiler, oil-fired heater, filters, burners, &c., complete. (Messrs. J. Samuel White & Co., Ltd., Cowes, I. of W.)
6. Water-tube boiler complete. (Messrs. Babcock & Wilcox.)
7. Hot air engine, with pump attached, water meters, &c. (Messrs. Hayward, Tyler & Co., Ltd.)
8. Marine motor engine. (Messrs. John I. Thornycroft & Co. Ltd., Chiswick.)
9. Wood-working lathe and circular saw. (Messrs. A. Ransome and Co., Ltd.)
10. Motor starters, circuit breakers, &c. (Messrs. Ferranti, Ltd., Hollinwood.)
11. Various meters, electrical instruments, &c. (The Walsley Electrical Co., Ltd.)
12. Assortment of electrical switches and gear. (The Ventnor Switch Co., Ltd.)
13. High-speed twist drills, turning and planing tools. (Messrs. Turton Bros. & Matthews, Ltd.)
14. Water meters and fittings. (Messrs. Glenfield & Kennerly, Ltd.)
15. One 14-in. reversible level. (Messrs. T. Cooke & Sons, Ltd.)
16. Various tools as desired. (The Hardy Patent Pick Co., Ltd.)
17. Electrical machinery, telephone gear, &c. (The General Electric Co. of China, Ltd.)
18. Fery spiral radiation pyrometer. (The Cambridge Scientific Instrument Co., Ltd., Cambridge.)
19. Photo arc lamp. (The Westminster Engineering Co., Ltd., London.)
20. Case of steel fractures. (The Eagle & Globe Steel Co., Ltd., Shanghai.)

### TRAMCAR GEARS.

WE understand that the Birmingham tramways are to adopt the system of driving from both ends of the motor spindle, employing two sets of wheel and pinion gear, and thus equalising the distance between the road wheel and the gear wheel on the two sides of the motor. Incidentally, and this is perhaps not the least important benefit which will accrue from the change, the wear on the motor bearings will be equalised between the two ends, and there will be no further need for two patterns of white metal or the casings there. The parallelism of the motor spindle and the driven axle should no longer be a matter of few seconds' duration, but should be permanent, and the bearing pressure between the gear teeth should be distributed and should remain distributed across the faces of the wheels, so that the wear of the teeth to a sharp edge at one end, while the other end remains nearly of its full section, will be avoided. As it is obvious that two wheels of half breadth will be stronger than the present double-breadth single wheel, it will be seen that this is a move that ought to have been made years ago, for the faults of the existing system are all too visible, and they have often been pointed out.

The use of the parallel axle should also receive consideration. In railway work the parallel axle condemned itself years ago by its frequent breakages, and amendment was only secured when the axles were forged or rolled dovetail thinner in the middle, in order to give them elasticity. This was done in the days of wrought-iron axles, and wrought-iron was much less liable to fail than is steel.

This liability to failure of steel is still more marked here wheels with sharp-edged bored centres are fitted lightly on a plain straight axle. After such axles have run for a time, they break off at the edge of the wheel bore. The best way to overcome the trouble is to turn the wheel-cent slightly larger in diameter than the rest of the axle, and to make this swelled portion shorter than the length through the boss. Thus the boss overhangs the swell, as in fig. 1, and failure is not caused, for there is no keen pressure on the axle by the sharp edge of the wheel bore at *a*. If the swell is not made upon the axle, then the boss of the wheel would not be bored of equal size right through. Half an inch from each end the bore should begin very gently to



FIG. 1.

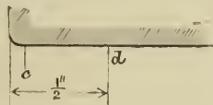


FIG. 2.

increase in diameter, as shown much exaggerated in fig. 2. The diameter between *d* and *c* is to be increased, so that *c* a fairly stout "feeler" can be entered, and then beyond the corner may be rounded to  $\frac{1}{8}$  radius.

There must not be an angular change at *d*, but the curve *d* should be hyperbolic, so that where it departs from *d* the change of diameter shall be insensible. By this means any sudden nip in the metal of the axle is avoided. Even in fig. 1 the same bell-out of the bore may be carried out with advantage.

Where keyways are sunk in a shaft or axle the end should not be sudden, but the bottom of the keyway should curve gradually up to the surface, so as to avoid the risk of that sudden change of section, so fatal to steel.

Experience may show that the system of equalised double driving will not only diminish the breakages of axles, but may do something towards diminishing the evil of rail corrugation as well, which some engineers believe to be caused or intensified by the greater length of axle exposed to torsion on one side than on the other side of a car. If the two wheels differ in circumference, the long end of the axle is wound up by torsion like a spring. When the torsion stress exceeds the frictional grip on the rail, one wheel releases itself and holds on the rail, and produces an abrasion. Such release will be determined for a given wheel by a variety of circumstances such as the relative quality of the two treads concerned, and the class or quality of the rails on which the wheels happen to be running at the time.

Axle torsion can, of course, occur in any case of unequal wheels, but in the case of driven wheels there is the additional fixed point of the gear wheel. With two points of gearing the torsion angle will be small, for there will be so short a length of axle to twist, and the intermittent slip which causes corrugation will be so frequent as to become equivalent to a steady grinding. In aid of the solution of corrugation some assistance might, perhaps, be obtained from tests on the angular torsion of axles under stress, with a view to finding how far two wheels can be put out of phase with each other before they slip on a restraining braking surface.

## ELECTRICAL DANGERS.

By S. LEES.

THE intelligent observant mind cannot fail to have noted with something akin to alarm the rather disturbing frequency of fatal electrical accidents, particularly amongst skilled workers, during the past 12 months or so. At the subsequent inquiries into several cases of fairly recent date, it transpired that the victim had either omitted precautions altogether, or taken quite inadequate ones against risk of shock whilst working in a dangerous situation. In some other cases, although the medical testimony was clear enough regarding the cause, no evidence was forthcoming as to how the deceased had received the shock.

It would seem, at first thought, inexplicable that skilled workers, extraordinarily conscious of the grave possibilities attendant on such lapses from what really is, or, at any rate, ought to be, part of their routine, should ever, even for a moment, allow vigilance to relax, or permit their mind to wander from the thought of the dreaded danger, as so often happens, within easy reach of it. One reads too often of the sad results following neglect to use the much-maligned rubber gloves. But those having actual experience of the average example of rubber glove, especially in confined places—and it is under such conditions that the employment of these accessories mainly applies—will readily concede that some extenuation may not unreasonably be allowed where a skilled worker disdains to wear the protective rubber sheath. Armed with the average glove, the manipulation of anything smaller than, say, a  $\frac{1}{2}$ -in. size spanner, will almost invariably require the dexterity of a Maskelyne. The operator knows full well that he needs must keep a watchful eye on small details, such as nuts, screws, and what not, these often of Lilliputian proportions, as the inadvertent loss of one or other amongst a mass of closely adjacent "live" metal may easily complicate matters regarding not only the quality of his work, but what is most important of all, his personal safety, by introducing an element of added danger in the process of recovery thereof.

With men accustomed to handling "live" work, involuntary twitching of the nerves is a fairly common complaint, and often an attack which may be only of momentary duration is mistaken for the sensation of electric shock. The effect is certainly very similar. The sensation consequent on a blow struck on the ulnar nerve, or, as it is more popularly known, the "funny bone," is remarkably like the sensation of electric shock, and, curiously, this part of the human anatomy seems peculiarly liable to injury. Now, such a circumstance occurring under the usual conditions surrounding live working is easily conceivable, and it will be obvious that the almost inevitable, although, maybe, only very temporary confusion following, may be easily attended with serious results to the unfortunate worker. Again, a simple fit of sneezing, which under more congenial surroundings might prove beneficial, would, perhaps, possess grave potentialities of harm to the one so affected. The writer has often watched men working in risky places and become interested as to the cause of the profuse perspiration which attacks them, even during the coldest weather. An explanation would seem to point to some form or other of slight paralysis, or intense numbness, which temporarily affects the respiratory organs. Cramp of the fingers is common to men who are used to working on live metal in confined places, and it is quite the usual course for such workers to take a temporary rest to enable them to massage their hands.

Following the adoption of the Home Office new rules and regulations, manufacturers and others closely interested have hastened to remedy or otherwise bring into conformity with the changed order of things, apparatus, notably switchgear, of ante 1910 design. While undoubtedly some considerable measure of success has attended these laudable efforts, there still exist on the market numerous examples of switchgear of various types, which, owing principally to price considerations, find a ready sale, in spite of the fact that under the new regulations the employment thereof is prohibited. One well remembers the almost feverish cry so familiar some two years ago for all-metal enclosed switchgear. The result was the production on an unparalleled scale of a type of the now common ironclad gear, which was to prove the panacea for all the troubles hitherto experienced, which switchgear was often supposed to be heir to. But too often one is forced regretfully to admit that the substantial-looking mechanical iron case covers up a multitude of electrical sins inside.

The design of switch-handling media, too, still seems to receive but scant consideration from manufacturers generally, notwithstanding that in the new Regulations it is provided that:—(Clause 3) Every switch, switch fuse, circuit-breaker and isolating link shall be (a) so constructed, placed, or protected as to prevent danger; (b) so constructed and adjusted as accurately to make and maintain good contact; (c) provided with an efficient handle or other means of working insulated from the system, and so arranged that

the hand cannot inadvertently touch live metal; so constructed or arranged that it cannot accidentally fall or move into contact when left out of contact.

Speaking from extensive actual experience under everyday working conditions, the writer is reluctantly forced to the conclusion that even in these enlightened days, sub-Clause (c) in the extract quoted above is more often honoured in the breach than in the observance thereof. These details were better understood a quarter of a century ago. The writer remembers some examples of low-pressure switchgear by Siemens during the early nineties, which afford an interesting comparison at the present time. The gear referred to formed part of a large three-wire central supply station switchboard. All the generator switches thereon were fitted with interlocking devices to prevent mishap due to inadvertent operating, and, in addition, hand-insulating shields of circular form over 6 in. in diameter were provided for the safety of the operator.

It has now become the common practice to provide the popular knife switch, or its many modifications, with some form or other of sparking device to prevent injury caused to the main contact member by arc burning. The form usually adopted is a light construction of one or more auxiliary contact pieces hinged to the main member. It is no exaggeration to state that with the majority of such switches the disposition of the handle or grip is such that the operator runs not a little risk of injuring his hand owing to the too close proximity of the surrounding metal, which often presents sharp projections. One well-known make of switch of the type referred to has several wicked-looking spear-like mountings placed so close to the handle that it is physically impossible to close the blade without lacerating some part or other of the operator's hand. The *modus operandi* usually observed in working such switches is first to half-close by hand, and then to drive home by means of a stout piece of wood. To open under load the only way consistent with a reasonable margin of safety is to use the aforesaid stick with the addition of a hook-like projection. Further, the practice of mounting handles and grips directly on top of vertically-disposed switches, especially of the conventional knife type, is distinctly bad, and should be rigorously condemned. When coupled together such handles are almost invariably secured to an indifferently designed insulating cross-bar, which usually, owing to manufacturing considerations, literally bristles with "live" metal, and against which no protection, or worse than no protection—an apology in the shape of a ridiculous flange turned on the handle itself, which gives the operator a false sense of security—is provided for the hand.

Metal-clad switchgear, especially for situations where it is liable to be subjected to careless handling by the non-technical worker, whilst being a step in the right direction, is rather apt to be over-estimated in order of importance. It is obvious that switchgear of robust mechanical design is worthless unless embodying equally sound electrical construction. It is of no use to employ massive metal moving parts, including handles or grips, with contingent heavy cast-iron covers, water-tight, dust-excluding, fool-proof, and what not, whilst the safe working of such devices depends wholly upon the integrity of a diminutive vulcanite or fibre washer, or ferrule. Yet it is a matter of common knowledge that numerous examples of such gear are made and marketed and assured of ready sale at this day.

We know the laboratory teaches us that substances such as vulcanite, mica, &c., all possess really wonderful insulating properties, even when only of microscopic thickness, but experience should surely have taught us also by this time the absurd fallacy of carrying laboratory conditions into switchgear practice, particularly for work on heavy power service. Further, one might, not unreasonably either, go a step further and include some of the smaller types of illumination switch apparatus. Many examples of small-current hand switches are veritable sinners in this respect, the insulation (save the mark) usually being of ridiculous proportions, and not a few accidents to operators have been traced to failure of the insulation in ordinary tumbler switches, key-lampholders, adapter devices, &c. The last-mentioned are used largely on inductive circuits with fan-motors, vacuum cleaners, &c.; the inadvertent opening of such a circuit at

the adapter connection would, in all probability, be attended by serious injury to the operator's hand.

Most, if not all, makers now provide some arrangement or other, usually a bonding screw, for earthing purposes, in compliance with the revised Regulations. Given good earth, and good earth is not by any means a definitely certain quantity, it might not unreasonably be urged that no untoward consequences need be apprehended in the event of a defect developing on the circuit apparatus or gear. But a condition is easily conceivable where, say, a metal switch-handle may be very much "alive," whilst the metal protecting cover of the switch proper remains insulated therefrom, and at earth potential.

The continuity question is still awaiting satisfactory solution, and regarding this subject it appears to the writer at least that the efforts of some would-be solvers, although otherwise laudable enough, seem at times rather inconsistent. On the one hand we have manufacturers who pride themselves, naturally enough, on the excellence of the enamel protection used on their products, especially conduit tubing. On the other hand, we find the same maker, or, it may be, some trade rival, evolving some contraption or other which only requires springing or clipping on such tubing to ensure perfect metallic continuity, or for earthing. The excellent quality of the aforesaid enamel, which is declared to be absolutely impervious to all sorts of severe tests, is, as it were, rendered instantly impotent by the adoption of *So and So's* patent continuity device.

Quite recently the writer in the course of his vocation had to do with a number of D.C. motors of a certain well-known make and of up-to-date design. Excellent machines otherwise, they had one potentially weak point. The brush gear was fitted with a tension device, adjustment of which was provided for by means of a small insulating knob, about  $\frac{1}{4}$  in. in diameter, and flush with the metal spindle to which it was attached. It was practically impossible to grip the said knob without some part or other of the hand coming into contact with "live" metal. Another case of, one might well say, unpardonable inconsistency, was a batch of automatic circuit-breakers, splendid switches as regards duty, by the way. The trip coils had been most carefully insulated on the exterior with sheet fibre, the whole finally being securely bound together with several turns of No. 16 bare copper wire, the ends of which were firmly anchored to one of the breaker's live terminal binding posts.

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## EFFICIENCY IN THE ESTIMATING DEPARTMENT.

[COMMUNICATED.]

In the hurry and rush of modern business, and particularly during "boom" periods, such as that which we are at present experiencing, it is impossible to give too much attention to those internal methods, which, when carefully arranged, make for smooth working. The writer hopes, therefore, without giving an exhaustive description of estimating department practice, the following remarks may prove of interest and value:—

Considering, in the first place, the personnel of the department, there can be little doubt that, in most cases, the average engineer, by his very training, becomes unfitted to take control of office routine work, but, perhaps, in the future, the further development of the so-called "commercial" engineer will tend to improve matters in this respect. However, when the most desirable state of affairs is not possible, it should not be detrimental to the work of the department if the head be a non-technical man, provided he has that keen commercial spirit, tact, and general capability which are essential, and can be assured of an adequate staff of assistants. These assistants may be partly recruited from pupils who have finished their shop experience, and have also been through the drawing and design offices, &c., but a proportion of them should be on the permanent staff, so far as is possible.

Taking here as an example one of the "universal provider" class of manufacturers, the sectional work should be subdivided within reasonable limits, and with careful consideration of its nature. To quote an instance, the machine section should obviously deal with all the concomitant apparatus, such as starting, regulating and switchgear, &c. This sub-division, however, must not be carried to extreme, and it is a mistake to go so far as to create several estimating departments where one should suffice, thereby involving a certain amount of overlapping, duplication of work, and lack of cohesion, besides increasing the establishment charges, which disadvantages greatly outweigh the few minor advantages obtained with the separate departmental system.

With regard to clerical routine, the following procedure is one which the writer has found by experience to be most advantageous.

Enter every inquiry immediately on receipt under the following headings:—Date received; reference number of inquiry; name; description (class of apparatus stated briefly); date quotation due out.

These headings could, of course, be extended to suit various requirements. It may, for instance, be useful to add a column for the name or initials of the estimating man who will prepare the tender, or for that of the salesman who will follow it up. The reference number should be quoted in all correspondence, and when, as is often the case, a later revised inquiry is received, it is not advisable to assign a new reference number, but the original number should be retained, with the suffix "a," &c. If this method is not observed, considerable difficulty in keeping the correspondence files straight may be experienced.

Such an elementary matter as indexing need not be here mentioned in detail, but although it forms part of the deadly dull routine work usually relegated to the office boy, its prompt and accurate execution is essential to the well-being of the department.

There is one point of great importance (though nevertheless often neglected), viz., that all inquiries should be immediately acknowledged where it is not possible to quote by return post. Frequent negligence in this matter is discourteous and inexcusable, and, being so, naturally causes offence, and in these days of keen competition no one can afford to offend a possible customer. This leads up to an equally important requirement, namely, the necessity of preparing and dispatching quotations and tenders with the utmost expedition. It is, unfortunately, too often the case that there is a prolonged delay in sending out estimates, with exasperating results all round. Imagine the consternation and distress of mind of an unfortunate salesman, following up a tender, after perhaps several hours' travelling under the worst conditions, upon being told on arrival that the order was placed some days "before your people quoted, as I thought they were too busy!"

When it is necessary to refer to one or more of the design departments, to the drawing office, or any other part of the organisation, or to outside manufacturers, steps should be taken to ensure that each portion of the specification is put in hand concurrently, and not consecutively. This may be done by copying out essential extracts, but such typing should be carried out judiciously, for to retype the whole of a long specification is, in most instances, sheer waste of time. (In the case of publicly advertised contracts, most municipal bodies will willingly furnish a duplicate copy of the specification.) It is impossible to emphasise this question of promptitude too much, as it constitutes one of the principal factors tending towards good business relationships between the manufacturer and his customer.

In the case of an important inquiry, where ample time is allowed for preparation of the tender (and *à propos*, some kind friends err very much the other way: may they read these notes!) it will be found very advantageous to go through the specification immediately on receipt and to make memoranda of the more important features before referring it to the designing engineers. Later, when finally making up the tender, reference to these notes is an extremely useful check. Such memoranda should preferably be made by the head of the department, before turning the inquiry over to the assistant.

Prices should always be "made up" on an estimate sheet,

this being so arranged as to set forth clearly the cost of each item, freight and packing, special development charges which may be incurred, per cent. profit, total cost, total selling price, &c.; this sheet should be checked by another member of the staff.

All estimating men should cultivate the art of quick and accurate dictation and composition, observing the necessity of stating with brevity and lucidity the vital points of the tender and the more important features of the apparatus; particular emphasis should be laid upon any advantages over competitors' apparatus, which can be demonstrated, and mention made of any installations which may have been carried out. Do not hesitate to submit an alternative proposition, if the circumstances warrant it. Tact in plenty is a very necessary qualification, and is never more required than when corresponding with clients having idiosyncrasies (they do exist!). Avoid ambiguity of expression, repetitions, and side issues. Even if not asked for, it is advisable to state a time for delivery, and to forward descriptive literature, illustrations, and dimensioned prints, as attentions of this nature at the outset are not only appreciated by the prospective customer, but are helpful to the salesman, and often save future correspondence.

Three copies of the quotation may be made, these being disposed of as under:—

1. Filed numerically with complete correspondence in suitable folder.
2. Filed alphabetically in customer's docket.
3. Handed to the salesman.

Further copies may, of course, be distributed to meet any requirements that may arise.

As indicated at the outset, these notes are by no means intended to be exhaustive, but the writer ventures to hope that they will be of some use to others who may be considering the subject as it affects their own particular sphere, though the application of the suggestions herein expressed will not, of course, produce any good results unless tempered with that grain of common sense, without which no system, no matter how perfect theoretically, can flourish.

**The International Ampere.**—A detailed account is given in No. 2, Vol. 8, of the "Bulletin of the Bureau of Standards," of the work done by Messrs. E. B. Rosa, N. E. Dorsey and J. M. Miller in a redetermination of the international ampere in absolute measure. The mean of the five most accurate previous determinations gave for the E.M.F. of the Weston normal standard cell at 20° C. the value 1.01824 "semiabsolute volts." The authors adopted the Rayleigh balance, with a single moving coil suspended coaxially between a pair of fixed coils, the planes of the coils being horizontal. Water-jackets were employed to maintain the fixed coils at a definite temperature, and to ensure perfect constancy in the unavoidable convection currents due to the heating of the moving coil, the effect of which was eliminated by successive weighings with the current in the fixed coils reversed. The construction of the balance and of the coils, &c., is minutely described in the article, as well as the methods of making the observations, which extended over four years. The final conclusion is that the E.M.F. of the Weston cell at 20° C., as realised by the Bureau of Standards, is 1.01822 "semiabsolute volts," with a possible uncertainty of 2 parts in 100,000. The result differs from that obtained in 1907 at the National Physical Laboratory (1.01818 volts) by 4 parts in 100,000. Part of this may be due to a real difference in the E.M.F. of the standard cells. The International Committee has defined the E.M.F. of the Weston normal cell as 1.0183 international volts.

From the results obtained is deduced the value of the electrochemical equivalent of silver, 1.11804 mg. per coulomb. The value adopted by the London Conference was 1.11800.

The article describing the investigation occupies 124 pages of the *Bulletin*.

**Electrical Industries in the U.S.A.**—The following table gives the approximate results of the past year's electrical work in the United States, as estimated by the *Electrical World*:—

	1911.	1912.
Electrical apparatus made ...	\$325,000,000	\$350,000,000
Electric railway earnings ...	575,000,000	625,000,000
Central station earnings ...	375,000,000	450,000,000
Telephone earnings ...	310,000,000	350,000,000
Telegraph earnings ...	75,000,000	85,000,000
Isolated plant service ...	125,000,000	125,000,000
Miscellaneous electric service ...	100,000,000	125,000,000
	\$1,885,000,000	\$2,110,000,000

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING DECEMBER, 1912.

THE December returns of electrical business, which we publish herewith, complete the series for the year 1912.

The exports for the month amounted in value to £510,700, inclusive of telegraphic material, and to £456,874, exclusive of the latter, and represent rather above the average value for a month.

The totals for the preceding month, comparing with the above, were £468,465 and £430,000 approximately.

The imports for the month reached £231,554, a decrease on the previous month's total of £252,672; the latter figure, however, is considerably above the average of the year.

The re-exports, at £24,867, were over £5,000 less in value than in November.

As the export figures indicate, December was a good month for

the home electrical manufacturer, whose staple exports, machinery and cables, were represented to the extent of some £198,000 and £102,000 respectively.

In other lines, telephonic exports were valued at £60,000 roughly, but some falling off occurred in the battery, lamp and instrument sections.

In the case of the imports, the value of machinery, telegraphic and telephonic material, and electric lamps, entering this country fell considerably as compared with November, but the cable imports more than doubled those of the latter month.

Our best customer during December was India, with Canada, New South Wales, and Brazil following; Germany sent us some £150,000 worth of material during the same period.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable, and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	1,213	192	104	67	62	575	5,481	484	...	101	328	978	9,585
Germany ...	1,636	2,201	110	31	577	...	2,335	...	8	3	49	...	6,950
Netherlands, Java & Dutch Indies ...	537	2,876	139	32	54	142	1,980	40	65	18	7	634	6,524
Belgium ...	623	705	435	49	153	61	2,566	281	3	75	941	218	6,110
France ...	778	...	5,032	88	39	12	14,097	246	...	...	315	1,240	21,847
Portugal ...	414	42	...	18	11	26	759	18	...	13	237	38	1,566
Spain, Canary Isles and Spanish N. Africa...	2,759	5,218	291	211	3	312	10,175	2,635	7	25	246	569	22,451
Switzerland, Italy and Austria-Hungary ...	293	36	124	9	79	41	2,225	511	...	430	30	3,239	7,017
Greece, Roumania and Turkey ...	91	8	213	16	12	8	1,771	9	43	12	1,050	31	3,264
Channel Isles, Gibraltar, Malta and Cyprus...	354	539	117	119	19	11	17,775	...	...	...	32	145	9,111
U.S.A., Philippines and Cuba ...	216	7	31	452	344	245	1,060	...	...	185	...	357	2,897
Canada and Newfoundland ...	535	3,040	1,114	1,460	...	3,154	32,560	...	8,717	3	286	348	51,217
Br. West Indies, Br. Honduras and Br. Guiana	162	36	20	42	17	8	385	...	...	32	28	48	778
Mexico and Central America ...	25	14	...	12	...	...	52	...	...	...	14	612	1,119
Pern and Uruguay ...	48	7	17	62	16	...	306	...	...	5	...	10	746
Chile ...	553	336	180	123	5	150	4,576	733	151	42	...	560	7,409
Brazil ...	1,716	3,686	1,771	345	9	292	7,203	904	82	78	9,286	20,657	46,023
Argentina ...	2,202	8,564	626	321	167	285	3,864	2,356	4,874	248	2,584	3,531	29,622
Colombia, Venezuela, Ecuador and Bolivia...	122	38	1,263	16	...	...	1,646	...	...	17	8	805	3,946
Egypt, North Africa and Persia ...	199	1,984	104	244	9	...	624	72	15	7	12	974	4,244
British West Africa, Congo, Liberia, &c. ...	52	168	48	54	14	115	17	...	2	27	219	97	813
Rhodesia, O.R.C. and Transvaal ...	2,434	1,991	454	967	4	469	1,606	112	17	44	354	18	8,470
Cape of Good Hope ...	1,852	2,392	502	605	6	35	3,271	2,390	650	87	188	34	12,012
Natal ...	1,029	6,113	393	69	...	...	812	...	52	1	425	64	8,958
Zanzibar, Brit. E. Africa, Mauritius & Aden	132	94	190	149	...	689	540	32	31	11	40	261	2,169
Azores, Madeira and Portuguese Africa ...	364	316	78	41	11	46	491	...	...	11	66	245	1,669
French African Colonies and Madagascar ...	...	5	...	16	...	...	33	...	5	...	...	64	123
China and Siam ...	406	1,620	210	136	6	168	770	882	30	4	268	6,892	11,392
Japan and Korea ...	668	2,966	617	55	4	902	21,843	...	2,234	8	3,365	345	33,007
India ...	5,103	20,191	4,815	1,380	164	760	14,597	1,687	1,344	266	381	1,650	52,341
Ceylon ...	324	569	101	41	34	516	615	16	2,266	...	32	19	4,533
Straits Settlements, Federated Malay States, Sarawak and Borneo ...	1,387	1,497	405	33	12	112	1,354	34	169	143	79	4,255	9,480
Hong Kong ...	55	73	215	11	...	131	253	...	...	3	...	...	746
West Australia ...	238	301	98	51	8	232	454	...	...	17	2,831	101	3,836
South Australia ...	814	2,923	90	229	3	538	1,080	...	447	8	481	56	6,669
Victoria ...	2,369	8,184	581	560	69	163	4,140	520	885	14	3,225	1,527	22,237
New South Wales ...	5,159	17,480	319	307	128	421	16,714	2,150	286	...	5,705	1,983	50,652
Queensland ...	140	562	42	104	12	100	6,934	44	10	...	10,181	204	18,333
Tasmania ...	153	...	68	...	...	...	8	...	...	132	...	537	898
New Zealand and Fiji Islands ...	1,494	4,676	466	350	4	665	4,050	695	935	...	6,801	1,078	21,214
<b>Total, £</b>	<b>38,649</b>	<b>101,644</b>	<b>21,383</b>	<b>8,875</b>	<b>2,055</b>	<b>11,384</b>	<b>181,022</b>	<b>16,841</b>	<b>23,360</b>	<b>2,051</b>	<b>49,636</b>	<b>53,826</b>	<b>510,700</b>

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	28	21	...	146	38	...	3,152	281	308	25	9,301	13,300
Germany ...	10,230	15,674	1,827	17,217	9,208	4,507	63,300	11	5,694	9,484	13,192	150,344
Holland ...	...	117	...	2,500	1,027	...	22	...	...	...	142	3,808
Belgium ...	571	5,165	79	366	205	54	3,454	20	266	27	8,227	18,434
France ...	241	1,150	1,052	1,073	205	364	702	151	251	3,873	658	9,720
Switzerland ...	241	809	4	64	...	223	887	21	17	45	720	3,031
Italy ...	20	2,376	218	...	520	...	896	13	...	...	1,398	5,441
Austria-Hungary ...	...	2,257	...	549	56	...	190	...	15	1,504	...	4,571
United States ...	3,170	60	322	18	579	206	9,987	6,463	425	20	846	22,096
<b>Total, £</b>	<b>14,501</b>	<b>27,629</b>	<b>3,502</b>	<b>21,933</b>	<b>11,838</b>	<b>5,354</b>	<b>82,590</b>	<b>6,960</b>	<b>6,976</b>	<b>14,978</b>	<b>34,184</b>	<b>230,745</b>

Additional imports: Spain, carbons, £210; Japan, glow lamps, £15; Victoria, telegraphic goods, £209; and Canada, carbons, £375.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	13,636	1,425	...	2,802	519	...	5,257	...	163	1,061	4	21,867
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TOTAL EXPORTS: £510,700.

TOTAL RE-EXPORTS: £24,867.

TOTAL IMPORTS: £231,554.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

**ELECTRICAL EXPORTS AND IMPORTS DURING 1912 AND PREVIOUS YEARS.**

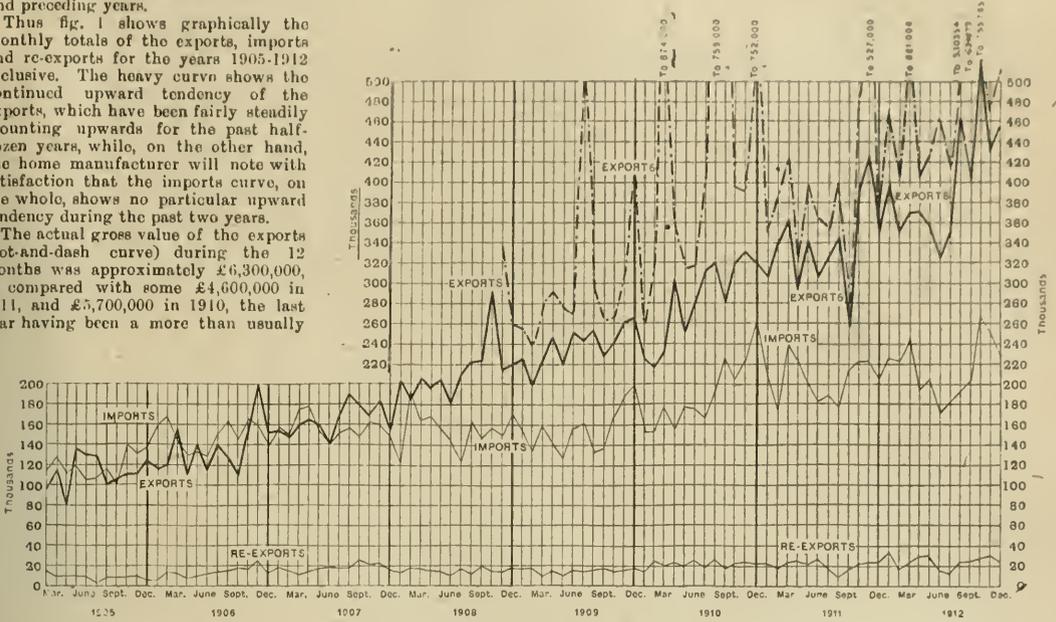
As in previous years, we publish simultaneously with the December returns of electrical exports and imports, a series of curves illustrating as concisely as possible the trend of electrical business during 1912 and preceding years.

Thus fig. 1 shows graphically the monthly totals of the exports, imports and re-exports for the years 1905-1912 inclusive. The heavy curve shows the continued upward tendency of the exports, which have been fairly steadily mounting upwards for the past half-dozen years, while, on the other hand, the home manufacturer will note with satisfaction that the imports curve, on the whole, shows no particular upward tendency during the past two years.

The actual gross value of the exports (dot-and-dash curve) during the 12 months was approximately £6,300,000, as compared with some £4,600,000 in 1911, and £5,700,000 in 1910, the last year having been a more than usually

In 1910, and £231,000 in 1909, the larger proportion of which, of course, represents machinery and cable.

The character of the imports curve has been noted above; actually the average monthly value of approximately £217,000 was somewhat higher than that obtaining in 1911 while the same also applies to the re-exports, which were slightly on the up-grade.



The upper export curve is inclusive of telegraphic exports from November, 1908.

FIG. 1.—CHART SHOWING MONTHLY ELECTRICAL EXPORTS AND IMPORTS DURING THE PAST EIGHT YEARS.

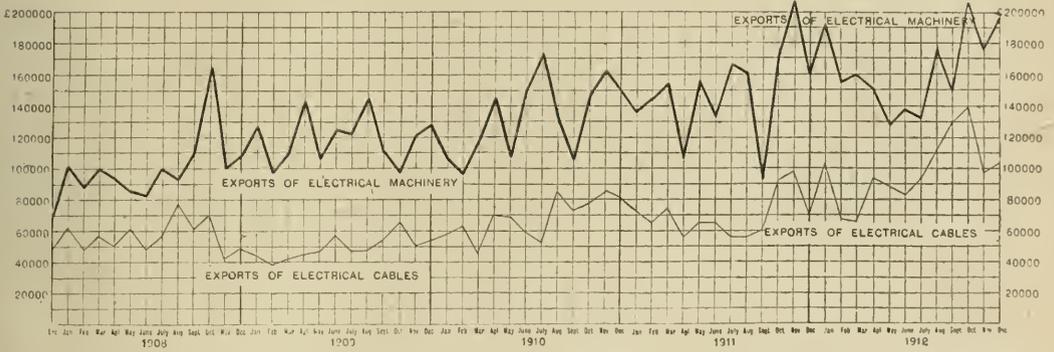


FIG. 2.—MONTHLY EXPORTS OF ELECTRICAL MACHINERY AND ELECTRIC CABLE, OTHER THAN TELEGRAPHIC OR TELEPHONIC CABLE, DURING 1908-12 INCLUSIVE.

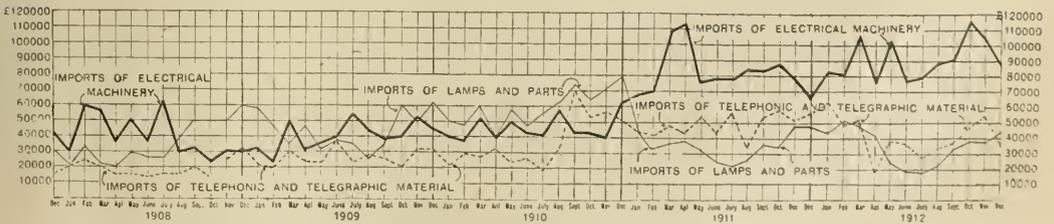


FIG. 3.—MONTHLY IMPORTS OF ELECTRICAL MACHINERY, TELEGRAPHIC AND TELEPHONIC MATERIAL AND CABLE, AND ELECTRIC LAMPS AND PARTS, DURING 1908-12 INCLUSIVE.

busy one for the telegraphic manufacturers, judging by the high total recorded.

Excluding telegraphic exports, the fluctuating character of which has been noted by us on several occasions, there remained an average monthly electrical export of nearly £400,000 during 1912, as compared with £338,000 in the preceding 12 months, £285,000

One or two suspicious kinks will be noted in the export and other curves during the past two years; such are particularly noticeable during 1912, where they roughly coincide with the labour troubles in connection with shipping and transport.

Turning to fig. 2, the progressive character of our export business in machinery and cables is clearly shown; the cable section in 1910

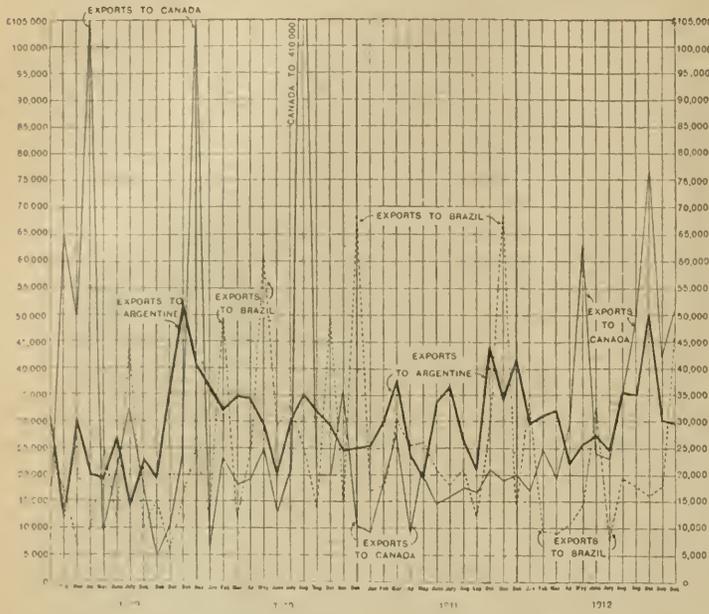


FIG. 4.—ELECTRICAL EXPORTS TO CANADA, ARGENTINA AND BRAZIL, 1909-12.

icates a particularly gratifying improvement after what has been a steady climb for some years.

It is interesting to compare with the above the year's progress of the three principal electrical imports into this country, shown in fig. 3, from which it will be observed that, although the value of machinery entering this country compared well with the preceding year, a decided decrease occurred in telegraphic and telephonic imports, while the lamp business was apparently a repetition of that for 1911.

**Purchasing Countries and Importers into the United Kingdom.**

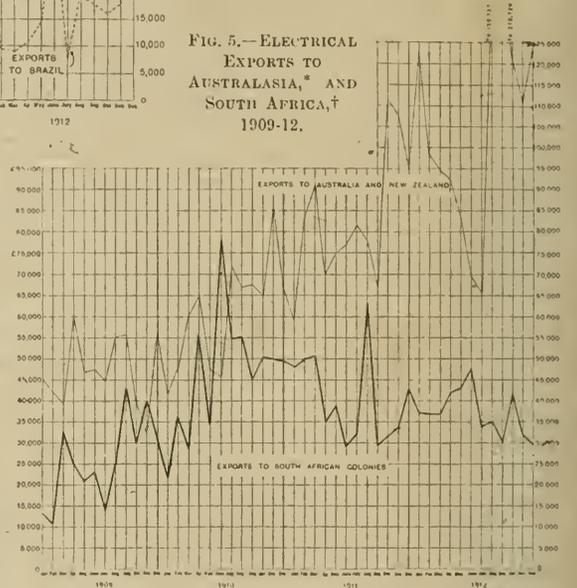
The remaining curves, in figs. 4, 5, 6 and 7, are an extension of those appearing a year ago, and bring up to date the various export and import features dealt with therein. Fig. 4 is of particular interest, as it emphasizes the rapid development of the Canadian market, which bids fair to easily outdistance the other American markets shown in the same chart, viz, Argentina and Brazil. In point of fact, our Brazilian electrical business declined heavily as compared with the previous two years, while our exports to the Argentine Republic show a comparatively small expansion as compared with the preceding year, and in view of the great electrical progress being made out there.

The two curves shown in fig. 5 are also of great interest as they indicate the expansion of our Australasian export business, beside which the lower curve of dwindling South African business is a disappointing contrast. Since June, 1910, our collective electrical exports to South Africa have steadily fallen off, due, no doubt, to the strong position of the German electrical interests on the Rand where the bulk of the engineering development has taken place.

The sixth set of curves shows the trend of our Indian and Far Eastern business; Japan, it will be seen, has been a particularly good customer during the past year, and, although to a less extent, India also increased her electrical trade with us. China, on the other hand, still remains "the coming market" so far as the British electrical manufacturer is concerned, judging by the almost featureless record of Chinese electrical business with this country during the past two years.

The last diagram, fig. 7, illustrates the progress made by our most prominent foreign

FIG. 5.—ELECTRICAL EXPORTS TO AUSTRALASIA,\* AND SOUTH AFRICA,† 1909-12.



\* Includes New Zealand, Australian States and Tasmania.  
 † Includes Cape Colony, Natal, Transvaal, Orange River Colony and Rhodesia.

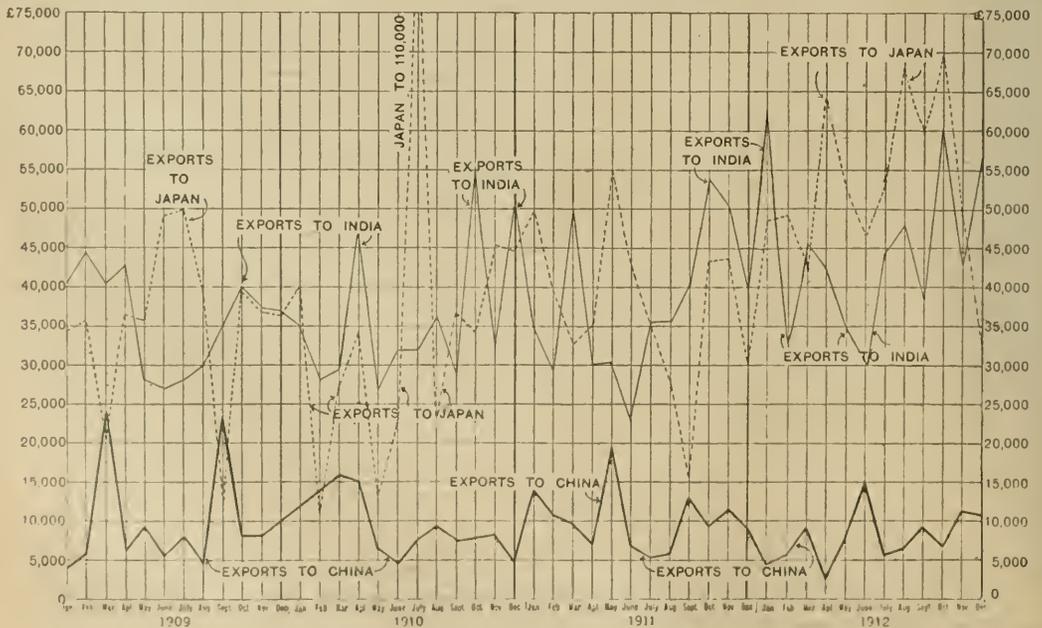


FIG. 6.—ELECTRICAL EXPORTS TO JAPAN, INDIA AND CHINA, 1909-12.

competitors in the English market during the past four years. It will be noted that only a slight extension of business, in any case, is indicated by any of the curves, unless it be with the U.S.A. German electrical imports into this country, still far ahead of those of any other country, were probably a little in excess of those during the preceding year, and amounted roughly to an average of £110,000 per month.

It should be understood that this represents electrical goods which were absorbed almost entirely by the people of this country (not being re-exported to any appreciable extent). As the figure

**NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.**

**"Meta" Heaters.**

THE METALLIC SEAMLESS TUBE CO., LTD., of 153, Corporation Street, Birmingham, are supplying a number of pleasing designs of electric heating apparatus, as the accompanying illustrations will

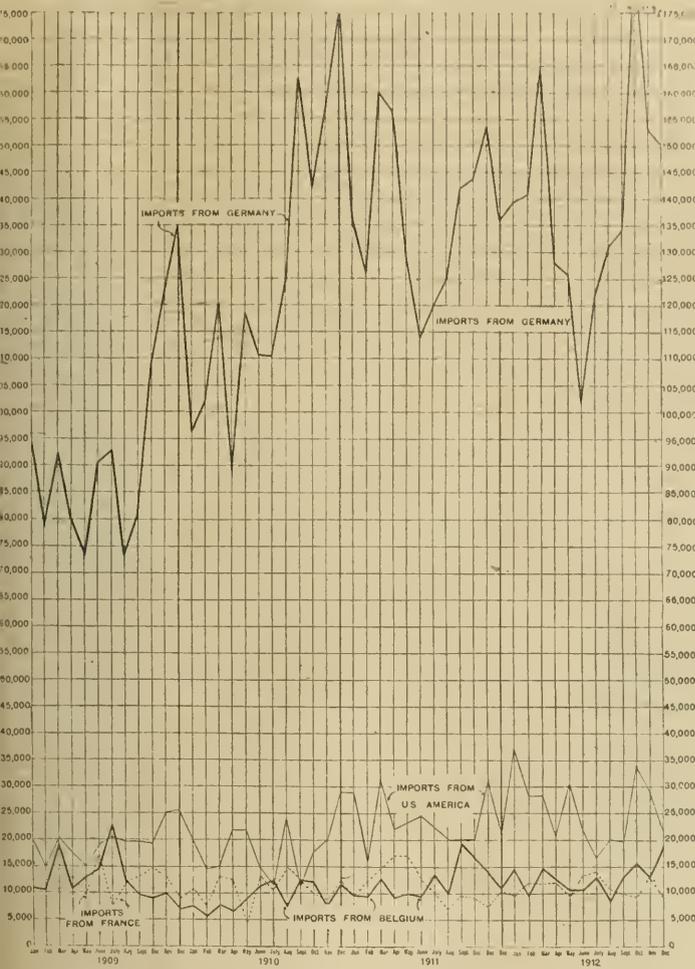


FIG. 7.—ELECTRICAL IMPORTS FROM GERMANY, U.S.A., BELGIUM AND FRANCE, 1909-12.



FIG. 1.—ELECTRICAL WARMING PLATE.



FIG. 2.—"META" FRYING PAN.



FIG. 3.—"META" HEATER.

mentioned amounts to about 26½ per cent. of our own average electrical exports to the whole of the world's markets, and the latter, we believe, form no inconsiderable proportion of the internal electrical trade of this country, it is evident that the German electrical industry still retains a very large proportion of the latter despite the efforts of the home manufacturer.

To some extent, no doubt, Germany retains her pre-eminent position by her adaptability to trade conditions, as, for instance, when a year or two since the metal lamps she imported into this country suddenly increased to a value in excess of machinery imports. Again, during the past year it is noticeable that German magneto imports have been increasing to large proportions, some £25,000 worth figuring in the December returns; this business, in common with a good deal of other small motor-car electrical supplies, represents work which might well be retained by the British manufacturer.

**General.**

In conclusion, it is evident that the year, in comparison with previous ones, has been a prosperous one for the exporter, despite the interference of labour troubles at home. Probably the most interesting feature was the rapid growth of the Canadian export business, which, in view of the great attention which has been drawn to its possibilities in our pages, is particularly gratifying to ourselves. Australia, India, Japan and, to a less extent, Argentina, were also improving markets, but, unfortunately, the best that can be said of our business with Brazil, our South African colonies and China is that it does not, so far as we can see, expand.

show. These are some of their popular domestic lines of "Meta" apparatus, of which prices are given in a new folder just issued for the use of the trade. Fig. 1 is a specimen of a warming plate, intended for table or sideboard use, for keeping dishes or food warm. It is constructed of brass, electro-plated, with aluminium top, either 7½ or 9 in. diameter. Fig. 2 is a "Meta" frying pan, 11 in. diameter, in polished aluminium; it has four-heat regulation by using triple cable. In fig. 3 will be found a "Meta" heater with two-heat regulation by two switches. This heater, which measures 16 in. x 16 in. x 8½ in., has a sheet-metal body mounted upon a cast-iron frame, and is finished black and relieved. Copies of the folder mentioned can be obtained free of charge, overprinted with name and address, on application to the company.

**Device for Making Earth Connection.**

The accompanying illustration (fig. 4, p. 202) shows an earth connection which is now being manufactured by the L.S. BRACH SUPPLY CO., of New York City. It is claimed that this device will produce a low-resistance contact between the earth wire and the earth itself which it is impossible to secure through the earth wire or plate in common use. To accomplish this, the earth connection has been designed to retain the moisture in the vicinity of the contact, to present a sufficiently large area of metal surface to the earth, and to ensure firm contact between the earth and the metal plates. To secure moist earth, three bowls or cups are fastened to a centre rod, providing a means for rain water as it soaks through the earth to be caught and retained within the earthing device itself. This water will remain in the bowls as long as the surrounding earth is moist.

When, by reason of the hot sun, evaporation takes place and the earth becomes dry, there still remains a local moist area due to the water that will be given off from the bowls. To aid in attracting and holding water, small pieces of charcoal are placed within the bowls and covered by a perforated metal screen. The perforated screen itself is intended to protect the space in the bowls from being filled up by the surrounding earth, so that ample water space may be retained. The three bowls, being sweated to the centre rod, offer more than three times the exposed surface which the common



FIG. 4.—DEVICE FOR MAKING EARTH CONNECTION.

ground plate can offer for a hole of given size. The third essential, that of securing firm contact with the earth, is provided for by reinforcing the bowls and the metal screw so that the earth may be packed tightly around the earth connection.

At the top of the centre rod a slot milled in a threaded portion affords a convenient means of joining the earth wire to the earth connection. These "hydro-grounds," as they are called, are now being manufactured in three standard sizes, each size carrying three bowls of varying diameters.—*Electrical World*.

**A New Electric Sign.**

THE FRANCO-BRITISH ELECTRICAL CO., LTD., of 50, Oxford Street, London, W., have just completed the erection of an animated sign, of which we give a reproduction from a photograph taken



FIG. 5.—"FRANCO" ANIMATED ELECTRIC SIGN.

while it was alight. The sign is made up on their well-known "Franco" principle, and is fitted with their patent porcelain holders and nearly 200 1-c.p. carbon lamps. The whole of the sign is supplied from a transformer, the secondary of which works at

14 volts and about 250 amperes, the corresponding primary taking 17 amperes at 200 volts. The sign works in connection with a "Franco" flasher which controls the whole of the 250 amperes. The working of the sign is as follows:—First of all, "The Angel" and "Kingston Bros." light up, then the barrel and the outline of table and glass; next a hand appears at the tap of the barrel and amber lamps representing a stream of beer become illuminated and have the appearance of continually flowing down into the glass, the latter gradually filling up with amber lamps until the top is reached. The froth now commences to rise and eventually to flow down the side of the glass and spread out over the table. After it reaches the edge of the table, the hand on the barrel disappears and the flow of beer stops. The froth on the glass then gradually subsides and the part which is at the side of the glass also goes out, leaving that which is on the table; this then commences to effervesce, and while so doing the words "Base Best Beer Drawn from the Wood" come in, one word at a time. After being alight in this way for some two or three seconds, the whole goes out and recommences. There are 75 switch wires controlling the sign. Although the surface of the sign is quite flat, the painting has been carefully done in order to give the necessary appearance. The sign is erected in Stratford Broadway and was supplied and fixed for Messrs. Stuart A. Curzon, of Westminster.

We understand that during the first few nights that this sign was alight, large crowds assembled in front of the public house to watch the operations, and it is said that the sign has not been a help to the temperance cause, judging from the increase in takings.

**Instanta Adjustable Rise-and-fall Pendants.**

A new rise-and-fall adjustable pendant, illustrated in fig. 6, has recently been designed by MESSRS. F. A. WILKINSON & PARTNERS, LTD. By its use the lamp can be raised or lowered to any desired degree by simply pressing the spring attached to the vulcanite

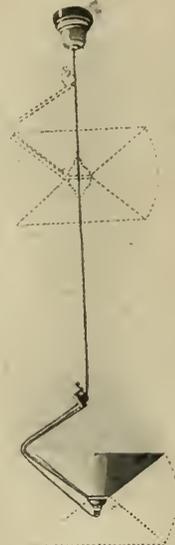


FIG. 6.—INSTANTA ADJUSTABLE PENDANT.

head. At the same time all the advantages of reflected or indirect lighting can be obtained from an ordinary lamp pendant.

The fitting can be attached to an ordinary pendant in a few moments without any rewiring or disconnection, and by its use the usual counterweights and pulleys are dispensed with.

**A New Folding Scaffold.**

We illustrate in fig. 7 an invention of MR. HEATHMAN, of Parson's Green, Fulham—a handy scaffold, for use in premises where every inch of storage space is a consideration. The "Shorolds" pattern telescopic folding scaffold trestle can be stored in a very small space, and easily carried to the position where it is desired to set it up for use. The trolley base is upon castors, so that it may be of service to move goods upon with a box or basket made to size for daily warehouse service, while it is available for the trestles for decorating purposes out of the usual business hours. The trestles are rapidly set up and fixed to the carriage by set screws, and the sliding section is easily adjusted to the height requisite to reach the work to be done. Two sets can be used conjointly with scaffold boards and protection rails, or one scaffold can be used separately as varying circumstances necessitate. The whole can be carried upon a barrow or



FIG. 7.—HEATHMAN SCAFFOLD.

cart, and is made in three or four sections (as well as the two sections illustrated) so that they may be used for very low as well as high rooms; the ladders can be used quite independently of the trolley base to lean against walls, as three separate ladders to each set, or as self-supporting trestles. These trestles are made with larger wheels for road and street service.

**The Electric Grate.**

A novel design of electric fire, illustrated in fig. 8, has been placed on the market by MESSRS. F. A. WILKINSON & PARTNERS, LTD., of Hatfield, Herts. Composed throughout of polished copper, with brass facings, it is extremely handsome in appearance, and in keeping with the most luxurious surroundings. The total power consumption of the grate is 28 units per hour, and heat regulation is effected by means of the two switches. There are four self-contained heating elements, each having a capacity of



FIG. 8.—ELECTRIC FIRE-GRATE.

700 watts. In design and appearance they are similar to ordinary incandescent lamps, but are mounted on mica bases and fitted with pin plug connections, the elements thus being instantly replaceable. An imitation of an ordinary coal fire is arranged within the grate, and when working glows with a cheerful appearance and gives out an intense heat. The dimensions of the grate are 24 in. high, 20 in. deep and 18 in. wide. It can easily be carried about and used anywhere.

**Porcelain Fuse Handles.**

MESSRS. A. REYROLLE & CO., LTD., of Hebburn-on-Tyne, have sent us particulars of their latest type of porcelain fuse handle, which is illustrated in fig. 9. In the earlier design of self-aligning

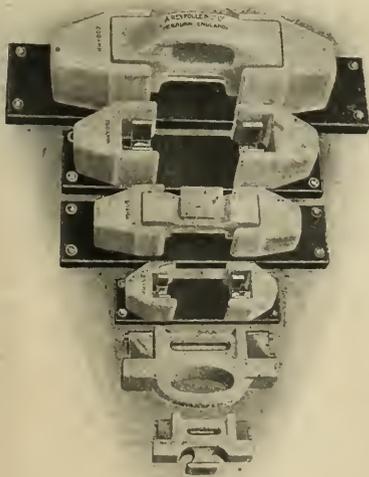


FIG. 9.—PORCELAIN FUSE HANDLES.

fuse handle, the bolt which secured the contact to the porcelain was carried through to the front of the porcelain, and a porcelain button was screwed over the shank. There was a possible disadvantage in this design, inasmuch as there was always the danger

of the porcelain button being broken, although the makers never had a case brought to their notice. In order to obviate any objection on this account, they now make the porcelain solid, and the bolts securing the contacts are screwed into nuts let into the porcelain, even in the smaller sizes there is not less than about 1/4 in. of porcelain between the hand and the live metal.

**FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.**

**AMENDMENTS.**

**ECUADOR.**—The Board of Trade has received a copy of a decree revising the tariff and tariff laws, with effect from January 1st, 1913. Amongst other things, it has been decided to impose a surtax of 17 per cent. *ad valorem* at all Customs Houses, where parcels are received by post, on all goods, with the exception of certain foodstuffs, agricultural implements and cotton goods. As regards incorrect declaration of the weight of imported goods, it has been decided that all excess of weight of 10 per cent. or more between the real weight and the weight declared in the Consular invoice manifest or application for clearance shall be penalised with a surcharge of 100 per cent. on the duties leviable; when the difference is less than 10 per cent., duty will be payable on the actual weight of the goods. A provision has been added to the valuation regulations to the effect that the value of the goods which is to be declared in the Consular invoice is that of the goods at the place of origin. The declaration for clearance of goods from the Customs, which must be presented within eight days after the arrival of the vessel carrying them, must specify, among other particulars, the net and gross weight of each imported package.

The following modifications of the Customs treatment of certain goods have also been made:—

	Previous rate.	Present rate.
"Focosa" for electric lamps ... ..	not specified	1 centavo per kg.
Lifts ... ..	5 centavos per kg.	free

NOTE.—100 centavos = 2s.

**RUSSIA.**—An arrangement has been made with the United States Government that goods of American origin imported into Russia shall be given the benefits of the lower rates of duty leviable under the "Conventional Tariff" which is applicable to goods imported from countries having most-favoured-nation arrangements with Russia. As a result of this arrangement, certificates of origin will no longer be required for goods imported from countries other than the United States in order to prove their non-American manufacture.

**SPAIN.**—It has been decided that English gold coins and Bank of England notes will be accepted by the Spanish Customs at their full value in payment of Customs duties. Bills of exchange or cheques on London, provided they are drawn in pounds sterling, are duly guaranteed and can be cashed at the exact equivalent in gold of their face value, will also be accepted.

**UNITED STATES.**—The Customs authorities have decided to grant free entry of articles imported in order to be exhibited at expositions to be held in New York by the Merchants' and Manufacturers' Exchange of that city.

**MEXICO.**—The Board of Trade has received information from Mexico that the proposal of the Mexican Government, recently referred to in the *ELECTRICAL REVIEW*, to increase the Customs duties by 7 per cent., has been approved by the House of Representatives. It will, however, still have to be approved by the Senate before it becomes law.

**ST. VINCENT.**—The Government of St. Vincent has decided to continue to levy the surtax of 10 per cent. of the duties levied on all goods imported into St. Vincent from January 1st last until March 31st next.

**HOLLAND.**—The Dutch Customs authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods:—

Fully finished copper bonds for electric tramway rails, dutiable as "finished copper goods" at the rate of ... ..	5 % ad val.
Steel pins belonging to the above, as "Steel goods," at the rate of ... ..	5 % ad val.
Switchboards—	
Belonging to, and imported at the same time as, dynamos or duty-free electric motors ... ..	Free.
In other cases—dutiable as "instruments," at the rate of ... ..	5 % ad val.
Marble slabs and slate slabs for switchboards, not furnished with any fittings ... ..	Free.

**FRANCE.**—The French Customs authorities have decided that current limiters (automatic switches to prevent the excessive consumption of electricity) are to be dutiable as electrotechnical apparatus at rates varying from 20 fr. to 110 fr. per 100 kg., according to weight and nature. Detached parts of these current-limiters will be dutiable as "detached parts of electrotechnical apparatus," at rates varying from 25 fr. to 110 fr. per 100 kg. according to weight. It has also been decided that steam or water turbines imported without their shafts are to be treated as incomplete apparatus.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

996. "Electric heating apparatus." M. J. RAILING and C. H. ANCHER. January 13th.
997. "Telegraphically transmitting signals by means of a perforated strip." SIEMENS BROS. & CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) (Addition to 8,103 of 1908.) January 13th. (Complete.)
998. "Hot-wire electric measuring instruments." SIEMENS BROS. & CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) January 13th. (Complete.)
997. "Wireless telegraph installations for aerial vessels." L. ROTZKE. January 13th. (Complete.)
- 1,002. "Series systems of incandescent lamp lighting." E. BOOTH and N. R. BOOTH. January 14th.
- 1,010. "Protective device for electric motors and electrically-driven machinery." G. P. HEARN. January 14th.
- 1,047. "Apparatus for controlling motion from a distance applicable more particularly to the control of searchlights or projectors, steering gear and the like." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Addition to 956 of 1912. Convention date, July 24th, 1912, Germany.) January 14th. (Complete.)
- 1,049. "Telephony and like systems." E. A. GRAHAM and W. J. RICKETS. (Addition to 19,095 of 1911.) January 14th.
- 1,064. "Magneto sparking plugs." SIEMENS & HALSKE AKT.-GES. (Convention date, January 26th, 1912, Austria.) January 14th. (Complete.)
- 1,066. "Electrical accumulators." C. DE SEDNEFF. (Addition to 18,571, 1912.) January 14th. (Complete.)
- 1,068. "Electric water heaters." E. M. T. BODDAM. January 14th.
- 1,069. "Loud-speaking telephone for closed motor-cars and other closed carriages." R. PECORINI. January 14th. (Complete.)
- 1,093. "Magneto apparatus for use especially in connection with internal-combustion engines." "MAGAM" MOTOR APPARATE G.m.b.H. (Convention date, February 3rd, 1912, Germany.) January 14th. (Complete.)
- 1,098. "Apparatus for producing electricity." R. J. MEYERS. January 14th. (Complete.)
- 1,100. "Devices for the production of induced currents in magneto machines, dynamos, and other induction generators." A. KELLER-DORIAN. (Convention date, August 9th, 1912, France.) January 14th. (Complete.)
- 1,103. "Electrical control of drop hammers." BRITISH THOMPSON-HOUSTON CO. LTD. (Allgemeine Electricitäts Ges., Germany.) January 14th.
- 1,134. "Resonating relays." H. V. KRAMER and G. KAPP. (Addition to 10,856, 1911.) January 15th.
- 1,149. "Arc-light carbons." H. AVERTON. January 15th.
- 1,157. "Switches for automatic telephone systems." W. J. BRUCE, Jun. (Convention date, January 25th, 1912, United States.) January 15th. (Complete.)
- 1,163. "Incandescent electric lamps." A. A. BARRON. January 15th.
- 1,189. "Windings of dynamo-electric machinery." SIEMENS BROS. DYNAMO WERKE, LTD. (Siemens Schuckertwerke G.m.b.H. Germany.) January 15th. (Complete.)
- 1,198. "Direction indicators for machines." E. LANDI *nee* RICCARDI. (Convention date, May 15th, 1912, Italy.) January 15th. (Complete.)
- 1,199. "Electric revolution counters." E. LANDI *nee* RICCARDI. (Convention date, May 15th, 1912, Italy.) January 15th. (Complete.)
- 1,205. "Apparatus for lighting vehicles by electricity." T. W. TATTERBALL. January 15th. (Complete.)
- 1,207. "Systems of voltage regulation for electric circuits." A. H. OLMSTEAD. January 15th.
- 1,215. "Vacuum-light apparatus." MOORE-LICHT AKT.-GES. (Convention date, April 13th, 1912, Germany.) January 15th. (Complete.)
- 1,223. "Field-magnets." A. ROLFE. January 15th.
- 1,223. "Automatic telephone exchange system." WESTERN ELECTRIC CO., LTD. (Friedrich Wöhler, Germany.) January 15th. (Complete.)
- 1,243. "Electric clock mechanisms." F. T. REID. (Divided application on 1,693, January 22nd, 1912.) January 15th.
- 1,259. "Telephone attachment." A. O'HARE. January 16th.
- 1,277. "Method of rotating a magnetic armature step by step." SIEMENS BROS. & CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) January 16th. (Complete.)
- 1,278 and 1,279. "Electro-magnetically operated sound emitting or calling means." E. A. GRAHAM. January 16th.
- 1,281. "Spark-plugs." C. H. DECFY. January 16th. (Complete.)
- 1,285. "Alarm device for announcing fire and burglary." A. BARES and J. WEISS. January 16th. (Complete.)
- 1,287. "Shades or globe carriers for use with electric lampholders." M. J. RAILING and G. MATCICK. January 16th.
- 1,299. "Devices for telephone exchanges." SIEMENS BROS. & CO., LTD., and T. PERTHOREW. January 16th. (Complete.)
- 1,331. "Electric arc lamp." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 16th.
- 1,397. "Brush-holders for dynamo-electric machines." T. VON SWEIGERBERG. January 16th. (Complete.)
- 1,940, 1,941 and 1,942. "Manufacture of electric incandescent lamps." NAAMLOOZE VENNOOTSCHAP PHILIP'S METAALGLOEILAMPENFABRIEK. (Convention dates, December 6th, 7th and 7th, respectively, 1912, Germany.) January 16th. (Complete.)
- 1,313. "Machines for covering conductors with material." G. DATTA. (Convention date, July 5th, 1912, Belgium.) January 16th. (Complete.)
- 1,395. "Electric resonance operated apparatus." H. W. HANDCOCK, A. H. DYERS and W. DEBDELL. January 17th.
- 1,407. "Connections for continuous electric current apparatus." F. KRIPP AKT.-GES. (Convention date, March 1st, 1912, Germany.) January 17th. (Complete.)
- 1,413. "Means for controlling electric circuits." H. LEITNER. January 17th.
- 1,420. "Process of electrolysis." H. M. DU BOIS. January 17th. (Complete.)
- 1,431. "Combined mechanical locks and electric circuit breakers." ELEKTROMOTOR EQUIPMENT CO., LTD., and W. H. BRENNER. January 17th. (Complete.)
- 1,439. "Electrolytic cells." H. M. DU BOIS. January 17th. (Complete.)
- 1,441. "Electric resistance furnaces." J. A. SCULLAR. January 17th.
- 1,442. "Supports for the filaments of incandescent electric lamps." J. M. ROUX and J. SANCHEZ. January 17th.
- 1,444. "Telephonograph." E. CHARBAULT. January 17th. (Complete.)
- 1,449. "Sparking plugs." A. T. SCOREY and NILEMELOR (ENGLAND), LTD. January 17th.
- 1,457. "Dimmers for electric lamps." E. T. MIDDLEMISS. January 18th.
- 1,471. "Electric plug contact." E. M. WILDEY. January 18th.
- 1,469. "Primary and secondary electrical batteries." F. J. TURQUAND. January 18th.
- 1,406. "Time switches." H. F. J. THOMPSON and J. H. BOWDEN. January 19th. (Complete.)

1,501. "Magneto-electric machines for combined ignition and illuminating purposes." F. P. SIMMS. January 18th.

1,505. "Electrically-operated steering gear." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 18th.

1,512. "Regulators for dynamo." O. E. VON KERCKHOVEN. (Convention date, February 3rd, 1912, France.) January 18th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

## 1911.

ELECTRIC LOCKING DEVICES FOR LOCKS. G. SAHNER. 26,311. November 24th. (Addition to No. 15,991 of 1909.)

ELECTRIC SWITCHES. J. H. WHYMAN. 27,254. December 6th. (July 5th, 1912.)

ELECTRICAL EQUIPMENT OF ROUNDABOUTS, SCENIC RAILWAYS AND THE LIKE. L. A. HACKETT and E. W. WHITMAN. 28,899. December 22nd.

MAGNETIC SEPARATORS. FRIED. KRUPP AKT.-GES. GROSSENWERK. 29,201. December 25th. (January 12th, 1911.)

APPARATUS FOR THE MAGNETIC SEPARATION OF ORES AND OTHER MATERIAL. G. ULLICH. 29,230. December 28th. (Addition to No. 14,082 of 1908, January 17th, 1911.)

ELECTRIC SAFETY LAMPS. G. A. DICKIE. 29,331. December 30th.

## 1912.

STORAGE BATTERY LAMPS. C. B. BARTLEY. 71. January 1st.

PORTABLE UNSPILLABLE ELECTRIC BATTERY LAMPS FOR USE IN MINES, SHIPS AND LIKE PLACES. T. SPARKS. 75. January 1st.

WIRELESS TELEGRAPH RECEIVERS. G. MARCONI and G. S. FRANKLIN. 86. January 1st.

ELECTRIC BATTERIES. P. L. LINEY. 181. January 2nd.

ELECTRIC HEATING ELEMENTS. E. TOWNSHEND. 987. January 5th.

TELEPHONE RECEIVER HOLDER. H. BROWN. 416. January 5th.

ELECTRIC CONTROLLER REGULATORS. H. SELTON-JONES. (AMERICAN AUTOMOBILE CO.) 523. January 6th.

AERIAL CONDUCTORS USED IN WIRELESS TELEGRAPHY. Marconi's Wireless Telegraph Co., Ltd., and C. E. PRINCE. 2,456. January 30th. (Cognate application No. 2,457 of 1912.)

ELECTRIC ARC LAMPS OF THE TYPE IN WHICH CARBONS IMPREGNATED WITH CHEMICALS ARE CONSUMED IN A CHAMBER SUBSTANTIALLY AIRTIGHT. B. A. QUINN. 3,065. February 7th.

LOCOMOTIVES. BRITISH THOMPSON-HOUSTON CO. (GENERAL ELECTRIC CO.) 8,231. February 8th.

MEANS FOR SUPPORTING ELECTRIC LAMPS. BYNG & COLLINGS. 7,157.

POWER TRANSMISSION SYSTEM FOR DRIVING A DYNAMO WHOSE ELECTRICAL ENERGY IS SUBSEQUENTLY UTILISED FOR THE ELECTRIC PROPULSION OF MOTOR VEHICLES, BOATS, AIR-SHIPS OR THE LIKE. P. MARINO. 13,780. June 12th.

INDUCTION ELECTRIC FURNACES. J. BALLY. 16,040. July 9th. (July 11th, 1911.)

ELECTROMAGNETIC TRUCK BRAKES. MAGNET BREMSEN G.M.B.H. 26,295. November 15th. (January 9th, 1912.)

CONNECTION APPARATUS FOR ELECTRIC CIRCUIT CONDUCTORS. T. E. MURRAY. 26,337. November 16th. (Divided application on No. 19,585 of 1912, August 26th.) (February 9th, 1912.)

LIVE RAILS OF ELECTRIC ROUNDABOUTS, SCENIC RAILWAYS AND THE LIKE. L. A. HACKETT and E. W. WHITMAN. 27,046. November 25th. (Divided application on No. 28,899 of 1911, December 22nd.)

**Manchester Electro-Harmonic Society.**—The fourth concert of this excellent Society was held at the Albion Hotel, Manchester, on Friday, January 24th, when there were close upon 200 members and friends present. The programme included a good deal of highly classical music, and the performance was exceptionally well received. The next of these concerts will take place on Friday, February 21st, when the artistes will be as follows:—Solo violin, Mr. J. Sedgwick Bridge; solo cello, Mr. J. H. Foulds; soloist (bass), Mr. Hamilton Harris; entertainer, Mr. Wilfrid Ludlow; pianist and accompanist, Mr. E. Bennett North.

Mr. H. Clifford Palmer writes as follows respecting the evening:—"The Manchester Electro-Harmonic Society bids fair to become the equal of its London parent, if not in numbers, at any rate in quality of entertainment. It was my privilege on Friday evening last to attend one of these functions—to be exact, the fourth of their first season—and right merrily did the evening go. Mr. Dorman (of Dorman & Smith) officiated in the chair. Amongst others, the following well-known electrical men were present:—Alderman Walker (deputy-chairman of the Manchester Electricity Committee), Mr. F. Sells (director of the G.E.C.), Mr. Cramp (H. Simon & Co.), Mr. Marlor (Manchester Corporation), Mr. H. B. Leach, Mr. Shaw, Mr. Eckstein, Mr. W. J. Smith, Mr. J. Gibson, and Mr. J. Hill (hon. sec. of the Society). An excellent programme was provided, including Mr. Albert J. Holt (solo tenor, Manchester Cathedral), Mr. Harold Jones (solo violin), Mr. T. Stanley Greenwood (humorist), Mr. Jacques Fortescue (musical monologues), and Mr. H. A. Palmer (entertainer).

"The programme in general was so thoroughly enjoyable that it is hardly fair to mention one item without referring to all, but it might be said that Mr. Harold Jones's rendering of 'Canzetta' and 'Hejre Kut!' were well worth going many miles to hear. He quite 'brought the house down.' At the conclusion of the evening, Mr. F. Sells, in a few well-chosen words, proposed a vote of thanks to the chairman, which was seconded by Mr. Leach, and responded to in a very cordial manner. These evenings, I was given to understand, have become very popular, and I could testify to the extremely hospitable nature of our worthy electrical confederates in Manchester. These institutions in the provinces are calculated to promote amongst all sections of the industry that *esprit de corps* which, after all, is highly desirable if we are to foster the spirit of co-operative effort, the seeds for which are now being sown. It is to be hoped that the other large industrial centres in the provinces will follow suit."

# THE ELECTRICAL REVIEW.

Vol. LXXII.

FEBRUARY 7, 1913.

No. 1,837.

## ELECTRICAL REVIEW.

## UNIVERSITIES AND TRADE.

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In the January issue of the *Review of Reviews*, Mr. H. E. Morgun pleaded for the building of a half-way house between the University and the city office, to serve the purpose of a sort of superior Labour Exchange for introducing budding talent to remunerative employment in trade and commerce. The article has given rise to some newspaper comment of a very similar character to that which was made a short time ago in consequence of the observations of the chairman of one of our large electrical companies. In all these discussions, it seems to be accepted that there is some special virtue in University training, and some special repugnance to embarking in commercial work on the part of those who have received such training. Clearly there is a contradiction here. If the latter be true, there must be something defective in the training, and the Universities have not advanced with the times in teaching the dignity of labour, or the estimation of merit by results, rather than by inheritance or environment. Cobbett cannot be regarded as one quite capable of expressing the general opinion of his day, but his own opinion, recently republished, found utterance in the phrase: "I know what your college gentlemen are. They always have, and will have, the insolence to think themselves *our* betters; and our superior talents and industry and power and weight only excite their envy." English public schools and Universities have a fine record, but the raw material can go through both without acquiring either strength or finish. In consequence, the mere fact of University training is no proof of fitness for a business or any other career, and it is high time the idea that tone and character may be bought by an expensive education should be abandoned. But it is more than high time to recognise also that higher education is now a necessity in any branch of bread-winning. In the prevailing deprecatory attitude of the average English mind, it is the foreign example which is held up for comparison; but it is doubtful whether the appreciation of education in Germany to-day is higher than it was in Scotland a century ago, or even in England three centuries earlier, when Gresham, the founder of the Exchange which Queen Elizabeth proclaimed as "Royal," was sent to Cambridge to acquire the education then considered suitable for a merchant of London. It is, however, true that the English University for generations has been the favoured resort of the wealthy, or the necessary qualifying ground of the serious student who was unable to pass into the Church, the Law, or other profession, except through its portals. In other words, the University has been expensive and exclusive. Small wonder, then, if some old-time prejudices still remain. But what shall be said for the manager of an Employment Agency, who suggests in the *Standard* that the office hand from the University should be given special privileges over his less favoured colleagues?

## THE ELECTRICAL REVIEW.

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION

Ready Next Week.

**H. ALABASTER, GATEHOUSE & CO.,**  
4, Ludgate Hill, London, E.C.

Such a suggestion is, in itself, a reflection on University training, for it indicates a reliance on the source of an education rather than on the education itself. If the University man is not, as a result of his training, capable of proving his superior ability, it is folly to encourage him into any new path by holding out inducements in the form of special privileges. He must take his chance with the rest, and rise or fall in accordance with his capacity and character.

Some further comments on this question would almost lead to the impression that the educated business man is the exception rather than the rule. In fact, the business men of England differ but little from the business men of other countries, except, perhaps, in one respect—in comparison with their Continental fellows they have been too often content to limit their linguistic attainments. This is to be traced to the simple fact that the English language carries further than any other, but the international relationship of British commerce requires that a greater attention should be given to this matter, and the education of the day is tending to remedy the undoubted defect. The successful business man is as varied in other countries as in Great Britain. There are types everywhere of the cultivated and of the less well-educated, but shrewd and capable men, whose progress may be ascribed to instinct rather than to culture, to perception of an opportunity rather than to the absorption of knowledge from books.

The University man in business is, as we have seen, no new feature at home, even if, as probably is the case, other countries have in recent years outstripped us. Men of middle age will remember an inquiry in Parliament in the seventies regarding the appointment of a head to the Stationery Office, which was regarded as a "job" because the appointee had no previous experience of the work. They will remember, too, the vindication by a member of the Government, who was then Mr. W. H. Smith, and who related that he had placed at the head of his own immense business a gentleman from one of the Universities who was entirely new to the work, but carried it out with results which were eminently satisfactory. Business generally has grown so that in all departments a wider outlook is necessary. Experience in a particular groove is still of value, but the changes are more frequent, and there must be such mental culture as will enable the operative in a business house to acquire in a short time by observation what has hitherto been acquired in a long time by experience. Whether this mental culture is obtained in a University or elsewhere is immaterial, so long as it is there.

We doubt whether any exceptional agencies are needed to bring together the office and the man. If the student from the University directs his steps to the professions, it is because he sets his hopes upon their rewards. "It is written in the unalterable laws of human nature that no trade shall continue to be at the same time lucrative and easy." Widen the meaning of "trade" to include what are known as the learned professions, and the explanation of the trend of students is simple enough. True, not all exponents of the professions find lucrative employment, but those who strive to enter think not of the average but of the fortunate exceptions. Commerce is becoming more complex, it requires in its votaries a broader culture. The market price will rise and the stream of talent will tend without artificial assistance to fill the vacant places.

Of far greater importance is it that the need for higher education should be recognised, that its acquirement should be within the reach of the many and not limited by reason of its cost to the few. International competition is influenced largely, but not entirely, by education. May we not say that our endowments or our opportunities have stood us in good stead in spite of our tardy recognition of education's advantages? When it is remembered that compulsory education in England dates only from the Act of 1870, it will be seen how much we are behind our active competitors, and how important it is to give every possible encouragement to those who seek to redress the balance. In technical education we have made remarkable strides largely by reason

of the developments in electrical and general engineering. The City and Guilds and other similar institutions in London, and their counterparts in the provinces, have done, and are doing, educational work of the highest importance. The qualifying examinations require a fairly liberal general education, and the courses of instruction ensure to any capable and industrious student a training which fits him to embark upon any engineering enterprise. The standard has been raised, and there is no longer any chance for the incompetent or untrained in such work. There are evidences also that this standard of culture is overflowing into the commercial ranks, so that the opportunities for University men to feel any marked superiority, if they ever existed, are becoming less and less. One other change is going on also in commercial circles. It is the endeavour to promote by merit. The tendency may be accelerated with advantage, but it would be a great misfortune if the old-time promotion by seniority were replaced by a favouritism for the product of a particular school. The University man must establish his position, if at all, by his "superior talents and industry and power and weight."

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## MINING MATTERS.

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IN the House of Commons recently the Prime Minister said, in reply to a question, "Prices of coal have, no doubt, risen since the passing of the Coal Mines (Minimum Wage) Act," and he might have further said, had he been aware of the fact, that some wages had gone down while others had gone up, the latter, of course, at the expense of the former. As a matter of fact, individual good workmen who had the confidence of the management are, in many cases, earning less wages than they might otherwise have been paid, whilst others have had added to their actual earnings each week a certain sum to make them up to the minimum wages. The minimum wage set up by Act of Parliament forms a standard, and as this can be demanded by the workman, the management cannot be blamed for doing all in their power to see that he gets no more. Wages don't grow on trees, and they must be earned by someone, or they cannot be paid, hence the actual working of the Act results in the good man having to suffer for his poorer mate. We do not think it is likely to be continued after the end of the three years' period fixed by the Act, and there will be, in all likelihood, local disturbances when the rules and rates fixed under the Act come up for revision at the end of the first year.

The Minimum Wage Act was, of course, brought in to cobble up the consequences of the Eight Hours' Act, which was the immediate cause of the men earning less wages. With shorter hours of labour, less coal was produced by the individual workman, and in order to maintain the same output more men had to be employed, but naturally there was—with the same output—the same amount of money to be divided amongst the workmen, and as there were more of the latter, the "portions" were less—which, to say the least, was very disappointing and not at all anticipated by our friend the miner. Hence the Minimum—or "minium," as it is more commonly designated—Wage Act. Really, when one considers the fallacies upon which these two Acts are based, one cannot help thinking that there must be something after all in the pitman's plan for remedying the evils arising from a first "levelling" day, by "levelling" again. The next step in the miner's propaganda is

"five" working days per week, which will have the effect of further raising the price of coal, and following this is "nationalisation" of the coal mines, which latter is fully expected to yield good wages for very little work, if, in fact, any work at all is found to be necessary.

In the report of the Chief Inspector of Mines (Part II) we are told that the Eight Hours' Act is working *fairly* satisfactorily, even in Northumberland and Durham, with the exception that "the cessation of work late in the day on Saturdays still constitutes a grievance in some parts of Durham, and especially in the Cleveland ironstone mining district of North Yorkshire." This, however, is very far from the true state of the case, and it is perfectly well known that the "three-shift system," which is being worked at some of the collieries in Northumberland, is anything but satisfactory to the workmen, and at the present moment the whole county is being "stumped" by the miners' leaders to instigate a strike of all the miners against the system. A ballot is to be taken shortly, and there is a very grave fear that it will be in the affirmative. Durham is expected to follow the lead of Northumberland, so that both counties are involved in this question. The owners affirm that the pits cannot be worked profitably unless there are three shifts of hewers, as the hewers of these two counties only work from 6½ to seven hours, as against the full eight hours in all other districts—hence the difficulty in arranging the working of the mine to suit the difference between the hours worked by the hewers and by those engaged in removing the coal from the workings to the surface, who work eight hours. The owners have offered to do away with the multiple-shift system if the hewers will conform with the Act and work an eight hours' shift, but this reasonable demand they will not for a moment entertain. The Government were fully cognisant of the difficulties in connection with these two counties, as the law did not take effect there until six months after it had become operative in all other districts. The only advantages—if they can be termed such—were the reduction of the hours of the "lads" and "off-hand" men, who, previously to the introduction of the Act, worked from nine to 10 hours, but if they started at six in the morning they left off at four in the afternoon, and every day was the same. Under the Act it is true they work two hours less, but some start at six and finish at two, others start at two in the afternoon and finish at 10 at night, whilst the hewers may be on either day shift or night shift, and the whole of their social and home life is dislocated. The "lads" would readily agree to go back to the 10 hours' shift if they were allowed to do so. What will be the outcome none can say, but certainly the outlook for Northumberland, with its old and nearly worked-out mines, depending solely upon an export trade for its existence, is anything but bright at present. Such is the effect of "pitiful" legislation.

As regards the use of electricity in mines, we are glad to note that this is steadily increasing. Under Rule 15 of the Electricity Special Rules (1905) notices have to be given, when electricity is newly introduced into a mine, to the Inspectors of Mines for the different districts, and 46 such notices were given in 1911, as against 40 in 1910. It is also interesting to note that Scotland takes the lead with 20, and South Wales follows with 13. These rules merely require that notice of its introduction shall be given without any particulars of the plant being asked for, and, as a rule, none are given, but under the new Coal Mines Act, 1911, full particulars are to be given, so that a complete classification of the different systems of distribution, together with a measure of the growth of the use of electricity in mines, will be possible. Such particulars as have been given show that high-pressure alternating-current has been introduced into five mines, medium-pressure alternating-current into 11 mines, medium-pressure direct-current into 13 mines, and

low-pressure direct-current into four mines. In the last-named case, however, the current was only used for lighting purposes. The number of electrically-driven coal-cutters in use at the end of 1911 was 998, being an increase of 125 over those in use at the end of 1910.

As regards accidents due to electricity, it is regrettable to notice that 14 fatal accidents were reported to the Inspectors, causing in all 15 deaths. Two of these accidents causing three deaths, however, though reported to and investigated by the Inspector, had, strictly speaking, no connection with electricity in or about mines. There were, therefore, 12 deaths, as against 21 in the previous year, which is very satisfactory indeed. As we propose to deal with these accidents in some detail in a separate article shortly, we need not enter into this question further now, beyond noting that, with one exception which was due to burns following an ignition of gas in a motor room, all the accidents were due to electric shock. The Electrical Inspector of Mines also points out that "the provision of proper connections to earth might have been the means of preventing six of the accidents, or two-thirds of the total number." There were also 41 non-fatal electric shock accidents, many of which were trifling in their results, but in four of the cases the victims were unconscious for some time.

Three underground fires were caused by electricity, exactly the same number as in 1910, fortunately without loss of life, and in another case an explosion of coal dust in a coal crusher house on the surface was traced to the short-circuiting of one of the armature coils, which resulted in excessive sparking. Fortunately, no one was hurt, the building was fire-proof, and no great amount of damage was done. With the introduction of the new electricity rules which came into force on March 9th last in all coal mines, and on September 29th in all metalliferous mines, and which require more care and attention in the installation and use of electricity, a proper earthing system, and a sound mechanical construction of all apparatus, we hope to see electrical accidents—fatalities, at any rate—reduced to *nil*. The number for 1911 is far too great, but it will afford some little satisfaction to know that it represents only *one* per cent. of the fatal accidents in mines due to all causes during the year 1911.

**Ghent International Exhibition.**—Those responsible for the arrangements for the Ghent International Exhibition have seen to it that fire risk will be at an absolute minimum. They have profited by the lessons learnt from the disastrous fire at the Brussels Exhibition of 1910. There the disaster was largely due to the failure of the water supply, so at Ghent a powerful supply has been installed quite distinct from all other water supplies, and the grounds are mined in all directions by water mains, the largest of which are 300 millimetres, while the greater number are 200 and 150 millimetres in diameter. These mains serve the hydrants scattered throughout the grounds and pavilions. In no part of the whole Exhibition, the authorities state, are two adjoining hydrants more than 50 metres apart, the average distance being considerably less. The water supply is derived from the River Scheldt by means of large automatic pumps at a pressure of five atmospheres, and the hydrants will consequently be capable of throwing water to the top of any of the buildings. That the supply will be adequate in quantity is vouched for by the fact that these pumps can supply 600 cubic metres of water per hour. But the greatest safety from fire lies in the fact that all buildings are isolated, and in no place less than 10 metres apart, while in practically all cases they are much more. A special fire brigade station is also being installed by the municipal fire brigade in the centre of the Exhibition, and equipped with motor fire engines and a staff of 25 men. This brigade will be able to reach all parts of the Exhibition owing to the space between the buildings, and will also be independent of the water supply from the mains owing to the artificial lakes in the grounds. A supply of electric fire alarms connecting with the fire station will also be in operation just as in the London streets, while hand extinguishers will be placed in all buildings. The British Section will have yet another safeguard—and one of the greatest—in the fact that the floors are laid direct upon the ground and all platforms packed with earth, preventing the spreading of fire in the space below the flooring and confining a fire to where it can be reached at once.

**Canadian Inquiry.**—Among the inquiries relating to Canadian trade recently received at the office of the High Commissioner for Canada, 17, Victoria Street, London, S.W., was one from a Montreal importer, who desires to receive quotations from United Kingdom manufacturers of high-class machinery, iron and steel pipes, and all lines used by steam and electric railways, municipal and other engineers.

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

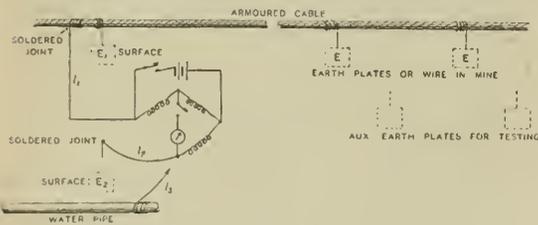
## Testing the Continuity of Earth Conductors.

Replying to "Continuity" *re* the testing of earthing conductors and the metallic coverings for continuity, the method of testing depends somewhat upon the arrangement of the earthing system. I presume the metallic covering would be bonded together to give continuity throughout, and the size of the earth conductor would be such as to meet the particular requirements, in accordance with the Home Office rules. Therefore, the only difficulty is in establishing a good "earth" connection, with facilities for testing the same from time to time.

The metallic covering would be connected to a main earth plate at the surface, and also to earth plates or an earth wire at several points in the mine, according to local conditions.

For testing purposes, a second earth plate should be provided at the surface, at a convenient distance from the first. The same should also be done in the mine. Every care should be taken to see that a good earth connection is made.

A bridge test can now be made between the auxiliary earth plates and various points of the earthing system, as



shown on the diagram. If a water pipe is convenient at the surface, a further check can be made.

When making tests, see that all connections are good, and also allow for resistance of lead. The arrangement also allows of a more rough and ready method of testing.

When a good earth has been established, the resistance between the earth plates can be taken periodically, and any rise in the resistance should be noted.

The metallic coverings should have copper bonds across all joints or junctions in the cables, and all connections to the earthing system should be well made.

When permissible, bad joints and connections can be detected by the use of a portable battery and sensitive instrument, taking the drop across the connection.

B. T. Davies.

Swansea, February 3rd, 1913.

## The Case of the Sub-Man.

I should like to say a few words in connection with the controversy at present waging in your columns between sub-men and wiremen, also *re* the formation of the A.E.S.E.

Primarily, what would happen if all the present sub-men were to deliver an ultimatum to their chiefs, to the effect that, unless they got a better living wage, they would resign their positions? Supposing their chiefs refused to consider this, which is more than probable, I think the sub-men would find their places filled up almost immediately by competent, well-educated men, whether they be college men or wiremen, well able to adequately carry out all the necessary duties required of them.

Secondarily, on examination of the modern power station and the duties required of sub-men, we find that modern running plant, if kept clean and well oiled, needs practically no attention. Should a fault in it chance to develop, all the education in the world would not prevent it. If of a mechanical nature, then the sense of hearing would probably give the first indication of trouble; by this means also it

could be located and then, if possible, rectified. If, on the other hand, the fault is of an electrical nature, then the only means of detecting this would be by daily testing the ohmic resistance of the insulation, this not being a very intricate matter, as it only requires a good sense of seeing, as the ohms and megohms are usually printed accurately on the instrument employed. This may prevent a fault developing, but in the majority of cases does not, as faults have the bad habit of happening unexpectedly.

Now these two senses of hearing and seeing are, as a rule, developed in one man as much as in another, be he a college man or a wireman. After all this comes the ability of the sub-man to keep logs, which, even to the working out of load factors and the plotting of load curves, is not such a very brainy matter. Do not think I am running down the fact of a sub-man having brains; I am only trying to expose the want of scope to employ such brains in such duties. Consequently, my advice is, "If your situation suits you, keep it; if not, you know the remedy."

To put the whole matter in a nutshell, electrical engineering in this country is overcrowded and becoming more so every day, there not being an equivalent outlet in the erection of power stations to hold the surplus.

*Transformation.*—The A.E.S.E. have, I think, solved the crux of the situation. By forming this association they may eventually improve existing matters considerably; at any rate, at present they will fill a want which is much felt, by allowing an outlet for a considerable amount of surplus brains and energy in the compiling and the discussing of interesting and instructive papers, and thus should go a long way in upholding the subman's welfare and status. Wishing the Association every success,

W. G. R.

## Electricity in Agriculture.

You recently published an account of successful results following the application of electricity to farm crops on a farm at Petrovic, near Prague.

It may interest your readers to know that this installation is arranged on the system introduced by ourselves, and that the apparatus used was supplied by us to Messrs. Elektrizitatis Aktien-Gesellschaft (formerly Kolben & Co.), of Prague, who erected the plant, and to whom we are indebted for a confirmation of the report which you have published. They also promise to send us a more detailed report of the results in a short time.

The Agricultural Electric Discharge Co., Ltd.

J. E. NEWMAN, General Manager.

Gloucester, January 31st, 1913.

## The I.E.E. Discussions.

I was interested to read the letter from "Battery" on the above subject in your current issue, and I can quite endorse his remarks.

I was not present at the meeting to which he refers, but I remember an occasion last year, when a member (unknown to me) was speaking, when suddenly the President rose and requested him (I had almost said "ordered" him) to reserve the rest of his remarks till the next meeting, and declared the discussion adjourned. The time was 9.30 exactly, and from the speaker's remarks I think it must have been evident to anyone that another 2 minutes at the outside would have enabled him to finish what he had to say. The member was evidently rather disgusted, and I think it very doubtful whether those remarks were ever concluded.

Personally, I considered the President's abrupt interruption not only very tactless and discourteous, but absolutely rude, as I could not, and cannot, see why he should not have waited a minute or two longer, and adjourned the meeting at the end of the member's remarks.

I have attended a good many meetings of other Societies and Institutions besides those of the Electrical Engineers, both in London and the provinces, but have never seen anything quite the same.

Why this cast-iron "Curtain at 9.30 sharp"?

There is only one conclusion, but those whom we honour placing in the chair, if bored by the discussion of a subject which does not interest them, might surely ask some other member to take their place.

Omega.

[Without expressing any view as to whether the discussions should be closed at 9.30 or not, we must, in justice to the Presidents of the Institution, emphatically state that in many years' experience of the I.E.E. meetings, we have never known the occupant of the chair to be wanting in courtesy to speakers in discussions. On the contrary, the latter have often been allowed to exceed their fair allowance of time, owing to the reluctance of the chairman to intervene, and we have witnessed many instances in which the speaker, after receiving a gentle hint that his time was up, has continued his remarks in open disregard of the chairman's warning. The discourtesy is on the other side.—Eds. E.R.]

PROCEEDINGS OF INSTITUTIONS.

Independent Steam Condensing Plants.

By W. A. DEXTER.

Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Leeds, January 15th, 1913.)

The author proposes to consider a few of the later forms of surface and jet condensing plant, such as are used in connection with steam turbines driving electrical machinery; he will also deal with various types of air-pumps, both reciprocating and rotary.

From entropy diagrams we find that for the non-condensing engine with steam at 165 lb. absolute pressure, we shall obtain 73 B.T.H.U. per lb. of steam; for the engine working condensing we obtain 248 B.T.H.U., and where the steam is expanded to a vacuum of 28 in. we should obtain 334 B.T.H.U. per lb. of steam, showing a gain of 43 per cent. and 93 per cent. respectively over the non-condensing engine. These figures represent the theoretical gain, and show the value of expanding steam below atmospheric pressure, and also the great gain in useful work which can be obtained by working an exhaust steam turbine in combination with a non-condensing steam engine.

For reciprocating engines of the low-speed type, such as are very

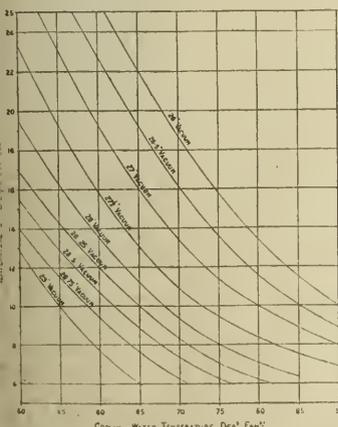


FIG. 1.—DIAGRAM OF TEMPERATURE DIFFERENCE FOR SURFACE WORK.

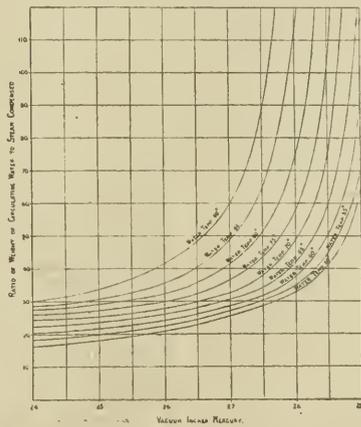


FIG. 2.—DIAGRAM OF CIRCULATING WATER RATES FOR SURFACE WORK.

common in the textile mills of this district, there is no doubt that the attached condenser and air-pump is the most efficient type; a high vacuum is not required, say 26 in. at the condenser. For high-speed engines a vacuum of 26 in. to 28 in. is quite sufficient for economical working. For steam turbines, and especially the low-pressure type, a high vacuum is really essential; but even here it is possible to aim at too high a vacuum for overall efficiency where there is not a good natural supply of cooling water at low temperature.

The most practical and efficient condensers for general conditions are the counter-current surface condenser, the low-level jet condenser, and the elevated self-draining "barometric" jet condenser with air-pump.

The surface type of condenser possesses many advantages over other types, though its initial cost is generally higher. The cost

of operating the air and water pumps is lower, due to the fact that the condensing water is kept out of the vacuum chamber of the condenser.

A point which requires careful consideration before deciding on a surface type of plant is the liability to corrosion or pitting of condenser tubes. This may be caused by local electrolytic action, stray electrical currents, &c., and it requires only very slightly acidified condensing water to convey these electrical currents from one part of the tube to another. The author has found this trouble most prevalent where cooling towers are used. In certain cases the first analysis has shown the water to be almost pure and good for drinking purposes, but there has been a very slight acidity, quite sufficient to convey local electrical currents between the different metals forming the alloy of the tubes. Many different mixtures of tubes have been tried with only partial success, and the trouble has in certain cases only been overcome by periodically adding a certain quantity of lime to the water in the cooling tank, sufficient to produce a neutral solution. This corrosion and pitting trouble is also very prevalent where sea water is used for condensing. Zinc and sometimes mild steel plates are fitted into the water chambers of the condenser and connected by mild steel studs to the tube plates, the idea being that these plates will be of negative polarity

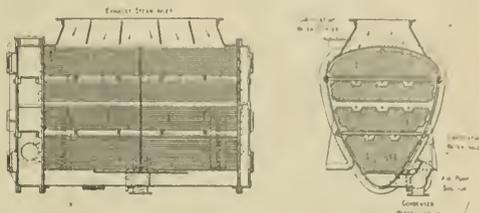


FIG. 3.

to the metal of the tubes, and thus be gradually decomposed instead of one of the metals of the tubes.

The most efficient condenser is one in which the condensing water leaves the condenser at a temperature equivalent to the temperature of the exhaust steam; at the same time the condensing water should be withdrawn at as high a temperature as possible.

In practice it does not pay to aim at so high a discharge temperature for the water, and the best temperature difference between the exhaust steam and discharge cooling water will depend on the inlet temperature of the water. Where there is a plentiful supply of cold water a greater temperature difference should be allowed than where cooling towers are used; also for lower degrees of vacuum, the temperature of the steam being correspondingly high, a greater temperature difference should be taken than for a high vacuum.

The curves in fig. 1 indicate what may be taken as fairly good allowances for temperature difference for various inlet water temperatures and vacua. Thus for 28-in. vacuum, inlet water temperature 75°, the temperature difference would be 8° F., and with water at 50° it would be 19° to 20° F. Fig. 2 is a series of curves showing the ratio of condensing water per pound of steam condensed for different degrees of vacuum and inlet water temperature based upon the temperature differences given in fig. 1.

For a given cooling surface the cheapest form of condenser is certainly one of circular section, relatively small in diameter and long between the tube plates; but it will probably be found that a greater heat transmission per sq. ft. of cooling surface can be attained by a condenser of different shape and design.

The velocity of the steam as it passes through the condenser should be maintained as near as possible to the velocity at the inlet branch. Anything which will retard the flow of steam or cause eddies should be avoided.

The volume of air entering the condenser with the steam is but a small proportion of the total volume of the steam and air, but as the fluid passes through the condenser the steam becomes condensed until at the air pump suction branch or outlet of the condenser, the air forms a very large proportion of the air and vapour mixture, and as the pressure throughout the condenser should remain nearly constant, the area of the path of flow near the outlet may be considerably reduced, leading to a condenser whose cross-section is of wedge or pear-shape.

The steam on entering the condenser should be directed equally over the whole surface of the upper row of tubes, and in its passage through the condenser each square foot of tube surface should condense an equal volume or weight of steam. To obtain this the steam inlet branch should be of large dimensions, following closely the contour of the top part of the condenser body. Plates may be fitted into the distributing chamber to direct the steam equally over the whole surface of the tubes. Except for comparatively small installations, separate air and water pumps give the better efficiency. A condenser approximating to the above-mentioned con-

ditions is shown in fig. 3. In this case the tubes are divided into four nests, and the condensing water is arranged to travel four times through the full length of the condenser.

Three-quarters of an inch outside diameter is the standard used by most manufacturers for the tubes, but where the water is more or less dirty, it may be necessary to increase the diameter to 1 in. or even more.

Where the cooling water contains a large amount of foreign matter liable to choke the tubes of a surface condenser, or contains salts which would form a scale on the tubes, and thus retard heat transmission, or is of a nature which may cause corrosion or pitting of tubes, or where it is not desired to collect the condensed steam

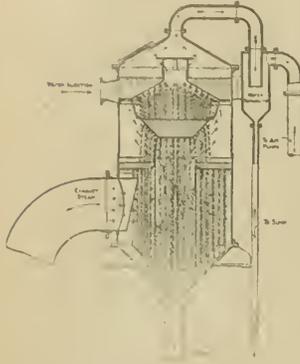


FIG. 4.

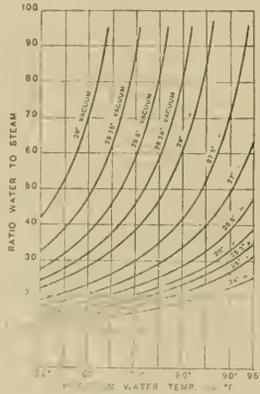


FIG. 5.—JET CONDENSERS: RATIO OF COOLING WATER TO STEAM CONDENSED AT 4° TEMPERATURE DIFFERENCE.

for boiler feed, it would be advisable to adopt a condenser of the jet type. It is a cheaper type of plant as regards initial cost than the surface type, but, generally speaking, requires more power for the operation of the pumps.

In the low-level type, the injection water is usually drawn into the condenser by the vacuum, but it is necessary to withdraw the water from the condenser by means of a pump against a suction resistance equivalent to the vacuum, say, from 28 to 32-ft. head. A separate pump should be used for dealing with the air and incondensable gases. Unless certain precautions are taken, there is a risk of flooding the turbine or engine with this type of plant.

In the barometric type, except in very rare cases, it will be neces-

it will be necessary to design the plant for a little higher vacuum in order to maintain an equivalent vacuum at the turbine.

The highest heat transmission efficiency will be when the water leaving the condenser is at the same temperature as the incoming steam. This result can be most nearly attained by arranging the steam to enter at the bottom of the condenser, the air and uncondensed gases being drawn off at the top. This gives counter direction of flow for the steam and water; the coldest part of the condenser is at the top and the hottest at the bottom; the water is being gradually raised in temperature during its passage through the condenser.

Fig. 4 shows a section of a vertical type jet condenser fitted with three distributing trays; these trays are perforated with elongated holes about 3/8 in. x 2 1/2 in., which give a very good distribution and breaking up of the water, and at the same time allow the use of fairly dirty water. Where the water is very dirty the holes are left out, the trays made shallow or in the form of a flat plate, and the water then falls over the edges in the form of a cascade, suitable openings being arranged in the cascades to allow for the passage of the uncondensed steam and gases. The air is drawn off at the top of the condenser after passing through the coldest condensing water, and is therefore at minimum volume. Where dry-air pumps are used, it is advisable to fit a water separator in the air suction pipe; the water from this separator is drained to the condensing water outlet pipe. With the condenser as illustrated, the author has seen a number of tests carried out under full load conditions where the water has been discharged at a temperature within 1 or 2 degrees of the exhaust steam temperature.

For a good counter-current jet condenser and for the Leblanc multi-jet type with reasonably good air conditions, it is safe to allow for the condensate and injection water being discharged at a temperature within 4° of the temperature corresponding to the vacuum, and in fig. 5 curves are drawn showing the ratio of injection water to steam condensed at various degrees of vacuum and for a temperature difference of 4° F.

The absolute pressure in a condenser is the sum of the pressure corresponding to the vapour tension of the condensed water and the pressure due to the volume of air present in the condenser.

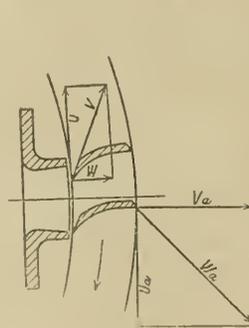


FIG. 8.

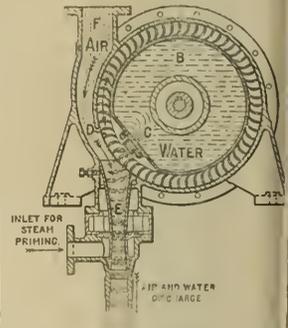


FIG. 9.

CUBIC FEET OF AIR PER POUND OF WATER.

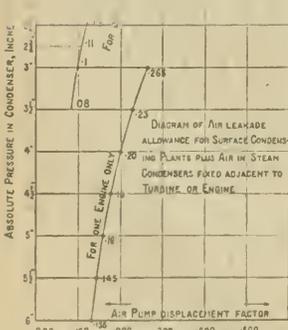
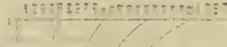


FIG. 6.

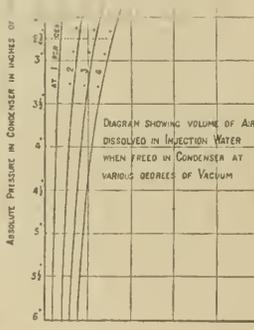


FIG. 7.

ary to pump the water into the condenser, but no pump is required to extract the water, as the condenser, being fixed at a barometric height, will be self-draining. The air pump will be the same as for the low-level plant. The pumping power will be smaller for the barometric than the low-level type, as the full effect of the vacuum can be utilised in raising the water to the condenser. It is a safer and easier plant to operate, as, if properly designed, there is no risk of water flooding the exhaust pipe and thence getting back to the turbine or engine. It is more expensive than the low-level type on account of the longer length of steam, air and water pipes required; also, on account of the long exhaust main,

The air pump should therefore be of such a capacity and efficiency that it will effectively deal with the amount of air passing through the condenser, in a highly attenuated state or at low absolute pressure, thus closely reaching an absolute pressure in the condenser equal to the vapour tension of the condensed water. The pressure of air in a surface condenser greatly reduces the rate of heat transmission.

The amount of air passing through a surface condenser will be that due to leakage at glands, pipe joints, &c., and to the small amount present in the boiler feed-water which will pass over with the steam; there will be a much greater amount in the case of a jet condenser, as, in addition to the above, there is the amount of air present in the injection water, which latter may be from 30 to 60 times the volume of the feed-water. The amount of air present in the feed or injection water may be anything from 1 1/2 to 5 per cent. of the volume of the water. Particular care should be given towards eliminating air leakage. All pipe joints should be as carefully made as though they had to stand a steam pressure of 300 lb. Low pressure engine glands should be very carefully packed, turbine glands should be water or steam sealed, the latter being preferable and for high vacuum it is better to have all valve spindles water sealed. The exhaust mains, if of cast-iron, should be of close grained metal, and care should be taken in the fixing of chaplet when casting; piping built of mild steel plates, if well made, makes the best job.

In a high-pressure turbine installation kept in good condition with the condenser fixed close to the turbine, the air leakage should be within, say, 6 lb. per 10,000 lb. of steam, or the equivalent of what would pass through a 3-mm. diameter expanding nozzle per 22,000 lb. of steam condensed. For a plant connected to a single reciprocating engine, the weight of air allowed for should be the equivalent to what would pass through a 4 or 5-mm. diameter nozzle. Exhaust steam turbine installations require careful attention. The pressure in the engine low-pressure cylinder and the

haust main up to the turbine should always be kept 1 to 2 lb. above atmospheric pressure.

In fig. 6, which applies only to surface condensers, curves are drawn representing the actual volume of air to be allowed for at different degrees of vacuum, expressed in cubic feet per pound of steam. The upper curve refers to turbine plants with directly-connected condenser, and the lower curve to an engine with directly-connected condenser. If two or more turbines or engines are connected to a central condensing plant the allowances will require to be increased.

The curves are based on a 3 per cent. volume of air in the feed-water and an air leakage equal to a 3-mm. diameter nozzle per 2,000 lb. steam per hour for a single turbine, and a 5-mm. diameter nozzle for one reciprocating engine at the same steam duty. Where more than one turbine or engine is connected to one condenser it is advisable to allow for an extra air capacity in the pump, say 10 per cent. extra for each turbine, other conditions remaining the same.

Referring to the curves, it will be seen that for a single turbine and attached condenser for a vacuum of 27 in., barometer 30 in., an actual air displacement of 0.1 cb. ft. per lb. of steam should be allowed, whereas for a vacuum of 28½ in. it would require 0.2 cb. ft. or a reciprocating engine at 26 in. vacuum it requires 0.2 cb. ft., and for 27 in. vacuum, 0.265 cb. ft. per lb. of steam.

Fig. 7 shows the cubic feet of air to be allowed for at different degrees of vacuum for the air contained in the injection water, and is, of course, applicable only to jet condensers. Four curves are shown for 1, 2, 3 and 4 per cent. volume of entrained air; the horizontal scale is based on cubic feet of air per pound of injection water.

To fix up the size of air-pump for a jet-condenser on the lines indicated, we will take the following example:—

Duty 10,000 lb. steam per hour; vacuum, 28 in. (bar. 30 in.); water, 80° F.  
 From fig. 5. Injection water = 60 times the steam.  
 From fig. 7. 2 per cent. curve  
 at 2 in. abs. ... .. = 0.0054 cb. ft. per lb. water.)  
 Volume of air in injection water  
 (per lb. steam condensed) ... = 0.324 cb. ft.  
 Volume of air by leakage (same  
 as for surface plant), fig. 6 = 0.15 cb. ft.

Total per lb. steam condensed 0.474 cb. ft.

$10,000 \times 0.474 = 4,740$  cb. ft. per hour required, or, say, 24 lb. air per hour.

It must not be overlooked that this figure is the actual volume of air which must be discharged by the pump, and full allowance must be made for the volumetric efficiency of the type of air pump employed.

The reciprocating wet air-pump with foot, bucket, and delivery valves has mostly been used in the past in connection with low-speed reciprocating engines, and driven directly from the piston rod or cross-head, and has in recent years been almost superseded by the Edwards valveless suction-pump. The principal objection to the former pump is the complication of valves, and especially the accessibility of the valves in the bucket. The most notable example of this type of pump is the Weir dual air-pump.

The Edwards pump is so well known that it is unnecessary to describe it. Its main feature is its simplicity, there being only one set of valves, and these being in the delivery plate, they are easily accessible for attention and replacement. The volumetric efficiency of this pump falls rapidly at high vacuum when the air is very attenuated; similarly it drops very much when the speed increases.

Much attention has recently been given to rotary auxiliaries, and especially to air-pumps. In general, the rotary air-pump consists of a centrifugal water-pump which is made to deliver water in jets or sheets through an ejector, the air and gases immediately surrounding these jets being carried along with the water by reason of the friction between the surface of the water and the air in contact with the same. In other cases jets or sheets of water are projected intermittently through passages in the pump casing, entrapping air between the intermittent plugs of water, the whole being discharged against atmospheric pressure by the energy due to the velocity of the water. Experiments have shown that a greater volume of air can be discharged by a given quantity of water when the air is entrapped between plugs or sheets of water than when it is drawn into the ejector by skin friction between the water and air. The velocity of the water being one of the main features of this system, it is essential that it be obtained with the least possible expenditure of power. The features above-mentioned are embodied in the well-known Leblanc pump, invented by Prof. Maurice Leblanc, of Paris, about eight years ago.

The author has, during the past few years, carefully investigated a number of the best known forms of rotary air-pumps, the result being that his firm have now taken up a licence for the manufacture of the Leblanc pump, both for land and marine purposes. There are over 12,000 Leblanc installations now at work. They are in successful use connected to steam turbine units of 15,000 kw. capacity. They have been taken up by several of the Continental and foreign navies, and in the French Navy they have practically superseded the reciprocating pump.

A Leblanc pump is essentially a high-vacuum pump, and where very large volumes of air have to be dealt with, the reciprocating type as last described would be the better, but for the very high vacuum required for turbines, it is a most suitable form of air-pump. The characteristic of the Leblanc air-pump is a water ejector, in which the necessary kinetic energy of the water is produced in the apparatus itself by a reversed turbine of partial section.

Fig. 8 shows a portion of the turbine wheel. The water enters in

the turbine with a velocity  $w$ , and as the wheel is moving in the direction of the arrow, this velocity, combined with the peripheral velocity  $U$ , gives the relative velocity  $v$ . This velocity becomes  $v_a$  at the discharge of the turbine, and, combined with the peripheral velocity  $U_a$ , gives an absolute velocity  $w_a$ , with which the water leaves the blades. The angles of the blades are such that the velocity  $w_a$  is about 130 ft. per second. In an ordinary water ejector a head of about 265 ft. would be necessary to produce this velocity. It is, therefore, quite clear that the kinetic energy will be transmitted to the water with a higher efficiency than if this necessary pressure were produced by a centrifugal pump and then transformed into velocity. Also in this arrangement the wheel is running in vacuum, thus reducing the friction losses to a minimum.

Fig. 9 shows a sectional arrangement of the Leblanc pump, which works as follows:—Sealing water is introduced through a suitable branch on the casing into a central chamber  $n$ , from which it passes through the water guide nozzle  $c$ . On leaving this the water is caught up (or chopped off) by the blades  $b$  of the air-pump wheel, or impeller, and ejected into the collecting cone  $e$  in the form of thin sheets, which travel with the velocity  $w_a$  until they meet the sides of the collecting cone, and thus form absolutely tight water-pistons, which entrap the air and non-condensable gases coming from the condenser or other apparatus through the suction  $f$ , and carry them out against the atmospheric pressure. The estimated thickness of these water-sheets is only from 4 to 8/1,000 of an inch. These sheets have the tendency to enlarge as the water particles are ejected divergently, and, as previously stated, they are concentrated in the collecting cone, forming a compact plug when passing through the smallest diameter into the diffuser, the energy of velocity being converted into pressure, and the plug, consisting of air, gas and water, being discharged against the atmospheric pressure. The great advantage of rotary air-pumps is their extreme simplicity and the small number of moving parts, usually only an impeller and shaft, and being adaptable for direct driving from electric motor, high-speed engine or turbine, all usual gearing troubles are eliminated.

There is no need to dwell in detail on circulating or injection water pumps of the centrifugal type. It is now possible to obtain high efficiencies w.h.p./b.h.p. with this type, and they lend themselves admirably to direct driving from electric motors or small steam turbines.

Steam-driven auxiliaries have a distinct advantage over electrically driven, in that they are not in any way affected by a disturbance of the electric supply. In the case of a single-unit plant the pumps can be started up before the turbine, and a full vacuum obtained in the condenser ready for the starting up of the turbine. This, of course, does not usually apply to a large central power station where there are always one or more generating sets at work.

#### DISCUSSION.

The chairman (MR. WILSON HARTNELL) said that what Mr. Dexter really meant when he said a vacuum of 30 in. was a pressure of 2½ in. above absolute vacuum. The absolute pressure in inches of mercury could be easily obtained by having a small manometer, instead of measuring the difference of pressures outside and inside the condenser as they usually did.

MR. R. H. CAMPION said he had beautiful water for drinking purposes, but which played great havoc with condenser tubes. There were a good many bad tubes on the market. The trouble was due to the aerated condition of the water which in passing through the cooling tower absorbed acids which were present in the air. They had earthed the condenser to get rid of electrolysis, and now they were fitting a special arrangement with the same object in view. His experience with the surface condenser suggested that they must not rely on any of these new ideas to do away with tube surface; there was nothing like tube surface. He had plant of the low-level type, which was described as rather unsafe on order, and he did not fear the bad results which the author foretold. As to the risk of flooding, they had two arrangements to prevent that.

MR. DEXTER said that corrosion of the tubes was a very serious matter indeed; he did not agree that it was due in any way to bad tubes. His own firm had had that trouble in many cases. In one case in Glasgow they found the water from the cooling towers was slightly acidified, and the trouble was got over entirely by adding periodically a certain quantity of lime to the cooling water. He had recommended this to a number of people, with very beneficial results. In many cases he had found that the more expensive tubes—particularly those which had been tinned—had given worse results than the inferior tubes had, and he thought it was mostly due to electrolytic action. The neutralisation of the water had the best results. In one case at Liverpool there was a centrifugal pump in which the impeller had been reduced 25 per cent. in weight in less than two months from the pump being installed. When he opened up the pump he noticed a deposit of copper at the bottom of the cast-iron casing in four places diametrically opposite. The pump casing was distinctly magnetised. He found quite a big difference of potential between the pump casing and the spindle, and came to the conclusion that the pump was running like a dynamo. They got over that case by making the whole pump and impeller and spindle all of gun-metal, and of the same mixture of gun-metal, too. They made tests before that, and found that with two different kinds of gun-metal they got quite a rapid corrosion with this water, which was pronounced by the city analyst to be splendid drinking water, and to have nothing wrong with it. They found slight acidity in the water, and since lime had been added to the cooling tower tank they had had no trouble, and they were running the same station with cast-iron pumps and impellers. The

station was divided in two, and the turbines and condensing plant were exactly the same on each side of the station; yet on one side a very large corrosion took place, and on the other side there was no corrosion at all. It was well to remove as much oil as possible before it got to the condenser, as otherwise it would coat the condenser tubes and the cooling towers, and they would soon have a loss of efficiency. The Leblanc type of plant was so safe that he had no fear whatever of using that type either with reciprocating engines or with turbines. If the vacuum dropped the pump did not give up lifting if the sealing tank was placed on the same level as the pump, so that the pump was always primed. Until about 2½ years ago that was a defect in the Leblanc pump.

MR. A. E. LEIGH SCANEN said that he noticed a very large temperature difference was given for a low vacuum. In his own opinion, it was never necessary to exceed 15° F.; it meant a quite unnecessary amount of pumping of the water and consequent increase of power. His firm (the Westinghouse Co.) had found, like Mr. Dexter, that the cheapest form of condenser was the circular shell, and he could not agree that any other form was advantageous in the long run, because of the higher initial costs. They found that with that they could obtain results better than, or equal to, certainly any make of condenser on the market of any shape whatever. One of the plants they made recently could condense 22 lb. of steam per sq. ft. with water at 60° F. and a 28½-in. vacuum. Mr. Dexter suggested that directing plates should be fixed under the steam inlet of the condenser. His own firm had found that if that was done there was an appreciable loss of vacuum in the condenser itself, and they found that a large steam inlet, as was also suggested by Mr. Dexter, was quite sufficient in ordinary practice. As to the safety of the low-level jet plants, they had never up to the present had an accident from that cause. They had found that under any conditions where it was possible to put in these Leblanc air pumps they could compete on a commercial basis with the best types of reciprocating pumps. He admitted that the presence of air in the condenser affected the vacuum, but he did not think it affected the heat transmission. Undoubtedly where the air was equally mixed with the steam it did affect the transmission, but it was not equally mixed in a surface condenser. Mr. Dexter suggested that steam-sealed turbines were preferable, but his own opinion was exactly the reverse; whenever they had the steam-sealed plant to deal with they always allowed a ratio of air in the proportion of four to three for what they allowed for water-sealed glands. The great point of the Leblanc rotary pump was that they could get a much higher hot-well temperature, which varied from 5 to 10° F. above that obtained with a reciprocating pump.

MR. DEXTER said he did not quite agree with Mr. Scanes about limiting the temperature differences. When they were working with high-temperature cooling or injection water to obtain a certain vacuum, it was policy to work at a very much closer temperature difference than they need do for a very low water temperature. With regard to directing plates, in one case he found a great improvement made by dividing up the main exhaust pipe, which was of large area, into sections by ribs and carrying these right through to the condenser, and then in the condenser continuing them, so as to direct the steam well towards the end of the condenser, and better results were got thus than by simply fitting the directing plates—much better than without directing plates, and also better than directing plates without the sectioning of the exhaust pipe. He believed there had not been any flooding accident so far with a Leblanc pump. He had been able to get results on low-level type condenser reciprocating pumps showing a temperature difference within one degree, and on several surface condensers he had got to within 1½ or 2 degrees, but these were under exceptional circumstances. In the case of plant where a reciprocating pump was dealing with dry air and a separate pump extracting water, he did not think there was much difference in the hot well temperature compared with that obtained with the rotary plant. He would like to mention the importance of engineers knowing what air capacity was being given to them when they were buying plant. It was very easy to ask for the square feet of cooling surface in a condenser, the quantity of cooling water circulated and power required, &c., but until quite recently he scarcely knew of any specifications issued where the weight or quantity of air which was provided for by the air pump was asked for. It did not matter to the purchaser whether he was getting 3,000 or 4,000 sq. ft. of cooling surface in the condenser unless the condensers were of the same power and of the same design. He had found that in many cases it had paid to give extra cooling surface and go in for a very simple type of condenser. He differed with Mr. Scanes about the air affecting the heat transmission. He thought the results of tests his firm had recently carried out at their works were conclusive on that point.

MR. MCLAY said that the obviously commonsense way was to bring the steam in at the bottom, and let it pass up through the condenser, the air being taken off at the top, and the condensed steam at the bottom. They should keep the upper tubes as dry as could be, so that no moisture was taken from the air, and the air would pass over to the pump practically dry. The condenser should be made of a shape suitable to deal with the volume which was going through it, and should be alongside the turbine. If they put their pumps into the basement they got no attention.

MR. DEXTER agreed with the principle of bringing the steam to the bottom and taking it out at the top, but said that did not fit in well with turbine arrangements. He had tried it many times, and it was very difficult to arrange. They had to have foundations; that in itself made a basement in most instances, and they found it was better to put the plant in the basement. Then they could get a much greater output from the same floor space. The basements were as well looked after as the main engine room.

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"CONSULTING ELECTRICAL ENGINEER" writes:—"I should be glad if you would kindly let me know in what position the local authorities stand in the following case: The urban council in question has no electrical powers, and it is questionable whether it will attempt to obtain them. There are several works within the area of the Council, and it is proposed to put an electrical plant in one of them, and transmit power to one or more works about 250 yd. away. An overhead cable would be more direct; but it is deemed best to put an underground cable down along the footpaths with two road crossings. The streets are side streets, and the roads and footpaths unmade and unattached. An application has been sent to the Council for permission to carry this cable as suggested; it is believed that the Council is going to object. Would you kindly state whether it is entitled to object, seeing that it has no powers, nor is it likely to acquire them in the immediate future. If the roads are unattached and the owners of the roads be agreeable, could a cable be laid in spite of the Council? The writer would be obliged for an early reply to these and any other points which may cover the case.

\* \* \* This query would appear to raise a question under Sec. 23 of the Electric Lighting Act, 1909, which, so far as is known, has not yet been considered by any court of law. A glance at that section, however, shows that it confers no right upon a local authority to interfere with the private supply of electricity unless that authority is itself supplying electricity under licence or provisional order. Moreover, although it enables a supply authority, being a local authority, to interdict the supply of electricity, it does not "prevent any company or person from affording a supply of electrical energy to any other company or person, where the business of the company or person affording the supply is not primarily that of the supply of electrical energy to consumers." It would therefore seem that so far as the Act of 1909 is concerned, the Council has no power or authority to interfere. A more serious question arises, however, with regard to the laying of underground cables. By the exercise of its powers in this respect, the local authority may effectually check the proposed enterprise. The Public Health Act, 1875, Sec. 148, vests "all streets, being, or which at any time become, highways repairable by the inhabitants at large within any urban district, and the pavement stones and other materials thereof in the urban authority." A similar provision applies to the Metropolis; and where an electric lighting company had illegally broken up the surface of a street within the district of a Vestry in the Metropolis and placed their pipes and wires at a depth of about 2 ft. below the surface, it was held that the Vestry was not, by virtue of Sec. 96 of the Metropolis Management Act, 1855, the owner of the soil of the street at that depth, and that, although the company had acted illegally in breaking up the street, and an injunction was granted restraining them from doing so again, the Vestry was not entitled to a mandatory injunction to compel the company to remove their pipes and wires, there being no continuing trespass upon, or interference with, any right of the Vestry (Vestry of St. Mary, Battersea v. County of London, &c., Co., Ltd., (1899) 1 Ch. 474). For the unwarranted breaking-up of the street, however, the company were summoned at the police court and fined. The suggestion may be thrown out that if the soil of the streets in question does not belong to the Council referred to, there will be nothing to prevent wires or cables being suspended at such a height as not to interfere with the traffic. If, therefore, the necessary wayleaves from frontagers and others can be obtained, there is no reason why an overhead system should not be adopted, provided the Public Health Acts Amendment Act, 1890, (if it has been adopted in the area in question) is complied with. Before embarking upon this course, however, a solicitor should be consulted, because the question whether the "soil" of the streets is vested in the Council is highly technical, and cannot be answered without a much fuller statement of the facts than that which is given in the query.

## British and American Electrical Machinery Exports.

—In Saturday's Parliamentary Papers Mr. Arnold asked the President of the Board of Trade to state what were the values of the exports of electrical machinery from the United Kingdom and from the United States from 1903 to 1911, inclusive; and what were the values of the imports of electrical machinery of United States manufacture into the United Kingdom during the same years.

Mr. Sydney Buxton, in reply, furnished the following statement:—

Year.	Exports of "electrical machinery of all kinds" to all destinations.		Imports into the United Kingdom of electrical machinery of all kinds from the United States of America.
	From the United Kingdom.	From the United States of America.	From the United States of America.
1903	£437,000	£1,064,000	£306,000
1904	523,000	1,391,000	290,000
1905	644,000	1,544,000	203,000
1906	842,000	1,724,000	259,000
1907	996,000	2,028,000	186,000
1908	1,354,000	1,449,000	161,000
1909	1,432,000	1,242,000	162,000
1910	1,603,000	1,491,000	153,000
1911	1,791,000	1,739,000	195,000

## BUSINESS NOTES.

**The Edison Car Lighting System.**—In connection with our recent article on the subject of car lighting dynamos, as shown at the Olympia Motor Car Exhibition in November last, Mr. JOHN F. MONROE, of 11, Great Portland Street, W., the sole concessionaire for the Edison battery, has brought to our notice an electric lighting system for motor-cars which he has introduced, in which the necessary supply of current is furnished by a battery of Edison accumulators, the use of a dynamo being dispensed with. The lighting set comprises a small Edison nickel-steel storage battery, two side lamps, a tail lamp, and a two-way switchboard. Four sizes are being made, the No. 1 set, which is intended for small cars, comprising a 40 ampere-hour 4-volt battery, three lamps, switchboard, and three 4-volt 4-c.p. metallic-filament bulbs, and being designed to give 13 hours' continuous lighting on one charge. The No. 2 set is also for small cars, and differs only from the former in having an 80 ampere-hour battery, for 26 hours' continuous lighting. The No. 3 set is for medium cars; the battery in this case is of 40 ampere-hour capacity at 8 volts, 4 c.p., 8-volt bulbs being used. The largest set is adapted for big cars, and is able to furnish current for 50 hours' continuous lighting on one charge, the battery having a capacity of 80 ampere-hours at 8 volts. In addition to lighting the lamps, the battery may be used for the operation of an electric horn. The different sets are neatly arranged, and where a supply of current for charging purposes is readily available, they will be found a much simpler and certainly less costly car electric lighting equipment than where dynamos are used. At the same time, the latter have the advantage that no special battery charging is necessary, this being automatically effected.

**Catalogues and Lists.**—MESSRS. GENT & CO., LTD., Parady Works, Leicester.—Two pocket leaflets; No. 510 illustrates and gives prices, &c., of bells for power circuits, while No. 511 deals similarly with the "Electromatic" C.B. interphones system, and contains a diagram. Contractors can have quantities of either with their names printed thereon.

**THE STERLING TELEPHONE AND ELECTRIC CO., LTD.,** 200, Upper Thames Street, London, E.C.—The company have, owing to the demand, decided to reinstate in their catalogue, and to stock in London, their cream and gold "Twencen" domestic telephone No. 1100, which they withdrew when issuing the eighth edition of their catalogue. They have now prepared for insertion in this catalogue a suitable priced leaflet relating to the instrument.

**THE "SAFETEE" CONTROLLING APPLIANCES CO., LTD.,** Luton, Beds.—Six-page illustrated price list, with particulars of parts of the "Safetee" combined switch fuse for 1 to 500 amperes and for 250 and 500 volts.

**THE UNIVERSAL ELECTRICAL MANUFACTURING CO.,** 14, Station Road, Queen's Road, Peckham, London, S.E.—Folding pocket card with calendar for the first quarter of the year followed by particulars and illustrations of the "Poplar" street lighting fitting.

**THE STURTEVANT ENGINEERING CO., LTD.,** 147, Queen Victoria Street, London, E.C.—New catalogue, No. 1,071 (32 pages), containing a full description of the Sturtevant system of mechanical draught for steam boilers. The pamphlet is fully illustrated with half-tone views of the system applied to a number of power stations and other works; also line drawings of typical arrangement of the economiser and system.

**MESSRS. VERITYS, LTD.,** London and Birmingham.—Publication No. 682, consisting of 16 pages of illustrations, notes and prices of "Aston" watertight fittings for outside and industrial service, ship installations, porcelain acid-proof fittings, inverted reflector fittings, &c.

**MESSRS. J. WADDINGTON & SON,** builders and electrical fitters, 6 and 7, Creed Lane, Ludgate Hill, E.C., have sent out a useful little desk calendar, with framed monthly slips, a complete year appearing on the back.

**THE RECORD ELECTRICAL CO., LTD.,** Caxton House, Westminster, London, S.W.—Twelve-page catalogue (M 10), containing a full and illustrated description, and table of prices, of their new moving-coil instruments for direct current. Also a collection of illustrated price lists in binding cover, particularising their auto-battery cut-in and cut-outs, circuit-breakers, moving-iron and moving-coil instruments for A.C. and D.C., and switchboard and portable shunts.

**MESSRS. BEDFORD, STEER, END & CO., LTD.,** 78 to 84, Long Lane, Borough, London, S.E.—Price leaflet relating to asbestos woven wire resistance nets.

**THE GENERAL ELECTRIC CO., LTD.,** 67, Queen Victoria Street, London, E.C.—Leaflet (S 1,514) giving prices of Osram candle lamps (plain and twisted flame, and "Spearhead"). Eight-page catalogue (No. F 1,660) containing illustrations and prices of a number of designs of Holophone pendants for direct, indirect and diffused lighting.

**THE ARMORDUCT MANUFACTURING CO., LTD.,** Farringdon Avenue, London, E.C.—A two-colour folder, showing by means of outline maps the extent of an order recently received from the Postmaster-General of New South Wales for Armorduct vulcanised rubber cable (1,115 miles).

**THE WESTMINSTER TOOL AND ELECTRIC CO.,** Suffolk House, Laurence Pountney Hill, London, E.C.—Illustrated price leaflets relating to the Westminster electric grill, No. 6 electric cooker (oven, grill and boiling plate), and the No. 3 cooker.

**MR. C. M. SIMPSON,** Canada House, Baldwin Street, Bristol.—Neat little calendar for 1913, with monthly slips.

**MR. H. C. SLINGBY,** 142-146, Old Street, London, E.C.—Large sheet of illustrations showing a marvellous collection of a thousand different ladders, trucks, tower wagons, hand-carts, and other such things.

**THE EBONESTOS MANUFACTURING CO.,** 127, Pomeroy Street, New Cross, London, S.E.—Advance copy of a new catalogue of moulded insulators. Considerable additions have been made to the number of standard sizes of bushes and handles, all of which can be delivered from stock. The firm have made considerable reduction in the prices of most of their standard articles. In order to encourage the trade to keep to as small a number of standards as possible, a selected number of bushes printed in black are offered at greatly reduced prices. The catalogue opens with particulars of tests, and the following sections, which are separated by a thumb index, contain dimensioned full-size sketches of bushes of different kinds, handles, sleeves and washers, caps, terminals and brushholders, and hand wheels. A loose list shows and prices insulated lampholders, and a £50 free insurance against death from electrical shock is available for anybody who may be using inferior insulators.

**THE WANDSWORTH ELECTRICAL MANUFACTURING CO., LTD.,** Imperial Works, Ludgate Hill, Birmingham.—Seventy-two-page catalogue containing descriptive notes, prices, and very clear illustrations of a variety of switchboards, tumbler switches, ornamental switch-covers, secret switches, combination switches and plugs, two-pin floor and wall sockets and plugs, adapters, cut-outs, fuseboards, main fuses, spring-contact switches, knife switches, ironclad switches, and so forth.

**SIEMENS BROTHERS DYNAMO WORKS, LTD.,** Caxton House, Westminster, S.W.—Twelve-page pamphlet containing a list of their lantern slides that are held in stock. Since the first issue of this list it has been revised and considerably increased by the addition of many interesting and up-to-date slides, and now consists of 238 different views. The slides are kept in stock at Caxton House, and are loaned free of charge to lecturers, schools, &c.

**MESSRS. SIEMENS BROS. & CO., LTD.,** Woolwich.—New catalogue (No. 529) of eight pages and cover, giving full descriptive notes, with prices and illustrations, concerning their small and large electric motor syrens for ordinary and for sharply defined signals.

**Trade Announcements.**—MESSRS. STEINBACH AND HORN, 669, Mansion House Chambers, Bucklersbury, London, E.C., have been appointed sole agents for the United Kingdom for Messrs. Lindner & Co., of Sondershausen, manufacturers of electrical porcelain ware and fittings.

**THE M.A.N. MASCHINENFABRIK AUGSBURG-NURNBERG A.G.,** announce that owing to increased business they are this week moving from their offices in the East Block of Caxton House to a larger suite of offices on the first floor of the West Block in Caxton House.

**MR. E. ALLEN,** formerly manager of the Central Electric Co., has started in business for himself under the title of E. Allen & Co. electrical engineers and contractors, at 138B, Newington Butts, London, S.E. Lists and catalogues from the trade are asked for.

**MESSRS. GRANT & EVANS,** electric bell fitters, &c., of 41, Bridge Street, Berwick-on-Tweed, have opened a branch establishment at Market Place, Coldingham.

On Monday last MESSRS. MANX, EGERTON & CO., LTD., of Norwich, removed their electrical offices from 82, Victoria Street, Westminster, to 379-381, Euston Road, London, where they have taken extensive premises for their motor-car and electrical staff. The firm obtained additional accommodation owing to the increase in their electrical and motor-car business in London.

**MR. S. J. BRADWALL,** electrical engineer, of Macclesfield, has removed from Duke Street to more commodious premises at Lowe Street, Park Green.

**MR. L. A. WELLS,** late electrical contractor, of 19, St. Margaret's Street, and Parade, Canterbury, has disposed of his business, and is leaving for Sydney by the *Drama* on the 14th inst. He will be pleased to receive all correspondence, especially catalogues from sign specialists, at G.P.O., Sydney, New South Wales.

**THE DISTRICT IRON AND STEEL CO., LTD.,** Smethwick, have appointed Mr. F. S. Rippingille, of Winchester House, Birmingham, as their representative for the specialties manufactured in their electrical conduit department, which comprise close-joint conduit and electrically-welded screwed conduits, clips, saddles, couplers, &c.

**Private Arrangements.**—HAMMOND & CHAMPNESS, LTD., Alfreton Street, Old Kent Road, London, S.E.—The creditors interested herein were called together on Tuesday, at the Great Eastern Hotel, Liverpool Street, E.C., when a statement of affairs was presented, which had been prepared by Messrs. Henry J. Burgess & Co., 14, St. Mary Axe, E.C., showing the position as at January 17th last. This disclosed liabilities of £7,658. The assets were valued at £4,525. Mr. Burgess reported that he had been appointed to act as the voluntary liquidator of the company, and also as the Receiver on behalf of the debenture-holders. The assets had not been taken on a realisation basis, and at a forced sale they might not realise the amount at which they were set down. All the debentures were issued for cash. The company was registered in March, 1910, with a nominal capital of £4,000, divided into 3,700 preference shares of £1 each, and 6,000 ordinary shares of 1s. each. The total number of shares taken up was 603 preference shares, and the 6,000 ordinary shares of 1s. each had also been issued. All those shares were fully paid up. A creditor said he understood that the cash claims were in respect of moneys advanced to the partnership by the partners,

and the debts were taken over by the company. The liquidator replied that there were cash creditors who had never been partners in the concern, while the directors were now creditors for a larger amount than at the formation of the company. A solicitor, who appeared for the cash creditors, intimated that all those claims would be withdrawn, and a document to that effect was produced at the meeting. In answer to questions, the liquidator stated that the first balance-sheet prepared was at September, 1910. It covered a period of 15 months' trading, including nine months of the trading of the business before the company was registered. During that period there was a loss of £292, while in the succeeding 12 months there was a loss of £1,450. During the 12 months to September, 1912, the debit balance was increased to £2,100. Mr. E. H. Hawkins pointed out that ever since the company had been formed it had carried on business at a loss. In answer to questions, it was stated that in the last balance-sheet the goodwill of the company was set down as £700, but in the statement of affairs no value was placed upon it. Mr. Burgess added that he had been carrying on the business and had completed some small contracts. He could offer the business for sale as a going concern, and if that was not successful he could attempt to dispose of the assets under the hammer. The opinion was expressed by certain creditors that application should be made to the Court for the appointment of an independent liquidator. A motion to that effect was, however, defeated, and it was decided to appoint a committee of six of the principal creditors to act with Mr. Burgess in the liquidation of the company. The following are the principal creditors:—

Adams British Oil Co. . . . .	416	General Electric Co. . . . .	£36
Aston Construction Co. . . . .	154	Hoffmann Manufacturing Co. . . . .	50
Auto Machinery Co. . . . .	40	Knights, H. Newton & Co., Ltd. . . . .	174
Aldous & Smith . . . . .	45	Lift and Hoist Co. . . . .	16
Bergthell & Young, Ltd. . . . .	40	Macnamara, J. J. . . . .	17
Buckley, B. . . . .	48	Marrat & Place . . . . .	28
Brotherhood, P., Ltd. . . . .	49	Mawdsleys, Ltd. . . . .	197
Bellows, J. . . . .	40	Mosers, Ltd. . . . .	112
Butler & Jordan . . . . .	20	Nash, W. . . . .	82
Balmforth, T., & Co. . . . .	126	Nettleford & Sons . . . . .	30
Brotherton Tubes and Conduits, Ltd. . . . .	31	Oliver Arc Lamp Co. . . . .	46
Crogon & Co., Ltd. . . . .	16	Pater, P. W., & Co. . . . .	55
Couldray, W. . . . .	15	Redpath, Brown & Co. . . . .	100
Cohen, J., & Co. . . . .	21	Reid Gear Co. . . . .	65
Dixon & Corbit and R. S. Newall & Co., Ltd. . . . .	50	Rodney Foundry Co., Ltd. . . . .	147
Electric Control, Ltd. . . . .	55	Russell, J., & Co., Ltd. . . . .	22
Geipel, Wm., & Co. . . . .	63	Smith, A. J., & Co. . . . .	241
		Swell, Edwards & Nevill . . . . .	28
		Varley Magnet Co. . . . .	30

**Bankruptcy Proceedings.**—SAMUEL LORD, director of a limited company, 18, James Street, Liverpool.—This debtor attended at the Court House, Government Buildings, Victoria Street, Liverpool, on January 27th, for his adjourned public examination, before Mr. Registrar Howarth. The Official Receiver said he had no further questions to ask. Although he was not satisfied with the information he had obtained from the debtor, he did not think he could carry the matter further. Mr. Ross, solicitor, said that the debtor had given all the information in his power, and as no good purpose would be served by keeping the matter open, he asked that the public examination should be closed. The Official Receiver said he would not oppose the closing, as he was not prepared to proceed further at present. The examination was ordered to be closed.

WESLEY SUTTON, 62, Dale Street, Liverpool.—This debtor also attended on January 27th, before Mr. Registrar Howarth, for his adjourned public examination. The Official Receiver made the same observations as in the above case, and the examination was ordered to be closed.

CHAS. LEWIS, electrical engineer, lately licensed victualler, Old Trafford.—Receiving order made at Manchester on January 29th, on debtor's own petition. First meeting, February 12th; public examination, February 21st.

**Patents Applications.**—THE ECONOMIC ENGINEERING AND CONSTRUCTION Co. have applied for the restoration of patent No. 8,328, of 1907, granted to E. M. Bassler, for "Improvements in and relating to Conveyors."

An order has been made restoring patent No. 22,968, of 1904, granted to H. H. Lake for an invention communicated by the Oil and Waste Saving Co., of U.S.A., for "Improvements in Centrifugal Machines."

**Finding Lost Pipes.**—We regret that in our issue of January 24th the address of the English makers of the wireless pipe locator was incorrectly stated. The firm is that of MESSRS. EDWIN A. MANSFIELD & Co., 12, Beokenham Road, New Brighton, Cheshire, and all applicants will receive full particulars on application.

**Dissolution.**—WHEELER & MURPHY (J. E. Wheeler and W. Murphy), electrical engineers, Northwood.—Partnership dissolved; Mr. Wheeler attends to debts.

## LIGHTING and POWER NOTES.

**Aberdeen.**—In view of the proposal to supply electricity to Banchory and Ballater and intermediate places on Deeside, Mr. Bell has been authorised to visit districts where overhead transmissions are in use.

The Electric Lighting Department is to apply to the Secretary for Scotland for borrowing powers for £80,000.

**Accrington.**—An application has been received by the Electricity Committee from Messrs. Peebles & Co., of Rishton Paper Mills, for a minimum electrical supply of 1,000,000 kw. hours per annum. This has been referred to the sub-Committee for consideration, with power to agree to terms. A contract has been entered into for a supply of electrical energy to the Accrington Brick and Tile Co. for a period of three years.

Alderman Higham, the chairman of the Electricity Committee, last week forecasted an early reduction in the price of current for lighting. The experiment of generating electricity by the Mond gas system, said Alderman Higham, was proving a success, and the tabulated results would doubtless be eagerly awaited and keenly criticised by electricity experts throughout the country. Quite a number of people interested in the cheap production of electricity had visited the electricity works since the plant was started.

**Athens.**—The proposed improvements to be effected in this town include an electric lighting scheme, to cost £2,000.

**Bewdley.**—At a meeting of the T.C. on Monday, it was announced that negotiations were proceeding for the establishment of electric light works in the town by a private company, who would give the Corporation the option to purchase the undertaking at stated intervals. The Mayor stated that the negotiations, although not yet completed, were in a very forward state, and there was every likelihood of the scheme being carried through.

**Bolton.**—An inquiry was held on January 30th, on behalf of the L.G.B. relative to the T.C.'s application for sanction to borrow £130,000 for carrying out a big extension scheme in connection with the electricity undertaking, including the erection and complete equipment of a generating station on a site known as Back-o'-th-Bank. The town clerk said that the land had already been acquired. In consequence of alterations made in the scheme, the actual amount now estimated to be required was £122,000.

The scheme, for which the borough electrical engineer, Mr. A. A. Day, is responsible, has been deemed necessary by reason of the fact that the existing power station at Spa Road has become inadequate. The initial capacity of the plant proposed is two 4,000-kw. turbo-alternators generating three-phase current at 50 cycles and 6,500 volts. Coal will be delivered from the L. & Y. Railway siding direct on top of the boiler house, and on the other side of the site is the River Tonge, the water of which will be available for condensing purposes. In addition to the river, there will be extensive reservoir capacity for condensing purposes.

The Inspector said if the Board approved the general scheme, subject to future details being satisfactory, it would fix a limit to the expenditure.

**Canada.**—The Carillon Falls, on the Ottawa River, 35 miles from Montreal, will be the source of power of the National Hydro-Electric Co., with a capital of £1,000,000, which will seek a market in Montreal for the 148,000 h.p. which could be developed from them.

The immense water-power of the river St. Lawrence, above Montreal, is a source of great temptation to speculators and others on both sides of the Canadian border. Another attempt is to be made to convert the possibilities of the river into an electric development proposition. The promoters of this scheme are the Canadian Light and Power Co. Application has been made some time ago to the Government at Ottawa for authorisation to build dams across the river near Coateaw, at the head of the rapids, and at the entrance to the Cedars. Works involving from \$15,000,000 to \$20,000,000 are projected, in addition to those already under construction at the foot of Beauharnais Canal. The scheme, it is understood, will provide for the production of close to a half-million horse-power within easy reach of Montreal.

**Caton (Lanes).**—An effort is being made to establish an electric light undertaking at Caton. Efforts are being made to ascertain the probable number of consumers, and if there is a sufficient demand, steps will be taken to supply it.

**Christchurch.**—The B. of G. has decided to take a supply of current from the Bournemouth and Poole Electricity Supply Co., for at least five years, at 3½d. per kw.-hour for lighting, and 1½d. per kw.-hour for power and heating.

**Continental Notes.**—BELGIUM.—La Société Belge Popp (Traitement des Métaux par l'Electricité) is the name of a new company which has just been formed in Brussels with a capital of £50,000, to establish a plant for the electrical treatment of metal in accordance with certain patented processes.

SPAIN.—The municipal authorities of Sarria (province of Lugo) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

GERMANY.—The Ostharz Ueberland Zentrale Gesellschaft is the name of a new company which has lately been formed at Dessau, with a capital of £50,000, to establish a central electricity generation station for the supply of current for lighting and power purposes to a number of small towns and villages in the East Hartz district.

SWEDEN.—The new Swedish budget makes provision for the following electrical works and acquisitions for the State railways and power stations, &c.:—For the frontier railway, additional electrical equipment £30,555, and £22,222 for 1914; continuation of the works at the new Trolhattan canal, £166,666, including £5,277 already voted from the widening of the Stallback canal; extensions at the Trolhattan power station, for a first and second outbuilding, £7,222, and for a third building £8,888, with £7,222 for extras; for electrical plant at the Trolhattan power station £8,883; continuation of works at Porjus

power station, £44,000; and for increasing the water storage capacity of the Store Lule river £4,000; for the Alfkarely station £159,000, besides a like amount for the transmission network from stations.—*Affarsvärlden*.

**Derby.**—The E.L. Committee of the T.C. has recommended an application to the L.G.B. for a loan of £13,500 for additional plant, &c., viz., 2,000-kw. turbine set, with condensing unit and foundations, £9,000; rotary converter and transformer, 1,000; motor-generator, £2,500; switchgear, £750; cable work and sundries, £250.

**Douglas.**—At a special meeting of the T.C. it was decided by a majority of 3 votes to secure an estimate for a scheme of decorative electric lighting for the promenades of South Douglas, the cost not to exceed £12,000. An amendment to obtain a report on a similar scheme at half the cost was defeated. Another motion rescinding the previous decision empowering the Council to take a plebiscite of the town on an enlarged scheme to cost £28,000 was carried. It was pointed out that no Act provided for a plebiscite in electric lighting, and the Council would be liable to be surcharged with the cost.

**Dover.**—The sanction of the L.G.B. is to be obtained to the borrowing of a further £300 for transformers.

**Dudley.**—The Electric Lighting Committee is making necessary recommendation to the Council for the purpose of carrying on the generating station until such time as the works are handed over to the Electric Traction Co. and co-operating firms, in accordance with the deed of sale. Mr. C. E. Savage, the electrical engineer, has accepted another position near Dudley, but the Committee advises the Council to ask him to devote half or two-thirds of his time to the work of station engineer at the rate of £25 per month until the transfer. It is further recommended that the services of Mr. Savage be retained after the date of the transfer, at an annual fee of £21, for the purpose of inspecting the cost and quantities consumed on the street lighting contract, and for the examination of the tramway plant under the lease.

**Dundee.**—Messrs. Mather & Platt are fitting a factory in the centre of the city with three-phase motors, and those already connected to the Corporation mains are giving every satisfaction. Individual drive on the Schorch system has been adopted at a factory in the Lochee district, which is connected to the Corporation mains.

**Durham.**—The R.D.C. has decided to have the electric light installed at Houghal Hospital, where oil lamps are at present in use.

**Edinburgh.**—At a meeting of the Corporation Electric Lighting Committee, it was agreed to advise the T.C. to give a direct electric supply to Redford Barracks, conditional upon the consent of the county authorities being obtained. A proposal to give a supply to Duddingston was remitted to the engineer for report, and a Sub-Committee was appointed to consider the question of opening showrooms for the purpose of exhibiting electrical fittings and apparatus, and demonstrating their utility.

**Eccles.**—At a recent meeting of the E.L. Committee, particulars were given as to the annual amount of electrical energy which the Salford Corporation would agree to take for its tramways, and its willingness to agree to a "coal" clause, whereby a rise or fall in the price of coal would be reflected in the price of energy.

**Glasgow.**—At the last meeting of the Electricity Committee, the engineer reported that the consumption of coal at the generating stations, and the output of electricity had largely exceeded his estimates, and a special sub-committee has been empowered to purchase such additional quantity of coal as may be considered necessary.

The T.C. at its first meeting is to be asked to approve of a proposal by the sub-committee for the holding of an exhibition of electrical apparatus in the city at a date probably in the late autumn, and to empower the committee to make the necessary arrangements. Mr. James Freer, who managed the last two smoke-abatement exhibitions, is proposed to manage the latest venture, which was brought about on the invitation of several manufacturers and agents.

**Gloucester.**—The B. of T. has granted a licence to enable the T.C. to supply electricity to the Children's Hospital at Longford.

**Hertfordshire.**—Petitions are to be lodged by the C.C. against the following Electric Lighting orders:—Watford (Extension), Barnet (Extension), Colne Valley, Rickmansworth, Chesham and District, and the Northwood and Ruislip (Extension).

**Heston-Isleworth.**—In respect of mains and house services, two further loans of £1,200 and £800 are to be applied for by the Council.

**Hornsey.**—To-morrow the Council's new plant at the generating station is to be inaugurated. This consists of a 750-kw. Belliss-E.C.C. direct-current set, with a speed of 250 r.p.m. The engine is of the triple-expansion type, and exhausts to a Mirreles barometric condenser with two Rees-Roturbo pumps driven by a Bruce Peebles motor for supplying condensing water. A Baker oil separator is provided, and the hot well water is passed through a softening apparatus to the boiler feed tank, in connection with which a Rees-Roturbo electrically-driven boiler feed pump has been

installed. A Babcock water-tube boiler was installed about 12 months ago, and a further boiler of the marine type, with electrically-driven stoker gear, coal bunkers, &c., has been added, while the engine room has been extended sufficiently to accommodate two further large sets, in addition to that just installed. The work has been carried out under the direction of the Borough electrical engineer, Mr. Norman Staniland.

**Iford.**—Application is to be made to the L.G.B. for sanction to borrow £10,000, being the estimated expenditure on mains extensions during the next three years. The amount is made up as follows:—Private mains, £5,500; public mains, £1,000; house services, £3,500; legal and loan charges, £100. A supply is to be given by the Omnibus Co., at its new garage at Seven Kings, on the two-rate system.

**Kislingbury (Northants).**—A meeting of the rate-payers has passed a resolution supporting a proposal to obtain a supply of electricity from Northampton through the Electric Light Co., and pledging them to become consumers when a supply is available.

**Lewes.**—An 80-ft. chimney stack fell on Monday night on to the local electricity works, doing considerable damage.

**Liverpool.**—Applications are to be made to the Board of Trade and the L.G.B., for sanction to the borrowing of £8,000 and £40,000 for the provision of additional tramway cars and electric mains, respectively.

**London.**—HAMMERSMITH.—The Mayor and members of the Council last week paid a visit to the electricity works in Fulham Palace Road. Particular interest was taken in the last turbine installed, which was supplied by Messrs. Richardson, Westgarth & Co. It has a capacity of 3,000 kw., with 3,750 kw. in case of emergency for two hours. In the works there are now nine machines, viz., four turbines and five high-speed reciprocating generators, the total capacity of the whole being 10,300 kw.

The sum of £3,000 is to be taken up from the L.C.C. for electricity purposes, viz., £1,239 for mains, repayable in 25 years; £138 for switchgear, within 15 years; £1,321 for house services within 12 years; and £299 for meters within 10 years.

**Maidstone.**—The T.C. has adopted the recommendation of the Electricity Committee to extend the plant and buildings at the electricity works at an estimated cost of £5,620.

**Middlesex.**—With the view of protecting the county interests, a petition is to be lodged against the Metropolitan Electric Tramways (Railless Traction) Bill, 1913. Objections have been lodged against the Colne Valley Electric Supply Prov. Order and the Wood Green Electric Lighting Prov. Order.

**Newport (Mon.).**—As an experiment, the Borough Education Committee has decided to have the electric light installed in the Bolt Street and Ereswell schools.

**Oldham.**—A point in connection with the proposed new plant at the electricity works was raised at a meeting of the Corporation Electricity Committee last week. Councillor C. Hardman said that a local firm had asked if the Committee could let them have 1,000 h.p. The Committee had intended to get a 1,500-h.p. set, and that might be too small in view of the many applications. The engineer (Mr. Newington) said a 2,000-h.p. set was slightly more economical than the 1,500-h.p. set. The working cost was practically the same, and the present boiler power would be sufficient. It was decided that the Committee should put a 2,000-h.p. set in the application for borrowing powers which is to be made, instead of the 1,500 h.p. set, as first suggested; also to ask permission to supply a Royton firm, which is just on the border.

**Plymouth.**—The Electricity Committee of the T.C. has decided to extend and alter the plant and mains at the electricity works, at an estimated cost of £7,500. Of this £2,000 for alterations will be met out of the reserve fund, and a loan will be applied for, for the balance of £5,500.

**Rickmansworth.**—The U.D.C. has decided, for certain reasons submitted to the B. of T., not to support the application for a prov. order for electric light of Mr. R. E. H. Fisher, who had asked the B. of T. to dispense with the Council's consent. The Watford R.D.C. has also taken a similar attitude, and has informed the B. of T. that it cannot support the application of any particular electrical company.

**St. Albans.**—The B. of G. has appointed a Committee to go into the whole question of lighting the workhouse at present lit by gas.

**Salford.**—An agreement has been entered into with the Calico Printers' Association for supplying energy to them, subject to a minimum payment being guaranteed, and to the payment of £1 per quarter per h.p. demanded, and 3d. per kw.-hour. A contract is being entered into with the Lancashire Electric Power Co. for supplying energy in bulk; the Manchester Corporation also tendered for this supply. The sanction of the L.G.B. is to be obtained to the borrowing of £12,000 for the installation of rotary converters, transformers and switchgear required at the Frederick Road station in connection with the taking of the above bulk supply.

**Scarborough.**—The Corporation has appointed a Sub-Committee to consider the question of the taking over of the Scarborough electric supply undertaking. The Corporation has the option of doing so, if it thinks such a step desirable, at stated

ntervals. The Sub-Committee has been instructed to report generally upon the question of purchasing the undertaking.

**Shipley (Yorks.).**—The Shipley District Council contemplates extending its scheme of electric street lighting and has issued instructions for the preparation of a scheme and estimates of the cost of lighting both by electricity and by gas.

**Staveley.**—Several influential residents are interesting themselves in a scheme for obtaining a supply of electricity for the parish. Energy could be supplied from the Devonshire works of the Staveley Coal and Iron Co., Ltd., and it is understood that efforts will be made to secure a supply.

**Sunderland.**—The estimates for the Corporation Electricity Department for the year ending March 31st show an income of £67,912 and an expenditure of £61,218, leaving an estimated credit balance of £6,724—a substantial increase on the figures of last year. Of the net profit, it is intended to take £1,200 for the renewal of mains, and place the remainder to the credit of the renewals fund.

**Sutton (Surrey).**—The South Metropolitan Electric Tramways and Lighting Co. has decided to supply current to consumers at Sutton for heating at 1½d. per kW.-hour on a minimum quarterly consumption of 100 kW.-hours.

**Wednesbury.**—The Electricity Committee has recommended that application be made to the L.G.B. for sanction to borrow £2,000, for sundry electric mains, and a further sum of £1,000 to cover estimated expenditure on service connections.

**Westhoughton.**—It was announced recently that the D.C. had decided to approach the Lancashire Electric Power Co. as to whether it would be prepared to discuss terms for an extension of the lighting of the district by electricity.

**Whitstable-on-Sea.**—The electric light question, referred to in the last issue of the ELECTRICAL REVIEW, was again discussed by the U.D.C. on January 28th, when Mr. A. A. Kemp proposed that the resolution of September 1st, relative to the application of the Council to the B. of T. for a prov. order, be rescinded. On this being carried by 6 votes to 5, Mr. Kemp moved that the Council consider the establishment of an electric light undertaking by a private promoter, and this was adopted by 6 votes to 4.

**Wood Green.**—As recently stated in these columns, the U.D.C. has decided to sell its provisional order to the Tottenham and Edmonton Gas Co. for £500, subject to terms of supply, repurchase, &c. The Gas Co. is, therefore, seeking the necessary Parliamentary powers to supply electric light. On the other hand, the North Metropolitan Electrical Power Distribution Co. is applying to the B. of T. for an order empowering it to supply Wood Green. At a meeting on January 30th, arranged by the local Chamber of Commerce, the Chamber adopted the unusual course of inviting the heads of both the Electricity and Gas Co.'s to attend, and in response, Mr. Broadberry (manager of the Gas Co.), Mr. Devonshire (chairman of the Electricity Co.), and Mr. Ruthven Murray (the Electricity Co.'s expert), together with Mr. Spencer Hawes (the District Council's expert adviser), were present. Each was invited to express his views, after which they withdrew, and the traders—who will be the principal consumers, apart from the public lighting—voted upon the Council's action.

Mr. Broadberry, for the Gas Co., said his company was binding itself to a maximum price of 5d. per kW.-hour, and undertaking to supply within one year. The Order which the Power Co. was to obtain now fixed the maximum price at 8d., and did not undertake a supply for two years. His company would install gas engines of a new type, which would be almost as silent as sewing machines. It was not securing the Order to stifle it. With both gas and electricity in the hands of one concern, there would be no overlapping of canvassing, and it mattered not to the Gas Co. whether its gas was being used with incandescent mantles, or for the purpose of creating electricity.

Mr. Devonshire, for the Electric Power Co., said the Wood Green ratepayers owed the Power Co. a debt of gratitude, for in 1904 it saved them from what at one time appeared to be a very foolish expenditure, when about to embark upon the huge outlay of £45,000 upon electric lighting. Happily the scheme was abandoned, and he estimated that the Power Co. thus saved the ratepayers an annual expenditure of £12,000. From that time onwards, the Power Co. submitted various schemes for the supply of electricity in bulk, realising that with its enormous plant it could generate far more cheaply than the Council could ever hope to do it. In one bulk supply scheme that came near to adoption, the Council wanted an indemnity clause, to which the company could certainly not agree, so that the scheme was dropped. In 1907 another scheme was presented but never proceeded with. The Power Co. had endeavoured to do business with the Council, but it seemed as if it would not meet with success, and now it had had enough of it. Although the methods of procedure adopted by the respective companies to get the powers were different, they would both meet in Parliament, and he trusted that the Power Co. would be able to convince that high tribunal which was the better of the two schemes.

Mr. Ruthven Murray, the Power Co.'s expert, derided little gas stations, and said they were being scrapped. The maximum of 8d. was merely protective, and was seldom, if ever, reached.

Mr. Spencer Hawes, the Council's expert, emphatically declared himself in favour of the Gas Co.'s scheme, and assured the Chamber of Commerce that the Council had acted in the best

interests of ratepayers and possible consumers in agreeing to dispose of its order to the Gas Co., which had treated it most fairly in the matter.

Mr. F. G. Holmes, the only member of the Council against the scheme, said the Council would be at the mercy of the Gas Co. if the scheme were sanctioned by Parliament. He estimated that the total turnover on gas at Wood Green was £50,000 a year, yet the Council was giving the company a monopoly for £500. He believed in competition.

A resolution was carried that the Council's action in agreeing to sell the order to the Gas Co. was not in the best interests of the district. This decision is regarded in the neighbourhood as an important weapon with which to strengthen the hands of the electric light company.

**York.**—A report shows that the total income of the York electricity undertaking for the nine months ended December 31st, 1912, was £19,901, as compared with £15,944 during the corresponding period of 1911, an increase of £3,956. The expenses were £9,610, having grown from £6,904. The cost per unit during the period was 53d., as compared with 80d. The increased demands and the expected requirements of the next winter have resulted in the Electricity Committee recommending the Corporation to apply for power to borrow £30,600 for the purposes of extensions of plant and mains.

The loan is to be applied for, for the following purposes:—3,500-kw. turbo-alternator with condenser, £14,257; two water-tube boilers, with superheater and chain-grate stokers and steam pipes, £4,170; H.T. cables, £6,551; battery room and battery, £4,722; sheds for locomotive and main stores, £600; contingencies, £300.

A poll of the ratepayers was taken on Friday last to determine the future of the proposal to obtain Parliamentary powers to purchase the Gas Co.'s undertaking. Curiously enough, the proposal appears to have been largely supported by the members of the local Electricity Committee, but nevertheless the ballot resulted in a majority of 2,067, out of 8,629, against the proposed Bill.

## TRAMWAY and RAILWAY NOTES.

**Belfast.**—The extension of the tramways system was opened on the 28th ult., and since then there has been a substantial traffic on the new roads—Bloomfield, Donegal Road, Oldpark Road, Ligoniel, Stranmillis Road and Ravenhill Road. The B. of T. inspection was carried out the day before.

**Blackpool.**—The T.C. has approved of the Tramways Committee's proposal to borrow £10,000 for extensions, including the purchase of six additional "toast-rack" cars.

**Brighton.**—The T.C. has rejected a proposal of Messrs. Tilling to run a service of petrol-electric 'buses.

**Cannock.**—The R.D.C. has decided to support the application of the Great Wyrley P.C. to the Walsall Corporation for motor-bus or tramway facilities between Great Wyrley and Walsall. The P.C. has received a communication from the Corporation stating that the matter will receive consideration by the Tramways Committee, but that the latter could not embark upon any scheme which would not provide 8d. per mile for every car-mile run.

**Continental Notes.**—**AUSTRIA.**—An extensive scheme for the enlargement of the tramway network is projected at Trieste, by which some 27 public thoroughfares will be intersected and served by tramway lines. The official authorisation for the preliminary studies has been granted. At Prague the Advisory Committee of the Tramways Co. has recommended the construction of six new lines in that city and its suburbs.—*Elektrotechnik und Maschinenbau.*

**Edinburgh.**—On condition that the Corporation aids substantially the proposed Zoological Gardens for Edinburgh, and that the gardens will be opened within the next 12 months, the Tramways Co. is prepared to contribute £1,000 to the undertaking.

**Glasgow.**—At its last meeting the T.C. instructed the Tramways Committee to proceed with negotiations with the various local authorities and other parties interested along the line of route, in connection with a considerable extension of the line of tramways, which, if carried out in its entirety, will add about 20 miles of double track to the system. It is expected that the negotiations will take up the better part of the spring and summer, and upon their success or otherwise will depend the future action of the T.C. in seeking for Parliamentary sanction for the extensions. In submitting the proposals, Bailie Kirkland, the convener, spoke at some length of the great congestion of traffic in the centre of the city. He admitted that the tramways were to a very considerable degree responsible for this, and suggested that in the near future the question of a central relief route would have to be considered. This would probably involve the construction of another bridge over the River Clyde, but if the Corporation approved of the erection of such a bridge as would suit the needs of the tramways department, the latter might be looked to for a large contribution, if not the payment of the whole cost. As to

the extensions, which are, with three slight exceptions, all into the country, and link up villages and populous centres, it was contended that such routes had paid as well as, if not better than, the crowded city lines.

With the extension of the half-ponny stage distance on the T.C. tramway cars the fear at first was expressed that there would be a considerable falling-off in the revenue derived. This fear has now had the edge taken off it by the report from the department that the income for the present financial year has exceeded that of 1911-12 (up to the end of February), by over £1,000. The figures are from June 1st to February 1st, 1912-13—£666,617, and June 1st to February 1st, 1911-12, £665,612. While, through 1912 being Leap Year, the last 12 months had one more working day than the present year (and a day's drawings, which will not be included in 1912-13, are averaged at £2,100), it is confidently expected that the record in the income created last year will be eclipsed on the present occasion. So far as passengers carried are concerned, the totals already far exceed those of any previous similar period of nine months, and are nearly 26 millions more than in the corresponding spell of 1911-12.

**Goldthorpe.**—The U.D.C. has under consideration a scheme for the establishment of a service of railless cars between Bolton, Goldthorpe and Barnsley.

**Hertford.**—The County Council has decided to abandon the Watford-Bushey tramway scheme, which has been on the boards for 12 years. The introduction of the motor-bus is considered to account for the decision.

**Hythe (Kent).**—The T.C. at a special meeting on Saturday decided to support the Bill of the Tramway Co., which is being promoted by Mr. Cownie.

**Japan.**—The Aichi electric railway is about to commence the construction of a light electric railway about eight miles in length.

**London.**—CENTRAL LONDON RAILWAY.—The work of reconstructing the permanent way has been commenced. This is being carried out at night, three 42-ft. sections being hauled from the depot where they are built, to the desired position on a special train consisting of bogie trucks, which are motor-driven from Edison batteries. Two of the latter, each with 220 cells, are installed on each truck, and the latter are also provided with cranes for lowering the track into position.

**Newcastle-on-Tyne.**—The estimates for the ensuing year of the Corporation tramways have been presented to the committee. The income is put at £10,000 more than in the past year, but the estimated expenditure is put a like amount higher, the increased expenses being attributed to higher wages of drivers, conductors, &c., £3,000; street repairs, £2,000; and increased cost of coal, &c. It was reported that several works were urgently needed, including the renewal of lines in Shields Road, Jesmond Road, and Grainger Street, &c., the total cost of which was put at £61,000, which would be met out of the reserve fund.

**Northampton.**—The Tramways Committee has had under consideration the advisability of adopting a motor-omnibus service or extending the tramways to Far Cotton. It has been decided to take the latter course and construct a double track throughout, with the exception of a portion which will cross the L. & N.W. Railway, at an estimated cost of £17,340. Tenders are to be obtained for carrying out this work, and also for the doubling of certain track, estimated to cost £5,090. With regard to the motor-buses, the Committee expressed the opinion that buses cannot, either as regards reliability or comfort, compete with modern tramcars, and their working expenses were greater than would justify the Town Council in adopting this method of traction.

**Salford.**—In default of the proposals of the Salford Corporation being accepted as to the terms for the future supply of energy by Eccles to Salford for working the tramways in Eccles by the Salford Corporation, application is to be made to the B. of T. to appoint an arbitrator to settle the question.

**Sandgate (Kent).**—The U.D.C. has decided to proceed with the petition against the Bill of the Tramway Co. for power to construct and operate a railless traction system in the district.

**Scarborough.**—The Scarborough South Cliff Tramway Co. proposes to introduce pumping by electricity.

**S.E. & C. Railway Electrification.**—Speaking at the meeting of the South-Eastern and Chatham Railway recently, Mr. Cosmo Bonsor, who presided, stated that the directors had not abandoned the idea of electrifying the railway. At the present moment, they were having a report made by an eminent engineer as to the wisdom of the proposal. The system, the chairman added, was a difficult one to deal with, for they must either electrify it throughout or leave it alone altogether. The question was entirely one of money.

**Sunderland.**—The estimates for the year ending March 31st next show an income of £68,769, a slight decrease on the figures for the preceding year. The net profit is put down at £11,076, and of this £6,076 is to be placed to the reserve fund, and £5,000 to the borough fund for the relief of the rates. The slight decrease in income is attributed to the bad weather, which caused a reduction in the traffic to the seaside.

## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—The Federal Government has accepted tenders for the installation of automatic telephone exchanges on the Strowger system in the Glebe, Newtown and Balmain suburban areas of Melbourne. The contract price is about £37,000. The system has already been installed at Geelong, at a cost of £14,293.—*Sydney Morning Herald.*

The report of the Postmaster-General for 1911 shows that the revenue of the Commonwealth from the telephone service increased by £233,674, and from the telegraphs by £10,673. The total length of wire in use for telegraphic purposes was 97,053 miles—the number of telephone instruments in use was 102,654, an increase of 16.5 per cent. The number of telephone exchanges rose from 678 to 927. The telephone trunk lines aggregated 39,088 miles.

**Imperial Wireless System.**—On Wednesday last week the cross-examination of Mr. W. R. Lawson by Mr. Falconer before the Select Committee occupied the whole sitting. Mr. Lawson admitted that at the time when the contract was drawn up there was no company in the same position as the Marconi Co. to carry out the work. He had said that the effect of wireless telegraphy in naval warfare had not been thoroughly tested or thought out, and that there was no mention of the subject having ever come before the Cabinet, but he withdrew the latter statement. He admitted that the rates to be charged by the Post Office for messages would not be affected by the amount at which the Marconi companies were capitalised, and that if the market value of the shares was excessive, that was not the fault of the company. Regarding his statement that the State had associated itself with a huge Stock Exchange gamble, he said he had never been able to verify the rumours that Ministers had been interested in the speculation.

On the following day, Mr. Lawson withdrew the allegations that wireless telegraphy had never been considered from the point of view of its effects on naval warfare, and that the Post Office had shut itself out from the services of all other patentees. He admitted that the cable companies had been granted landing rights without payment, while the Marconi Co. had been refused a licence in 1910, and that there was no analogy between the position of the cable companies and that of the Marconi Co., and he therefore withdrew his statement that the treatment of the former was in striking contrast to the favour accorded to the Marconi Co. He agreed also that there was no analogy between the positions of the National Telephone Co. and the Marconi Co. He further withdrew his statement that the affiliated companies of the Marconi Co. were all heavily loaded, and modified other passages in his previous evidence.

On Monday Mr. Lawson's cross-examination was continued. The witness protested against the mode of cross-examination adopted by Mr. Falconer, and expressed a wish to take out the whole of his evidence with regard to the Government being tied to the Marconi Co. by the agreement. He agreed that the company was financially in a position to carry out the contract, had a system capable of trans-Atlantic communication, and had a large and highly-qualified engineering staff, a more important consideration than that of patents. The company had great financial influence, but he admitted that the Government were absolutely independent of the company.

A letter was read from Mr. Marconi, stating that he was compelled to go to the United States before March 1st in connection with certain patent actions brought by his company, and must absent himself from London for 10 or 14 days before sailing. He therefore requested to be heard by the Committee as soon as possible. The chairman said they could not break off the journalists' evidence at present; and as the House of Commons would rise on February 14th, the Committee could not call Mr. Marconi till after Easter.

The Committee sat again on Wednesday.

The Committee appointed by the Postmaster-General to advise on the existing systems of wireless telegraphy requests any person desiring to be heard by the Committee to apply to the Secretary, Mr. E. H. Rayner, National Physical Laboratory, Teddington, Middlesex.

The Select Committee, to which the Postmaster-General referred the request of the Marconi Company to be released from the contract, has replied that it cannot advise on the matter until the inquiry is concluded. Mr. Samuel therefore has refused to release the company, pointing out that a provision was embodied in the contract that it should not take effect until approved by the House of Commons.

**Telephonic Control of Trains.**—The Rhymney Railway Co. have put into operation over their system, which extends from Cardiff to the eastern and western valleys of Glamorgan-shire, a new train control system making use of the telephone, the first of its kind that has been installed in Great Britain. It was provided by the Western Electric Co., of North Woolwich. By means of a system of telephones to all signal-cabins, junctions, and stations on the line, the whole of the train working can be completely and directly controlled from the head office at Cardiff. It is believed that as the result of the new installation much time will be saved.—*Standard.*

**Wireless in the Antarctic.**—Several messages have been received from Dr. Mawson, leader of the Australian Antarctic Expedition, who is now in Adelie Land, but, so far, the Australian station has not been able to make him hear any reply.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdeen.**—February 10th. One 3,000-kw. turbo-  
alternator, with surface condenser and air pump, for the Corporation. See "Official Notices" January 24th.

**Arbroath.**—Tenders are invited for the electric lighting  
work for the reconstructed Sheriff Court House. Mr. P. C. Smith,  
arch engineer.

**Ashton-under-Lyne.**—February 19th. H.T. switch-  
gear, water-softening plant, steam, exhaust and feed pipes, tanks,  
&c., for the Corporation. See "Official Notices" January 31st.

**Australia.**—VICTORIA.—February 21st. Four 1,500-  
kw. rotary converters, for the Melbourne City Council. See "Official  
Notices" December 6th.

WESTERN AUSTRALIA.—February 19th. Armoured telegraph  
cable, for the P.M.G.'s department. See "Official Notices" January  
9th.

February 27th.—Buildings and boiler-house equipment, turbo-  
alternators and rotary converters, for a Government power station  
Perth. See "Official Notices" January 24th.

SYDNEY.—March 17th. Motors for the City Corporation.

SOUTH AUSTRALIA.—March 5th. One section of a common-  
battery switchboard, for the P.M.G.'s Department. See "Official  
Notices" January 31st.

**Austria.**—VILLACH.—March 1st. Tenders are invited  
for the supply of three portable 1.3-H.P. rotary current motors, a  
0.5-H.P. rotary current motor, and a 7-H.P. rotary current motor;  
also for a large number of machine tools for the railway work-  
shops. Forms of tender (2d.) and conditions of delivery (1s.), and  
other particulars, may be obtained of Abteilung IV, k.k. Staats-  
bahn-Direktion Villach, Austria.

KRAKAU.—February 19th. Tenders are wanted for the supply of  
three electric hand-boring machines, three ditto air, the equipment  
for a 60-ton wagon hoist, a 20-ton electrically-driven movable  
crane, a movable electric boring machine, a ditto screw-cutting  
machine, two electric Universal hand-boring tools, an electric polishing  
machine, an electric quick-borer and a rotary transformer. Particu-  
lars and tender forms from Abteilung IV, Staatsbahn-Direktion,  
Krakau, Austria.

INNSBRUCK.—February 21st. Tenders are required for the supply  
of a shaping machine with electrical equipment, an electrically-  
driven table boring machine for holes 15 mm. diameter, an electric  
hand-boring machine, the electric equipment of a 40-ton wagon  
hoist, an electrically-driven hammering machine, and other tools  
for the railway workshops. Particulars and forms of tender  
(enclosing 2d.) of Abteilung IV, k.k. Staatsbahn Direktion  
Innsbruck, Austria.

**Beckenham.**—February 10th. Arc lamp carbons (flame)  
and electrical house cut-outs and service boxes, for the U.D.C.  
and Offices, Beckenham.

**Belfast.**—February 24th. Stores and materials for one  
or three years, for the City electricity department. See "Official  
Notices" January 31st.

**Belgium.**—February 17th. The Belgian Department of  
Ridges and Roads in Brussels (52, Boulevard du Regent) are  
inviting tenders for the necessary installation for the supply of  
electricity for lighting purposes at the Royal Palace at Laeken.

**Birkenhead.**—February 11th. Continuous-current  
electricity meters and house service fuse boxes, for the Corporation.  
See "Official Notices" January 24th.

**Blackburn.**—February 15th. Materials for a year, for  
the Corporation Electricity Department. See "Official Notices"  
January 31st.

**Bolton.**—February 13th. Turbo-alternators with con-  
densing plant, water-tube boilers, economisers, switchgear and  
steam feed pumps, for the Corporation. See "Official Notices"  
January 24th.

February 24th. Materials and stores, for the Corporation Tram-  
ways Department. See "Official Notices" to-day.

**Bridlington.**—February 8th. One 600-kw. turbo-  
alternator, with switchboard and pipework extensions, for the  
Corporation. See "Official Notices" January 24th.

**Bristol.**—February 14th. Arc lamp carbons, joint,  
junction and fuse boxes, A.C. wattmeters, and D.C. mercury type  
ampere-hour meters, for the City Electricity Department. See  
"Official Notices" January 31st.

**Cardiff.**—February 14th. One steel chimney, with  
mechanical draught plant, for the Corporation. See "Official  
Notices" January 31st.

**Cheltenham.**—February 12th. Electric wiring, Mont-  
pellier Baths, for the T.C. Borough Engineer, Municipal Offices.

**China.**—February 10th. Six 625-K.V.A. three-phase oil-  
cooled transformers, for the Shanghai Municipal Council. See  
"Official Notices" January 24th.

**Colchester.**—February 10th. Duplicate motor-driven  
air-compressor plant, with pipework, cables, switchgear, &c., for the  
Committee of Visitors, Essex and Colchester Asylums. See  
"Official Notices" January 24th.

February 15th.—Rubber and fibre insulating materials, cables,  
electrical fittings (lighting), electrical equipment (cars), overhead  
equipment, car fittings, &c., for the Corporation tramways depart-  
ment. Mr. R. C. Bullough, General Manager and Engineer.

**Darlington.**—February 17th. One 1,000-kw. steam  
turbo-alternator, one 750-kw. and one 250-kw. rotary converter,  
and one water-tube boiler, for the Corporation. See "Official  
Notices" January 31st.

**Derby.**—February 19th. One 2,000-kw. turbo-alter-  
nator, for the Corporation. See "Official Notices" to-day.

**Dublin.**—February 13th. Water-tube boilers, econo-  
misers, pumps, conveying plant, pipework, &c., also boiler seatings  
and flue work, for the Corporation Electricity Supply Committee.  
See "Official Notices" January 24th.

February 13th. Arc lamp carbons, for the Corporation. See  
"Official Notices" to-day.

**Edmonton.**—February 26th. Electric lamps for the  
B. of G. Mr. F. Shelton, clerk, The Grange, White Hart Lane,  
Tottenham.

**Egypt.**—March 31st. Section des Municipalités invites  
tenders for electric light installation at Damietta. For further  
particulars see this column for January 24th.

**Finchley.**—February 17th. One 300H.-H.P. oil engine,  
coupled to a 200-kw. E.C.C. generator, for the U.D.C. See "Official  
Notices" to-day.

**France.**—PARIS.—February 14th. Tenders are invited  
by the Administration des Chemins de Fer de l'Etat for the supply  
of 500 electric connections for bearer rails, 60 metres of naked  
copper cable of section 200 square millimetres, and 700 metres of  
naked copper cable of 400 square millimetres section. Particulars  
may be obtained from Bureaux du Service-Electrique (1st division),  
43, Rue de Rome, Paris.

NANTES.—Orders are about to be placed by the Chamber of Com-  
merce of Nantes for three electric cranes. Particulars of the  
Chamber.

**Glasgow.**—It is recommended by the T.C.'s Com-  
mittee on Electricity that it is advisable to proceed with the  
erection of a new generating station on ground recently acquired  
for the purpose in Dalmarock Road, and the engineer (Mr. W. W.  
Lackie) has been authorised meantime to prepare forms of tender  
of specification for the erection of one pumping station for the  
purpose of pumping water from the River Clyde for condensing  
purposes, at an estimated cost of £3,000.

**Grimsby.**—February 11th. One 1,000-kw. mixed-  
pressure turbine and continuous-current dynamo, with condensing  
plant, for the Corporation. See "Official Notices" January 24th.

**Halifax.**—February 17th. Stores and materials for a  
year, for the Corporation electricity department. See "Official  
Notices" January 31st.

February 17th.—Stores and materials for tramways department  
for 12 months. Tramways Engineer, Tramways Office, Skircoat Road.

**Hornsey.**—February 24th. Electricity meters, cables  
and cable stores, for the T.C. See "Official Notices" to-day.

**Ilford.**—February 25th. Stores for a year, for the  
U.D.C. electricity department. See "Official Notices" to-day.

**India.**—February 18th. High and low-tension switch-  
boards, for the Bombay, Baroda and Central India Railway. See  
"Official Notices" January 31st.

**Leeds.**—February 19th. Coal and general stores for a  
year, for the Corporation electric lighting department. See "Official  
Notices" January 24th.

February 17th.—The City Tramways Committee invites tenders  
for electrical sundries and engineers' furnishings and other goods  
for the tramways during the 12 months ended March 31st, 1914,  
and also for the reconstruction of certain portions of tramway  
track, in respect of which tenders may be for six, nine or 12 months.  
General Manager, Tramway Offices, City Square, Leeds.

**London.**—BERMONDSEY.—February 17th. Stores for a  
year, for the B.C. Electricity Department. See "Official Notices"  
January 24th.

L.C.C.—February 11th. The tramways department is inviting  
tenders for 584 tons of special section mild steel bars for magnetic  
brake shoes. Specifications and form from Mr. A. L. C. Fell, Chief  
Officer of Tramways, 62, Finsbury Pavement, E.C.

L.C.C.—February 25th. Electric wiring of the Camberwell and  
Cressy Road car-sheds. See "Official Notices" January 31st.

FULHAM.—February 19th. Electrical and engineering stores for  
a year, for the B.C. See "Official Notices" to-day.

ST. PANCRAS.—March 4th. Arc lamp carbons, for the B.C. See  
"Official Notices" to-day.

SHOREDITCH.—The B.C. Lighting Committee is to invite tenders  
for economisers for Whiston Street generating station.

MARYLEBONE.—February 26th. Stores and materials for a year,  
for the B.C. Electricity Department. See "Official Notices" to-day.

MARYLEBONE.—February 12th. Converting plant, for the B.C.  
See "Official Notices" to-day.

**Manchester.**—February 18th. General stores for a year, for the Corporation tramways department. See "Official Notices" January 31st.

**Morocco.**—March 27th. 15,000 insulators for the Post and Telegraph service. Tenders to M. le Président de la Commission Générale des Adjudications et des Marchés, Dar-En-Niaba, Tangier. Deposit, 1,000 fr. *Board of Trade Journal.*

**Newcastle-on-Tyne.**—Messrs. C. A. Parsons & Co., Ltd., Heaton Works, are inviting tenders for a 10-ton single-motor electrically-driven travelling jib crane, 1 ft. 3½ in. gauge, with travelling, lifting and slewing motions, about 16 ft. radius, fitted with overhead trolley collectors, all for 110 volts D.C. supply.

**Oldham.**—February 21st. Two 500-kw. motor-alternators, for the Corporation. See "Official Notices" to-day.

**Portsmouth.**—February 10th. Arc lamp carbons (Conradtys), for the Corporation Electricity Department, for a year Electric Light Station, Gunwharf Road.

**Prague.**—February 28th. Tenders are invited for the supply of machine tools, with electric equipment, to the Bohemian Northern Railway. Particulars (enclosing 2d.) from the Direktion der Böhmisches Nordbahn, Abteilung IV, Prague.

**Rochdale.**—Engine room extension, new boiler house, &c., turbo-alternator, condensing plant, motor-alternator, water-tube boilers and boiler house equipment for the Corporation. See "Official Notices" to-day.

**Sheffield.**—February 8th. The Corporation Tramways Committee is inviting tenders for 1,000 tons of steel tramway rails. Specifications, &c., £2 2s. (returnable), from Mr. W. J. Hadfield, Surveyor of Highways, Town Hall.

**South Shields.**—February 17th. Uniforms, for the Corporation tramways department. See "Official Notices" January 31st.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

**Walthamstow.**—February 28th. Four double-deck tramcars complete with magnetic-brake equipments, for the U.D.C. See "Official Notices" to-day.

### CLOSED.

**Admiralty.**—The Walsall Electrical Co., Ltd., has received an order from the Admiralty for 1,000 switches and sockets.

**Australia.**—The *Australian Mining Standard* states:—"With reference to the acceptance of the tender of Australasian Wireless Ltd., Sydney, for the installation of wireless telegraph stations at Sydney and Fremantle, it is notified that the price covered by such acceptance has been increased to £6,150 in the case of the station at Sydney."

One lamp signalling trunk-line switchboard of nine sections, one three-position recording desk and one chief operator's desk, for £2,079, has been ordered by the P.M.G., Melbourne, from the Western Electric Co. (Aust.), Ltd., Sydney.

The same contemporary states that Messrs. W. G. Watson & Co., Sydney, have received an order for 11,000 Helleren dry cells, which completes a total of 33,000 supplied for the Sydney Post Office.

The Prahran-Malvern (V.) Tramways Trust has accepted the tender of Messrs. Siemens Bros., Melbourne, for an automatic reversing booster and switchgear, at £971.

**Bradford.**—The Board of Guardians has accepted the offer of Messrs. C. A. Parsons & Co. of a new commutator for one of the turbo-generators of the workhouse plant, at a cost of £75.

**Cheltenham.**—The Borough Education Committee has accepted the tender of Messrs. R. E. & C. Marshall for the electric light installation at Haunton Park Centre, at £31; and that of Mr. F. H. Bastin for the electric light installation at Marlborough House, at £26.

**Dover.**—The tender of Messrs. J. Wright & Sons, at £42, has been accepted by the T.C., for wiring the St. Martin's Schools.

**Eastbourne.**—The T.C. has accepted the tender of the British Westinghouse Electric and Manufacturing Co., for a 1,500-kw. turbo-alternator, without condensing plant, running at 3,000 R.P.M. for £5,236. The turbine is to be of the pure impulse type. Fifteen other tenders were received.

**Eccles.**—The tender of Messrs. Joseph Chapman & Sons, Patricroft, is to be accepted for the erection of the extension to the boiler house at the electricity works, for £518.

The T.C. has accepted the tender of Messrs. J. and G. Weir, Ltd., at £80, for the provision of an additional feed pump at the electricity works, and that of the British Electric Transformer Co., Ltd., at £115, for the installation of a 150-K.V.A. transformer.

**Glasgow.**—The Electricity Committee has recommended the acceptance of (1) an offer by Messrs. Willans and Robinson, Ltd., for one set of Curtis-Parsons turbo-alternators and condensing plant, at £16,064, and (2) an offer by the British Westinghouse Electric and Manufacturing Co., Ltd., for one set of Curtis-Rateau turbo-alternators and condensing plant, at £16,721.

**Gloucester.**—The Electricity Supply Committee has accepted the tender of the Phoenix Dynamo Manufacturing Co., Ltd., for two new armatures for No. 6 generating set, at £580 and that of Messrs. Sisson & Co., at £35, for alterations to the governors &c. The engine will be able to run at full load at reduced speed after these alterations.

**Haslingden.**—Mr. A. M. Cramp, of Haslingden, has secured the contract for electric lighting, power, bells, telephones and vacuum suction plant for Springfield Lodge, Haslingden, the new residence of Councillor R. Waddington, chairman of the Electricity Committee. Mr. Cramp is also carrying out the electrical equipment of Messrs. S. S. Stott & Co.'s Laneside Foundry and Elevator Works, Haslingden.

**Ilford.**—The U.D.C. has accepted the tender of Messrs. W. T. Henley's Telegraph Works, Ltd., at £87 10s., for the supply and delivery of 100 yd. of cable for switchboard connections.

**Ipswich.**—The B.G. has accepted the tender of the Chloride Electrical Storage Co., Ltd., for the maintenance of the storage battery at the Workhouse for five years.

**Leyton.**—The U.D.C. has accepted the tender of the Paterson Engineering Co., Ltd., at £150, for installing a cold process water softener at the electricity works.

**Liverpool.**—The following tenders have been accepted by the T.C.:

Jas. McKelvie & Co.—Annual supply of about 1,500 tons best Arley gas slack to the electricity department.

Halley's Industrial Motors, Ltd.—Chassis for motor tower wagon.

Sutton Heath and Lea Green Collieries, Ltd.—Annual supply of steam slack to the Lister Drive power station.

The following have also been accepted for plant for the Lister Drive power station:—

Babcock & Wilcox, Ltd.—Six boilers with chain grate stokers, stoker gear and steel up-take flues; induced draught fan, complete with motor; gravity bucket coal conveyor and motor; overhead coal bunkers and floor for supporting economisers, flues and fans.

E. Green & Son, Ltd.—Six economisers.

Jos. Crawford.—Four induced draught fans and control panels, motors and platform.

**London.**—SHOREDITCH.—The B.C. Lighting Committee has contracted with Messrs. Harrison, Tidswell & Co. for up to 2,000 tons of Whitwick deep seam slack, at 14s. 5d. per ton, delivered free alongside Whiston Street power station.

STEPNEY.—The B.C. Electricity Committee has accepted the offer of Messrs. W. Geipel & Co. for 28,000 Henrion flame arc lamp carbons, at 14s. 6d. per 100, less 50 per cent. discount. It also recommends the acceptance of the tender of Messrs. Strachan and Henshaw, Ltd., Bristol, for the extension of the telpher track at Limehouse station, for £2,722. Messrs. E. Wood & Co., Ltd., Manchester, tendered at £2,752.

POPLAR.—The tender of Messrs. M. Keenan & Co. has been accepted by the B.C. at £91, for lagging the main steam, feed, and blow-down piping in the extension at the generating station.

**Manchester.**—Messrs. Higginbottom & Mannock have received an order for the supply of six 2-ton electric cranes for No. 9 dock.

**Mersey.**—The Mersey Docks and Harbour Board has accepted the tender of Messrs. Geo. Russell & Co., Ltd., for 30-cwt. movable electric roof cranes for the double-storey shed on the south side of the Brocklebank Branch Dock.

**Morecambe.**—The Corporation has approved the acceptance by the Tramways Committee of the tender of Messrs. Hill and Smith, Wolverhampton, for the supply of an unclimbable iron fence at Bare in connection with the new tramway sheds.

**Newport.**—February 22nd. General stores for a year, for the Corporation electricity and tramways department. See "Official Notices" to-day.

**Salford.**—The T.C. has accepted the tender of the A.E.G. Electric Co., for the supply of 500 electric lamps at 30s. per doz., less 27½ per cent., also the tender of W. T. Henley's Telegraph Works, Ltd., for an annual supply of wire to the tramways department. Two overload circuit breakers are to be purchased from Mr. Bertram Thomas, for £90. The tender of Messrs. Mather and Platt, Ltd., has also been accepted, at £635, for the supply and delivery of filtration plant at the electricity works.

**Walthamstow.**—February 28th. Annual stores for the electricity and tramway departments. See "Official Notices" to-day.

**Willenhall.**—The U.D.C. has accepted the tender of the Rees Roturbo Manufacturing Co. for the pumping plant in connection with the new sewage disposal works.

## FORTHCOMING EVENTS.

## NOTES.

Association of Mining Electrical Engineers.—Friday, February 7th. At 8 p.m. At the I.E.E., Embankment, W.C. Paper on "Cables for the Shafts of Mines," by Mr. L. K. Scott.

(West of Scotland Branch).—Saturday, February 15th. At 4.60 p.m. Meeting at the Royal Technical College, Glasgow.

Royal Institution.—Saturday, February 8th.—At 3 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture I.) Saturday February 15th.—(Lecture II.)

Association of Engineers-in-Charge.—Saturday, February 8th. At St. Bride's Institute, E.C. Social. Dance.

Wednesday, February 12th.—At 8 p.m. At the St. Bride's Institute, E.C. Paper on "The Control of Alternating-Current Motors," by Mr. J. T. Mould.

Salford Technical and Engineering Association.—Saturday, February 8th. At 7 p.m. At the Royal Technical Institute, Salford. Lecture on "Our Annual Trip Round the Sun," by Mr. C. M. Dorman, M.I.E.E.

Institution of Post Office Engineers (Metropolitan Section).—Monday, February 10th. At 6 p.m. At the I.E.E. Paper on "Loading Coils," by Mr. S. A. Pollock.

Institution of Electrical Engineers (Newcastle Section).—Monday, February 10th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "The Special Application of Electricity in Warships," by Mr. A. P. Fyne.

(Manchester Section).—Tuesday, February 11th. At 7.80 p.m. At the University, Manchester. Paper on "Advertising Electricity," by Mr. H. C. Palmer.

(Scottish Section).—Tuesday, February 11th. Meeting at 8 p.m. At Princes Street Station Hotel, Edinburgh.

Saturday, February 15th.—At 7.60 p.m. At the Grosvenor, Glasgow. Annual smoking concert.

(Birmingham Section).—Wednesday, February 12th. At 7.30 p.m. At the University, Birmingham. Paper on "The Parallel Operation of Alternators," by Mr. A. R. Everest.

(Yorkshire Section).—Wednesday, February 12th. Meeting at the University, Leeds. At 7.15 p.m. Lecture on "Some South American Electric Plants," by Mr. T. Harding Churton.

(London).—Thursday, February 13th. At 8 p.m. Paper on "Parallel Operation," by Mr. A. R. Everest.

(Dublin Section).—Thursday, February 13th. Meeting at 8 p.m. At the Royal College of Science, Dublin.

Junior Institution of Engineers.—Thursday, February 13th. At 2.80 p.m. Visit to the works of the Osram Lamp Works, Ltd., Hammersmith.

Friday evening, February 14th.—At 89, Victoria Street, S.W. Paper on "Electrical Installations in Metal Conduit, with Special Reference to Earthing," by Mr. F. H. Taylor.

Saturday, February 15th.—At 6.30 p.m. At the Hotel Cecil. Annual dinner.

Institution of Mechanical Engineers.—Friday, February 14th. At 8 p.m. Annual general meeting. Paper on "Modern Condensing Systems," by Mr. A. E. L. Scanes.

Birmingham and District Electric Club.—Saturday, February 15th. At 6.30 p.m. At the Swan Hotel, Birmingham. Annual dinner.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, February 10th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, February 11th.—"B" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Thursday, February 13th.—"C" Company. Company training, 7 to 10 p.m.

Friday, February 14th.—"D" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, February 15th.—Headquarters will be open from 10 a.m. till 12 noon for regimental business.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adj't.,  
For Officer commanding L.E.E.

**The Electrical Trades Benevolent Institution and Life Insurance.**—We have received from Mr. Hawes, the secretary of the above Institution, particulars that are being issued by the Provident Clerks' and General Mutual Life Assurance Association respecting life and endowment insurance. This office undertakes to afford to members of the Institution an opportunity to effect life insurance on easy terms. Weekly payments can be made through the Institution's properly-appointed representatives. Full information as to scales for whole life, limited premium, and endowment policies can be obtained either from Mr. F. B. O. Hawes at 18, Park Mansions, Vauxhall Park, S.W., or the secretary of the Assurance Association named, at 27 and 29, Moorgate Street, London, E.C. It is hoped that the arrangement will form an inducement to many of the younger men in the industry to become members of the Benevolent Institution (minimum subscription 10s. per annum). Ten per cent. will be added by the Institution to the amount assured when the same becomes payable.

**Glasgow International Exhibition.**—There is a movement on foot for holding an International Exhibition in Glasgow in 1915 or 1916.

### Parliamentary Notes.—UNDERGROUND TRAMWAYS.—

Last week Mr. Kellaway asked the representative of the First Commissioner of Works whether, with a view to diminishing the existing congestion of London streets, his department had at any time discussed with the London County Council the possibility of allowing underground tramways to be made under thoroughfares and land within the jurisdiction of the Office of Works in such a manner as not to interfere with the amenities of any street or path beneath whose surface such tramways might be run. Mr. Benn replied that the possibility of allowing subways for tramways under land, &c., in the control of the Department was discussed with the London County Council in 1906. The First Commissioner was prepared to consider any further representations which the Council might make on the subject.

**SHEFFIELD CORPORATION BILL.**—According to the *Times* Parliamentary report, the House of Lords had under consideration the Commons' reasons for disagreeing with certain of the Lords' amendments. Lord Southwark moved that the House do not insist upon their amendments, but he also moved the insertion of a new sub-clause restricting the right of the Corporation to supply electrical fittings. This, he said, was an agreed compromise, and after a short discussion the motion was agreed to.

The following is the new sub-clause to Clause 90 in lieu of sub-clause 2:—

"The Corporation may enter into contracts for the execution of any of the powers of this section, including the wiring of private property. The Corporation shall not under the powers of this section sell any such electrical fittings (other than electric lines, fuses, switches, ceiling roses, and such other electrical fittings as are used in connection with the wiring of private property from the distribution main as far as the ceiling, wall or floor outlet only), except through a contractor carrying on his business independently of the Corporation."

Lord Southwark said that the new sub-clause practically meant that the Corporation would now have the power to carry wiring as far as the walls and the ceiling, and that the traders would have the rest of the work in connection with electric lighting.

**Inquiries.**—A correspondent wishes to get into touch with the makers of self-starting synchronous motors, British or Continental. The name of makers or agents of the "Leanda" lamps is asked for.

**Newcastle Contractors' Dinner.**—The Newcastle-on-Tyne Branch of the Electrical Contractors' Association held their annual dinner in that city on the 1st inst. The chair was occupied by Mr. W. Fletcher, and there was a fairly numerous company present.

The chairman proposed the toast, "The Electricity Supply Authorities." He said that the relations between the supply authorities and the contractors in that district were of a very friendly character. An evidence of this good feeling was to be found in the recent Electrical Exhibition in Newcastle-on-Tyne, where the contractors and the supply companies worked together with great success, and, he thought, to their mutual benefit.—Mr. C. Turnbull (electrical engineer, North Shields), in replying, referred to the relations between the wiring contractors and the supply companies, and said he thought the trouble was that everybody wanted something cheap. It was a difficult position, and it appeared to him that the chance of getting prices up was remote. It was a young industry, and one in which there was room for more efficiency. In looking over the details of gas companies' undertakings, he was struck with the large percentage of residuals of commercial value that were left over; if they could do something of that sort in regard to electricity, they might get down to 2d. per unit, and the day would not be far distant, as indeed he hoped it was not, when the consumer would be willing to pay a reasonable price for his installation. He thought that the way to do this was by co-operation between the wiring contractors, the supply authorities, the manufacturers and everyone in the trade, in order that they might be able to get cheaper materials—copper and rubber, for instance. Copper was one of the dearest metals in the market, and rubber as a commercial material was extremely expensive. He believed that many of their wires could be made of some cheaper material than copper, and that insulation might be made at a quarter the cost of rubber; but if they were to experiment in this direction, they should have some kind of testing authority which would examine all materials put forward, and would not pass any material to come into general use until they were satisfied that it would be good. By co-operation they could do much for the benefit of everybody. Commenting on the advance they were making in electrical machinery, he mentioned that Messrs. Parsons were constructing a turbine of 25,000 kW., and expressed the hope that in the not very far distant future they would see machines like that in use throughout the district.

Mr. J. Gledson gave the toast, "The Electrical Contractors' Association," the principal object of which was, he took it, the maintenance of a proper status in the profession, and to ensure the recognition of their rights.—Mr. R. Robson (the hon. secretary) responded to the toast, and said that the Association had devoted much of its time to opposing Bills in Parliament, and had been very successful in that respect and in getting clauses altered in favour of their trade. Perhaps, if their energies had been expended in other ways, they might have increased their membership. He thought it was about time that the Association, instead of devoting all its energies to fighting Corporations and municipal trading, devoted some of its time to fair trading. Mr. Cross had done an enormous amount of work in trying to make arrangements with the Manufacturers'

Association for fair trading by allowing the buyer to have a legitimate profit over anybody else for the same quantity of material purchased.

Mr. A. Andrews proposed the toast of "Kindred Electrical Trades." He said the electrical contractors were in that unfortunate position known as middlemen, but he thought that they could ask the Manufacturers' Association to grant them preferential tariffs. One of the originators of the Manufacturers' Association was Mr. Byng, who had written very largely upon preferential tariffs, and he suggested to Mr. Spence, who had to respond to that toast, that he should use his endeavours to get the contractors some preferential tariff as compared with the ordinary trader.—Mr. J. Spence acknowledged the toast, and said the delicate points put forward by Mr. Andrews required careful consideration. With regard to preferential tariffs, the manufacturers, as they knew, were in a most peculiar position. Although rather late in the day, the electrical manufacturers in this country had formed themselves into an Association, not for their own benefit altogether, but also for the benefit of the whole industry. The chief gain was mutual, since it came through standardisation in every department. Questions relating to treatment, tenders, time guarantees, and public bodies could be much better dealt with by an Association. The manufacturers had no desire to injure any other interest, least of all that of the contractors, upon whom they looked as their very best friends. The question of preferential treatment, however, was a very difficult one to discuss. He had been at a number of meetings of manufacturers, and he knew what was going on inside, and he could assure the contractors that this matter was receiving very serious consideration.

During the evening an interesting musical programme was provided.

#### Annual Socials and Dinners.—NEWCASTLE-ON-TYNE.—

On Friday evening last at the Central Exchange Hotel, Grey Street, Newcastle-on-Tyne, the staff dinner of Messrs. J. H. Holmes & Co. was held, Mr. Alfred Holmes presiding over a goodly company, which included several engineers engaged in electrical business in the Tyneside district. After the usual loyal toast, Mr. T. W. Wallis, London representative, proposed "The Firm." This was drunk with great enthusiasm, and Mr. A. Holmes, the senior partner in the firm, responded. There was an excellent programme of music and song. In addition to the customary printed programme, there was a second, which was in distinctly humorous vein, and was distributed after the tables had been cleared. It occasioned a good deal of merriment.

WARRINGTON.—The staff of the St. Helens Cable and Rubber Co., Ltd., held their annual whist drive and dance on Friday evening last, from 7.30 p.m. to 2 a.m., at Winmarleigh Café, Warrington. An invitation card of special design was issued in connection with the event.

DUNDEE.—The manager, Mr. D. Fisher, presiding at the annual supper and dance of the employés of the Dundee and Broughty Ferry Railway Co., said the company had had a successful year, and they had been throughout loyally supported by the staff. Mr. Wm. McGill, the secretary, congratulated the company and the employés on their immunity from accidents during the year.

ACCRINGTON.—Fifty-six Accrington Corporation tramway men, including the Haslingden staff, sat down to dinner, on January 30th, and afterwards adjourned to the Central Conservative Club. Mr. Billing, the general manager, presided, and was supported by Mr. Day, the Haslingden general manager, and Mr. Calvert. During the evening, the presentation of a clock was made to Mr. A. Duffy, in recognition of his services in connection with the benevolent fund for men who have been off work through sickness or accident while on duty.

BLACKPOOL.—The employés of Blackpool, St. Anne's and Lytham railways Co. held their seventh annual dinner and entertainment, on January 30th. Mr. H. W. Laing, general manager, presided and was supported by Mr. Wood, traffic manager, Mr. Partington, marshalled foreman, and other heads of departments.

LONDON.—The Merda-Gems held a very successful Bohemian concert at the Talbot Restaurant, London Wall, E.C., on Monday evening. Mr. E. Coote presided with much geniality over a gathering which taxed the holding capacity of the hall to its fullest extent. An excellent programme was provided and was enthusiastically received, number after number being encored. Clever caricatures of the heads of departments on the programme, and the general get-up of the latter, reflect credit on the firm and on the designer. The evening was most successful throughout, and everybody present left eagerly looking forward to the next B.T.H. event of the kind.

Copper.—Messrs. Merton's statistical circular for January last, 1913, shows a reduction in European visible supplies of 2,161 tons, made up of 2,343 less in English ports and 118 less at Havre, against an increase of 300 tons in the quantity afloat. Rotterdam (not included in the above) shows 400 tons better, and Hamburg 621 tons, so, if these were included, the reduction during January could be only 141 tons.

Arrivals from North America are well up to average; from Spain and Portugal, fairly high at 1,983 tons, the average being about 750 tons. Shipments from Chile are well up at 4,800 tons, a figure not reached since 1908; the average shipments from this country over the past 12 months are good, and the country appears capable of a steady output. Australian shipments are also strong and well maintained. The total deliveries are 46,067 tons, the highest figure since last June. The stocks in American Producers' hands (American Producers' Association) at the end of December are given as 47,014 tons, an increase of 8,548 tons over the quantity on November 30th, the total visible supply, including Holland, Germany and the United States, for the end of December, 1913, stood at 90,225 tons, an increase of 8,478 tons over the previous return.

**The Cortesy Steam Turbine.**—We have been able to gather further information concerning this proposal for a turbine without blades, and we find that it consists practically of a rotating annular drum, that is to say, the rotor and the casing are attached and rotate together, and steam is admitted by a nozzle or nozzles into the annular space in the direction of rotation. The drum thus rotates inside a whirl of steam. The length of the drum is divided by ring plates or diaphragms into several divisions of increasing cross-section and passes from one division to the next by a series of nozzles. At present we only seem to see in these division plates a means of imposing on the steam a path of sufficient length. For the rest our sketch of last week stands good. It only remains, therefore, to effect a proper joint at the first end of the turbine and a suitable connection to a condenser, in order to demonstrate what this smooth turbine will do. That it is unexpectedly powerful can be readily believed, and its value will be great if it only succeeds in being nearly as efficient as a bladed turbine. All that remains to be done is, therefore, to prove its efficiency in commercial sizes. Needless to say that though both casing and rotor are moving with the steam, their motion relative to the steam is small and the action depicted in our figure will take place with so much better efficiency seeing that both surfaces of impact are in motion. The proposal is of extreme interest if it can be proved far enough.

**Treatment after Electric Shock.**—The Highways Committee reported to the L.C.C. at Tuesday's meeting that they had arranged for lectures and demonstrations to be given to those employés in the tramways department whose work may bring them into contact with electrically-charged apparatus, in order that they may receive instruction in the treatment of persons suffering from electric shock. The number of men affected is about 300, and they will be divided into classes of about 15 each. The total expenditure will amount to about £12.

**L.C.C. Turbine Repairs.**—The Highways Committee reports that an accident occurred in July, 1912, to the generator coupled to No. 8 turbine at the Greenwich generating station, which necessitated the provision of new windings and other repairs. The work was put in hand at once by the makers of the machine, the British Westinghouse Electric and Manufacturing Co., Ltd. The cost of the work amounted to £2,010.

**Post Office Engineers.**—The ninth annual dinner of the Engineering Department, London, was held on January 29th, at the Connaught Rooms, Kingsway, W.C., the chair being taken by Mr. William Slingo, Engineer-in-Chief to the Post Office.

After the loyal toasts, in proposing the toast of "The Engineering Department," Mr. Herbert Samuel said there never had been an occasion when the Department was more deserving of toasting; the year 1912 had been a most arduous one for the engineering branch, which had been concerned with vast changes—the inventory of the National Telephone Co.'s plant, and the transfer of that great undertaking to the State; the amalgamation of the two systems, and of the two staffs; the arbitration, the greatest arbitration of its kind that had ever taken place in this country; and the readjustment of their engineering districts. One other event had happened which they might wish to see continued and repeated in future years—the introduction of higher scales of pay for certain of the classes. The efficiency of the telephone business depended to a large degree upon the way in which it was worked by the engineering staff of the Post Office, and he trusted that they would do their best to see that the public got a really efficient and satisfactory service. The development of the service was likely to be rapid. In the present financial year they would spend on construction, renewals, and maintenance, a sum of about 5½ million pounds. The money had been available before, but the staff had had so much to do that they had not been able to spend it. The future development of the telephone service was greatly bound up with the introduction, to a continuously increasing degree, of automatic systems. The experiments that had been made had been very successful, and the Department was taking steps to extend the use of automatic appliances. The late Engineer-in-Chief, Major O'Meara, was still assisting the Department, as special commissioner, and was investigating telephone systems on the Continent. They proposed to make an experiment of a very interesting kind; in some small towns, with less than 50 subscribers, an automatic installation was to be provided which would look after itself entirely. It would merely enable the subscribers to get into touch with the exchange in the nearest large town, and also enable the operators in that exchange to ring up the subscribers in the small place. One other development was the provision of a tube railway for the exclusive use of the Post Office in London. The scheme was well advanced, and the Post Office would before long have a tube of its own for the carriage of its mails and parcels from one end of London to the other. It was a great pleasure to him to toast their new Engineer-in-Chief, Mr. Slingo, who had risen in the Engineering Department from the lowest ranks up to the top.

Mr. W. Slingo, in reply, referred to the wonderful strides which the Engineering Department had made and the very great impression which he was sure the Department had made upon the heads of the Post Office. The importance of the work and the honour and credit of the Department were undoubtedly on the mind of every man on the staff; they were alive to the great interests entrusted to them and to the great work they had to do. The Department was increasing rapidly. Their expenditure this year was twice as much as it was last year, but they had done more than twice as much work for the double expenditure. The staff increased during the year by the acquisition of the National Telephone Co.'s staff from 9,000 to 16,000 men. The staff had under-

gone a reorganisation, and a largely extended benefit had resulted. He did not want a contented staff. A contented staff was a staff without ambition, and could never progress. He hoped no one would imagine that because there were to be no examinations there would be no selection. He was prepared to make the selection as keen as ever it was. The inventory had almost been forgotten; he wondered if anyone realised how much work there was in the inventory operations. The valuation, which succeeded the inventory, and to some extent proceeded concurrently with it, was another big work. Only those who went through that mill would ever know the extent of the grinding, and the time would come when credit would have to be given to some of the officers who so zealously threw themselves into this work. It was an honourable fight. They had been more than 74 days in Court, and at the end of that time there was hand-shaking all round, proving that there was the utmost good feeling.

Mr. W. Noble, on rising to propose the toast of "The Visitors," said they had with them not only the *élite* of the Post Office service but also the *élite* of the allied engineering professions outside the service, to whom they gave a very hearty welcome. He first referred to the "officially dead," namely, their veterans. Sir John Gavey would always have a very hearty welcome. It was only a few days since Mr. Kempe left them; recently, when he delivered a very interesting address at their Institution, one gentleman made the shortest speech on record: "Mr. Chairman and gentlemen,—Can you wonder that we all love Kempe?" With regard to their "officially live" guests, it was the universal opinion of all officers of the Post Office that they never had a more able Postmaster-General, nor one who had obtained such a grasp of the work of the great Department over which he presided.

Mr. A. M. J. Ogilvie and Mr. W. Duddell replied to the toast, and Mr. A. W. Martin proposed the toast of "The Chairman," who briefly responded.

**Institution and Lecture Notes.**—ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—At a joint meeting of members of the Association and of the Yorkshire Branch of the National Association of Colliery Managers, at Leeds, last week, Mr. David Bowen, acting head of the Mining Department of the Leeds University, gave an illustrated lecture on "An Account of Experiments on Safety Devices in Connection with Electrical Machinery for Coal Mines," with many details of experiments carried out at the University by himself and Mr. Walter C. French. He referred to the experiments carried out in Germany several years ago by Prof. Heise and Dr. Thiem, and continued by Messrs. Beyling and Goetze in Germany, and said that they had since been proved by himself and Mr. French to be unacceptable.

**THE IRON AND STEEL INSTITUTE.**—The annual meeting will be held at the Institution of Mechanical Engineers, Storey's Gate, Westminster, on Thursday and Friday, May 1st and 2nd. The Bessemer Gold Medal will be awarded to Mr. Adolphe Greiner, general director of the Société Cockerill, Seraing, vice-president of the Institute. The annual dinner will be held at the Hotel Cecil on Thursday, May 1st. The autumn meeting will be held at Brussels, at a date to be announced later.

**ROYAL SOCIETY OF ARTS.**—On Wednesday evening, a paper on "The Economic and Hygienic Value of Good Illumination" was read by Mr. Leon Gaster.

**THE SOCIETY OF ENGINEERS (INC.).**—On February 3rd, a paper on "The Bus r. Tram Controversy, and Other Aspects of the London Traffic Problem," was read by Mr. Wm. Yorath Lewis, who endeavoured to awaken Londoners to the seriousness of the present situation, urging that the traffic facilities should be controlled by Government. The formation of a "London Transport Association" was suggested, for the purpose of studying the problems, educating the public, and using all possible means to secure cheap and effectively rapid transport. At present, he said, the London County Council was balked in every direction, and its tramway undertaking was excluded from the lucrative short-journey traffic which would be ensured by inter-connections through the central area. The author then investigated whether motor-omnibuses adequately filled the needs of the central area and the connections with the immediate surroundings, concluding that if they did so, which was not by any means the case, it was only at enormous cost to the traveller using them, although they operated under conditions of unmatched freedom, conditions which could not be justified. The "door to door" speed possible with buses within the central areas was on the average only 4 miles an hour. The average amount paid per passenger-mile ridden was at least 1d., and of every penny taken 58 per cent. was clear profit. In comparison with this, on the Glasgow tramways the amount paid per ridden mile was under a halfpenny, and on the L.C.C. tramways the amount paid per ridden mile was as low as 4d. The huge profit made by buses in the central area enabled the omnibus company to make big average profits, even if the suburban traffic was run at such rates as left in some cases little, if any, margin. Mr. Lewis concluded that the Adkins-Lewis system of continuous transport was superior to motor omnibuses and tramways for the central area.

**Lamp Standards for Motor-Car Electric Lighting Installations.**—At a recent meeting of the Standards Committee of the American Society of Automobile Engineers, in New York, a report was presented by the Division on Lamp Standards. The relative advantages of the earthed and unearthed returns for lighting systems commanded attention on account of the rapid development in car electric lighting recently. It was brought out that the earthed return provided bigger contact points and better insulation of the lamp receptacles. Further, with earthed returns there were fewer connections at the switch; an ordinary system involving head, side and tail lamps had 11 connections with the earthed, as against 14 with the unearthed system.

As to the advantages of the unearthed return, they all hinged on the fact that accidental earthing on the battery side of an earthed return system short-circuited the current and damaged the battery; whereas, in the unearthed return system it would be necessary to earth both sides of the circuit simultaneously. With earthed systems horns and other dash electric devices must be carefully insulated from the metal parts of the body. No definite recommendation was made on this point.

The report recommended that standard electric light bulbs be known as 7-volt bulbs, and have an efficiency of 11 watts per candle at voltages between 6.5 and 7 volts. Standard electric headlights are to be 2 1/8 in. in diameter, and capable of being focused in a reflector of 7—8 in. or greater focal length. An effort is being made to get data from battery makers from which to specify standard dimensions of batteries and plates, giving three standard plate sizes from which batteries of any capacity can be made by increasing the overall battery length.

**Electricity Supply Rifle League.**—On Saturday last the first annual dinner of the League was held at the Talbot Restaurant, London Wall; the president, Sir Alexander Kennedy, occupied the chair, and there was a large gathering of members and guests, numbering over 100.

After the toast of "The King," Mr. L. L. Robinson, electrical engineer and manager to the Hackney Borough Council, proposed success to the League, remarking that the Hackney staff were the prime movers in forming the League early last year, and that they had a most energetic secretary in Mr. E. Matthews. Westminster had won all their matches, and scored 20 points, Central being second with 11. All managers, he said, were anxious to encourage the League, which had proved a splendid thing; they would endeavour to promote shoulder-to-shoulder matches, so as to get acquainted with one another at the different works. Hackney had an excellent range of 100, 50 and 25 yards, and they hoped to hold a gala day there next summer.

Mr. Matthews, who received an ovation, said that in addition to the undertakings already enrolled, those of Brompton, St. James's, Poplar, Bermondsey and Hampstead were coming along this year.

Mr. S. T. Dobson, of the St. James's Co., briefly proposed the health of the President, who, in responding, said he was more concerned with the 13.5-in. gun, having a range of 20,000 yd., than with the rifle. He was pleased to see that the shooting men were drawn from every branch of the staff; that was an ideal condition. He conveyed a challenge to the League from the Railway Rifle League to a match (which was at once accepted), and offered to present a disappearing target apparatus to the League if they would devise one. He then presented souvenir medals to the members of the Westminster team:—Messrs. H. A. Pearnan (average 96.2); Foster (95.4); Neville (95.3); Winchcombe (94.86); Partridge (93.9); W. A. Pearnan (92.0); Horley (91.8); Litt (90.0); and White (89.87).

Mr. C. Newton Russell, proposing the "Visitors," said that all the sports clubs that had been formed at Shoreditch had proved failures with the exception of the rifle club, which was thriving. Mr. G. Spencer Hawes replied with a humorous speech, and Mr. L. Wilde proposed "The Aristies," for whom Mr. J. H. Heathman responded. Mr. Heathman was in charge of the excellent musical programme, which was rendered by members of the League, and proved that the latter were no less efficient as musicians than they were as riflemen.

**Educational Notes.**—An announcement is made in our advertisement pages regarding a course of 12 lectures on "The Design of Turbo-Generators," to be delivered by Prof. Miles Walker at the City and Guilds (Engineering) College, South Kensington, commencing on February 12th.

A site for the proposed Engineering Laboratory at Oxford has been obtained outside the park. The original proposal to erect it in the University Park met with strong opposition.

**Fatality.**—A correspondent writes:—"While Edward Blanche was engaged, on Tuesday night, wheeling a motor-car into a shed, the car touched a live wire, and the man received such a severe shock that he died on the way to the hospital."

**Osram and Robertson Social and Athletic Club.**—The Fancy Dress Dance of this club was held at Brook Green, Hammersmith, on Saturday last, and was a great success. Dancing commenced at 7 o'clock, and despite the inclement weather, about 300 people were present. The music was rendered by Mr. F. Windett's scarlet orchestra. The M.C.'s were Messrs Pluck and Minson. Prizes were offered for the best fancy costume, and the judging resulted as follows:—

Ladies.—First, Miss Palombo, "Lady Gainsborough"; second, Miss Brayshaw, "Indian Lady"; third, Miss Bignell, "Charles I"; fourth, Miss Ritchie, "Pompadour".

Gentlemen.—First, Mr. Woodward, "Skipper"; Mr. Cook, "Cowboy".

The prizes were presented by Mrs. C. Wilson, to whom a hearty vote of thanks was accorded, and Mr. Wilson, on behalf of Mrs. Wilson and himself, suitably replied. Amongst the company were:—Mr. and Mrs. H. Hirst, Mr. M. Railing, Mr. F. Sells, Mr. and Mrs. Sheppard. The party broke up about midnight, after having spent a very enjoyable evening.

**Royal College of Physicians.**—*Nature* states that the Goulstonian Lectures, to be delivered by Dr. A. J. Jex-Blake on February 25th and 27th and March 4th, will deal with "Depth of Lightning and Electric Currents."

## THE POWER STATION OF LIENFOS, NORWAY.

[BY OUR BERLIN CORRESPONDENT.]

WHILE the abundant water power of Norway is used extensively for the supply of light and power, and more



THE POWER STATION OF LIENFOS.

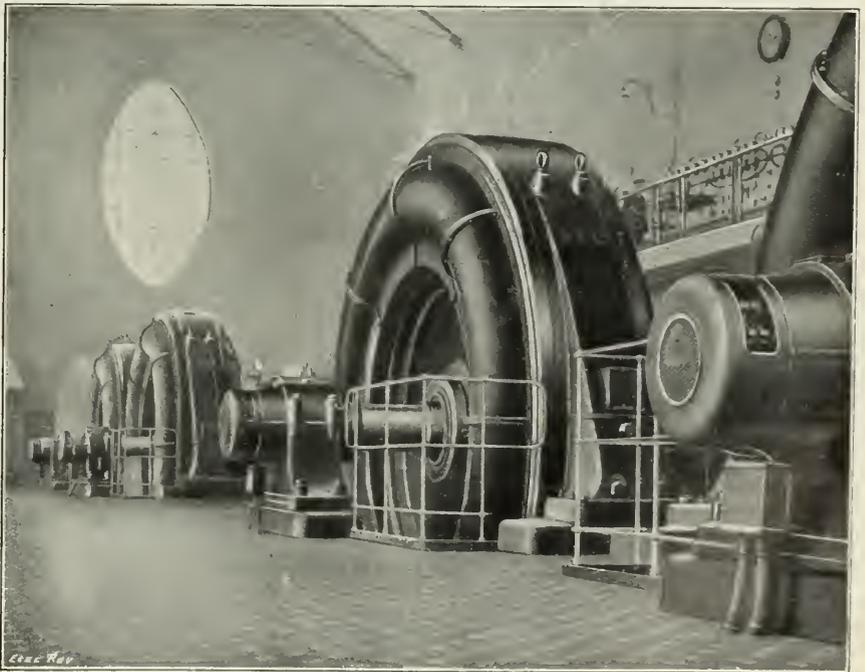
recently for railway operation, many of the large waterfalls situated in the interior of the country would have had to remain idle but for the extraordinary industrial developments brought about by the advent of new processes for the production of calcium carbide, the fixation of atmospheric nitrogen and the manufacture of iron and steel in the electric furnace. In Telemarken, in particular, where local conditions are especially favourable, a large number of plants have already been installed. A natural lake, the Mjös vand, situated at an altitude of 902 metres, and having an area of 41 sq. km., forms a gigantic reservoir which is capable of supplying up to 50 cb. metres of water per second continuously throughout the whole year. The water flows through the power stations Rjukan I, Rjukan II (under construction), Svaelfos, Lienfos, Tinfos and Skaatfos, so that one reservoir supplies six power stations, a number to be even increased later on by the use of other falls. These favourable local conditions can be expressed in figures by stating that the cost of electrical energy, including the purchase of the site and the building of the station, only amounts to 100-125 marks per H.P.-year.

It is intended in the following to give a short description of the electrical equipment of the Lienfos works, situated 3 km. above Notodden, on the River Tin, which was supplied by the A.E.G. This power station, like the Rjukan works and Svaelfos power station, belongs to the Hydro-Electric

Nitrogen Co. (Hydro-Elektrisk-Kvælstof-Aktieselskab), which manufactures nitre and by-products in its factories at Notodden and Snaheim.

In the Lienfos power station, high-pressure current at 50 cycles is produced directly by the generators and passes on to the transmission lines without further conversion. The electrical equipment comprises two continuous-current exciters driven by small turbines, four large three-phase generators, cables leading to the switch-gear, the switchgear itself with the apparatus and oil switches for the four generators and four transmission lines, the bus-bars and the lightning arrester plant, as well as the switchboard and the lighting installations. Further, in the switchgear, branches have been provided to the Svaelfos sub-station of the Tinos railway, as well as to the station transformer. The connections are so designed that each machine can work separately on the transmission line to which it belongs or in parallel with the other machines on to the transmission lines over the bus-bars. For this purpose the bus-bars are so arranged that they can be cut off by isolating switches from the junction points of the machines and transmission lines. Each pair of three-phase transmission lines is carried on one row of poles. The main conductors are arranged in a

hexagon, above which a smaller neutral wire is led which is earthed at the receiving station. This wire can carry the neutral wire currents of two adjoining machines, but two neutral wires can also be connected up in parallel by means of special bus-bars. They are only provided with isolating switches and not with oil switches.



INTERIOR OF LIENFOS POWER STATION.

Each exciter has an output of 300 kw. at 230 volts and 400 R.P.M., and suffices for the excitation of all four generators. By switching out the shunt regulator of the exciter which happens to be running, the excitation can be cut off from the power station in the event of a dangerous breakdown.

The four generators, coupled to the turbines by flange

couplings, are each designed for an output of 6,600 K.V.A. at  $\cos \phi = .6$ , and for a pressure of 10,000 to 11,000 volts

action is very powerful and sets up an appreciable partial vacuum in the dynamo-room when the windows are closed, so that a single door leading into the open air can only be opened with difficulty. The regulating shutters placed in the air passages are completely closed in winter: the air then re-enters the dynamo-room for heating purposes, through gratings above the air passages and also through openings in the backs of the stators.

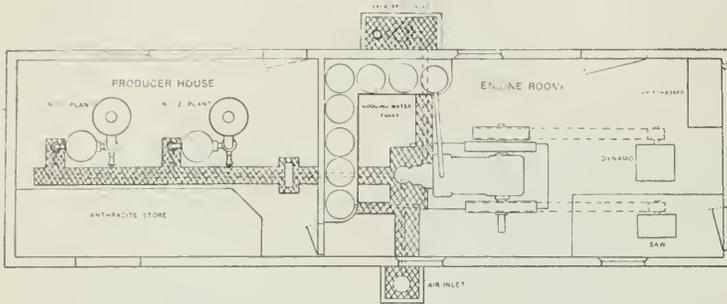


FIG. 1.—ARRANGEMENT OF GENERATING PLANT AT GLENQUAY RESERVOIR (See p. 225).

at 50 cycles and a speed of 187.5 R.P.M. The rotors, which are tested up to excess speeds of 80 per cent., have cast-steel

the contacts are provided with additional sparking contacts and magnetic blow-outs. The controlling gear is switched

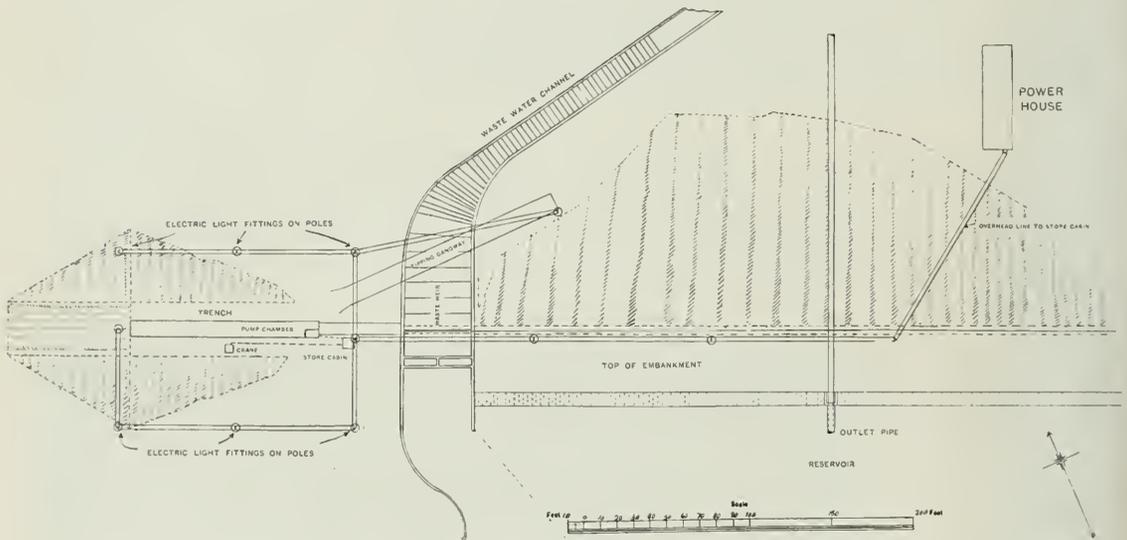


FIG. 2.—PLAN OF WORKS AT GLENQUAY RESERVOIR (See p. 225).

rims into which the poles are dovetailed; the latter have bare copper windings and oblique pole shoes. The semi-enclosed stators are constructed in four parts with removable feet, and have former-wound coils laid in open slots in three layers. The stators are mounted in the pits on four rollers on which they can be turned completely round. A maximum temperature rise of 40° C., a test voltage of 22,000 volts and an efficiency of 93.5 per cent. were guaranteed. The cooling air, driven into the machine radially by means of fan rings on both sides, is led through the back of the stator to the generator pit, which is covered in. From here it passes into the open air through two air passages each having a section of 1 sq. metre, which are provided with regulating shutters. The ventilating

out automatically in the end position. It should also be mentioned that the exciter switches of the generators are electrically interlocked with the field regulators, so that

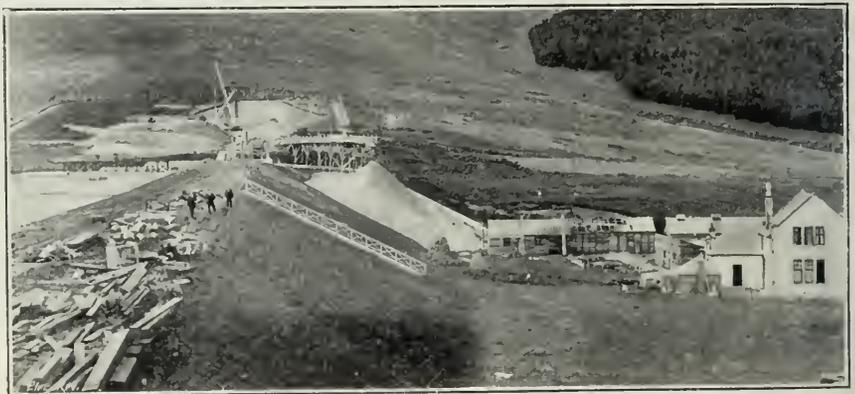


FIG. 3.—VIEW OF WORKS, GLENQUAY.

they can only be opened when the regulators are switched out and the generators are not excited.

Two four-core cables arranged in parallel lead the three

phases and the neutral wire from each generator to the end sealing boxes of the switchgear, whence the conductors are carried on in the form of bare copper rod. The phases are kept separate throughout the entire switchgear. The oil switches each consist of three remote-control separate switches coupled by elmins. Smooth insulators and concentric terminals are employed everywhere, and impart a very pleasing appearance to the installation.

Tests made on delivery gave very favourable results. Although the area of the air outlet is very much reduced in winter, the guaranteed temperature rise was adhered to. The efficiency was found to be 1.3 per cent. better than the guaranteed figures, and amounted to 91.8 per cent. at  $\cos \phi = .6$ , so that the high efficiency of 96.8 per cent. was attained with phase coincidence.

## ELECTRICITY IN CONSTRUCTIONAL WORK.

THE supply of labour is of vital importance in the carrying-out of constructional work, and will often decide whether a contract shall prove profitable to the contractor or not, and whether he will be enabled to adhere to the specified time of completion. In this article we do not intend to disparage the substitution of mechanical power, which has hitherto advantageously superseded manual labour to a considerable extent with the aid of comparatively small and inefficient steam plant, but, as a general rule, we consider the application of electricity obtained from a central source of power by means of connection to the mains of a supply authority in the neighbourhood, or by the equipment of a power station to suit requirements, to be much preferable as regards both convenience and economy in working.

No better results in this connection have been obtained than in the working of pumps—results, indeed, maintained by any other method of transmission, because of the steady load



THE CRYSTALATE MANUFACTURING CO.'S WORKS, TONBRIDGE (page 227).

on the motor. A further recommendation for this duty is the mobility of the pumps and motors, as, the energy being transmitted by cables, it is obvious that very little work is involved in removing the pumps to new positions as found necessary.

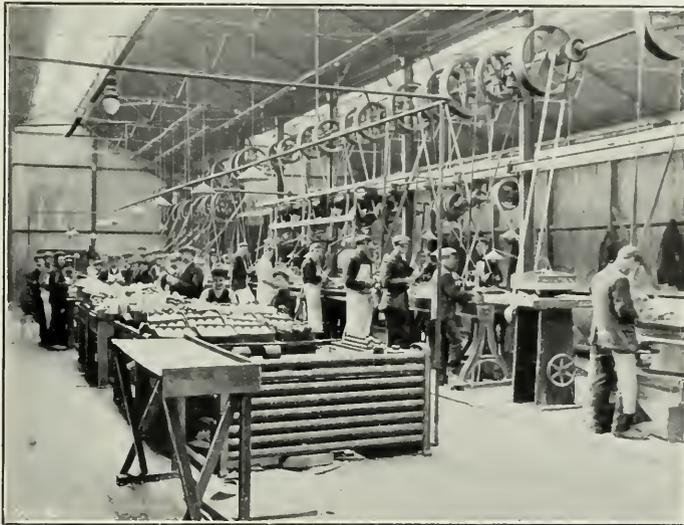
One of the most recent instances of the use of electricity in contracting is to be found in the work now being completed at Glenquay Reservoir, in Perthshire. This undertaking was carried out three or four years ago to provide storage for the water supply to the Southern District of Fifeshire, and particularly in anticipation of the increased demand likely to be created by the Naval Base at Rosyth. About 18 months ago it was found necessary to extend the

puddle trench of the retaining bank into the hill at the east side, with a view to increasing the capacity of the reservoir, which has been planned to provide double storage at any future time by raising the existing bank by 11 ft.

The enterprising contractors—Messrs. Wilson, Kinmond and Marr, Ltd., of Glasgow—were entrusted with the extension, and on the advice of their consulting engineers, Messrs. James E. Sayers and Caldwell, of Glasgow, decided to provide generating plant in a position accessible for the easy delivery of fuel, the power being supplied to the pump, crane, &c., by means of an overhead transmission line.

The position of the power house in relation to the work can be seen in fig. 2, on the opposite page, while the plan, fig. 1, shows the general arrangement of the generating plant.

The gas engine and suction-producer plant were manufactured by the National Gas Engine Co.; the engine is capable of giving 75 B.H.P. maximum and 68 B.H.P. constant working load on suction gas of 135 B.T.H.U., when running at 210 R.P.M. The engine is provided with magneto ignition and compressed-air starter.



TURNING AND POLISHING SHOP, CRYSTALATE CO.'S WORKS (page 227).



VIEW IN PRESS SHOP, CRYSTALATE CO.'S WORKS (page 227).

Owing to the continuance of operations night and day during the execution of the contract, double producers and scrubbers were provided, which are connected together: but



A CORNER OF THE PRESS ROOM IN THE CRYSTALATE CO.'S WORKS.

as each is capable of taking three-quarter duty, they are so arranged that either plant can be disconnected to allow of the other producer being relined with firebricks at intervals. A motor-driven fan is fitted to one producer for starting.

The dynamo, of 40-kw. capacity, manufactured by the Edison & Swan Co., is compound wound to generate 135 amperes at 300 volts and 800 R.P.M., and is connected by belting to the engine pulley.

A circular saw is accommodated at the end of the power house building, and is driven by belting from the engine fly-wheel.

The supply of electrical energy is transmitted to the bank workings by overhead bare conductors, supported on insulators fixed to poles and entering buildings through porcelain

As the growth of water was uncertain, one pump was supplied in the first instance, and has proved sufficient to deal with the amount of water in the trench.

The centrifugal pump and motor combination, manufactured by Weise & Monski, will deliver 300 gallons of water per minute against a total varying head of from 50 to 190 ft. The pump delivery to the 5-in. rising main pipe column, fitted with a retaining valve, is throttled at the sluice valve as required to keep the quantity of water normal during sinking operations at reduced head. The 25-h.p. motor, running at 1,700 R.P.M., is of the shunt-wound protected type for operating at 250-300 volts, and suitable for driving the pump at full load without destructive heating. Although the pump was used intermittently, spare impeller parts and a motor armature were available to ensure continuity of service, but it is particularly gratifying to know that neither have so far been necessary.

A 3-ton electric derrick crane, by Messrs. Butters Bros., lifting at the rate of 80 to 120 ft. per minute, is fitted with a 60-ft. steel lattice jib, made in two portions for convenient delivery and erection. A 12-B.H.P. motor of the enclosed



THE ROLLING AND MIXING DEPARTMENT, CRYSTALATE CO.'S WORKS (p. 227).

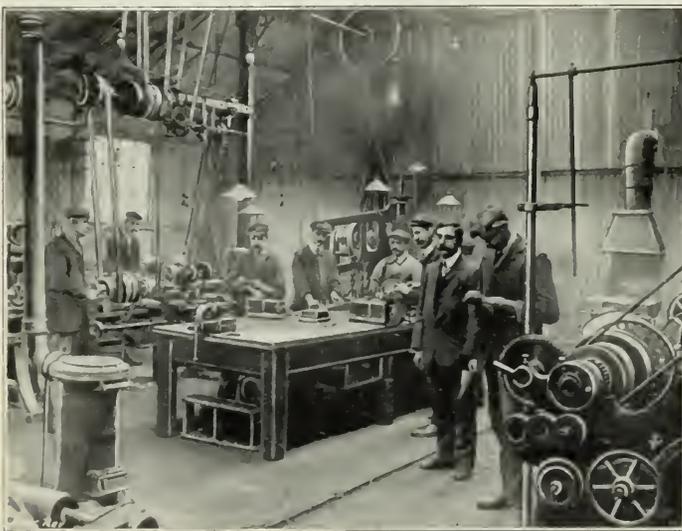
reversing type, series-wound for 250-300 volts at 700 R.P.M., is fitted to this crane, and a tramway type controller with magnetic blow-out and suitable resistance is mounted alongside. The crane has handled fully 10,000 cb. ft. of earth and rock excavations, besides the necessary timbering, &c.

Aerial conductors for electric lighting are supported on porcelain insulators fixed to cross-arms on poles spaced about 20 yards apart, the connections being taken from these conductors to 24 electric lamp fittings fixed to poles by clamping rings underneath.

The erection of the plant and wiring was carried out by the Harland Engineering Co., and Messrs. Telford, Grier and MacKay.

During the 18 months the plant has been in operation only 55 tons of Polmaise anthracite (washed singles), costing £56 12s., including delivery charges, was consumed by the producer plant.

The above instance of the application of electricity to contracting work is sufficient to warrant the special consideration of its further development by firms who carry out the erection of large buildings, the driving of tunnels, the excavation of sewers, and other large public works necessitating the operation of lifts and hoists, concrete mixers, derricks, and other contracting appliances.



VIEW IN THE TOOL SHOP, CRYSTALATE CO.'S WORKS.

tubes. Separate cables radiate from distributing boards in a store cabin adjoining the excavations for the supply of the pump, crane and lighting.

## CRYSTALATE IN THE MAKING.

It is probable that very few of our readers require a lengthy introduction to Crystalate, a substance which has been widely applied during the past few years, both industrially and for sporting and other purposes. In the industrial sphere, its electrical uses are very numerous; in the world of sport and pastime its use for billiard and baguette balls is too well-known to need description, while it is also largely employed in the making of gramophone records, dominoes, &c.

The Crystalate Manufacturing Co.'s works are situated about five miles from the old town of Tonbridge, Kent, amidst surroundings which certainly do not suggest manufacturing operations, although some 300 workpeople are employed there. Broadly speaking, the company's product is divided into Crystalate, a material which has as many as 30 different compositions and can be made in any colour, and Crystalate Star Grade, a fireproof black or white insulating material specially produced for electrical purposes. Both classes of material are very largely used for switch handles, bases, covers, bushes, conduit fittings, telephone mouth-pieces, receivers and similar things, all over the world, but particularly in Germany.

The Star Grade is a new material only recently put on the market, and an expensive plant has been installed for its production, the company having the sole manufacturing rights for the whole of Europe. It is made in several grades for moulding, machining and sheets, and differs from nearly all other insulating materials of the kind, in that it is unaffected by high temperatures, non-hygroscopic, has a high insulation resistance, and is both tough and strong.

A Faraday House test, for instance, gave a specific resistance of 113,000 megohms; a breakdown voltage of over 7,000 volts on a sample .351 cm. thick; a percentage absorption of water after 48 hours' immersion of .44; and showed that heating in a Bunsen flame, and in a crucible, to 680° F. had no effect on it.

A special department is given up to the preliminary mixing of the raw constituents of the Star Grade Crystalate, which subsequently passes to a hydraulic press room, where it is measured preparatory to moulding, an operation carried out in special dies, and under considerable pressure. A number of large and small presses are employed in this work, the largest being a 1,200-ton press used in the manufacture of slabs, &c., and these are worked from a hydraulic pumping plant with two 100-ton accumulators.

From the press room the moulded articles pass to gas-fired furnaces, where, placed in racks, they are subjected to a very high temperature for periods up to 24 hours, and emerge practically fireproof.

The next step is "finishing," the rough fired pieces being machined, ground, polished, &c., as required for the trade.

The mention of dies reminds us that the company has a special tool shop for the production of the various dies, moulds, &c., required in the works. This department is fully equipped with machine tools, &c., for the cutting and working of the steel slabs from which the dies are produced; this class of work is a speciality of the company, which has, of course, had considerable experience both as a maker and user of dies.

So far we have not referred to the manufacture of ordinary grade Crystalate, the better known product of the company, which differs in process from that described. In this case the preliminary mixing of the raw ingredients is followed by calendering, four sets of steam-heated calenders being employed in this work; the resulting product passes to a press room where upwards of a hundred presses are continually in use, moulding the numerous articles for which ordinary Crystalate is employed. These, of course, include a great variety of electrical parts, as well as billiard and baguette balls from  $\frac{1}{2}$  in. to 3 in. in diameter, gramophone records, dominoes, bottle stoppers, &c. The company's record business has developed very much recently, and considerable extensions are now being made to cope with it. In the course of our visit we were shown the depositing shop, where the matrices are obtained from the original wax records; these, after being soldered on to copper plates and nickelled, form the dies for use in the Crystalate moulding process, which subsequently takes place in the press shop.

The billiard balls, after leaving the press shop, are subjected to very high pressure in enclosed cylinders, and subsequently are turned and buffed preparatory to packing, &c., the latter department being provided with a box-making plant.

The finishing process, of course, also applies to ordinary Crystalate electrical goods, which are scraped and buffed and take a very high polish; in the case of small turn switches, such as are used on the Continent, the thumb piece is moulded on to the spindle, and in the same way Crystalate is moulded on to brass screw threads, where these are desired.

The various operations carried on demand a considerable amount of power, and three steam and three suction-gas engines, varying from 50 to 250 H.P., are in use. The works are lighted electrically, and in several of the shops the Cooper-Hewitt mercury vapour lamp is in use.

In conclusion, we are indebted to Mr. Chas. Davis, managing director of the company, for an instructive visit, affording us an insight into an industry which, though of itself little known, is relatively of great interest to electrical engineers. On pages 225 and 226 we give a number of views of the workshops.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—Owing to the termination of the electrical engineer's (MR. C. E. SAVAGE) contract, at the end of last month, temporary arrangements have been made by the Dudley T.C. for the continuation of his services as electrical engineer, giving not less than one-half or more than two-thirds of his time, payment to be made at the rate of £25 per month. These terms are to be continued until the day of the transfer of the undertaking takes place. Mr. Savage being retained afterwards for the purpose of inspecting the cost and quantities consumed on the street lighting contract, and for the examination of the tramway plant under the lease, at an annual fee of £21.

The assistant borough electrical engineer of Poplar (MR. W. INNES) has resigned his position as from January 31st last in order to enter private business. As a consequence the Electricity Committee have decided to discontinue this office and to give more prominence to the managerial side of the department. It is proposed that there should be four departmental officers directly responsible to the chief engineer and manager, viz., assistant manager, station engineer, mains engineer and sales manager. MESSRS. TATE, managerial clerical assistant, V. H. CRUICKSHANK, station superintendent, and E. R. INGRAM, mains superintendent, have been appointed to the three first mentioned positions at salaries of £250, rising by annual increments of £12 10s., to £300 per annum, in the case of F. Tate, and £212 10s. per annum, rising by annual increments of £12 10s., to £300 per annum, in the case of the two other appointments.

MR. SAMUEL WILLIAMS, late burgh electrical engineer in Motherwell, has been appointed to a similar position in Wishaw. There were 46 applicants for the vacancy. Mr. S. Williams resigned the post of burgh electrical engineer for Motherwell in May, 1911, since when he has been suffering from acute rheumatism and unable to attend to business of any kind. We are glad to learn that he has now sufficiently recovered to take up the Wishaw appointment.

The salary of MR. J. W. SPEIGHT, station superintendent to the Leyton undertaking, is to be increased from £200 to the maximum of £250, by annual increments of £10.

The salary of the deputy borough electrical engineer of Salford is to be advanced by £30 from April next, in lieu of £25 from April, 1914, and the salary of the mains engineer by £30 instead of £10.

At the Barrow T.C. meeting on Monday, after some discussion, the salary of the borough electrical engineer, MR. H. R. BURNETT, was increased from £500 to £550 per annum. The salary of MR. J. ATREY, chief clerk and storekeeper, was increased from £125 to £135 per annum, with two further annual increases of £10 and £5 respectively up to £150 per annum. MR. H. R. BARNWELL, works superintendent, was advanced from £180 to £190, with a further increase of £10 twelve months hence to a maximum of £200; and MR. J. F. HESLOP, mains superintendent, had his salary increased from £165 to £180 per annum, with further increases of £10 per annum to a maximum of £200.

Todmorden T.C. has now appointed MR. JOS. BOYCE, for 12 years assistant electrical engineer to Darwin Corporation, as chief electrical engineer and manager of the destructor department. There was a large number of applicants. Mr. Boyce served six years' apprenticeship with Messrs. Charlesworth, Hall & Co., electrical and general engineers, of Oldham. Subsequently he was with Mr. G. St. J. Day, an electrical engineer in private practice at Oldham, and Messrs. G. L. Adamson & Son, of Rochdale, where much experience was gained in the application of electric power for driving mills, works and mines.

MR. FRED RILEY, of Rawtenstall, has declined the appointment of electrical engineer to the Todmorden Corporation.

MR. DUNROSE, of the Stoke-on-Trent electricity staff, has been presented by his colleagues with a case of outlery on his marriage.

Newport (Mon.) Education Committee has appointed the borough electrical engineer, MR. A. NICHOLS MOORE, as teacher of electrical engineering at the Technical Institute, in place of Mr. Whitehouse, who has resigned.

MR. C. E. SAVAGE, chief electrical engineer to the Dudley Corporation, has accepted a position under the Earl of Dudley at Baggeridge Wood Colliery.

The General Purposes Committee of Blackburn Corporation have adopted a scheme involving an increase of £1,178 in the salaries of Corporation employes, with further increases, when the maximum is attained, amounting to £1,457. In the case of employes other than clerks, there is an advance in the first year of £730, including the electricity department, £75; tramways department, £538. The increase in the tramways department includes a farthing per hour all round for motormen, conductors, and depot employes over 21 years of age. In all cases where holidays with pay have been less than five days, it is recommended that they be increased to that number.

MR. JOSEPH S. AINSWORTH, who was chief assistant at the electricity works of the Monmouth Corporation, and in a similar position with the Brynamman and District Electric Light and Power Co., South Wales, has resigned from the staff of the electricity works of the Gloucester Corporation, so as to accept an important position in New Zealand in connection with a new water-power scheme. On behalf of the staff of the Gloucester electricity works, Mr. Corson, the city electrical engineer, presented MR. AINSWORTH with an oval-shaped glass-sided travelling timepiece in leather case. Mr. Ainsworth sails on February 14th.

The Electricity and Tramways Committee of the York T.C. has appointed MR. L. M. JOCKELL, of Middlesbrough, as fourth engineer-in-charge at the electricity works.

On the occasion of his leaving Ilkeston to take up a similar appointment at Bexley Heath, MR. H. P. STOKES was entertained to dinner on January 22nd, by a number of the members of the Council and prominent townspeople. After the dinner, and between items in the programme, the Mayor (Councillor F. P. Sudbury) presented Mr. Stokes with a silver tea urn, and spoke of the very high esteem in which he was held, of the hard work he had done, and of the satisfactory state in which the two departments were, as compared with the time when he took over the management. At a meeting of the employes, the chief inspector asked Mr. Stokes, on behalf of the employes, to accept a silver cake basket.

**General.**—At the annual social of Darwen tramway employes on January 30th, MR. R. W. SMITH SAVILLE was presented with a silver rose-bowl by the Corporation tramway staff upon his retirement from the post of engineer and manager. Alderman James Tomlinson made the presentation, which was given in recognition of the cordial relations which have existed between the recipient and the staff during the past 12 years.

The *Australian Mining Standard* states that MR. C. H. MERZ, before leaving for England, was entertained at luncheon by the Victorian Premier, MR. WATT, and speeches were made. Most of the members of the Ministry, several members of both Houses, and officers of the Railway Department, were present.

We are officially informed of the following changes in the boards of the following companies:—

**Central London Railway.**—Lord Knollys, Lord Rathmore and Mr. Robert Fleming have resigned, and Lord George Hamilton, Colonel Sir Herbert Jekyll, and Mr. A. H. Stanley have been appointed in their places. Mr. A. H. Stanley will be appointed managing director of the company. Mr. H. F. Parshall has tendered his resignation as a director. Mr. A. H. Stanley has been appointed managing director. Hon. Sydney Holland will be elected to fill the vacancy. Lord George Hamilton will become chairman of the board.

**City and South London Railway.**—Mr. J. F. S. Gooday, Mr. S. Barclay Heward and Mr. Edwin Tate have resigned, and Admiral Sir Cyprian Bridge, Mr. T. C. Jenkin (who has resigned as general manager of the company), and Mr. A. H. Stanley, have been appointed in their place.

**London Electric Railway.**—Lord George Hamilton resigns as chairman of the company, the resignation taking effect after the half-year meeting held last Friday, when Lord Farrer was appointed in his place. Lord Knollys has been elected to a seat on the board.

Messrs. T. L. Miller, H. W. Wilson, and H. V. Pegg (Miller, Wilson & Pegg, consulting mechanical and electrical engineers, Liverpool and Belfast) have dissolved partnership. Mr. T. L. Miller will attend to debts at Tower Buildings, Water Street, Liverpool.

Congratulations to Past-President DR. ZIANI DE FERRANTI and Mrs. Ferranti on the birth of a daughter on January 29th, at Baslow, Derbyshire.

MR. E. J. ARNOLD, until recently fittings department manager for the General Electric Co. in Liverpool, has severed his connection with the company, in order to start in business upon his own account in partnership with MR. I. E. POYSER, as the Liverpool Fittings Co., at 55, Renshaw Street, Liverpool.

The *Times* says that SIR HENRY NORMAN has been elected an Associate of the Institution of Electrical Engineers.

The wedding took place at St. John's Church, Blackpool, on January 30th, of MR. C. NICKSON, an electrical engineer, younger son of the late Ald. John Nickson and Miss Ethel Eyre.

MR. W. C. JEARY, the general manager of the Magic Appliances, Ltd., has been elected to a seat on the board.

MR. GEO. H. GYTON having secured an appointment with Messrs. J. M. Doughty & Son, Ltd., of Clerkenwell, is resigning his position with Messrs. D. H. Bonnella & Son, for whom he has acted as London representative.

MR. ALVIN E. LOE, who has been manager of the General Electric Co.'s Telephone Department (Glasgow Branch) for several years, has resigned his position. Mr. Loe will continue to place his specialised knowledge on telephony and allied subjects at the service of his friends at (for the present) 13, Apsley Street, Partick, W. Glasgow.

**Obituary.**—THE EARL OF CRAWFORD.—We deeply regret to record the death, which occurred on January 31st at Cavendish Square, London, of the Earl of Crawford and Balcarres, Kt., F.R.S., at the age of 66 years. On Tuesday a memorial service was held at the Chapel Royal, St. James', on Tuesday, 4th inst., when the Institution of Electrical Engineers was represented by Mr. Walter Judd (vice-president), Mr. Robert Hammond (Honorary treasurer) and Mr. P. F. Rowell (secretary). The late Earl, who was one of the founders of the Institution, was, at the time of his death, the oldest surviving officer of the Institution, having been, as Lord Lindsay, the first vice-president of the Institution, holding that office for three years—1872-3-4—during the presidencies of Sir William Siemens, Frank Ives Scudamore and Sir William Thomson. On the occasion of the special meeting of members of the Institution on June 30th, 1908, when the purchase of the present home of the Institution was sanctioned, the following letter from the deceased Peer was read to the members:—

I regret that I shall not be able to attend the meeting called for the 30th. I must, however, write a line of congratulation to the Institution on their acquisition of so fine a home, especially when I think of the first thoughts of its formation in my old laboratory in a news behind Green Street, Park Lane, all now swept away, and of the first source which was held in my laboratory in Greek Street, Soho. I believe that now I am the senior surviving officer of the Society, as I was Vice-President to Sir William Thomson (one of our first Presidents), and as such I offer my congratulations.—Very faithfully yours,  
CRAWFORD.

The February number of the *Faraday House Journal*, which has been issued this week, contains an article on the deceased peer, from which we gather that he had been closely associated with Faraday House for the last 23 years. It is stated that as far back as 1869, Lord Lindsay (as he was then called) had an electrical laboratory in Eaton Place, where he continued many of Faraday's researches. "Some of his original apparatus is still in everyday use in the laboratories at Faraday House. It was at Eaton Place that in the first inception of the Society of Telegraph Engineers was made, a society which is now called the Institution of Electrical Engineers. Lord Crawford has told how he and Cromwell and Alfred Varley first discussed the project, and how anxious they were that Prof. Sir William Thomson (Lord Kelvin) should be their first President. . . . In 1878 he was elected a Fellow of the Royal Society, and became for the first time President of the Royal Astronomical Society—a post which he filled with great distinction. In the same year (1878), he and Lord Rayleigh were elected Honorary Members of the Institution of Mechanical Engineers." For very many years, and until the time of his death, he was closely identified with the London Electric Supply Corporation, Ltd., as chairman, but he was constantly engaged in a battle against ill-health.

DR. GUSTAF DE LAVAL.—We regret to record the death which occurred at Stockholm last Sunday of DR. G. de Laval, the inventor in 1889 of the well-known high-speed turbine which bears his name, and which may be described as laying the foundation of the impulse part of the modern turbine which is a combination of the inventions of de Laval and Parsons. The de Laval turbine is used for small and moderate powers in various electrical and other works abroad, and for a number of private works installations in this country. The English rights were held by Messrs. Greenwood & Batley, Ltd., of Leeds, whose works installation comprised a number of these turbines. The deceased gentleman was 67 years of age.

MR. THOS. BLANE passed away, on January 30th, at his residence at Blackpool, at the age of 62 years. Deceased was chairman of Blackpool, St. Annes and Lytham Tramways Co., and a director of other concerns.

A correspondent says that much regret was felt in Newport (Pife) at the death in Winnipeg, of a well-known native, MR. DAVID C. JACK, an electrical engineer and a partner in the Hub Welding Co., Winnipeg. Mr. Jack was only 30 years of age.

## NEW COMPANIES REGISTERED.

**Portable Electric Light Co., Ltd. (126,782).**—This company was registered on January 27th, with a capital of £10,000 in £1 shares, to carry on the business of dealers in electrical and mechanical novelties, &c. The subscribers (with one share each) are:—M. Goddellow, 6, Shaftesbury Avenue, New Barnet, secretary; A. Herrmann, 39, Norfolk Avenue, Stamford Hill, N., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Solicitors J. and M. Solomon, 58, Finsbury Pavement, E.C. Registered office, 120, Shaftesbury Avenue, London.

**Baldar Engineering and Supply Co., Ltd. (126,901).**—This company was registered on February 1st, with a capital of £6,000 in £1 shares (3,000 preference), to carry on the business of gas, electrical and mechanical engineers, manufacturers of and dealers in gas and electrical fittings, accessories, conveniences and apparatus, &c. The subscribers (with one share each) are:—G. A. Hattin, 51, Morland Buildings, Earl Street, Westminster, clerk; A. G. Ferris, 104, Tordian's Avenue, Camden Road, N.W., clerk. Private company. The number of directors is not to be less than two or more than five; the first are J. T. Grein (chairman) and H. C. Cayley (both permanent); qualification, £50 shares; remuneration of chairman, £50 per annum. Registered by Strong & Co., 70, Gracechurch Street, E.C.

**Arden Vulcaniser Syndicate, Ltd.** (126,762).—This company is registered on January 27th, with a capital of £1,000 in £1 shares, to take or from R. K. Hearn the benefit of certain inventions relating to electric heating apparatus, and to carry on the business of manufacturers of and dealers in vulcanisers, electric heaters, &c. The subscribers (with one share each) are:—R. K. Hearn, Netherton, The Downs, Wimbeldon, engineer; J. F. Earn, Netherton, The Downs, Wimbeldon, gentleman. Private company. The first directors are R. K. Hearn and E. F. Hearn (both permanent) solicitors: Stanley Evans & Co., 20-22, Theobalds Road, W.C. Registered office, 314, King Street, Banmet Smith.

**Pritchard, Foxcroft & Co., Ltd.** (126,838).—This company is registered on January 29th, with a capital of £1,000 in £1 shares (500 20 p per cent. cumulative shares) to carry on the business of electrical, telegraph and telephone engineers, scientific and optical case makers, electricians, advertising agents, manufacturers of cinematograph films and apparatus, &c. The subscribers (with one share each) are:—H. Pritchard, Empress Works, Ackwell Lane, Dalston, N.E., engineer; B. H. Guttenberg, 40, Grosvenor Road, Canonbury, N., jeweller. Private company. The number of directors not to be less than two or more than five; the first are H. Pritchard and H. Guttenberg (both permanent). Registered office, Empress Works, Ackwell Lane, Dalston, N.E.

**Georg, Ltd.** (126,852).—This company was registered on January 29th, with a capital of £3,000 in 15 shares to carry on the business of electricians, engineers, suppliers of electricity, manufacturers of and dealers in clocks and time-registering and automatic machines and appliances, &c. The subscribers (with one share each) are:—E. H. Campion, B.A., 23, Old Broad Street, E.C., solicitor; E. R. Baines, Green Street Green, Orpington, accountant. Private company. The number of directors is not to be less than three or more than seven; the subscribers are to appoint the first; no qualification required; remuneration according to profits. Registered by H. G. Campion & Co., 23, Old Broad Street, E.C. (solicitors).

**Pernambuco Tramways and Power Co., Ltd.** (126,731).—Registered January 24th, by Norton, Rose, Barrington & Co., 57 1/2, Old Broad Street, E.C. Capital £1,000,000 in £1 shares (400,000 preference). Objects:—to acquire or construct, develop and extend any tramways, railways, or light railways, to equip, work, and maintain the same with electrical, steam, kinal, or other power, &c. The signatories (with one share) are:—E. T. Washington, 100, Westmount Road, Eltham, Kent, clerk; J. A. J. Scott, 85, Spring Road, S.W., clerk; H. L. Hamlyn, 80, Bestrevor Road, Fulham, S.W., clerk; H. Harper, 10, Penderley Road, Catford, S.E., accountant; F. H. Hetherst, 18, Egerton Gardens, Hendon, N.W., buyer; C. M. Plumtree, 68, Ashfield Road, East Dulwich, S.E., clerk; M. P. Hewell, 15, Culverden Road, Balham, S.W., registrar. Minimum cash subscription, seven shares. The first directors (to be not less than three or more than seven) are Eugénie de la Roche, Rio de Janeiro; Follet Hott, 6, Sussex Square, W.; Eugénie G. Ho, Pernambuco; H. K. Heyland, 174, Gresham House, E.C.; Sidney Jennings, Glensiston, Wimbeldon, S.W.; Sidney Jones, Paris; and Henri Archel. No qualification required for first directors; qualification of subsequent directors, £1,000; remuneration, £1,900 per annum, divisible.

**Roberts Bros. & Holloway, Ltd.** (126,786).—This company is registered on January 27th, with a capital of £1,500 in £1 shares, to carry on the business of electrical engineers carried on as "Roberts Bros." Bradford, and to adopt an agreement with Mary Agnes Roberts and A. Roberts. The subscribers (with one share each) are:—Mrs. M. A. Roberts, 2, Cottage Cottage, Rawdon, electrical engineer; E. R. Holloway, 145, Bradford Road, Frizinghall, Bradford, electrical engineer; G. E. Holloway, 145, Bradford Road, Frizinghall, Bradford, clerk. Private company. The number of directors is not to be less than two more than five; the first are A. Roberts and E. R. Holloway; qualification, 5 shares. Registered office, 3, Nutter Place, North Parade, Bradford. Director, H. H. Duncan, 14, Piccadilly, Bradford.

**Price Adjustable Reamer, Ltd.** (126,783).—This company is registered on January 27th, with a capital of £1,000 in £1 shares, to take or from improvements in adjustable reamers, taps and the like, to carry on the business of mechanical, electrical, motor and general engineers, manufacturers of and dealers in cycles and motors, &c., and to adopt an agreement with F. Price. The subscribers (with 10 shares each) are:—W. Williamson, Goswell House, Earlsdon Avenue, Coventry, manufacturer; E. L. Roberts, Cornford Street, Coventry, cycle engineer. Private company. The number of directors is not to be less than two or more than five; the first are F. E. Price, W. Williamson and E. L. Roberts; qualification, £10. Registered by Price & Sons, Ltd., 116-117, Chancery Lane, W.C.

CITY NOTES.

Yorkshire Electric Power Co.

The directors report for the year ending December 31st 1912, to be submitted at the half-yearly meeting at Leeds on February 10th, state that the gross profit on the revenue account for the three years ending December 31st, was as follows:—1912, £2,719; 1911, £12,572; 1910, £11,308. The net profit, after payment of mortgage interest for the same periods, was—£7,361 £7,781 £6,303. The accumulated profits up to the end of 1911 enabled the company to write off administration and development expenses amounting to £11,017, and to pay the dividend due on the cumulative preference shares, leaving a balance to carry forward of £330 which, added to the profit for the year 1912 of £7,361, gives a total of £7,691; and, deducting the dividend paid on the preference shares to June 30th, 1912, of £2,323, leaves a disposable balance of £5,368. The directors recommend that the balance should be dealt with as follows:—Dividend for the half-year ending December 31st, 1912, at the rate of 6 per cent. per annum on the cumulative preference shares, £2,803; write off the special expenditure during 1911 in connection with generating plant, £1,921, carrying forward £645. The supply for power and light was fully maintained throughout the coal strike, though the additional cost to the company was very considerable. That strike, and the partial breakdown of plant last July, referred to in the last half-yearly report, have greatly retarded the progress of the company and affected its profits by delaying connections to the premises of new consumers from whom important increases of revenue would have accrued in the second half of 1912. Considerable additions have been made to the generating plant at Thornhill to meet the normal increase of business, and that which is expected from agreements already made and others in process of negotiation. During the year there has been considerable capital expenditure on the extension of the distributive system, and the company is now giving a supply over a large area in the West Riding. There has again been an increase in the amount paid for rates, and the company is now paying these in 56 parishes and townships. In accordance with the resolution passed at an extraordinary meeting held on September 17th last, an issue of £50,000 6 per cent. cumulative preference shares has been offered to shareholders, and up to the end of 1912 applications had been received for £20,535 of this capital. On May 20th, 1912, the Yorkshire Waste Heat Co., Ltd., was incorporated under the Companies' (Consolidation) Act, 1908. A generating station is now being erected at Barugh, near Barnsley, and to construct this station an issue of £25,000 of 5½ per cent. first mortgage debenture stock was in November offered to the shareholders of the Power Co. Of this issue £10,460 has been applied for up to December 31st last. The directors anticipate that the whole of both issues will shortly be taken up.

**Company Registrations in 1912.**—In the course of its usual annual review, the *Investors' Guardian* gives the following among its other statistical returns:

	1910.	1911.	1912.
English registrations	6,707	5,960	7,095
No. of companies	2,408,457	3,168,645	7,570,780
Electric	5,889,442	8,424,402	8,885,757
Engineering and hardware	1,013,362	835,125	407,900
Gas	3,293,050	2,721,345	7,253,879
Motor, cycle and carriage	34,802,337	15,860,820	23,633,152
Oil	3,952,640	5,182,855	3,314,200
Railways and tramways	44,046,045	9,458,775	3,200,965
Rubber			

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Brown, Boveri & Co., Ltd.** (89,167).—Capital, £50,000 in shares (1,500 "A" and 3,500 "B"). Return dated December 14th, 1912 (end December 17th). All shares taken up, 15s. per share called up on 8,500 "B," £6,975 paid, £7,500 considered as paid on £1,500 "A." Mortgages and charges: Nil.

**South London Electric Supply Corporation, Ltd.**—Issue January 21st, 1913, of £1,400 debentures (sold to brokers at 99 per cent.) of a series of which particulars have already been filed.

**Electrical Installations, Ltd.**—A memorandum of satisfaction the extent of £200,000 dated January 16th, 1913, of debentures dated December 6th, 1912, securing £2,000, has been filed.

**Blackpool and Garstang Electric Light Railway Co., Ltd.** (150).—Capital, £10,000 in 25 shares; return dated January 6th, 1913 (filed on 6th); 200 shares taken up; £1 per share called up; £1,700 paid (including 23 received on application for further shares not allotted); £10 remains in cash. Mortgages and charges: Nil.

**Isaacs and Brown, Ltd.**—Particulars of £800 debentures, dated January 23rd, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Oriental Telephone and Electric Co., Ltd.** A memorandum of satisfaction to the extent of £1,450, on January 22nd, 1913, of trust deed June 28th, 1905, and supplemental deed of acknowledgement dated on 12th, 1907, securing £200,000.

**British Insulated and Helsby Cables, Ltd.**—The directors have declared a dividend on the 6 per cent. cumulative preference shares to December 31st.

**Torquay Electric Tramways Co., Ltd.**—The annual report for 1912 gives the following figures:—Traffic revenue, £28,112, as against £22,635 in 1911; advertising, £278; total receipts, £28,438; expenditure, £17,008; profit balance, £11,735; passengers carried, 4,207,619, compared with 3,591,317 in 1911; car-miles, 626,478, last year 494,468; receipts per car-mile, 10.77d.; 1911, 10.99d.; receipts per passenger, 1.60d., 1911, 1.51d.; energy per car-mile, 1.97d.; 1911, 2.41d. After paying debenture interest and providing for sinking fund for prior lien debentures, there is a balance, with a "carry forward" of £883 from 1911, of £5,988. A dividend of 3 per cent. on the ordinary shares will absorb £3,599; £1,500 will be allocated to the reserve and renewals fund, and £37 will be carried forward. The year's profit is £2,860 in excess of that for 1911. Considering the wet weather which prevailed last year, the result is regarded as satisfactory. Mr. W. B. Cowrie, who has been a director since the formation of the company, has been appointed managing director. The annual meeting was held in London on Wednesday.

**Consolidated Diesel Engine Manufacturers, Ltd.**—In a report dealing with the progress made by the company since its incorporation, the directors state that many important contracts have been booked, both by the company and its associates, Messrs. Usines Caréls Frères. The construction of the Ipswich works has not progressed as fast as was anticipated, owing to various obstacles having to be overcome during the preliminary stages. The activity in the steel trade has caused a certain delay in the delivery of material, but the contracts for steel work were placed before the present inflated prices came into operation. The greater part of the foundations for the buildings is completed, and the structural work is in course of erection. One section of the shops will be built first, and as soon as this is ready a number of the staff will be transferred to Ipswich to carry on the preliminary work upon which they are now engaged either in London or Ghent.—*Financial News.*

### LANARKSHIRE TRAMWAYS CO., LTD.

THE meeting of the shareholders of the above company was held on Tuesday at the offices, 83, Cannon Street, London, E.C., Mr. A. R. Monks presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 147), said that the capital expenditure for the half-year had only amounted to £726, which had been met to the extent of £500 by the issue of further debentures. The traffic receipts showed an increase for the first half of the year of £668, and for the second half an increase of £1,891, a total of £2,459. The receipts for the first half of the year were largely affected by the coal strike, and they estimated that but for the strike they would have shown a further increase of about £2,500. Advertising and other sundry revenue items were a few pounds in excess of the previous year, which gave them a net gain in the gross revenue of £2,462. Taking the expenses, the power costs showed an increase of £177, all of which was due to higher prices ruling for coal. Traction expenses were £2,287 more than for the previous year, nearly £2,000 of which was due to increased maintenance charges for permanent way and electrical equipment of line. The net increase in expenses was £4,002, so that the gross profits were £1,600 less than for the year 1911. This was offset to the extent of nearly £1,200 by the reduction of their payments to local authorities. For 1911 the payments amounted to £2,892 (this was on a 6 per cent. dividend basis), but as they could only pay 5½ per cent. for 1912, their payments were reduced to £1,704. The expenses in connection with the Act promoted by the Lanark County Council amounted to £818. They had written this amount off, also £137 for repair shop equipment, loose tools, &c. £9,500 had been transferred to reserve for depreciation, making, with interest, a total addition for the year of £11,448, increasing the reserve to £63,263. The balance of profit available allowed for payment of a 6 per cent. dividend for the half-year, making 5½ per cent. for the full year, and after reserving £307 for additional remuneration to the directors, they had £1,577 to carry forward to the current year. Having in mind the adverse effects of the coal strike, he thought they would agree that the results for the year were very satisfactory. They had invested during the year £4,987 in trustee securities, making a total investment to date of £21,134. The two matters in dispute with the Lanark County Council, namely, the utilising of money paid by the company for road widenings in building the new road known as Coronation Road, New Stevenston, and the application for Parliamentary powers for the immediate purchase of their undertaking, had been satisfactorily disposed of during the year. The County Council had been granted powers to construct the uncompleted lines authorised by their 1903 order. By an agreement between the County Council and the company, these new lines would be proceeded with shortly, and would be leased to the company on the terms of their paying to the County Council the interest charge on the amount expended on the construction. Under the agreement, the Council, with the other local authorities interested, had an option to purchase the undertaking at any time before 1928 at a price to be agreed upon between the local authorities and the company. If the local authorities did not buy them out within two years from the date of the opening for public traffic of the new lines, they were to purchase from the County Council the new lines at the cost price. No wayleave would be payable in respect of the new lines during the first two years of their operation. To meet the traffic on the extensions, they were ordering 12 additional cars and had also to extend their car-sheds, repair shops, &c. The directors had also decided to run motor-omnibuses, and services would be inaugurated in the near future.

MR. G. FRANKLIN seconded the motion, and the report was adopted.

### METROPOLITAN DISTRICT RAILWAY CO.

THE ordinary general meeting was held on Friday last at the Westminster Palace Hotel, London, under the presidency of Lord George Hamilton.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 168), said that the six months under review showed progress and some expansion of traffic, but the profits upon the expansion were to a considerable extent neutralised by the rise in the prices of certain articles, notably in that of coal. The amount expended on capital for the half-year was £25,000. The estimate of further capital expenditure was £205,000, and included the following provisions:—New rolling stock—30 additional cars, £67,000; extension to Charing Cross sub-station, including additional converters, £10,400; additional converters in Victoria, Earl's Court, Ravenscourt Park, Acton Town and Hounslow sub-stations, £10,000; flying junction at Earl's Court, £62,000; and electrification of section of District Railway between West Kensington Junction and Earl's Court Junction, £4,000. The gross receipts amounted to £346,655, being an increase of £23,840, or 7.39 per cent. over the receipts for the corresponding half-year. The passenger receipts amounted to £327,236, an increase of £26,611, or 8.35 per cent., while the average receipt per passenger was 1.82d., or an increase of 0.01d. compared with the corresponding period. The expenditure for electric train working amounted to £66,806, as compared with £78,510 in the corresponding half-year, being a difference of some £11,700. The total expenditure for the half-year was £166,200, as against £152,600 for the six months of the corresponding last half-year, showing an excess of £13,600; £6,000 of which was the extra cost of train working, due principally to the increased cost of coal. They consumed about 3,000 tons of coal per week, and the rise of a few shillings in the price per ton caused a substantial increase in this

item of their expenditure. The price of coal materially affected their working expenses, and he was afraid there was every indication that during the current year the price of coal would continue to be high. The car-mileage had increased by 403,058, or 5.20 per cent., notwithstanding which the passenger receipts per car-mile were 9.625d., or an increase of 0.323d. over the corresponding period. The percentage of operating expenses to gross earnings was 43 per cent., compared with 41.91 per cent. for the corresponding period. The same sum had been reserved for renewals, namely, £10,000, as for the corresponding period of last year. The balance available for the dividend was £85,694, which was practically the same as that available for a similar purpose last year. This balance they proposed to distribute as follows:—On the 4 per cent. guaranteed stock at the rate of £4 per cent. per annum, £28,714; on the first preference stock at the rate of £4 10s. per cent. per annum, £33,750; and on the 5 per cent. second preference stock at the rate of £2 per cent. per annum, £14,700. This would leave a balance of £8,528 to carry forward. The accounts would have permitted a slight increase in the dividend on the second preference stock, but the directors were of opinion that it was preferable that no increase to their dividends should be made this half-year, but that the carry-forward to the current year should be increased. There were two Bills referred to in the report, one by their company, and the other by the Wimbledon and Sutton Railway Co. The first one provided for the widening of their Fulham extension railway, consisting in the provision of two additional lines of track for a distance of about three-quarters of a mile, and of two island platforms at Parson's Green allowing of the passing of slow and fast trains, which extension when constructed would improve the train working on this branch. The Bill also authorised the Metropolitan Co. and their company to lengthen the platforms of the Aldgate East Station on the City lines so as to allow of the running of longer trains, the Aldgate East platforms being at the present time the shortest on the railway. The important part of the Bill was in connection with the Wimbledon and Sutton Railway. They would remember that this railway was authorised by Act of Parliament in 1910, but no portion of the railway had been constructed. The directors were of the opinion that this railway would serve a very desirable residential district close to London, and that a through service of trains direct from the City to Sutton would be the means of rapidly developing the latter district, and ultimately be to the advantage of the District Railway. The Bill took powers on behalf of the Wimbledon and Sutton Co. for an extension of time for the purchase of lands and the construction of the railway, as well as for additional capital and borrowing powers. Certain changes in the personnel of the staff had occurred during this period. The District Railway was by far the oldest of the various undertakings controlled by the Underground Co. They had the advantage of this maturity in possessing an experienced staff and personnel, many of whom had spent much of their lives in the service of the company, and who took an inherent and genuine interest in the work and well-being of the company. On the other hand, age, time, and death caused greater gaps amongst the heads of departments than was the case with younger companies. Having referred to the retirement of Mr. Whittle, who had been the accountant of the company for 42 years, and to the death of Mr. Soar, an old servant, the chairman concluded by saying that the past six months showed the same steady and continuous expansion which had been characteristic of the reports of the District Railway during the last six years. It was true that high prices, especially those of coal, had interfered with and marred the increased profit which they otherwise would have been able to show. The railway from its small mileage and from the complicated and hampering conditions which old Acts of Parliament had imposed upon it could not be expected to show in any half-year, or even in any full year, a revenue advancing by leaps and bounds. Such performance were outside its capacity and limitation, but it had shown an would, he thought, continue to show progress, which though slow was steady and unbroken, a progress not very noticeable in an one half-year, but which by continuous accumulation over number of years would steadily increase the aggregate dividend and the value of the property of its stockholders.

MR. ERNEST LAW seconded the resolution, and the report was adopted.

**Stock Exchange Notices.**—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

British Columbia Telephone Co., Ltd.—10,000 6 per cent. cumulative preference shares of £100 each, fully paid (Nos. 1 to 10,000).

Compania Hidro-Electrica de Tucuman.—£300,000 5 per cent. first mortgage debentures of £100 each.

Mexico Tramways Co., Ltd.—Further issue of £1,288,000 general consolidated first mortgage 5½ per cent. gold bonds.

The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Cordoba Light, Power and Traction Co., Ltd.—Further issue of 127,500 ordinary shares of £1 each, fully paid (Nos. 472,446 to 600,000).

Rhondda Tramways Co., Ltd.—Further issue of £40,000 5 per cent. first mortgage debentures (registered) of £100 each (Nos. 2,001 to 2,400).

**Consolidated Gas, Electric Light and Power Co of Baltimore.**—The directors have declared a dividend of 1½ p cent. on the common stock for the quarter ending March 31st, at 3 p cent. on the preferred stock.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended December 27th, 1912, amounted to 806,132, compared with 656,441 units in the corresponding four weeks of 1911.

**Central London Railway Co.**

directors' report for the half-year ending December 31st, states that the amount of capital expended during the half-year was £53,148. The following are the financial results of the year's working:—

	1912.	1911.	Increase.
Traffic receipts	£101,028	£125,806	£24,778
Miscellaneous receipts	10,327	12,746	2,419
Gross receipts	£111,355	£138,552	£27,197
Less working expenses	70,328	70,696	368
Balance to L of revenue account	£41,027	£67,856	£26,829

After providing for interest on the debenture stock and other items, the net revenue account shows that, including the amount brought forward from last half-year, there is an available balance of £85,420, as compared with £83,170 in the corresponding period. After deducting £6,739 for interest on the 4½ per cent. preference stock, there remains a balance of £78,680, out of which the directors recommend the declaration of the following dividends:—Undivided ordinary stock at the rate of 3 per cent. per annum for the half-year; preferred ordinary stock at the rate of 4 per cent. per annum for the half-year; deferred ordinary stock at the rate of 2 per cent. per annum for the whole year. The payments will require £51,162, leaving a balance of £27,518. The number of passengers carried, including season tickets, through tickets and the cheap return tickets issued before 7.30 a.m., follows:—

Year.	Half-year ending June.	Half year ending December.	Total.
1910	20,664,896	19,995,660	40,660,556
1911	20,006,287	18,076,956	38,083,243
1912	17,349,169	18,690,031	36,039,200
Total carried			510,962,053

The extension of the railway to Liverpool Street was opened for traffic on Sunday, July 28th last, and the Broad Street booking offices on Thursday, October 10th last. The number of passengers using this extension, and the receipts therefrom are considered satisfactory. The proposals of Underground Electric Railways Co. of London, Ltd., referred to in the chairman's circular letter of December 14th last, having been accepted by the holders of over 75 per cent. in the aggregate of the ordinary, preferred ordinary, and deferred ordinary stock, the offer has now become binding on the Underground Co.

The directors propose, in future, to submit accounts yearly, and to hold an ordinary general meeting in January or February in each year. Interim dividends will be declared in the month of July or August.

The Right Hon. Lord Esher retired from the board in October and Sir Henry Babington Smith was elected in his place. The meeting was called for yesterday, 6th inst.

**Great Northern and City Railway Co.**

The half-yearly general meeting of the shareholders of the above company was held on 29th ult. at the Westminster Palace Hotel, Earl of Lauderdale presiding.

The CHAIRMAN, in proposing the adoption of the report, said he would see by the accounts a falling-off in the traffic. Consequently their working expenses which, at the corresponding half-year of last year, were 51.50 per cent., had been for the last half-year 54.11 per cent., though actually in money only £155 up. They had this year to contend with the competition of motor-buses and motor-cars, which accounted for there being no set-off against the increase by the usual normal increase of travellers. A working expense of £5,086 appeared as the result. That sum, however, had not been provided, as in past years, from outside sources. He would mention what perhaps was an open secret, that the directors and friends of the company, who had provided over £28,000 to meet those recurring deficiencies by means of free gifts to the company out of their own pockets, had been Messrs. S. Pearson & Son, Ltd., who constructed the railway, and who were large shareholders and creditors of the company. Had it not been for that help and continuous support, the concern would, he thought, have long since passed into the hands of a receiver. A fresh issue of preference stock to the amount of £85,000 had been made to Messrs. Pearson, which, as they were all, no doubt, aware, had been used to them for some years past. They would also see that whilst the company's bonds had increased by £40,000, the loan due to the contractors had been reduced by a like amount. The cross-action between the Regent's Canal Co. and the railway, in reference to the water supply, had been settled on fair and satisfactory terms, and the railway company would, in future, obtain its feed water from other sources than the canal, and would also make a direct payment to the canal company in respect of water supplied by the latter for other purposes. They must all be conscious of the fact that the history of the company had been one of continuous disappointment; and it had not been for the fact that the directors entered into a competitive struggle with other lines, the company would quickly have succumbed. As it was, they had carried on for nine years a struggling existence, and one made more difficult year by year, owing to the unexpected arrival of the motor-bus and the electrification of the tramways, &c. That had all tended to make it extremely difficult for that little disconnected railway to hold its own. Some time ago the directors thought it advisable to link up the line with a main-line system, so that the value of its large tunnels might be utilised, and various negotiations took place, but until a

few months ago without success, when the matter was taken up by the Metropolitan Co. The latter company now had a Bill before Parliament which provided for the revival of the extension of the railway to the Bank, which that company only allowed to lapse through sheer inability to show any prospects of being able to finance it. In addition it was proposed to extend the railway to a junction with the Waterloo and City Railway so that it would be possible to journey under cover all the way from the South-Western stations to the North of London. Other extensions were also proposed which, in short, meant that the Metropolitan Railway proposed to take over their line and develop it as it required to be developed. They had to congratulate themselves upon the fact that a total loss of their capital was not to be their fate. So far as the debenture-holders were concerned, they would receive £ for £ an equal amount of Metropolitan 3½ per cent. "A" debenture stock, and the "A" shareholders were receiving 75 per cent. of the face value of their shares in Metropolitan ordinary stock, with dividends slightly restricted. The "B" deferred ordinary shares would get 50 per cent. of the face value. As it was, their line was earning nothing for its shareholders, and by itself had no prospect of earning a dividend, as part of a large and energetic railway, however, it promised to become a profitable feeder, and with its success their prospects would also be improved. It was true they would have to submit to a reduction of ½ per cent. of their interest, but, on the other hand, they would secure an easily saleable stock of unquestionable security. Out of all the debenture-holders 87½ per cent. had sent in consents to the scheme. Some comment had been made on the fact that whilst the preferred, ordinary, or "A" shares, got 75 per cent., the "B" shares received only 50 per cent. in stock. It was only right to explain that both the preferred and deferred were ordinary stock, and as a matter of strictness on a division, each share, whether "A" or "B," was entitled to receive the same amount of stock. Inasmuch as the arrangement with the Metropolitan Co. had got to be carried through by agreement, and each class of share was dependent on the vote of the other to secure the acceptance of the agreement, it had been thought right that the "A" shareholders, who were entitled to a preferential dividend, should, as some compensation, get a larger amount of stock, and so the "A's" got 75 per cent., and the "B's" only 50 per cent. A special meeting of the "B" shareholders would be held later on, when they would be asked to waive their strict rights to an equal distribution and to agree to the acceptance of the smaller proportion. As regarded the directors, he (the chairman) and his colleague, Sir Clarendon Hyde, would join the board of the Metropolitan, and the other directors would resign. He thought that whilst recognising that the Metropolitan Railway had made a fair bargain in the matter, it had, at the same time, saved them all from a very unsatisfactory position. Not one proxy had as yet been sent in against the scheme. He proposed that the report and accounts be adopted.

MR. CHARLES STEEL (deputy chairman) seconded, and the motion was carried.

After the auditors, &c., had been re-elected, the SOLICITOR to the company explained briefly the object of the amalgamation, and the proceedings closed.

**Mersey Railway Co.**

The directors' report for the half-year ending December 31st, 1912, states that the train mileage run during the half-year was 276.73 miles as compared with 301.685 during the corresponding six months of 1911. The number of passengers conveyed during the half-year was 6,622,684, as against 5,914,743 for the corresponding period of 1911, exclusive of season ticket holders. The total receipts from all sources for the half-year were £69,651, as compared with £54,150. The working expenses, exclusive of the charges for pumping, ventilation, and lifts were £27,427, equal to 45.97 per cent., as against £27,065, equal to 49.98 per cent. These charges for pumping, ventilation, and hydraulic lifts, for the past half-year amounted to £3,818, equal to 6.40 per cent., as compared with £3,125, or at the rate of 5.77 per cent. Under the scheme of agreement scheduled to the Mersey Railway, 1900, as extended by the Mersey Railway Acts, 1906 and 1910, the payment of interest on the following debenture stocks, viz.:—1866, 1871, 1882/3/5 and B, was contingent on the revenue of the company available therefor in each separate year. The auditors had certified that the revenue available for this purpose for the year ending December 31st, 1912, amount to £18,061, which was accordingly being distributed to the debenture-holders as follows:—Interest at 4 per cent. on the 1866 debenture stock, £4,664; interest at 3 per cent. on the 1871 debenture stock, £3,000; interest at £2 17s. 9d. per cent. on the 1882/3/5 debenture stock, £10,395; balance carried forward, £1 12s. 7d. The interest on these debenture stocks was duly paid to the debenture-holders on February 1st, 1913. The meeting is to be held in London on February 11th.

**South London Electric Supply Corporation, Ltd.—**

The directors recommend, subject to final audit, a dividend on the ordinary shares for the year 1912 at the rate of 5½ per cent. per annum, as compared with a 5 per cent. for the previous year.

**Metropolitan Electric Tramways, Ltd.—**

An extraordinary general meeting will be held at Electrical Federation Offices, W.C., to-day, Friday, to consider a resolution approving the Bill intitled, "A Bill to empower the Metropolitan Electric Tramways, Ltd., to provide and work vehicles by means of railless traction; and for other purposes."

### City and South London Railway Co.

The report of the directors shows that the receipts from all sources for the half-year ended December, 1912, amounted to £83,877, and the cost of working was £42,941, leaving a profit of £40,936. Inclusive of the balance brought forward, the net revenue account shows an aggregate total of £43,130. After making provision for the debenture stock interest, rent charge, and the transfer to the renewal fund of £1,500, a balance remains available for dividend of £27,538. Out of this the directors recommend that the full dividend of 5 per cent. per annum be paid on the preference stocks, 1891, 1896, 1901 and 1903, and that a dividend at the rate of  $\frac{1}{2}$  per cent. per annum be paid upon the consolidated ordinary stock for the half-year, leaving £2,588 to be carried forward to the next account, as against  $\frac{1}{4}$  per cent. per annum and £2,815 carried forward last year.

Half-year.	Passengers, inclusive of season tickets.	Receipts, including season tickets.	Dividend per cent.
June 30th, 1910	12,857,324	£83,413	1 $\frac{1}{2}$
December 31st, 1910	12,860,719	£86,103	1 $\frac{1}{2}$
June 30th, 1911	13,818,622	£67,591	1 $\frac{1}{2}$
December 31st, 1911	12,940,839	£85,817	1 $\frac{1}{2}$
June 30th, 1912	12,510,728	£81,656	1 $\frac{1}{2}$
December 31st, 1912	12,018,874	£78,830	5

The decrease in traffic receipts was appreciated very generally throughout the line, and about one-fourth of the whole amount was in bookings with other companies. The directors attribute it mainly to the extensive and general development of motor-omnibuses, which, by direct competition and by intersecting routes, have diverted much of the traffic which formerly came to this system. The directors, foreseeing that the reduction in the receipts had not reached its limit, decided that the interests of all classes of stockholders would be best served by arriving at an arrangement with a larger company, and after anxious consideration and some delays, a scheme was negotiated with the Underground Electric Railways Co. of London, Ltd. The full details of this arrangement were submitted to the ordinary stockholders. Approximately 99 per cent. of the consolidated ordinary stock of the company has, in pursuance of this scheme, been transferred to the Underground Electric Railways Co. of London, Ltd. The directors who have resigned in accordance with the terms of the scheme are Messrs. J. F. S. Gooday, S. Barclay Heward and E. Tate, and in their places have been appointed Mr. A. H. Stanley (managing director), Mr. T. C. Jenkin, and Admiral Sir Cyprian A. G. Bridge, G.C.B. In intimating these resignations, the chairman desires to place on record his regret at parting with colleagues much esteemed on personal grounds, whose counsel and co-operation had been at all times of the greatest value to the company. The appointment of Mr. Jenkin to a seat on the board involved, and was preceded by, his resignation of the office of general manager. This office he had held since May, 1890, and had displayed therein a degree of vigilance, courtesy, and organising capacity which it would be difficult to overpraise. It is satisfactory to be able to announce that in his new capacity Mr. Jenkin's devotion and experience will still be at the service of the company. The company are promoting a Bill in the ensuing session for enlarging the tunnels, for raising the necessary capital for this work, for new rolling stock and electrical equipment, and for other purposes, which will be submitted to the proprietors at a special meeting to be held at the conclusion of the ordinary general meeting. The London Electric Railway Co. are promoting a Bill, which will also be submitted to the special meeting, to authorise a physical junction near Euston, between this company's line and the Charing Cross, Euston and Hampstead Tube. This junction will enable up-to-date trains to run from Edgware, Golder's Green, Highgate, &c., through this company's enlarged tunnels to Euston, King's Cross, the City, London Bridge, and Clapham Common.

The meeting is to be held on February 11th.

### London Electric Railway Co.

The ordinary general meeting of the shareholders was held on Friday last at the Westminster Palace Hotel, London, Lord George Hamilton presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 168), said that the capital powers of the company had been increased by £700,000 additional capital, and £200,000 additional borrowing powers authorised by the London Electric Railway Act, 1912, and by £600,000 additional capital and £200,000 additional borrowing powers authorised by the Edgware and Hampstead Railway Acts, 1902 and 1912. The amount of preference stock created had been increased by £23,670 for which an equivalent amount of ordinary shares of the Edgware and Hampstead Railway Co. was received in accordance with the terms of the London Electric Railway Act, 1912. During the half-year £235,056 of debenture stock was issued, the proceeds of which were being used for paying the cost of the Golder's Green, Paddington and Charing Cross extensions. The amount spent on capital account was £279,322, of which £159,251 was expended on the extension from Golder's Green, £39,830 on the Paddington extension, £35,223 on the Charing Cross extension, and £41,518 on Earl's Court escalator. The gross receipts had amounted to £376,710, being an increase of £10,520 for the corresponding period of the preceding year. There had been an increase in expenditure of about £3,300 compared with the corresponding period, of which £4,000 was increase in cost of train working, due principally to the increased cost of coal, and there was every indication that the price of coal would continue to be

high during the current year. The car-mileage showed an increase of 351,210, or 8'85 per cent., while the passenger receipts per car-mile were 8'87d., compared with 9'01d. for the corresponding period. The percentage of operating expense to gross earnings was 43'19 per cent., compared with 42'12 per cent. for the corresponding period. There were two Bills referred to in the report, one by their company and the other by the City and South London Railway Co. The powers sought in the company's Bill were to enable them to construct a physical connection between the City and South London and their Hampstead and Highgate railway at Euston, so as to allow of a through service of trains into the City. In order that this might be done, it was necessary for the City and South London Co. to enlarge its tunnel, which was of a smaller diameter than their company's, and that company was promoting a Bill seeking powers for that purpose. The work on the Paddington and Charing Cross extensions involved many complicated engineering problems, but it was progressing satisfactorily, and it was hoped that both those extensions would be opened for traffic either in the late summer or the early autumn of the present year. The contract had also been made for the installation of escalators at Oxford Circus Station, and this work had commenced. This was the last occasion upon which he would act as chairman. He was sorry to leave the company; his relations with all concerned had been most pleasant and harmonious. He was especially sorry to leave it at a time when it was embarking into a larger system of co-operation with other companies and in extensions of its own. The Underground Co. had been forced, not by any desire to create a monopoly, but by the pressure of the circumstances with which it had had to deal, to extend its operations and to enter into arrangements with other enterprises similarly engaged. The huge and ever-growing daily passenger traffic throughout London could not otherwise be handled, if the convenience of the traveller had to be consulted and proper facilities afforded for the increasing number of persons requiring daily, constant, continuous, and rapid transport to and from all parts of the metropolis and its suburbs. This class of traffic could not have its necessities adequately met if London was arbitrarily divided into artificial and self-contained sections. The Underground was, therefore, forced to become a very large concern, and that being so, it was desirable to so adjust and shape every part of the co-operation thus necessitated so as to ensure smooth and harmonious working throughout. In the opinion of those whose judgment he trusted, it was thought that he might be more usefully engaged elsewhere. He bowed to that decision and took leave of them all with regret. He was consoled by knowing that his successor, Lord Farrer, was a director of exceptional experience in railway management. He came from a family distinguished in many walks of life, and he had no doubt that these railways would prosper under his direction. His experience as chairman, and the constant examination and revision of the figures brought weekly under his notice, had made it clear that it was only by a closer interchange and linking up with existing systems that an adequate return could be secured upon the great outlay of those underground undertakings. During the last two years, excluding the exceptional period of the Coronation festivities, the growth of traffic receipts was almost entirely derived from terminal and exchange stations. The intermediate stations held their own, but no more. For short distances, especially in fine weather, the motor-buses were their most formidable competitors. They had in hand a number of extensions and improvements which could not fail to largely augment their present traffic. The Paddington extension would bring them into direct physical connection with the Great Western system, whilst the further extension from Paddington to Queen's Park would enable them to co-operate with the London and North-Western Railway in bringing passengers from their lines straight through to lines operating on the south of the Thames. The Golder's Green extension would run through a rapidly increasing residential neighbourhood, a large proportion of whom were daily conveyed to and from the Metropolis. Under the Bills promoted this session by the City and South London Railway Co., their railway would be so connected with their lines as to become an integral part of their system. The Charing Cross improvements which were approaching completion would, when finished, provide a consolidated station which would afford full facilities for a thorough exchange of passengers between the Bakerloo, the Hampstead, and the District Railways. Those and other developments had not been promoted piece-meal or at haphazard, but they were part of a general policy carefully thought out, by which they hoped out of the isolated and scattered lines they originally started, to establish a compact and ubiquitous system of underground travel through the Metropolis. He should watch with interest and attention the development and realisation of this great utilitarian idea.

SIR ALGERNON WEST, G.C.B., seconded the motion, and the report was adopted.

**Underground Electric Railways Co. of London, Ltd.**—The directors have declared a dividend at the rate of 6 per cent. per annum on the income debentures, and at the rate of 6 per cent. per annum on the income bonds.

**London General Omnibus Co., Ltd.**—The directors recommend, subject to audit, the payment of a dividend on the ordinary shares of the company for the period ended December 31st, 1912, of 8 per cent., free of income-tax.

**South London Electric Supply Corporation, Ltd.**—The directors recommend, subject to final audit, a dividend on the ordinary shares for the year 1912 at the rate of  $\frac{5}{2}$  per cent. per annum. This compares with a 5 per cent. dividend for the previous year.

### Liverpool Overhead Railway Co.

THE directors' report shows that the gross revenue receipts for the half-year ended December, 1912, amounted to £43,985, and the working expenses to £28,869.

The number of passengers carried during the last two years is as follows:—

	Half-year June, 1911.	Half-year Dec., 1911.	Half-year June, 1912.	Half-year Dec., 1912.
First class . . . . .	579,328	617,007	628,852	674,460
Third class (including trams)	3,113,073	3,398,069	3,323,291	3,618,008
Workmen (spec. ret. tickets)	1,701,196	1,723,940	1,913,695	1,976,079
Total . . . . .	5,394,597	5,739,016	5,871,339	6,297,546

In consequence of ill-health, Sir W. B. Forwood has resigned his position as chairman of the company. He will retain his seat on the board, and, it is hoped, will, ere long, be able to take his usual keen interest in the working of the railway. The meeting of shareholders will, in future, be held only once in each year, in the month of February. The directors intend, when possible, to declare and pay interim dividends in the month of August, as heretofore. The receipts from passenger traffic amounted to £42,566; miscellaneous receipts and interest, £1,419 = £43,985; less working expenses and transfer to renewal fund, £28,869 = £15,116; less interest on mortgage debentures, and on calls paid in advance, £1,329; also less provision towards cost of adjustment of loan capital, £500, and written off for depreciation of investments, £300; leaving £9,986, plus £4,852 brought forward. This leaves available for dividend £14,839, out of which the directors recommend dividends at the rates of 5 per cent. per annum on the preference shares, and 2½ per cent. per annum on the ordinary shares, leaving £4,913 to be carried forward.

### Metropolitan Railway Co.

THE half-yearly meeting was held on Wednesday, January 28th, at the Great Eastern Hotel, E.C., Lord Aberconway presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 189), said that on the expenditure side of the revenue account there was a saving in expenses of £1,239. Locomotive and generating expenses showed an increase of £1,751. Like all other railway companies, they were suffering from a serious increase in the price of fuel and also from an increase in the price of materials generally, and but for these circumstances, they would have shown a very considerable saving on this account, because their new generating machines at Neasden were enabling them to produce the current they required at a much smaller consumption of coal than under the old conditions. During the half-year they had burnt in the power house 31,089 tons of coal, as against 37,341 tons in the corresponding period, the decrease being 6,252 tons, or 17 per cent., while the output of current had been practically the same. On the receipts side of the account the disappointing feature was the first item, which showed that the receipts from the conveyance of passengers, apart from season ticket holders, showed a decrease of £1,444. The longer distance and the season ticket traffic both showed substantial advances, the falling off having been in the short-journey traffic, where they had a very severe competitor in the motor-bus. Their losses on the working of the Hammersmith and City Railway and on the East London Railway were both less than in the corresponding period, and their proportion of the profit from the working of the City lines and of their joint lines with the Great Central Co. north of Harrow showed a substantial increase. The net result was that they had available for dividend £171,778, as against £164,677. That would enable them to pay the dividend on the whole of the preference stocks as usual, and to pay at the rate of £1 15s. per cent. per annum on the ordinary stock, carrying forward £9,496. Put shortly, the effect of the accounts was that they paid the same dividend as 12 months ago on the ordinary stock, notwithstanding that the amount of that stock had been increased by £729,000; they put £7,500 to their electrical renewal and depreciation fund, as against £5,000 in the corresponding period; and they were carrying forward £280 more than on the previous occasion. Having referred to the progress being made with various alterations and widenings, the chairman said that at Neasden the whole of the five new sets of machines had been installed, though they were not all yet out of the contractors' hands. From their experience of them up to now, he might say that they were quite satisfied that they would effect all the economy in working that they intended they should do. They were putting up some additional sheds at Neasden for the housing of their rolling stock, and they hoped thereby to reduce their maintenance costs, as a great part of the stock had at present to remain in the open at night. They were laying an additional high-tension cable between Neasden and Moorgate Street to meet the increased call for current necessitated by the increased train services which they were now running, and which they had in prospect. In view of this they had placed an order with the Metropolitan Carriage, Wagon and Railway Co. for the building of 36 new cars which they required for working the electrified East London Line, the Hammersmith and Richmond Line, and for other purposes. The proprietors would be aware that in November last they issued an official statement through the Press in reference to the relations of the company with the Underground Co., which was a virtual amalgamation of most of the tube lines, the District Co., and the London General Omnibus Co. He had referred to this question at one or two previous half-yearly meetings, and they thought it right, in view of certain unauthorised statements having appeared in the newspapers on the subject, to issue an authentic announcement. He would like to state frankly and fully the reasons that led the board to the decision that it was not in the

interests of the company that there should be a financial fusion between the Metropolitan and the Underground group. In the first place, he must remind them that the very serious and increasing competition of the motor-omnibuses with the whole of the underground lines in London was the main factor in determining those who had control of the majority of the tube lines to acquire the control of the Omnibus Co., and that they acted wisely in doing so there could be no question whatever. The motor-bus had introduced a new and formidable element in competition. The old horse bus competed with the underground lines to a certain extent in the old steam days, but it could not compete effectively after these lines were electrified. The motor-bus, on the other hand, could compete with them in the matter of speed for short distances, and the very great convenience it offered to the public in picking up people and setting them down at any point they desired, rendered it a very formidable competitor. Under these circumstances, and as the tube lines were dependent for practically the whole of their earnings on traffic for which the motor-buses were competing, a common control of the two interests was undoubtedly desirable from every point of view. The Metropolitan Co.'s position, on the other hand, was quite different. Less than one-half of their total revenue was derived from traffic for which they were in competition with the motor-buses, the main part of their receipts being from their longer distance traffic, from their goods traffic, and from their exchange with various trunk lines, where, for obvious reasons, they need not fear competition from the source he had named. That they had suffered and were still suffering seriously from the diversion of traffic to the motor-buses within the London area was undoubtedly a fact, and though they were doing, and would continue to do, everything that lay in their power to attract short-distance traffic to the line by affording every possible facility, he had no hesitation in saying that they must not expect any growth in that section of the business. On the other hand, their longer distance traffic was capable of large expansion, and their policy during recent years had been to encourage and develop the traffic in their outlying districts. The board gave very careful, and indeed anxious, consideration to the whole matter before deciding to discontinue the negotiations with the Underground Co., and he hoped he had said sufficient to satisfy them that the possible sacrifice of future prospects that would have been involved in an amalgamation with the group in question would have been greater than the circumstances justified. He considered it would have been a mistake to have exchanged the prospects that they undoubtedly had for such immediate benefits as might have come to them by throwing in their lot with the underground group. Their discussions with the Underground Co. were carried on throughout in a most friendly spirit, there being an earnest desire on both sides to make the best arrangement possible for the respective undertakings. It was finally recognised on both sides that it was practically impossible to devise a scheme that would be mutually satisfactory, and it was thought that, so far as the working of the undertakings was concerned the objects in view could be accomplished without a financial union. As regarded the East London line, where they were joint lessees with several other companies, the work of electrification was approaching completion, and they expected the line would be ready for electrical operation in the course of about two months. They would then resume the running of through trains between New Cross and their system, which was previously a source of considerable profit to them.

MR. PAUL SPEAK seconded the motion.

MR. POWNALL, in a lengthy speech, criticised adversely the proposal of the directors to purchase the Great Northern and City Railway Co. That company was, he said, an unsuccessful and bankrupt concern. Having given the figures of the actual results shown by the line, as compared with the estimates in the prospectus and pointed out that only on two occasions had the company earned sufficient to pay the interest on the debenture stock, Mr. Pownall gave it as his firm opinion that the future prospects were not more encouraging. They were, he said, told that if they did not buy the line the Great Northern Railway Co. would do so, and if that was so, he would rather that company bought it than the Metropolitan.

The CHAIRMAN said that in the opinion of the board they had the opportunity of purchasing the Great Northern and City Co. on very favourable terms, and they were satisfied that if it came into their hands, and they extended it as they proposed, it would put the earning value of the line upon a footing that it had never yet occupied by reason of its short length. He reminded the shareholders that the Metropolitan Co. had a power station at Neasden capable of turning out a very much larger quantity of electrical power than they could now consume, and it was proposed to use this surplus energy to run the new line, and to use the station of the Great Northern Co. for other purposes.

After a long discussion, the report was eventually adopted.

A Wharnciffe meeting was subsequently held, at which the CHAIRMAN proposed a resolution approving the Bill providing for the purchase of the Great Northern and City Railway. In the course of a long speech defending the proposal, he explained the various extensions which they proposed to make, and said it was their intention to take over the line as and from July 1st next.

Considerable discussion ensued, in which various shareholders urged the desirability of delay in order to give further time to consider the matter, and in the end it was decided to adjourn the consideration of the question to a special meeting, to be held on February 12th. In the meantime it is proposed that a number of the largest shareholders shall confer with the board on the matter.

## Smithfield Markets Electric Supply Co., Ltd.

THE directors' report for the year 1912 shows that the gross profit amounted to £4,005, compared with £3,869 last year, and the net profit to £1,525, compared with £1,383. A further sum of £400 has been placed to the debenture stock redemption fund, making a total of £1,282 at the credit of this account, and £500 to depreciation and general reserve fund accounts. The available balance, including £629 brought in from 1911, is £2,154, which the directors propose to deal with by paying a dividend at the rate of 2 per cent. per annum on the ordinary shares (£1,200), and carrying forward £954. The output of current for lighting has been maintained, but the demand for power has been rather less, probably due to the abnormal conditions prevailing during the summer months. The plant and machinery have been efficiently maintained and a reduction in generating costs per unit effected. The installation of the new generating plant is proceeding satisfactorily and will be completed very shortly. The vacancy, caused by the death of Sir J. H. Morris, K.C.S.I., one of the trustees for the debenture-holders, has been filled by the appointment of Sir Herbert Leon, Bart., as a trustee.

The annual meeting takes place to-day (Friday).

## STOCKS AND SHARES.

Tuesday Evening.

MARKETS in the Stock Exchange have called something of a halt pending the war developments in the Balkans. Opposed to the idea which existed, even up to Monday night, that the two combatants would not come to blows after all, was the hope that they would fight out their differences once and for all, and so settle the matter. For a great deal too many years the Near Eastern Question has been a constant thorn in the side of the Stock Exchange; and its extraction, even if a painful process during the operation, would be welcomed by financial circles the world over. Business, meantime, is very quiet, and the liveliest feature this week amongst electrical sections have been the movements in Marconi shares.

The Home Railway market was greatly cheered by the declaration of unexpectedly good dividends by some of the Northern lines. Prices of steam stocks improved generally, and this had a good effect upon Metropolitan and Districts, the quotations of which improved. Metropolitan, allowing for deduction of the dividend of 17s. 6d. per cent., are 1½ up; while Districts have recovered 1. The eagerly-expected report of the Underground Electric Railways Company showed that the earnings were sufficient to pay the full 6 per cent. on the Income Bonds, but the carry forward did not come up to hopes which had been expressed about it previously, and was not large enough to justify some of the extravagant talk recently heard in connection with the company's Ordinary shares. The price of the latter, therefore, eased off ½ to regain it later, while the Is. shares fell ½, and the Income Bonds themselves at 95½ showed a fall of ½. Confidence in all these issues, however, remains strong; and unless holders come in to realise their shares more eagerly than they have done so far during the past week, there might be a recovery, provided the meeting is a satisfactory one.

Central London Ordinary and Deferred both shed a point; but the Preferred is 1 up, in consequence of the good return which the stock shows at the present price, included in which, of course, is the recently-declared dividend of £2 per cent. Great Northern and City Preferred fell 10s. to 2½ on the opposition manifested at the meeting of the Metropolitan Railway shareholders to the scheme for the absorption of the Tube line by the Metropolitan. When the project was first announced, the wonder was expressed here why the older railway should want to acquire the Great Northern and City, and evidently some of the Metropolitan proprietors are still unsatisfied on the point.

British Electric Traction 6 per cent. Preferred stock has receded to 11½, but Potteries Preference are better, and there is a vague notion that the Company's Ordinary shares may be worth picking up as a gamble that ought to be kept. In view of the very small market that there is in the shares, it would seem to require some courage to buy these, even for the purpose of putting away.

Dividend announcements have already begun to appear from the English electricity supply Companies. The Westminster Company announces a distribution at the rate of 11 per cent. per annum, making the regular 10 per cent. for the year; while the St. James's Company is paying 5s., also as usual, making a similar percentage.

The list of prices has been rectified to some extent, and brought more into line with the actual conditions of supply and demand in the market. Chelsea, London Preference, Metropolitan Ordinary, and County Ordinary and Preference have been marked up ½ in each case. Westminsters and St. James's have both declined, in spite of their dividend declarations. The principal change is a rise of 15s. in City of London Ordinary, the market being strengthened by recurrence of the demand from the same group whose operations started the previous rapid improvement. The market is none too supplied with shares of any of the best London Electricity Supply Companies, but there is not a great deal of inquiry to stimulate prices, and the National Telephone Arbitration award is not yet far enough away to remove a certain feeling of doubt as to how the electric undertakings will be treated in 1913.

Remark was made here in our last report upon the way in which the manufacturing shares were being picked up by people who knew how busy quite a number of the companies are at present.

This movement has gone further. Electric Constructions have followed up their advance of a week ago by a gain of ½. British Aluminium Ordinary and Preference have both improved, and the Prior Lien Debentures gained 1, a similar advance being secured by British Thomson-Houston Debenture. Castner-Kellner Debenture stock recovered 1½ of its dividend deduction, while Edison & Swan 4 per cent. Debenture stock rallied a point after its drop of last week, although the Ordinary shares (partly paid) have been marked down to the lugubrious figure of nothing to ½. No doubt the readers of these Stock Exchange notes are better conversant with the amount of work which manufacturing companies have in hand, than a mere financial writer can expect to be, since he is but the wax upon which are stamped the impressions of those more fully informed. Babcock & Wilcox rose ½ to 3½, but in Willans and Robinson there are no changes.

The Marconi market, as noted above, is one of the most active in the Miscellaneous section. The price of the shares has spurred strongly, touching 4½ on Monday, and finishing on Tuesday night at 4½, leaving a rise of ½ on the week. The cross-examination of Mr. W. R. Lawson, one of the journalistic critics of the Marconi agreement, is followed with particular interest in the Stock Exchange, because Mr. Lawson is a member of the House. With the parent shares, the prices of Canadian, American and Spanish Marconis have advanced in sympathy. The market is a very difficult one to read, and it is largely at the mercy of a comparatively small clique, whose extensive deals bring about these violent fluctuations.

National Telephone Deferred has quieted down again, and the price shows a fair recovery after its very steep fall. So many conflicting calculations are being made even yet as to the price at which the stock will be paid off that no good purpose can be served by reproducing these guesses. American Telephone Capital stock fell 1½ for the same reason as mentioned on a previous occasion, namely, that it is feared the United States Courts may declare the Company to be an illegal combination in restraint of trade. The same contention applies—more indirectly, of course—to the Anglo-American Telegraph Company, now under the wing of the Western Union Company. But the prices of the Anglo group are unaffected, because it is taken for granted that, even in the event of the so-called trust being dissolved, the Anglo could keep up its own end perfectly well. Mackay Common shares fell 2. Cuba Telegraphs are a good spot, with a 10s. rally; but West India and Panamas continue to sag, and the price has lost another ½. The Eastern group keeps very steady, and there is not a change worth mentioning beyond a point decline in Eastern Ordinary stock.

The unpleasant flavour left in the mouth by the Georgia Light and Power incident continues to militate against this department. Georgias themselves have recovered to 4½, and the Mexican group is a little better. Brazil Traction recovered the 1½ per cent. deducted for dividend, and another ½ in addition; while British Columbia Electric stocks are just steady, the Deferred losing a point, which the Preferred picked up. Rio First Mortgage Bonds are better. Barcelona Trams rose from 47 to 50, and reacted to 49. United Electric Tramways of Monte Video shares are a shade easier, but there is not much doing in them, and the prices of the pre-ordinary issues remain very firm. Mexico Trams are harder, and in the Mexican Light and Power group the only alteration is a partial recovery of the coupon on the company's 5 per cent. First Mortgage Bonds.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.).	Receipts for the month.		No. of wks.	Total to date.		Route miles open.
		£	£*		£	£*	
Bath	Jan. 29	2,714	+ 105	5	8,669	+ 265	.. 7
Blackpool-Fleetw'd	Feb. 1	955	+ 1	4	1,176	- 63	8
Bristol	Jan. 31	27,302	+3,810	4	30,511	+ 2,967	30.6
Brit. Elec. Trac. Co.	" 24	91,496	+5,392	33	78,748	+ 6,145	..
Chatham and Dist.	" 30	3,345	+ 325	4	3,600	+ 103	14.98
Cork	" 30	1,742	+ 31	4	1,876	- 97	9.80
Dublin	" 31	22,051	+1,724	4	24,687	+ 503	64.25
Hastings	" 30	2,831	+ 66	..	..	..	19.9
Lancashire United	" 29	5,059	+ 39	4	5,463	+ 304	39
Llandudno-Col. Bay	" 24	598	+ 52	8	1,176	+ 68	6.5
London United	Feb. 1	21,282	+ 401	6	27,151	+ 705	..
Tyneside	Jan. 29	1,621	..	5	1,709	- 126	11
Anglo-Argentine	Jan. 28	219,170	+18,666	4	219,170	+18,666	..
Auckland	Dec. 29	20,556	+2,578	25	1,7759	+18,280	24.11
Bombay (B.E.T.)	Jan. 3	12,668	631	22	160,993	+ 3,237	..
Brisbane	Dec. 25	25,890	+1,560	62	254,311	+ 2,211	..
Brit. Columbia Ry.	Feb. 1	17,655	+1,167	..	..	..	..
Calcutta	..	..	..	..	..	..	..
Cape Electric T. Ld.	..	..	..	..	..	..	..
Kalgoorlie, W.A.	Dec. 2	3,206	..	52	57,810	..	20.6
Lisbon	..	..	..	..	..	..	..
Madras	Jan. 31	3,541	+ 369	4	8,511	+ 868	14.7
Montevideo	Jan. 30	38,761	+2,010	13	102,167	+11,355	..
Can. London Ry.	Feb. 1	27,465	+1,688	5	280,070	+ 2,289	6.78
City & S. Lon. Ry.	Jan. 25	12,491	+1,305	4	12,491	+1,305	7.26
Dublin-Lucan Ry.	" 31	455	+ 20	5	605	- 8	7
G.N. and City Ry.	Feb. 1	6, 76	- 751	5	7,429	- 958	8.6
L'pool Over'd Ry.	Jan. 26	6,544	+ 575	4	6,544	+ 575	6.6
London Elec. Ry. Co.	Feb. 1	60,430	- 180	6	75,240	- 805	21.25
Mersey Railway	" 1	8,991	+ 561	6	11,819	+ 608	4.6
Metropolitan Ry.	Jan. 20	67,408	-1,043	4	67,408	-1,043	26.75
Met. District Ry.	Feb. 1	63,683	+2,732	5	64,913	+ 3,115	25

\* Compared with the corresponding period of 1912.  
; Includes horse, steam and other receipts.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

Table listing English Electricity Supply and Power Companies. Columns include Name, Stock or Sharo, Dividends for, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c., Name, Stock or Sharo, Dividends for, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c.

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Table listing Colonial and Foreign Electricity Supply and Power companies. Columns include Name, Stock or Sharo, Dividends for, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c., Name, Stock or Sharo, Dividends for, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c.

TELEGRAPH AND TELEPHONE COMPANIES.

Table listing Telegraph and Telephone Companies. Columns include Name, Stock or Sharo, Dividends for, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c., Name, Stock or Sharo, Dividends for, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Paid in deferred interest warrants. ‡ Interim Dividend. § Ss. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railways and tramways in the home market. Columns include Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c. Includes entries like Bath Trams, Great Northern & City, London Elec. Railways, etc.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railways and tramways in colonial and foreign markets. Columns include Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c. Includes entries like Anglo-Arg. Trams, La Plata Elec. Trms, Lisbon Elec. Trams, etc.

MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations Feb. 4th, Rise or Fall, Present Yield p.c. Includes entries like Aron, Babcock & Wilcox, British Aluminium, etc.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

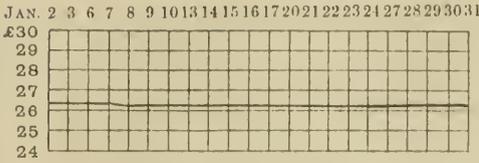
METAL MARKET.

NOTES FROM CANADA.

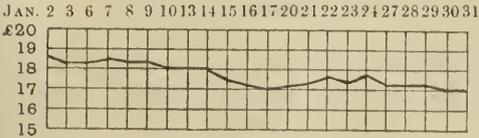
Fluctuations In January.

[FROM OUR SPECIAL CORRESPONDENT.]

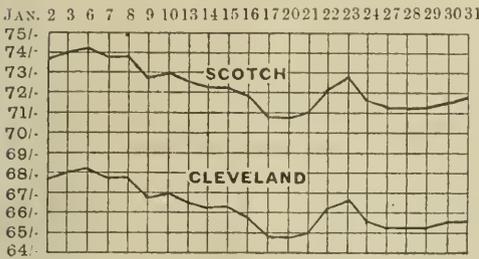
SPELTER (G.O.B.'s.).



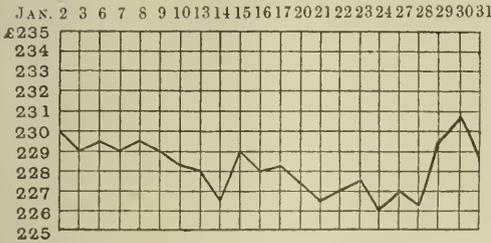
LEAD (ENGLISH).



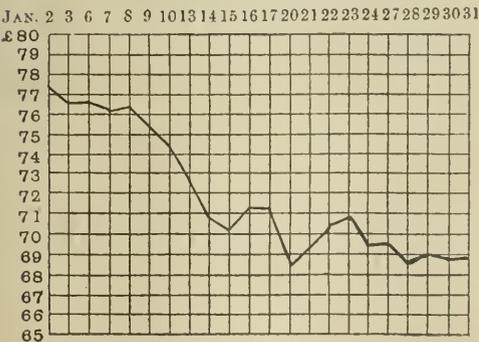
IRON.



TIN.



COPPER (G.M.B.'s.).



**Rail Welding.**—MESSRS. THERMIT, LTD., London, have contracts in hand—or shortly to be started—for the welding of the tramway rails on the following, among other systems:—Ayr, Bolton, Birmingham, Dublin, London County Council, Manchester, Portsmouth, Salford, York, &c. The number of joints welded on new and reconstruction work during 1912 amounted to over 15,000, which is equivalent to nearly 30 miles of single track, 60-ft. rails.

The writer of these notes has just received the ELECTRICAL REVIEW of January 3rd, which contains the report of Mr. C. Hamilton Wickes on the Chicago Laboratories.

Mr. Wickes has carefully gathered his facts and marshalled them well, for he sets out the existing state of affairs very accurately. The most noteworthy of his statements are the following:—

I. The third paragraph of the report, relating to the "... other difficulties appertaining to the position ..."

II. The last paragraph under the heading "British Manufacturers v. the Operations of the Underwriters' Laboratories, Chicago."

III. Also Secs. 2, 4 and 5 under the same heading.

The statements referred to in I are self-evident truths to anyone acquainted with this Continent, and need no comment.

The question of danger to life (Sec. 2) is an important one, as neither the U.L.C., nor any of the bodies associated therewith, are in a position to enforce rules on this point; the only thing that they can do is to make recommendations. The sole means which the Underwriters possess of enforcing their rules is to raise the insurance rate or refuse insurance altogether; manifestly, then, as they do not insure lives they are quite powerless where life hazard comes in, except in so far as this may be introduced through fire. Even in respect of the fire risk, if this be not excessive and the business is good, the rules are frequently winked at.

From this it is plain that, if a person cares to take the risk of being without insurance, or of insuring with a company outside the Fire Underwriters' organisation, he can please himself what he does. As for the electric supply companies, some of them will connect up to any pair of terminals without much question as to what is on the side remote from their mains.

It seems a great pity that the U.L.C. are not supported by the Life Assurance companies as well, because, if this were so, proper safeguards against shock would immediately be taken and enforced. Even this arrangement, however, would fall a little short of the ideal, as some people do not insure at all.

Mr. Wickes refers (Sec. 3) to "the intolerable state of affairs" which necessitates British-made products, intended for "a portion of the British Empire," being approved or rejected by a foreign corporation.

This is exactly the view of the situation taken by the writer and already set forth in these "Notes" some little time ago.

Secs. 2, 4 and 5, referred to in III above, are all closely related, and may be considered together.

The Imperial Trade Commissioner remarks: "I think he" (the British manufacturer) "should be supported in this objection, unless, indeed, we are prepared to concede that the United States engineer is the repository of all the wisdom of the world . . ." It would be one thing for a Britisher to refrain from conceding such a point, but quite another to induce the "United States engineer" to join in the *refrain*, at least so far as this continent is concerned.

The statement that "the introduction of new methods or fresh standards might meet with considerable opposition" is very much too mild, for it may be confidently predicted that the "opposition" from the "manufacturing," and some of the "other Mercantile Associations," would be of a very determined character, if any such step as that recommended by Mr. Wickes were under contemplation.

It is not to be denied that the U.L.C. have done practically all the pioneer work and are efficiently performing a duty not undertaken on this side by any other body. This is all very well for the States, but when one turns to Canada it is regrettable to find the British manufacturer practically shut out from certain lines.

Mr. Wickes, in discussing the suggestions at the end of his report, thinks that the adoption of his third proposal "would throw open to our British manufacturers not only the Canadian, but the American, market."

Supposing that the American manufacturer came to the same conclusion—would he supporting the U.L.C. as he does,

quietly submit and allow his markets to be thus thrown open, or would he not rather rise up and, in every way possible, strenuously fight the matter—there seems to be only one answer to this: he would also have the strong, and not-to-be despised, co-operation of the electrical contractors and jobbers who are naturally in close touch with the manufacturers.

If the American market cannot be "thrown open" (to say the least the task would be difficult), what about the Canadian one? If the Canadian fire underwriters be willing to forgo the U.L.C. inspection and specifications, and accept those of a British laboratory, this might be done. If, however, this latter be merely an "offshoot" (or, shall we say, an "adjunct") of the U.L.C., it may be taken for granted that practically no new methods or standards would be introduced over here; the matter would, therefore, resolve itself into the British manufacturer being compelled to get out new drawings, tools, jigs, &c., in order to make apparatus and fittings which would comply with the American standards. To some extent this procedure is inevitable if any Canadian trade is to go to Great Britain, but the situation might be mitigated were the problem of securing this trade for the home country attacked in a somewhat different way from that recommended in the report now being criticised. In view of the, as yet, comparatively small size of the Canadian market, the British manufacturer must ask himself seriously—"Will it pay to go to the expense of getting out new standards, tools, &c., for the sake of obtaining a *share* of the Canadian trade if, as seems likely, no American trade can be looked for?"

Of course, it pays him to supply material and goods of his own standards, and, in regard to meters, motors, large cables, &c., he is allright in this country now, but when it comes to small switches, lampholders, fuses, ceiling roses, &c., the design of which is covered in the specification of the U.L.C., the case is very different.

Mr. Wickes's suggestion to extend the policy to other parts of the Empire is a very good one, but it must be remembered that in most, if not all, other parts of the Empire, except Canada, British, and not American, standards and designs are predominant. Canada's position is quite unique in this respect, as was pointed out in the columns of the REVIEW a little while ago.

In the opinion of the writer, the best way of dealing with this problem would be to combine Mr. Wickes's first and second proposals, *i.e.*, that laboratories should be established both in Canada and in England, these, of course, to work in conjunction with each other, and be independent of the U.L.C., though not essentially antagonistic thereto.

Probably it would be difficult to establish a fully-equipped laboratory here for some years, so that elaborate tests, when required, might be carried out in England (if need be, at the National Physical Laboratory), under the supervision of both Canadian and British engineers. Mere inspections, labelling, &c., could readily be done both here, for the Canadian manufacturer, and in England, for the British manufacturer.

The system established in the U.S.A., and at present operative here, of having all fittings, &c., made to the standard specifications of the U.L.C., is an excellent one, and as all municipalities, &c., adopt the one set of rules, *viz.*, the National Electric Code, the training of wiremen and the ordering of material are very much simplified as compared with English practice.

Many of the devices used and methods adopted are eminently suited to the conditions of the country, and it would be both unnecessary and unwise to alter them, but the British manufacturer labours under great disadvantages at present, even though he be prepared to supply goods in strict accord with U.L.C. requirements.

The Imperial Trade Commissioner for Canada is to be heartily congratulated for having grasped the situation so well in the short time he has spent in the Dominion, but your correspondent takes issue with him on the method which he recommends for the removal of the disadvantages just referred to. The work of a British laboratory, which was merely an "off-shoot" of the U.L.C. would not, in the opinion of the writer, help the British manufacturer much in his trade relations with this continent; rather would it tend to "throw open" the markets of the Empire to the American

manufacturer, as, with a laboratory in England practically subordinate to one which is in constant touch and already thoroughly acquainted with his own products, every possible influence would be exerted to enable him to introduce his wares into other British possessions with the object of making them standard there in place of designs of British origin.

If the British manufacturer wants to strike in his own interests let him strike off his own bat, and, as the captain of a certain eleven is said to have told a batsman who was not quite sober, "hit with the *middle* bat," too, *i.e.*, with the real bat, not a visionary one. It would be far better to leave the American market alone, if the attempt to secure it (success being very uncertain) means that the markets of the Empire will be thrown open to the American manufacturer.

## GRAPHS IN A CABLE-SHIP DRUM-ROOM: NOTES FOR JUNIOR ASSISTANTS.

By EDWARD RAYMOND-BARKER.

(Continued from page 154.)

63. Fig. 6 shows a complete cable-slack-per-cent. calculator board\* dealing with all cable values—whether in N.M. or in knots—in a manner involving no converging origins.

64. One of the main features of these calculator-board graph-sheets (figs. 6 and 7) is the use of *Morse-code figures* for vertical and horizontal co-ordinates and *percentage diagonals*.

As far as the writer has been able to ascertain, this application of Morse figures as a means for quick differentiation of any number of sectional lines, diagonals, curves, or lines of any kind where easy and rapid identification is desirable, is quite new. This system will commend itself to draughtsmen, hydrographers, chart-makers and others, embodying as it does a simple way of drawing any number of lines in as many different ways, thus facilitating identification of a given line, from one part of a large chart to another, without any irksome following of a line throughout its entire length.

65. In figs. 6 and 7 every fifth vertical and horizontal line is continuous, whilst intervening lines in all cases severally are "1" to "4" in Morse figures of *dots* and *dashes*. Similarly, the diagonal *percentage* lines are in Morse figures from "1" to "20" inclusively, so that where rectangular intersection of *taut wire* and *cable* co-ordinates takes place on any diagonal, the *cable-slack percentage* indicated by that diagonal is at once recognised in the Morse figures composing the diagonal. There is no need, therefore, to follow the diagonal line up to the percentage figures at the top of the graph sheet.

66. In fig. 6 the *taut-wire* vertical-scale divisions range from 2 to 5 on the left of the sheet, and from 5 to 10 on the right.

67. The corresponding *cable* horizontal-scale divisions range from 2 to 6.5 from left to right and from 5 to 12, right to left.

68. The respective two corresponding sets of *slack-per-cent.* diagonals incline opposite ways and lead up to slack percentage figures clearly inscribed at the top of the sheet.

69. For *taut-wire* values between 2 and 5, a single diagonal thread is used, moving radially from a pin attachment at the point of origin.

70. For like use between 5 and 10, a transparent celluloid radial arm moves with its base in a curve so formed as to cause the arm to move radially on an inferred origin—that is, on that common point of origin towards which the diagonals tend to converge. Movement of the radial arm causes its straight-edge to coincide successively with the various percentage lines. In fig. 6, this coincidence is not absolute, because, when the photograph was taken, the upper end of the radial arm was not close up to the board, but must have been hanging away slightly from it.

\* Maker: W. H. Harling, 47, Finsbury Pavement, London, E.C.

71. So much for *length* and *speed* values between 2 and 5, and between 5 and 10. What provision, then, is to be made for values between *zero* and 2? As far as values 0 to 1 are concerned, these naturally will be the same as those from 0 to 10, any difference depending merely on the position of a decimal point. What *are* wanted are the values between 1 and 2.

72. Hence, on the calculator board shown in fig. 6, which, to facilitate the verification of co-ordinates, is fitted with horizontal and vertical-cursor threads, an *extra set* of vertical and horizontal axes, also diagonals, have been provided on an extended scale.

*Taut wire* vertical scale : 1 to 2.  
*Cable* horizontal scale : 1 to 2.6.

The corresponding diagonals are seen, in fig. 6, to the right of the others.

73. On the other hand, supposing that with a *taut wire* rate of 7.5 knots, it be desired to lay about 6.5 per cent. of cable slack.

(1). Horizontal cursor is placed at 7.5.

(2). The radial arm is then moved on its curved base till the straight-edge lies about half-way between the 6 per cent. and the 7 per cent. diagonals.

(3). The vertical cursor, on being brought to the intersection of radial arm and horizontal cursor, is found to indicate the required cable rate, viz., eight knots.

76. Thus it is seen that the calculator-board, fig. 6, fulfils all percentage conditions between 0 per cent. and 20 per cent., without any converging origins.

77. After what has gone before, fig. 7 will be found self-explanatory. It shows a calculator board\* specially designed by the writer for paying-out purposes, and for giving, at a glance, for all types of cable on board a ship, the required

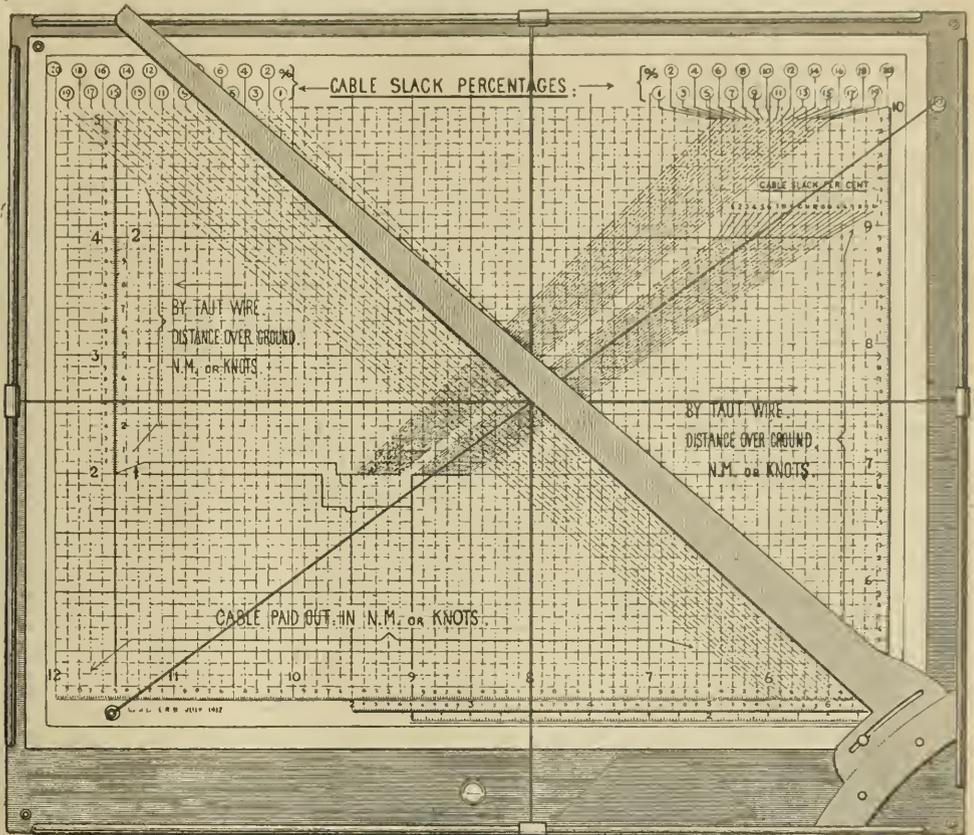


FIG. 6. (Sectional sheet, reduced from 700 mm. x 500 mm.)

73. In connection with these last, an example may be cited.

Supposing *taut wire* paid out = 130 N.M.

Horizontal cursor placed at 1.3 (see fig. 6).

Supposing *cable* paid out = 140 N.M.

Vertical cursor placed at 1.4.

Radial thread caused to cut the two cursors at their point of intersection is found to lie between the 7 per cent. and 8 per cent. diagonals. Actual slack = 7.7 per cent.

74. Second example (see fig. 6).

Let *taut wire* be going out at 7.5 knots.

Horizontal cursor placed at 7.5.

Let *cable* be going out at eight knots.

Vertical cursor placed at 8.0.

Straight-edge of radial arm brought to traverse point of intersection is found to coincide with a position a little over half-way between the 6 per cent. and the 7 per cent. diagonals.

Actual slack = 6.6 per cent.

*cable-drum revs. per minute* corresponding with any likely rate of laying that might be adopted.

78. Below the horizontal cable scale is a space into which, for any cable-laying expedition, may be pinned a fresh table of corrected drum revs. per minute values, so written, and arranged, that the several sets of values for the various cable types on board, lie in line with the corresponding graduations of the cable knots horizontal scale.

79. The afore-mentioned table would be based on a formula developed from data given in 36 and 37—

$$\text{Drum revs. per minute} = \frac{\text{cable N.M. per hour}}{1 \text{ drum-rev. in N.M.} \times 60}$$

(all values corrected, see 36 and 37).

80. In fig. 7 (on the extra slip of canvas paper pinned in afresh for each expedition) there are *drum-revs. per minute* columns given for *eight* different cable types.

\* Made by W. H. Harling, of 47, Finsbury Pavement, London, E.C.

81. The positions (as shown in fig. 7) of the thread-cursors afford an example of the general working of this calculator board.

Wire going out at 118.3 measuring-wheel revs. per min. = 7.1 knots : speed of ship.

Horizontal cursor at 7.1.

Cable type B going out at 15.7 drum revs. per min. = 8.1 knots. Vertical cursor at 8.1.

The two cursor threads are then seen, at a glance, to intersect on the cable-slack diagonal of 14 per cent.

82. Conversely, if with wire going out at 7.1 knots, it be desired, for certain reasons, to lay over a particular part of the cable route, slack to the extent of 14 per cent., the wire horizontal cursor is placed at 7.1 and the cable vertical cursor is brought to the point of intersection between the horizontal cursor and the 14 per cent. diagonal. The vertical cursor then automatically indicates not only the necessary cable rate in knots, for any cable type, but also, the corresponding drum-revs. per min. necessary to produce that same paying-out rate.

83. If the graph method involved in fig. 4 be used (see 38) the 1 drum-rev. in the formula (see 79) is left

where along the cork strips let into the calculator-board frame.

85. With the scales, sectional lines, figures, and data available, innumerable changes may be rung by means of these calculator boards, in the manipulation of percentage and other figures.

(To be continued.)

LEGAL.

INTERESTING TRAMWAY CASE AT BRADFORD.

At the Bradford City Police Court on Friday, the Stipendiary Magistrate (Mr. H. W. Wilberforce) delivered judgment in a case in which a man travelling on a Leeds Corporation car was summoned for using obscene language. The Stipendiary Magistrate said: "This summons alleges a breach by the defendant of one of the Tramway By-Laws of the Bradford Corporation, in using obscene language upon a tramcar. The facts are not really in dispute, but the question arises whether the by-laws apply to a particular tramcar

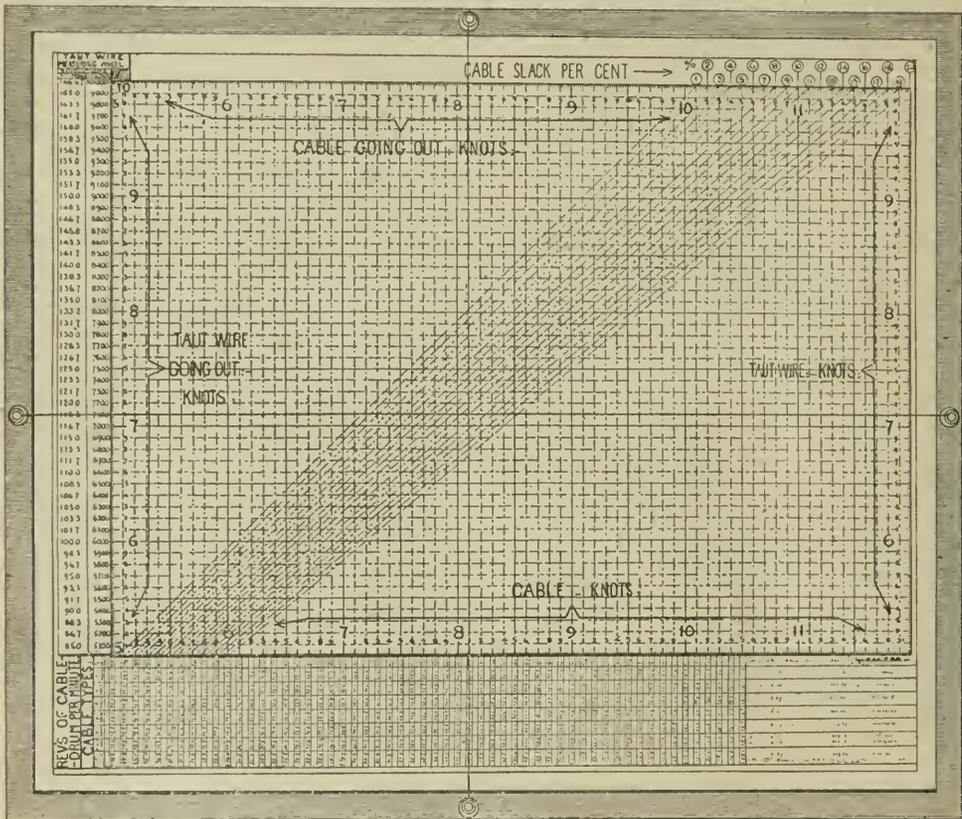


FIG. 7. (Sectional sheet reduced from 700 mm. x 500 mm.)

uncorrected for cable circumference, and the formula becomes:—

$$\text{Drum-revs. per min.} = \frac{\text{cable N.M. per hour}}{1 \text{ drum-rev. in N.M.} \times 60}$$

One single table, in that case, would suffice for all types of cable (see 80) the correction for cable circumference being applied at the final stage, by means of data obtained from the curve in fig. 4, in the manner shown in 38 and 43.

84. In practice the cursor threads are best made of the finest red-silk-covered elastic.

In fig. 6 the cursor threads are adjusted by brass attachments sliding along rods.

A preferable and more simple method of adjusting the cursors is shown in fig. 7. The threads are attached to glass "photographic" pins easily inserted, at pleasure, any-

upon which the obscene language was used. The car was the property of the Leeds Corporation, and was running upon Bradford tramlines in pursuance of an agreement between the two Corporations entered into under the authority of Sec. 12 of the Bradford Act, 1899. (Sec. 12—"The Corporation on the one hand, and the owner and lessee of any trains or light railway in any adjacent district which can be worked with any of the Corporation trams on the other hand, may from time to time enter into and carry into force contracts and agreements with respect to the purchase, sale, lease, working or management and maintenance by the contracting parties, of all or any of their respective tramways, light railways and works, or any part or parts thereof respectively; the making of all necessary junctions, the supply under any agreement for all or any of the respective tramways or light railways of the contracting parties being worked by the other of them as aforesaid, and rolling stock, plant, machinery and electrical energy or power necessary for the purpose of such agreement; the appointment and removal of officers and servants the payments to be made and the conditions to be performed in respect of such working or management and maintenance; the interchange, accommodation, conveyance, trans-

mission and delivery of traffic, coming from or destined for the respective undertakings of the contracting parties, and the diversion and apportionment of the revenue arising from such traffic and the payment of any fixed or contingent rent.) The point was, therefore, can this tramcar, although the property of the Leeds Corporation, be said to be a carriage belonging to the Bradford Corporation, within the meaning of the section of the Act of 1870. It need hardly be said that it would be the height of absurdity that a tramway passenger in Bradford who finds himself in a car which happens to be the property of the Leeds Corporation running in Bradford, should therefore be able to commit nuisances with impunity. Still, this absurdity, if it existed, would not be due to the Act of 1870, which neither contemplated nor authorised the subsequent development of municipal enterprise, but to omissions in the various private Acts, which sanctioned this development. This consideration, accordingly, is irrelevant to the interpretation of the language of the section. Now, looking to the words themselves, it is to be said that in their ordinary use "belonging to" may bear a variety of meanings, ranging from absolute ownership to a connection or relation of a very much slighter kind, and in this particular section the meaning cannot, I think, be limited to absolute ownership. For instance, if a car were hired, whether on a hire-purchase agreement, or for a period, by the Bradford Corporation from the makers, and not bought outright, such a car would, I take it, be within the meaning of the section. So, too, if a car is lent on approval to the Corporation. Considerations of this kind seem to me to give to the words a meaning in this section rather of possession and control than of ownership, and accordingly it becomes necessary to inquire what was the position of the Bradford Corporation in reference to this particular car. Broadly speaking, the result of the agreement between the two cities as to cars, the property of Leeds, running in Bradford, is that Bradford pays the working expenses of the car, receives the fares, and has control of the car and the men in charge of it. I do not lose sight of the fact that these cars are alluded to in the agreement as "belonging to Leeds," and that claims for damage caused by the cars, or those in charge of them, are to be satisfied by Leeds. Looking, however, to the agreement as a whole, the possession and control of this car was, in my opinion, clearly with the Bradford Corporation. That being so, although my opinion has wavered, and I regret that the case has not been argued on the other side, I come to the conclusion that this possession and control brings the tramcar in question within Sec. 46 of the Act of 1870, and therefore within the similar, though not identical, words of the Corporation by-laws. There will, accordingly, be a conviction. Defendant will be fined 2s. 6d. and 13s. costs.

#### BARNESLEY CORPORATION v. BARNESLEY MOTOR OMNIBUS CO., LTD.

At the Barnsley County Court last week, the plaintiffs sued defendants for £25 damages done to an electric switch-box. The case occupied considerable time. It appeared that on the night of October 24th last a taxi-cab belonging to defendants collided with an electric pillar-box. The street was 27 ft. wide. The cab struck the box in avoiding a tramcar. Immediately the box, which contained the electric main for the town's lighting system, was struck, the wire fused, and the whole town was plunged into darkness for a time. The defendants had maintained that the cause of the mishap was the state of the tramway. It was stated, however, that the borough engineer had examined the site and found that the condition of the tramway was such that it could not even be a contributing cause to the accident. The defendants pleaded that the affair was a pure accident, owing to the greasy state of the road, and the onus was on the Corporation to show that there had been negligence. At this point, near a dangerous corner, it was the practice of motor-drivers to drive in the middle of the road, and very properly so. They maintained that the wheels of the taxi-cab caught in the tramline, and the cab skidded into the pillar-box. His Lordship eventually gave judgment for the defendants, with costs.

#### THE GRAETZIN LAMP AGENCY JUDGMENT.

In our summary of the judgment in this case last week, an error occurred in the first five lines on page 176. What should have been reported will be gathered from the following extract which we have made from a *verbatim* copy of the judgment that we have since seen:—

"If I should be wrong in holding that the interpretation of the contract is governed by German law, I should have held at English law that the defendants had no right to cancel the first contract of Krupka & Jacoby, so as to avoid paying the plaintiff commission on the guaranteed sums; that they had no right to make the contract of February, 1912, without the plaintiff's consent."

#### COLLISION BETWEEN TRAMCAR AND MOTOR-CAR.

In the King's Bench Division on January 31st, Mr. Justice Buckley and a special jury concluded the hearing of an action in which Mr. Leslie Montague Sarll, formerly of Richmond and now of Chelsea, claimed damages from the London United Tramways, Ltd., for injury to his motor-car by a collision with one of the defendants' tramcars. The accident happened on February 10th of last year, under a railway arch which crosses the Kingston and Malden Road in Surrey, the roadway under which is not sufficiently wide for

ordinary vehicles to pass a tramcar, and each party contended that the other ought to have given way.

The question was entirely one of liability, the amount of damage done having been agreed between the parties at £207 in respect of the plaintiff's motor-car, and £1 13s. in respect of the tramcar, for which the defendants counterclaimed.

The jury, in the result, found for the plaintiff on both claim and counterclaim, expressing an opinion that the motor-car was under the archway before the tramcar.

#### OSHAM LAMP CO., LTD., v. THE ORO LAMP CO., LTD.

In the Chancery Division on Friday, January 31st, Mr. Justice Swinfen Eady had before him a motion in this action.

MR. GRAY stated that it was a motion to restrain an alleged infringement of patent rights. The parties, however, asked for a week's adjournment, defendants undertaking not to commit the acts complained of during that time.

His LORDSHIP: Very well.

#### THE SINGAPORE ELECTRIC TRAMWAYS, LTD.

On a petition by this company, Mr. Justice Joyce in the Chancery Division sanctioned a reduction of its capital from £100,000 to £100,000. It was stated that the difference between those two sums was the amount of capital lost or unrepresented by available assets, and the reduction was to be accomplished by reducing the £1 shares to shares of 5s. each.

Mr. Hughes, K.C., and Mr. J. W. H. Holmes appeared in support of the petition, and there was no opposition.

#### SMITH v. STANTON IRON WORKS CO. COLLIERIES, LTD.

THE Master of the Rolls and Lords Justices Buckley and Hamilton heard an appeal by the defendants of Wilfred Smith, a boy of 15, from the refusal of the Judge of the Mansfield County Court to make an award against the company in respect of the boy's death, on the ground that the accident causing death did not arise out of, or in course of, his employment.

MR. WARD (for appellants) said that the lad was employed as "electric motor driver," and had to work in a shed 27½ ft. long: at one end was a motor switchboard, which the boy worked according to signal. Another part of his duty was to oil and clean an engine in the shed when it was at rest. The boy was found dead on the cog-wheel of the electric motor. Counsel submitted that it ought to be presumed that he met his death in the course of his employment, either in oiling or cleaning the engine.

The Court dismissed the appeal without calling on the other side, and the MASTER OF THE ROLLS said that no fact had been found in the case which would justify the inference that the unfortunate accident arose out of the boy's employment. The explanations put forward on behalf of appellants were mere guesswork, and that was not enough.

#### POST OFFICE TELEPHONE CHARGES.—CUSTOMERS' COMPLAINTS.

In the City of London Court, on January 30th, the Postmaster-General sued the British Motor-Cab Co., Ltd., Pimlico, for £4, balance for removing a switchboard from one room to another.

MR. L. C. BULLOCK, defendants' solicitor, said that one of the Postmaster-General's responsible officials obtained an undertaking from the defendants under misrepresentations. A verbal price of £2 to £3 was given, and yet the Postmaster-General charged £7.

MR. MACINTYRE, for the Postmaster-General, said there was no doubt that an estimate of £2 to £3 was given, but before the work was done defendants were required to give an undertaking to pay the charges, whatever they were, as they could not be determined before the work was done. It was a large switchboard that had to be removed. In the ordinary course the cost would have been £17, and the Postmaster had charged £7.

MR. BULLOCK said that the engineer to the Post Office specified that the cost would be £3 at the outside.

MR. WEYMAN, the engineer, said that the work was delayed at the request of the defendants, and that increased the cost. There was no standard price for removing a switchboard. An undertaking always had to be given to prevent the public having to pay for the delays of subscribers. At first they charged £9, and then reduced it to £7.

JUDGE RENTOUL said it was a question whether the defendants had not been misled unintentionally as to the amount.

MR. BULLOCK said they would not have had the work done had they known it was to cost £7. They had paid £3.

MR. MACINTYRE urged that the Crown was not bound by what a servant chose to say. The engineer was pressed to give a figure, and said £3. He had no authority to quote a price. That was why the undertaking was required.

JUDGE RENTOUL said he had never known Mr. Macintyre to be wrong before. He was on that occasion.

Judgment for the defendants, with costs, with leave to appeal.

**NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.**

**New G.E.C. Balancer Starter.**

THE GENERAL ELECTRIC CO., LTD., have recently designed a special type of starter which possesses several original features, and avoids the use of a no-volt release. The new arrangement consists



FIG. 1.—G.E.C. PATENT BALANCER STARTER.

of a main switch which is interlocked with a starter, so as to ensure the following sequence of operations:—

1. That the starter must be in the "off" position before the main switch is closed.
2. If the main switch is opened when the starter is in the full "on" or any intermediate position, it cannot again be closed until the starter arm is moved to the "off" position.

It will thus be seen that the dangers connected with the "no-volt" type of balancer starter will be obviated.

**Distribution Boxes.**

We illustrate in fig. 2 one of a line of distribution boxes, which has been developed by MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne, to meet the Home Office Regulations. The boxes are of stout cast iron, fitted with latched doors, and the range of sizes runs from a single-way 25-ampere box up to a nine-way 400-ampere box. The fuse handles are of the firm's well-known patent self-aligning type, and, as we recently explained, these are not now



FIG. 2.—REYROLLE DISTRIBUTION BOX.

fitted with buttons on the front, thus removing what might have been a source of danger in the event of a button breaking. The space between the porcelain screens of the individual fuse handles is fitted with insulating screens, and, where different poles or phases are brought into the same box, vertical screens are fitted.

**New Wandsworth Switches.**

THE WANDSWORTH ELECTRICAL MANUFACTURING CO., LTD., of Ludgate Hill, Birmingham, have recently introduced a new switch—the A1—which is shown in the "on" and "off" positions in fig. 3. The movement of this switch is new in principle, and

unique in construction and design. The main feature is a spring-influenced cam with a double-fly action. The springs are in tension during the initial movement of the dolly in either direction, and then re-act through the cam, to force the switch-arm into or away from the contacts, irrespective of any further movement of the dolly. These springs also serve to lock the switch in both "on" and "off" positions. The switch has an easy action, and it is impossible to get an intermediate position. The switch cannot be held in partial contact by the operator. The action of the switch has been covered by letters patent.

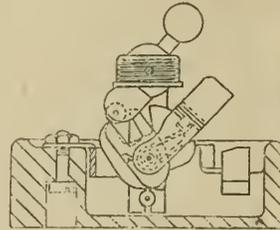
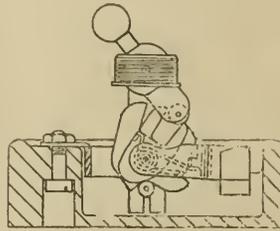
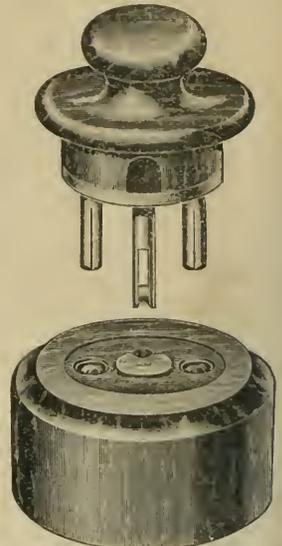


FIG. 3.  
NEW WANDSWORTH SWITCH AND SWITCH-PLUG.



A further combination of switch A1 with an ordinary plug and socket, fig. 4, is so arranged that the action of pushing the plug into, or withdrawing it from, the socket automatically moves the switch to the required position. As in switch A1, it can never be held or left in such a position as to make only partial contact. There is no intermediate position between "on" and "off." The circuit is automatically made and broken by the switch and not by the plug. It can be fitted with an earthing device if required. This combination switch plug has also been patented.

**The "Indra" System of Lighting.**

The "Indra" patent system of light distribution, which is being introduced by the ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., 109-111, New Oxford Street, W., is a mode of lighting whereby a very high general illumination can be secured, or the light can be directed to illuminate brilliantly a given area without the eye strain consequent upon the use of naked lamps and reflectors. In the "Indra" system the actual source of light is not seen, yet the bulk of the light is directly reflected through clear glass. A simple fitting consists of a combination of specially

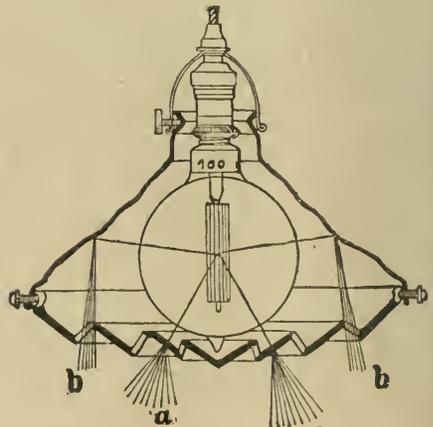


FIG. 5.—SECTION OF "INDRA" FITTING.

designed upper reflector and lower distributor. The upper reflector is preferably of opal glass, but where the whole of the light is required in a downward direction, an aluminium reflector is supplied. The lower plate (fig. 5) is provided with alternating rings of clear and etched glass.

As is well known, the bulk of the rays of light from metal-

filament lamps are emitted at right angles to the filament. These rays (*b*) strike the reflector, and are directed through the clear glass rings of the distributor. The rays (*a*) which strike the distributor direct are diffused through the translucent or etched glass rings, so that a very high general illumination is secured without eye strain. From photometric tests which have been carried out, it is found that the illumination is much greater when the "Indra" fitting is used than that from an ordinary lamp with reflector, the eye is not blinded by the brilliant glare, and the general illumination is far superior.

The fittings are arranged to meet all possible requirements of lighting; they can be supplied to focus the light on a given spot or to spread it over a desired area, or to give a general illumination, and are made up in designs suitable for all applications. They are supplied in various sizes, from 8 in. to 20 in., and are suitable for metal-filament lamps ranging from 50 to 1,000 c.p.

#### Automatic Change-over Switch.

Half the benefit of a duplicate supply of electricity to a theatre or other public building is lost if an appreciable interval of time elapses between the failure of one and the switching-on of the other system, and, where the change-over is effected by hand, such an interval is inevitable—it may be of several minutes' duration if there is no switchboard attendant. An automatic device should, therefore, be provided in all such cases, capable of acting instantaneously and transferring the load to the sound supply with no more than a flicker of the lamps at the most. Such a device has been developed and patented by the ADAMS MANUFACTURING CO., LTD., of Bedford; it consists essentially of two magnetically-operated main switches controlled by a magnetic relay, and is applicable to all cases in which both supply systems are at the same voltage, D.C. or A.C. With suitable modifications, cases where the voltages or systems are not identical can be dealt with. As the conditions vary in each case, the apparatus cannot be standardised to meet all cases, but is made up according to requirements.

## REVIEWS.

*The Energy Diagram for Gas.* By F. W. BURSTALL.  
London: Constable & Co., Ltd. 1912. Price 5s. net.

This is a novel presentation of the energy diagram, with special reference to nitrogen, because the specific heat of this gas varies directly with temperature, and that of other gases can be found by the formula  $\kappa$  times molecular weight = constant. The units are English, except for temperature, and so it happens that the bastard figure of 1,400 is favoured for  $J$ .

Everyone knows the ordinary  $p$   $v$  diagram for gas. It is easy to explain, especially with the indicator as an aid, for the ordinates so obviously mean pressure, as drawn by the instrument, and the engine draws in its own volumetric abscissæ. But the energy curve is too much of an abstract idea for most men, and it almost seems that the men who could profit by this book are those who could have written it. It has involved an immense amount of work, and will doubtless be of service to those who can use it, but those will be comparatively few. But possibly they will be as many as the author looks for. To the academic variety of author accustomed to the daily use of the higher mathematics, the ignorance of mathematics of the average engineer, and his clumsiness in using it, is either an unknown quantity, or it is beneath contempt. One of these mental attitudes possibly stands behind the fact that there is no list of symbols. The reader is supposed to know what is meant by all those which are employed. If this book was intended to be used by engineers generally, every symbol ought to have been defined. Instead, the first page starts off with the symbol  $\kappa_p \kappa_v$ , only to be known by inference.  $p$ ,  $v$  and  $T$  are more obvious, but what of  $a$ ,  $b$ ,  $s$ ,  $s$ ? Why define  $p$ ,  $v$ ,  $v$ , and omit  $r$ ?

The fact is that these energy diagrams are outside the unassisted ken of ordinary mortals, and authors will not assist such.

The ordinary engineer can understand the indicator diagram, and knows that the hyperbola is so near to the actual steam expansion curve that an engine will do a little more work than hyperbolic false theory teaches. He knows that adiabatic expansion falls below the hyperbola, and he can find out pretty closely what is really going on in an engine. Cannot the present author state in plain language just how the energy diagram is applicable to practical conditions?

How does the applier need to take cognisance of cylinder effects in the steam engine or the worse jacket cooling effects

of the gas engine? If the diagram is to come into real use, it must be fully explained for the benefit of those who, if not mental gymnasts, are sound enough engineers, for steam engine economy has not been brought about by mathematics, but by the application of simple observation. The diagrams with which the book is illustrated are not too easy to read, being a mass of curves and figures. Yet the author places the description of fig. 1 on one page and the diagram on the back of that page. The reader cannot even tear the page out for convenience. Fig. 5 is on page 13, its description on pages 14 to 17. Fig. 6 on page 16 faces the description, as all should. These diagrams should all be plates to lie wholly beyond the book when opened out. Without such an aid no student can follow either diagrams or description without eyestrain and worry. If it be argued that the book is not intended for such as cannot follow its matter with facility we may cease complaint.

Let it be added that the value of the specific heat of nitrogen is that of Holborn and Henning, as given by the formula  $\kappa p = 0.2246 + 0.000038 T$  and  $\kappa_v = 0.1541 + 0.000038 T$ . The connection between pressure, volume and temperature is  $p v = 98.86 T$ .  $T$ , of course, is absolute. The energy chart has been constructed so that all calculations in connection with the internal-combustion engine can be made with a pair of compasses.

The indicator diagram is transferred to the energy diagram by multiplying the volumes of the indicator diagram by a factor which is the reciprocal of the charge weight. To explain his book, the author considers a series of heat-engine cycles that have been employed and some of which are still employed. He also explains the large diagram for nitrogen which is folded in a pocket in the back cover. This large diagram carries the adiabatic curves from  $T = 300^\circ C.$  to  $1,600^\circ C.$  There is a curve of specific heat and scales of velocities, thermal units and absolute temperatures, and also a curve of velocities. An excellent little work, but quite insufficiently explained to the man who perhaps wants it most, while clear enough to him who could have written it, like the author himself.

*Primer of Scientific Management.* By FRANK B. GILBRETH.  
1912. London: Constable & Co., Ltd. Price 4s. net.

This book has been written as a reply to the enormous number of inquiries following the publication of "The Principles of Scientific Management," by Dr. F. W. Taylor, in the "American Magazine"; and it is arranged in the form of answers to representative questions concerning the methods put forward by this well-known authority. It is practically a defence of Dr. Taylor's system, and, we may add, a very convincing one; at any rate, such will be the case as regards the employer. To convert the British workman, the subject will have to be dealt with in simpler language.

General principles only are considered, and they are applicable to any industry in which piecework is practicable.

The opinion that the details of the American system of management are needlessly complex is widespread in this country, but that the general principles are correct and worthy of study will be freely admitted by all who have followed Dr. Taylor's investigations regarding cutting speeds and other features of production.

Under the old system of works management a drawing was sent into the machine shop showing the finished part, but no instructions were issued as to how the work was to be done or what tools were to be used. This system was improved upon by the introduction of jigs, and some attempt to provide tools of the best form for cutting various metals at the highest speeds, but the workman still had to rely upon the foreman and his own ingenuity to turn out the job in the quickest way. Then followed the recording of the times taken, which enabled a specialist to forecast, to some extent, the correct allowance of time for new work. This was all very good in its way, but the results were not accurate enough for the fixing of piecework rates, and the men systematically limited their output to prevent the cutting-down of the prices.

Under the Taylor system not only is the time for each machine operation very carefully studied, but also every motion made by the operator in setting up the work. This

timing of each motion by stop watches very naturally engendered suspicion amongst the men, who looked upon it as preparatory to a crusade of "nigger-driving" which only the strongest could survive, while employers condemned the methods as being needlessly costly and complex.

The results where the Taylor system has been tried have proved that the cost of finding out the quickest way to do each job is far more than recovered by the time saved, while the workmen are enabled to earn much higher wages year in year out, without the slightest injury to their health, in fact their condition has been actually improved. As regards this feature, one aim of the system is to ascertain the amount of rest needed to enable a workman to keep up the speed without any possibility of wearing himself out.

Every employer who reads this book, and Dr. Taylor's works on the same subject, will be easily convinced of the advantages attaching to the system; the difficulty is to make the men understand the benefits accruing to them. This will be a slow process in the early stages, but there is little doubt that scientific management on these lines will extend and eventually become universal. In any case it is a subject which no manufacturer can afford to ignore, and we believe that Dr. Taylor's methods have already been very carefully studied by a large number of manufacturing firms in this country.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 1,562. "Holders for electric ironing-irons." H. SAMUEL. January 20th. (Complete.)
- 1,563. "Reverse current or power cut-outs." J. ROTHMAN, J. DENHAM and FERANTI, LTD. January 20th.
- 1,579. "Electric vulcanisers for tires." B. KISSHAZY. January 20th. (Complete.)
- 1,591. "Electric motor-control systems." SIEMENS BROS. DYNAMO WORKS, LTD., F. LYDALL and A. M. DEKE. January 20th.
- 1,592. "Electrical distant-control systems." SIEMENS BROS. DYNAMO WORKS, LTD., F. LYDALL and A. M. DEKE. January 20th.
- 1,598. "Electric measuring instruments." BRITISH THOMSON-HOUSTON CO. LTD., and A. P. YOUNG. January 20th.
- 1,599. "Electric switches." BRITISH THOMSON-HOUSTON CO., LTD., and H. C. HEATH. January 20th.
- 1,600. "Electric measuring instruments." BRITISH THOMSON-HOUSTON CO., LTD., and A. P. YOUNG. January 20th.
- 1,617. "Semi-automatic winding machines." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) January 20th. (Complete.)
- 1,636. "Manufacture of chrome-alum by electrolysis." H. CHAUMAT. (Convention date, January 24th, 1912, France.) January 20th. (Complete.)
- 1,653. "Process of and means for forming clay solids employed in the manufacture of insulators and other articles." W. PODMORE. January 21st.
- 1,652. "Electric ball-pushes and the like." E. G. HARCOURT. January 21st.
- 1,716. "Telephone systems." E. A. GRAHAM. (Addition to 10,577,10.) January 21st. (Complete.)
- 1,735. "Circuit controlling device." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) January 21st. (Complete.)
- 1,745. "Method of and means for electro-plating certain articles." G. P. M. LEE and H. A. HARVEY & CO., LTD. January 22nd.
- 1,756. "Means for the control of electric pressure and current regulators." W. J. POOLE. January 22nd. (Complete.)
- 1,776. "Arc-light carbons." H. AYRTON. January 22nd.
- 1,776. "Apparatus for detecting and estimating certain substances by virtue of their polarising or depolarising action on an electrical couple." E. K. RIDGAL and U. R. EVANS. January 22nd.
- 1,780. "Two-line electric plug and sockets and the like." J. J. CLIFFORD and C. E. BUBELL. January 22nd.
- 1,795. "Means for intermittently indicating or displaying the names of stations or stopping places in trains or other vehicles, or other situations or other devices or matter in such vehicles or other situations." C. J. EVANS and J. M. CATER. (Addition to 26,450, 1911.) January 22nd.
- 1,801. "Construction of incandescent electric lamps." O. SCHALLER. (Addition to 16,195, 1911. Convention date, August 23rd, 1912, Germany.) January 22nd. (Complete.)
- 1,812. "Production of gases by electrolytic processes." KNOWLES OXYGEN CO., LTD., and R. W. GRANT. January 22nd.
- 1,843. "Process and devices for producing in a continuous manner Röntgen rays, having any desired degree of hardness which can be adjusted at a moment's notice." J. E. LILIENTHAL. (Addition to 23,165, 1912.) January 22nd. (Complete.)
- 1,856. "Electric measuring instruments." BRITISH THOMSON-HOUSTON CO., LTD., and A. P. YOUNG. January 22nd.
- 1,857. "Automatic regulators for level-compounding or over-compounding on alternating-current circuits." A. M. TAYLOR. January 22nd.
- 1,895. "Switch for electric lighting on a small scale." ELEKTROMECHANISCHE INDUSTRIE G.M.B.H. and F. HERMANN. January 23rd. (Complete.)
- 1,899. "Insulating sectional iron masts." SIEMENS BROS & CO., LTD., and G. W. PERRY. January 23rd. (Complete.)
- 1,902. "Telephone exchange systems." WESTERN ELECTRIC CO., LTD. (Western Electric Co., U.S.A.) January 23rd. (Complete.)
- 1,915. "Manufacture of anodes." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 23rd.
- 1,927. "Automatic electric switch." H. F. BIGGE and F. R. BUTT. January 23rd.
- 1,933. "Production of alkali metals by the molten electrolysis of alkali compounds." W. JOHNSON. (Deutsche Gold und Silber Scheide Anstalt vorm. R., Germany.) January 23rd.

- 1,955. "Electrolytic processes and apparatus particularly applicable to the production of alkali compounds." C. WHITE. January 23rd.
- 1,913. "Electric switches." G. HESSE and W. ZABEL. January 24th.
- 1,951. "Magneto-electric generating apparatus especially suitable for ignition in engines of motor-cycles and motor-cars." A. G. HINTON. January 24th.
- 1,978. "Filaments of incandescent electric lamps." E. M. LACKY. January 24th.
- 1,984. "Electric quick-make and quick-break vibration proof switch uses." R. C. PENFRET. January 24th.
- 1,990. "Dynamo machines for constant output at various speeds." W. G. LEE and P. J. OLDFIELD. January 24th.
- 1,995. "Receiver for submarine signalling." SIGNAL G.M.B.H. (Convention date, June 1st, 1912, Germany.) January 24th. (Complete.)
- 1,996. "Receiver for submarine signalling." SIGNAL G.M.B.H. (Convention date, November 30th, 1912, Germany.) January 24th. (Complete.)
- 1,997. "Method of transmitting the effect of vibrations by wireless telegraphy." W. L. CONRY. January 24th.
- 2,001. "Wire drawing." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 24th.
- 2,022. "Telephone systems." E. A. GRAHAM. January 24th.
- 2,027. "Telephone or like apparatus and telephone systems." W. K. L. DICKSON. January 24th.
- 2,070. "Mechanism suitable for use in connection with electric switches or for other purposes." A. H. F. PERL. January 25th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 3d. (in stamps).

### 1911.

ELECTRIC PRINTING TELEGRAPHS. A. T. M. JOHNSON, F. H. VARLEY, MICHAELIS, POWER and JOHNSON Secret Wireless Telegraph and Telephone Testing Syndicate. 22,079. October 6th. (Cognate application, 10,749 of 1912.)

ELECTRIC CLOCKS. C. VOGT. 27,291. December 6th.

### 1912.

DEVICE FOR THE TRANSMISSION OF SIGNALS UPON POWER TRANSMISSION LINES AND LIGHTING MAINS. Soc. Industrielle des Telephones. 412. January 5th. (January 5th, 1911.)

TELEPHONE SYSTEMS. W. H. DERRIMAN. (Automatic Electric Co.) 687. January 9th.

ELECTRIC LAMP HOLDERS. G. ST. J. DAY. 750. January 10th.

ELECTRICAL APPARATUS FOR TRANSMITTING AND RECEIVING SIGNALS. SIR A. T. DAWSON and G. T. BUCKHAIN. 777. January 10th.

APPARATUS FOR THE ELECTROLYTIC MANUFACTURE OF ALLOYS OF LIGHT METALS WITH HEAVIER METALS AND THE CONTINUOUS TREATMENT OF SUCH ALLOYS FOR OBTAINING FINAL PRODUCTS. E. A. ASHCROFT. 1,001. January 15th.

APPARATUS FOR THE ELECTROLYTIC MANUFACTURE OF LIGHT METALS AND REACTION PRODUCTS THEREOF. E. A. ASHCROFT. 1,003. January 15th.

APPARATUS FOR THE ELECTROLYTIC MANUFACTURE OF CAUSTIC ALKALIES IN PURE ANHYDROUS CONDITION. E. A. ASHCROFT. 1,001. January 15th.

CIRCUIT INTERRUPTORS FOR THE TRANSMITTERS OF ELECTRIC TELEPHONES. W. A. LEGGAL. 1,168. January 15th.

OPERATION OF DIRECT-CURRENT ELECTRIC MOTORS. J. S. FECK and S. ECKMANN. 1,365. January 17th.

ELECTRIC METALLURGICAL FURNACES. V. STOBIC. 2,061. January 26th.

ILLUMINATED SIGNS ADAPTED TO BE SUPPORTED ABOVE THE GLOBE OR LIKE PART OF AN INCANDESCENT ELECTRIC LAMP. W. J. BEVILLE. 2,565. January 31st. (Addition to 229 of 1912.)

TREATMENT OF METALS. BRITISH THOMSON-HOUSTON CO. (General Electric Co.) 3,752. February 14th.

ELECTRIC TELEPHONES. L. G. HAMMER. 4,358. February 21st.

CONSTRUCTION OF TWO-WAY ELECTRIC SWITCH. G. MARK. 4,498. February 22nd.

ELECTRIC PHOTOGRAPHIC COPYING MACHINES. J. B. HALDEN. 5,278. March 2nd.

MEANS FOR DECREASING THE INJURIOUS EFFECTS OF TOXICITY IN ELECTRIC CONDUCTORS. F. A. BOEKER. 4,061. March 11th. (March 13th, 1911.)

ELECTRIC CONTROLLERS. BRITISH THOMSON-HOUSTON CO. and H. C. HASTINGS. 7,704. March 24th.

GRIPPING AND SHEARING GRAPNEL FOR RAISING SUBMARINE TELEGRAPH CABLES. W. HENSINMAN. 7,986. April 2nd.

ELECTRIC LIGHTING APPARATUS. F. DUSSAND. 8,057. April 3rd. (April 6th, 1911.)

ELECTRIC IGNITION DEVICE FOR INTERNAL-COMBUSTION ENGINES. H. BAUER and M. ECKMEYER. 9,492. April 2nd.

METHODS AND APPLIANCES FOR OBTAINING INSTANTANEOUS RADIOGRAPHS. SIEMENS and HALSKE Akt.-Ges. 9,459. April 2nd. (April 21st, 1911.)

ELECTROMAGNETIC SEPARATOR FOR THE WET SEPARATION OF ORES. Elektro-magnetische Ges. 10,619. May 4th. (May 4th, 1911.)

REGULATION OF ELECTRIC INSTALLATIONS. H. D. EARL. 11,671. May 18th.

SPARK PLUGS. H. J. C. POTTERSTER. (Harcourt-Whitton Motor Motorial Manufacturing Co.) 12,809. May 31st.

ELECTRICAL SWITCH CONTACT DEVICES. W. S. HICSFORD. 13,442. June 7th. (September 30th, 1911.)

AUTOMATIC ELECTROMAGNETIC CUT-OUTS. P. WESSEL and T. GYSLER. 14,120. June 17th.

APPARATUS FOR THE PRODUCTION OF HIGH-FREQUENCY OSCILLATING CURRENTS. V. F. FEENEY. (National Wireless Telephone and Telegraph Co.) 14,725. June 24th.

ELECTRIC IGNITION APPARATUS. S. ROTHSCHILD. 14,738. June 24th. (November 16th, 1911.)

METHODS FOR COMPENSATING FOR THE FLUCTUATIONS IN THE LOAD OF ELECTRIC MOTORS. Siemens-Schuckertwerke Ges. 15,669. July 2nd. (July 8th, 1911.)

MAGNETO-ELECTRIC MACHINES. C. W. HINKELMAN. 15,704. July 5th.

OVERHEAD CONTACT CONDUCTORS OF ELECTRIC RAILWAYS. Bergmann Elektricitäts-Werke Akt.-Ges. 16,130. July 8th. (August 23rd, 1911.)

ELECTRIC TRANSFORMER BOILERS. J. DALRY. 16,043. July 9th. (July 20th, 1911.)

REVOLVING ELECTRIC FURNACE INTENDED (SHEPHERD) FOR THE MANUFACTURE OF ALUMINIUM NITRIDE. Soc. Générale des Nitrures. 16,406. July 18th. (August 4th, 1911. Addition to No. 29,259 of 1910.)

ROTARY MAGNETS. O. T. BLADTHY. 16,658. July 15th. (August 24th, 1911.)

ELECTRIC IGNITERS. J. G. COOK. 16,064. July 17th.

DEVICE FOR AUTOMATICALLY ADJUSTING THE TIME OF IGNITION IN INTERNAL-COMBUSTION ENGINES USING MAGNETO-ELECTRIC IGNITION. Robert Bosch (Firm of). 17,029. July 22nd. (September 2nd, 1911.)

PORTABLE ELECTRIC HAND LAMPS. A. H. HUNT. 17,850. August 1st.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

FEBRUARY 14, 1913.

No. 1,888.

## ELECTRICAL REVIEW.

## INTERNATIONAL SPECIFICATIONS.

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The inherent difference in the treatment, from the point of view of unification, of such things as steel girders, rails, rolling stock, cement, &c., and of those which may be properly said to come under the heading of electrical machinery and apparatus, is not always as fully appreciated as it might be.

In regard to the former, it will be noticed that in the majority of cases concrete figures, chemical analysis, and even actual designs, have been agreed upon between buyer and seller, as representing the best up-to-date practice, and it is undeniable that manufacturers have thereby reaped much benefit, through the lowering of the cost of production; on the other hand, combinations upon these lines, if carried too far into detail, may develop into trusts which tend to rob the consumer of the benefits which healthy competition brings, even if prices are not raised.

In regard to the latter, generally speaking, unification is brought about through agreement as to the tests which a machine or apparatus intended for any particular purpose shall fulfil; that is to say, in matters electrical unification is usually based on results, and not upon the means by which those results are obtained. On this principle neither dimensions nor design are touched upon, and whilst on the one hand a real basis of comparison is established, on the other hand invention and progress are in no way hampered, and commercial enterprise has free scope for development.

The difficulties surrounding international agreement as to engineering specifications generally, may, to a large extent, be traced to these fundamental differences; yet international co-operation in engineering affairs is certainly coming to the front more and more, and, in spite of many obstacles, is succeeding. It is, however, one thing to attempt, internationally, to draw up a specification for steel, and a very different problem to agree internationally upon the rating and tests for electrical machinery.

In the case of steel, the very fact that the question of chemical analysis must form the basis of any specification shows that the whole subject bristles with commercial difficulties and rivalries.

Manufacturers, as well as users, however, can only welcome the establishment of international rules for guidance in specifying electrical machinery, and many are the difficulties and annoyances, from the point of view of foreign trade, which will undoubtedly be obviated when such rules are promulgated by a recognised authority.

In its early stages it appeared to some that the Electro-technical Commission was not likely to prove of much utility or even practical interest to the electrical industry as a whole. Its programme of work, including, as it then did, only symbols and nomenclature, seemed somewhat too far removed from the domain of practical politics and its organisation too cumbersome to effect much solid achievement.

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION

Ready.

**H. ALABASTER, GATEHOUSE & CO.,**  
4, Ludgate Hill, London, E.C.

The report, however, which we publish elsewhere in this issue, will show that the formation of the small International Committees has had the fortunate effect of overcoming this initial inertia, and from what we have been able to gather, the work of the Zürich meetings, when printed and issued by the Central Office, should prove of more than ordinary interest. From the British point of view, it is particularly gratifying to see that the B.E.A.M.A. was officially represented; the spirit of intimate co-operation displayed by the various bodies interested should certainly result in work of much practical utility. When, therefore, this first chapter, as we may be permitted to call it, is ratified at Berlin next autumn, it is to be hoped that it will be widely disseminated, and at a very moderate charge.

If the recommendations are added to year by year, and, by periodical revision, kept abreast of progress, the time and money expended will have been well justified.

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## APPRENTICESHIP SYSTEMS.

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THE *personnel* of a works is of a scarcely less importance to its success than the quality of the plant and machinery; and a great steel maker once gave it as his conviction that a fire which should destroy his works would be preferable to the loss of the services of his trained staff. The one may be rebuilt and equipped with equal or better machinery than before, but the *personnel* of the other can never be the same, and it may take years to train men up to fill satisfactorily all the old positions.

Works, like individuals, cannot stand still, they must either develop or decline, so that in every well-organised establishment there must be a continuous system of training recruits to fill new positions of responsibility rendered necessary by the natural expansion of the business, or to fill vacancies due to resignations, death or other cause.

This system of training in engineering works is known generally as the apprenticeship system, a system which has had to be considerably modified in recent years to meet the changes which in workshop practice have been brought about by the ever-increasing use of labour-saving tools.

In the days preceding the machine-tool era, when hand-craft and manual dexterity were of prime importance, the apprentice system had become regularised, and a youth could enter a works with the certain knowledge that he would at least have an opportunity of becoming a skilled artisan in a definite or specific trade, and he might reasonably expect to have in due course a general knowledge of the details and construction of the machines manufactured. He would be able to make practically every part and to assemble and fit them together and set the machine to work.

Nowadays, a boy may be set to watch or mind a machine while it repeats day in and day out, with monotonous regularity and precision, a stereotyped operation; his foreman will keep him at this occupation as long as he will stand it, and when he at length gets a change, it will be to watch another machine go through another set of mechanical operations.

The problem of recasting the apprenticeship system in a form suitable to modern workshop conditions has been attacked both by educationists and by engineering employers, but whilst many suggestions have been made, no regularised or standard system has been evolved, and it is at present left to individual employers to work out their own schemes in

detail to suit the conditions existing in their particular works.

In general, however, the new apprenticeship embraces not only the service of a specified number of years in a workshop, but also the attendance at day or evening classes in a technical school. We have from time to time given in our columns details of the conditions of apprenticeship adopted by various engineering firms, and we give below the chief points from a notice recently issued by Messrs. Mather and Platt, Ltd., of Manchester, regarding apprentices. Three classes of apprentices are taken, viz. :—

*Class 1.*—This class consists of boys of not less than 15 years of age, who desire to become artisans or "tradesmen" on reaching the age of 21. They must produce proofs of having had a satisfactory elementary education, and have passed Standard VI. They must attend evening classes at the Manchester or Salford Schools of Technology, or other approved schools. In some cases those who can show that they will derive full benefit therefrom, may be granted the privilege of attending the special day courses for apprentice engineers at the Manchester School of Technology, no deduction being made from their wages for the time so spent.

*Class 2* consists of a limited number of youths not under 17 years of age, who can give proof, by examination or certificate, of having had a good general education at a secondary or public school; those who have had a recognised course of technical training, or have obtained distinction at a public school. A knowledge of French, German, or other modern language, is considered an additional qualification. This class is for youths who desire a practical training in different branches of engineering, and they are transferred from department to department as circumstances permit, so as to obtain as wide an experience as possible. The departments included in the curriculum are: the foundry, machine tools, fitting and assembling, and either the test room or drawing office. A probationary period of six months without wages must first be passed through, after which apprentices in this class receive 10s. a week up to the end of their apprenticeship. All second-class apprentices must continue their technical education at an approved technical school, or at the University, and as in the case of Class 1 the special day classes for apprentices may be attended if permission be obtained from the works manager.

*Class 3* is for young men of not less than 20 years of age who desire to acquire a practical workshop training. They must have passed through a complete course of technical training or obtained an engineering or science degree at a University. Admittance to this class depends upon the educational qualifications a candidate is able to submit, and great importance is attached to a thorough knowledge of modern languages. A probationary period of six months without wages is necessary, at the end of which there is no obligation on the part of either probationer or firm to continue the employment. If, however, it is continued, a written agreement is entered into for a definite period, and although the firm cannot undertake that men in this class shall spend a specific time in any particular department, the management will, as far as possible, select such departments as shall be most suitable to the attainments and capabilities of each man.

*General.*—No entrance fee or premium is charged, nor is any apprentice indentured, nor is there any obligation to continue the employment of any apprentice.

Shop hours must be kept, and the usual works regulations observed by all classes.

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A Visit to  
Paris.

READERS who are members of the I.E.E. will be interested to learn that the Société Internationale des Electriciens has invited the Institution to Paris for a few days in May next. During recent years great developments have taken place in the electrical world of Paris; railways have been electrified, new electric railways have been built, large power stations have been erected—there is much to see, of the greatest electrical interest, and we are sure that those who take part in the visit will have a thoroughly good time.

Artificers  
in the  
Royal Navy.

A REMARKABLE pamphlet, accompanied by a letter from the secretary, has recently been sent to us from Devonport by the Royal Naval Artificer-Engineers' and Engine-Room Artificers' Benevolent Fund, in regard to which it is necessary to have reluctantly to confess that, although we have always listened attentively and sympathetically to any supported expressions of opinion of men within the Service touching matters of importance to the efficiency and well-being of the engineer branch, the statements put forward in the present instance seem to call for other treatment, as they are singularly lacking in force and justification. It has to be explained that this communication has little, if anything, in common with the old trouble concerning engineer officers. It is a plea put forward by certain discontented chief and engine-room artificers, entered at full age as fully qualified engineering mechanics, chief and artificer engineers promoted from chief and engine-room artificers, and a few engineer-lieutenants promoted from chief artificer engineers. Under existing conditions, the Navy is, in effect, a secret service, and it is impossible to determine the merits of an alleged grievance of this kind by direct question and answer. All that can be done is to examine the scanty information available, and to endeavour to test whether it is in agreement with such facts as have been published officially regarding the organisation of the Navy. The demand made is for increase in pay, increase in pension, openings to rise to the higher ranks in the engineering branch of the service, the opening of the Royal Naval Reserve to members of the corps of royal naval artificer engineers and engine-room artificers, and the retention by them of the engine-room watch keeping. As abstract propositions these are all legitimate, and, if made to the proper authorities, they would, no doubt, receive careful consideration; but the attempt to force them upon the public, through the Press, upon the questionable grounds stated in the above-mentioned letter and pamphlet, must entirely alienate the grumblers from the sympathy of those who have more than a superficial knowledge of service matters, and, incidentally, of those who have the best interests of the corps at heart. It may be asked: Then why take any notice of such statements? The answer is that—in justice to the great body of artificer engineers—it is desirable that the public should have the means of checking the statements of a misguided few.

The letter declares that "we are rapidly drifting towards the serious position of a steam Navy minus engineer officers." It states, moreover, that it is notoriously difficult to get candidates to enter for the engineer branch at all. It suggests also that for five years not a single engineer officer will have been added to the Royal Navy. These loose and inaccurate statements are made the lever for a demand of 7s. a day as starting pay for the Corps, and a minimum pension of £100 a year for chief artificer engineers. The argument is based upon the fact that Keyham College was closed in 1910, and that the first batch of the new engineer officers, under the new scheme of education and training for naval officers, cannot have specialised until the end of 1915. Nevertheless, anyone who cares to consult a *Navy List* will see that there is not likely to be a disappearance of engineer officers in 1915, and although there must necessarily be questions arising for adjustment between the old and the new schemes of entry, it is an entire misrepresentation to ask the public to believe that we are drifting towards the position of a steam Navy without engineer officers. There will be similar matters for adjustment in regard to new-scheme officers for the navigating, torpedo, gunnery and Royal Marine branches; and are we to be told that these branches will also be depleted until the end of the first term of specialisation in each branch? Again, the suggestion that it is notoriously difficult to get new-scheme candidates to enter for the engineer branch is difficult to reconcile with the assertion that the first batch of the new engineer officers "cannot have specialised until the end of 1915," for how is it possible, early in 1913, to contend that there is difficulty in getting

them to enter, say, a year hence? The contingency has not yet arisen, and is not likely to arise.

It is most unfortunate that the question of linking-up the artificers with the commissioned ranks of the Engineer Branch of the Navy should have been put forward in this misleading manner, for we are firmly of opinion that, in the future, that branch will be greatly strengthened by a healthy system of promotion of men of ability from the lower deck. It is scarcely practicable to carry out such a reform in a hurry, and it must necessarily take effect upon those who have entered the service as boys and youths, rather than upon those who have entered later in life from a variety of mechanical trades, some of which are only remotely concerned with naval engineering. Again, it is difficult to see how those who are promoted can hope to qualify for the higher commissioned ranks: for the standard of education and training required for commanders, captains and admirals tends ever to become more exacting. The way may, nevertheless, be left open, so that those who can climb may climb. The general course of events will probably be that, instead of adding greatly to the accommodation at Dartmouth College to meet the future demands of the technical branches of the Navy in respect of watch-keeping lieutenants, the lower commissioned ranks will, of an increasing extent, be replenished from among the most deserving of the warrant officers, and the result will be to the advantage of the whole service.

Storage in  
Electricity  
Supply.

THE important paper read by Mr. Whysall before the I.E.E. last month brings the question of storage on the large scale prominently forward once more.

Our readers will recollect that in 1908 Mr. A. M. Taylor dealt with the subject very fully at the I.M.E.A. convention, and advocated the installation of very large batteries on the grounds of reliability and, above all, economy, bringing forward very cogent arguments in support of his views. On that occasion we expressed our cordial agreement with the author, having maintained for many years that engineers responsible for the design of central stations showed a regrettable lack of appreciation of the important advantages to be gained by the use of *adequate* storage—not the half-hearted, hesitating installation of a battery having an output of, say, 10 per cent. of that of the generating plant, though that at least ensured the maintenance of the station lighting and the excitation of the generators in time of emergency, but really *adequate* storage. What we mean by this may be exemplified by the policy of the four American undertakings cited by Mr. Taylor, which, even in 1908, possessed storage batteries of more than 130,000 kw. output, at the one-hour rate. The present paper, giving the actual results obtained with a big battery, and showing an important saving even when Mr. Pearce, to avoid undue optimism, discounted the results to the utmost possible extent, will arouse renewed interest in the matter, and encourage those who are considering the advisability of providing storage on a large scale.

We are impelled to enlarge upon this topic by the fact that during the past year there has been a deplorably large number of total or partial shut-downs of electricity works, and we are anxious to invert the order of the two qualifications of the storage battery to which we have referred. We want to urge station engineers to put down large batteries on the grounds of economy, and, *above all, reliability*. There is a grave risk that electricity supply will get a bad name for its lack of reliability unless station engineers not only *talk* about the extreme importance of reliability, as they often do, but also *do* something towards ensuring its achievement. Our rivals the gas suppliers are doing all they can to stem the tide of electricity supply, and they make the greatest possible use of every reported breakdown to back up their arguments.

The fact that important economies can be effected with storage batteries ought alone to suffice to ensure their adoption; the reliability thus obtained should be a still more potent argument, and when these two considerations are combined the case is irresistible.

## ARC LAMPS FOR THE OUTSIDE LIGHTING OF SHOPS, &c.

By W. FENNEL, A.M.I.E.E.

THE situation at Wednesbury six months ago with regard to the out-side lighting of shop premises was as follows :—

From its commencement about seven years ago the electricity undertaking had been making very good headway, and in the centre of the town, at least, the majority of the business premises used electricity extensively, and in many cases there were outside arc lamps. These lamps were such as might be usually met with in a medium-sized town—chiefly enclosed lamps in pairs across 230-volt mains. Two adjoining shopkeepers had combined to run a series of 5 flame arcs, using metal-cored carbons, and there was one large consumer with a similar series; but, generally speaking, two enclosed lamps in series were usual, the shops not being large enough to justify the expense of a series of four or five low-voltage flame lamps. There were the usual complaints of burnt carbon holders, broken globes, badly adjusted lamps, and other troubles incidental to arc lighting, but still one could feel satisfied that electricity had practically outclassed gas, until high-pressure gas appeared. News was received one day that a notice had been deposited with the surveyor



OUTSIDE ARC LAMPS IN A SIDE STREET, WEDNESBURY.

to open the roadway to lay a high-pressure gas main in the Market Place, and the next day it was stated that one of the largest users of arc lamps had signed an agreement to take the new gas supply, and that negotiations were in an advanced state with others to change over from electricity to high-pressure gas.

On making a visit to a large town a few miles off, it was obvious that these same high-pressure gas lamps had swept the principal shopping streets of arc lamps within a few months. One was astonished at the swiftness of the change, and felt it would be disastrous if such a thing happened in Wednesbury. An inquiry as to the terms and conditions revealed the cause of the stampede. The gas authorities were offering to fix and maintain a 1,000-c.p. high-pressure lamp at £5 per annum, such lamp to be used during ordinary business lighting hours. Consumers were attracted by the low charge, and by the assurance of its being the first and last expense. Shopkeepers and their assistants hated messing with carbons and gas mantles. It had already been proved that they would not pay an extra for skilled attendance, and they grudged the expense of flame carbons. Again, and this is the most important point in a small town, shopkeepers did not want four or five lamps each, and two enclosed lamps cost more to run and gave less light than two high-pressure gas lamps. The various

metal-filament lanterns were also out of the question; they cannot compare with high-pressure gas.

The writer decided that the only way to meet this competition was immediately to offer a better light on the same terms. Not a very startling or original proposition; but it involves many side issues, some of which are important, and require courage to force through. A recommendation was made to the Committee to carry out the following scheme, which was adopted, and which is probably the first of its kind :—

Consumers were offered a 7-ampere flame arc lamp, giving about 1,500 c.p., at £5 per lamp per annum, including hire, trimming, cleaning and current. All the facilities given by the gas authorities were provided at the same price, and, in addition, more light.

In order to give this supply, a low-pressure 50-volt three-wire main would be run in the principal shopping centre, so that any consumer could have one, two, or more lamps. This circuit was to be supplied by a motor-generator, the generator being fitted with balancing slip rings and transformers.

The works are in this case very close to the centre of the town, so the machine is at the works, but it could be placed in a basement, or, indeed, in a balancing station if required.

In order at once to demonstrate the advantages of the proposal, temporary overhead mains were run and connected to some of the battery regulators, and two sample lamps, one with yellow and the other with white carbons, were exhibited. These lamps were fixed on shops adjoining the one which had deserted to the "enemy," and were lighted on the opening day of the high-pressure gas supply. A circular was issued calling attention to the demonstration and stating the competing terms.

The proceedings were hardly dignified, but the result was magical. The gas authorities have not secured a second consumer for their high-pressure gas up to the present. The circular caused several who had intended to use high-pressure gas to draw back, and applications were received from consumers quite away from the high-pressure gas area. It was originally proposed to confine this special main to the area served by the high-pressure gas main, but it has already extended rapidly. In the six months which have elapsed, over 40 lamps have been connected, most of them new business, *i.e.*, they have replaced gas lanterns, or there

had been no outside lighting, and there are several consumers with single arc lamps, some of them quite small shops. It is curious to note that those consumers who had series flame lamps have not changed over to the new circuit, although they were on the point of going in for gas six months ago. These are the occupiers of larger premises, of course, but there is no doubt they would have "deserted" if high-pressure gas light had made headway as in neighbouring towns.

In the first place, it was not claimed that the scheme would be very profitable—it was put forward as a necessary measure to retain the advertisement of outside lighting. The gas authorities were prepared to lose money on high-pressure gas, just as they are on street lighting. To be able to say that "So and so" has gone back to gas, or that shopkeepers are replacing electric lamps wholesale, is not only very gratifying to the gas interest, but it creates an "atmosphere" which is worth a great deal in hard cash. Its influence extends to every street in the town. One may perhaps be excused for saying that it cannot be easily understood how electrical engineers (or is it the Committee or directors?) can stand idly by while the gas authorities regain their old superior position, yet this is the state of affairs in many towns. Criticism was advanced by a few who said that to spend money without an assurance of a profitable

return was madness, and was not business; but these critics were silenced by those who were accustomed to spend money on advertisements and on selling below cost, if necessary, in special cases to secure a market. Nothing is heard from these critics to-day.

The great advantage of the special arc circuit is that it can be controlled, and the Early Closing Act has assisted in this respect. The circuit is only alive during the proper hours and on business days, so it is not necessary to watch the consumers, or to put in time switches or meters.

Using a three-wire circuit, lamps may be wired very simply and cheaply by running the outers only through a double-pole switch, and tapping the lamps off alternately.

The lamps are of the General Electric Co.'s magazine flame type, burning 60 to 70 hours. The trimmer goes round at fixed intervals, fills up the magazine, and cleans the lamp. Single-carbon lamps are at a disadvantage, because it would not pay to call at irregular intervals to see if lamps needed trimming.

Lamps must be used which will give either a white or a yellow light at will—consumers must have the choice, and they change their minds occasionally.

The lamps must be very good; an unsteady light or a sticky mechanism would be fatal to success.

The steadying resistance should be inside the lamp. On a 50-volt circuit it is quite small. In the lamps adopted, it consists of a resistance wire wound round a porcelain rod, and it supports itself.

The single burning lamp is very simple, no substitutional resistance or cut-out is required, and it is cheaper for that reason. This saving goes some way towards paying the cost of the special cables. It is also a steadier lamp than the series burning type, in which one lamp may affect another.

In considering the financial side of this question, it will be convenient to take all the standing charges, and after deducting them from the revenue, see what price is available per unit for the electricity. It is assumed that a 50-volt lamp installation, running 700 hours per annum, is to be taken.

	Capital cost.	Life.	Annual capital charges—int. 9½ % and repayment.
25-KW. motor-generator...	£150	15 years	£14
Mains—allow ... ..	300	25 "	21
Lamps (50 magazine type) ...	387	7 "	64
Wiring, 50 lamps... ..	50	10 "	6
<b>Total capital charges</b> ... ..			<b>£105</b>
Running charges, carboning and cleaning (assuming magazine arcs) 10s. per lamp per annum ... ..			£25
Repairs, say ... ..			10
Carbons, 700 hours at 15d.—8s. per lamp ... ..			20
			55
			£160
Revenue—50 at £5 ... ..			£250
<b>Balance for energy</b> ... ..			<b>£90</b>

This allows for 14,500 units at 1½d., which is not a very high price, it is true, but it must be considered that this price has only to cover generating costs and feeder costs, and has to bear no share of distribution expenses, as the cost is dealt with right from the motor-generator to the lamps, including mains and wiring. If one had even 1d. per unit for the electricity, it would pay to take the matter up, on the ground that a small loss or profit is of little importance compared with the advertisement.

At Wednesbury the cost of a motor-generator has been saved; a battery booster, used for charging the regulating cells, has been brought into use. It is not often that the battery is charged to gassing during shop hours, so that the one machine carries out the two operations. The booster armature has been provided with slip-rings and middle-wire gear, this being used only on the arc lighting circuit. The estimate allows for an entirely separate machine.

The illustration on p. 248 shows the effect of running the special low-voltage main in a street off the Market Place. It will be noticed that the shops are quite small, and are not of the kind which usually go in for arc lamps. Of the six shops illustrated, there is only one with two lamps, and it is safe to say that without the special main not one of these

shops would be using arc lamps, or, indeed, any outside lighting. The writer, of course, might have shown a view of important shops in the Market Place, but thinks this side street is far more eloquent testimony to the advantages of the low-voltage main for outside lighting.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Screw Caps for Radiator Lamps.

As the use of radiators is extending so rapidly, it is most important that every detail of their design should be entirely satisfactory before it is standardised. Is this not a matter, therefore, for the B.E.A.M.A. to decide, by common action between the leading radiator manufacturers and possibly the supply authorities, what type of lampholder they should be fitted with in future? It is evident that any lampholder with springs must sooner or later give trouble, and the points of contact on the plungers of the B.C. holder are too small for the necessary heavy current that passes through them.

The above authorities could easily decide then what was the best lampholder to be fitted, and standardise it accordingly; whether an improved form of B.C. holder like the "Mumps," or a good Edison screw holder, or any other more suitable type. I hope, therefore, that you may be able to persuade the powers that be to take some prompt action in this matter.

Johber.

### Costs of Running Small Generating Station.

Would any of your readers be kind enough to give me information as to the running costs and upkeep of a 500-H.P. suction gas or crude oil electric generating station, or of one of somewhere near this capacity?

E. B. Gray.

Maldon, February 6th, 1913.

### Testing the Continuity of Earth Conductors.

In reply to the letters of "Continuity" and Mr. B. T. Davies on the subject of Mines Regulations, Rule 8 (b) and Rule 14 (c), if "Continuity" henceforth orders his cables as recommended by the Engineering Standards Committee, and in conformity with Rule 12 (e), he will have no difficulty.

If he intends earthing cables installed previous to the regulations coming into force, Rule 8 (b) points out plainly what to do.

The easiest way out of the difficulty would be to install a bare copper conductor of half the sectional area of the cable to be earthed, if he is dealing with two-core or multicore cables. This could be fixed to all the apparatus on the cable, and to the cable-itself at intervals, and latterly brought to the surface and earthed. Of course, if "Continuity" had an armouring already on his cables which was not up to the standard, he could calculate the resistance of one of his main conductors against that of the armouring, find the deficiency in the latter, and make up with copper, so that the resultant would conform to the 50 per cent. regulation. In this case he would save the expense of putting in a conductor of half the capacity of his cable. At joints or distribution boxes, where a break in the main cable takes place, a bonding cable equal to 50 per cent. would be used to join the armouring. I use heavy brass split glands for this purpose, the cross bond being sweated directly into a hole in one lug of a half-gland, no sockets being necessary.

I think, however, that the best method is not to consider the armouring of an old cable, but to go right ahead with a proper earthing system. It is surprising that there are not more accidents with some of the so-called earthing systems in use to-day. I say at once that proper earthing is the

factor of safety governing a mining installation, and it can be made a very efficient and material one at that. I find no difficulty, and do not scruple in this respect.

The new regulations are easily complied with, and call for a standard of material and work that not only gives safety, but efficiency and immunity from breakdown. Undoubtedly they might be more explicit on some points, but what about the Insurance Act?

Mr. Davies, to my mind, does not interpret Rule 14, Sub-sec. (c) (i), properly—the thorough examination of all apparatus (including the testing of earth conductors and metallic coverings for continuity). This does not call for a “bridge” test, or for any definite measurement at all. A continuity test can be taken by joining one of the copper conductors to the armouring at the far end of the cable, and testing by “megger” or galvanometer from the same conductor to the armouring at the near end.

Obviously the “megger” would read zero, all being correct (unless it was a “bridge” megger), or the galvanometer would give a full scale deflection.

I do not think an expensive insulation testing ohmmeter and generator would be improved by this work, as it practically amounts to testing through a “short circuit.”

Mr. Davies tests the “earth” itself. Although I fully agree with him that this is necessary, the rule does not call for it. It only calls for the testing of the earth conductors.

The earth plates may have any value to ground. It is evident that if these are deficient in continuity to the general mass of earth, they are worse than useless—a source of very great danger indeed. Again, how many colliery electricians of the old school, the men in charge of plants varying from 100 to 300 kw., can take a “bridge” test? Simple in itself, the human element is a big factor in the case of taking accurate and sensible data. I may go further, and ask, “How many collieries, using electricity on the old basis, have such an instrument?” The average small colliery electrician is a man of resource. He is often “up against it” very hard, and generally pulls through; but “bridge” testing is probably without his sphere of knowledge.

Then, again, I wonder where he would get the time. I reckon a “bridge” test would be taken at the expense of a few thousand gallons of water, or perhaps a few tons of coal. Coal is surely our first consideration (not forgetting safety to life, of course), and I know of some instances where a “tester” could be continuously employed, and one section or another of a large “group” installation would be off daily for this purpose. Even then it would take the individual concerned all his time to comply with the rules if “bridge” tests were called for.

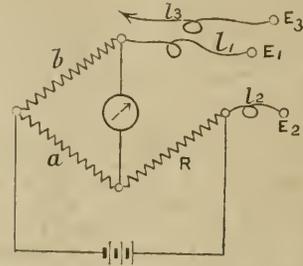
Mr. Davies shows a very good method of testing the efficiency of his earthing conductors, but he does not comply with the regulation, inasmuch as he does not test the continuity of the earth conductor. If the cable in his sketch was bare wire armoured, having an average resistance to earth for every foot of its length of, say, 1<sup>o</sup>, due to its lying in a damp roadway, he could actually have a break in the earth conductor—the armouring—which would not be shown by his method of testing.

Then, again, it is not applicable where cables are installed in accordance with Rule 12, Sub-sec. (e) (v)—that is, in conformity with Rule 15 (i).

When cables are installed in fiery mines, open sparking must be prevented (in case of roof falls, &c.). The manufacturer gets over this by making double wire-armoured cable, with a heavy layer of jute or lapping between the armourings, and the whole covered with a layer of jute. This is the class of (three-core) cable that should be installed everywhere; it pays in the end. Now where this class of cable is used, it would be useless to fix a local earth plate in the mine to the outer armouring only, and it is obvious that to open the outer armouring to get to the inner defeats the purpose for which the cable was made, to say nothing of destroying the waterproof and fireproof qualities of the cable, and adding to the resistance of the armouring by the insertion of a more or less perfect mechanical joint if installed where Rule 15 applied.

My idea would be to test the continuity of the earth conductors by the method I put forward. There is nothing to prevent a rapid “bridge” test being taken by “shorting”

one end, as before mentioned. Taking the resistance of the cable conductor plus the armouring, and subtracting the former, which could be known from calculation or a previous test, then I would apply the following method for testing the earth itself:—



Place two earths,  $E_2$  and  $E_3$ , equidistant from earth to be tested,  $E_1$ , say 20 ft.

Let  $E_1$  = earth to be tested;  $E_2$  and  $E_3$ , two auxiliary earths;  $l_1, l_2, l_3$ , the leads from the bridge.

Consider for simplicity that  $a = b$ , and that  $l_2$  and  $l_3$  are included in  $E_2$  and  $E_3$ : if—

$$R_1 = l_1 + E_1 + E_2,$$

$$R_2 = l_1 + E_1 + E_3,$$

$$R_3 = E_2 + E_3, \text{ then}$$

$$\frac{R_1 + R_2 - R_3}{2} - l_1 = E_1.$$

It will be noticed that the values  $l_2$  and  $l_3$  are not required separately. I should like to see some correspondence on the rules under discussion from other mining electrical engineers. With apologies to Mr. Davies, and thanking you for publicity.

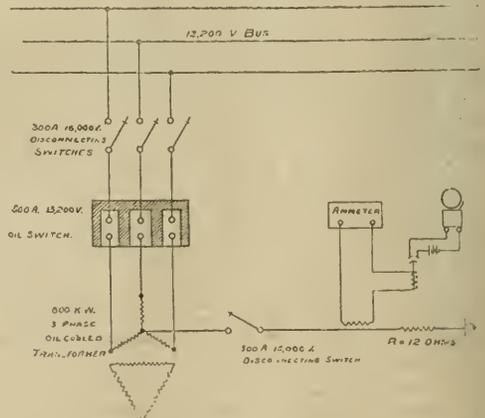
John P. C. Kivlen.

Uddingston West, February 8th, 1913.

**Earthing the Neutral.**

In your issue of January 3rd, page 6, we are very much interested in the correspondence covering the earthing of neutral, particularly because of the fact of the similarity of the scheme shown with that which we have had in use on our system since 1907. Our power system consists of:—

- (a) 7,000-kw. water-power station, with 3,450-volt three-phase generators and delta-delta step-up transformers, with ratio 3,450 to 13,200.
- (b) 9,000-kw. water-power station, with 13,200-volt three-phase generators, star connected.
- (c) 40,000-kw. steam station, with 13,200-volt three-phase generators, star connected.



In view of the fact that some of these units are not star connected, and also the multiplicity of units, we considered it undesirable to earth the neutral of the generating sets.

Therefore, the system which we show on the enclosed diagram was proposed in 1906, and was actually installed in 1907, and has been working very satisfactorily ever since. The oil switch on this equipment is of a non-automatic type. The 600-kw. transformer is specially wound to withstand the mechanical strains due to excessive overloads for short periods. The resistance in the ground leg consists of cast grids, and is proportioned to withstand a current of 500 amperes for one-half minute without undue heating. The 18,200-volt outgoing feeders are all equipped with triple-pole relays at the sending and receiving ends. The underground cable system has a charging current of 60 to 70 amperes per leg. The alarm relay is adjusted to notify the operator when this ground current exceeds 40 amperes. As our load is entirely a balanced one, you will see that ringing of the ground bell gives the operator warning of impending trouble on the system.

Before the installation of this neutral transformer, we had a considerable amount of trouble on our underground high-tension cable system, due to surges. In one case five separate burn-outs occurred at widely separated points on the system. Since that time we have been remarkably free from such trouble, for ordinarily we are able to detect the trouble before a serious ground or short circuit occurs.

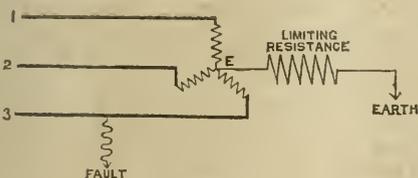
J. C. Vincent,

Assistant engineer, Minneapolis Street  
Railway Co.

Minneapolis, U.S.A., January 29th, 1913.

In your issue of January 31st Mr. Fedden is good enough to fall in with my request, and gives some figures taken under actual working conditions with the special earthing transformers installed at Sheffield.

The figures show clearly that the neutral point of the transformer coincides more or less closely with the neutral point of the system, even when one of the phases is earthed and a current of some 50 amperes is flowing through the fault. In his letter published in your issue of January 3rd, Mr. Fedden suggested that not only was this the case, but that the neutral point of the system would itself be kept at earth potential under similar conditions. That this cannot actually be the case when one of the phases has broken down to earth is, I think, clear, when it is remembered that the point marked *E* in Mr. Fedden's diagram is separated from



earth by a limiting resistance through which 50 amperes is flowing, whereas the point marked "3" is assumed to be dead earth through the fault. From this it follows that the point *E* must be raised considerably above earth.

It should be noted that in Mr. Fedden's diagram the resistance is shown in the line *F* (which presumably represents an artificial fault), whereas it should, I think, be shown between earth and the point *E*.

The state of affairs on the occurrence of an earth would then be as shown in the accompanying figure, from which the mesh-connected secondaries of the transformer have been omitted for the sake of clearness. Under these conditions, the point *E* must be raised above earth potential by an amount equal to the phase voltage of the system.

The net result, therefore, would be almost precisely the same as if an earthing resistance had been joined up between the neutral point of the generators or transformers and earth in the usual way, and while, under the special conditions prevailing in Sheffield, the arrangement had doubtless many advantages, it would hardly seem as though the greatly increased cost would be warranted in the majority of cases. This being so, it may be of interest to see how far the various advantages enumerated by Mr. Fedden, in his first

letter, are shared by the earthing resistance arrangement. Taking them in order, we have:—

1 and 2. With the neutral points of the generators connected to an earthing bar, and thence through a resistance to earth, no trouble is experienced in practice from triple-frequency currents, so that it is unnecessary, in the majority of cases, to take any special precautions with a view to preventing more than one generator being earthed at one time. Should trouble be anticipated from this cause, a resistance between each of the neutral points and the earthing bar will limit the triple-frequency currents to any desired extent.

3. The earth current can equally well be limited to the minimum value necessary for tripping any of the well-known earth current discriminating devices, and by this means the faulty feeder alone is cut off from the bus-bars.

4. In both systems—that is, with the earthing resistance or earthing transformer—the neutral point of the generators will always coincide with the neutral point of the system, and on the occurrence of a dead earth, the latter will be raised above earth potential by the phase voltage.

5. The fault current necessary to trip the breaker on the faulty feeder can be kept as low as may be thought desirable without interfering in any way with the overload settings of the relays or breakers.

6. The power taken by the earthing resistance method is, under normal conditions, *nil*, and the total cost of a Brazil carbon powder resistance would be something like one-fifth of that of the Sheffield transformer.

Kenelm Edgecombe.

London, S.W., February 11th, 1913.

## THE USE OF ELECTRICITY AND ELECTRICAL ACCIDENTS IN MINES.

The general report of the Chief Inspector of Mines for the year 1911 (Part II) contains a report by the Electrical Inspector of Mines, in which he says that electricity was newly introduced into no fewer than 46 mines in 1911, as against 40 in 1910. Under Rule 15 of the Electricity Special Rules, notice of the intention to introduce electricity must be given to the district inspectors, and 46 such notices were received. Of these 20 were in Scotland, four in the Newcastle district, two in Durham, two in Liverpool and North Wales; 13 in South Wales, and five in the Midland and southern district. Unfortunately, no particulars of the installation are required to be given under this rule, but from such particulars as are available, it appears that high-pressure alternating current was introduced in five mines, medium-pressure alternating current into 11 mines, medium-pressure direct current into 13 mines, and low-pressure direct current into four mines. In the latter cases the current was introduced for lighting purposes only. Under the new rules, however, which came into force on March 9th, 1912, full particulars of the installation must be given so that "a complete classification of the different systems of distribution, together with a measure of the growth of the use of electricity in mines, will be possible for the future." The fact that 46 mines newly introduced electricity is most satisfactory, and we are of the opinion that the new rules—which insist upon more attention being given to the design, installation, and use of electrical machinery than has hitherto been the case—will so far improve matters and lessen the number of accidents, that all the old objections as to its being a serious danger in a mine will be entirely removed and its progression will be by leaps and bounds. The most dangerous employment of electricity is admittedly that of coal-cutting, but in 1911 there were 998 electrically driven coal-cutters at work, an increase of no less than 125 over the year 1910. We will return to this question later on, and in the meantime it will be interesting to briefly review the inspector's reports of accidents due to electricity.

During the year 1910 there were in all 21 fatal accidents causing 21 deaths, but for the year 1911 there were in all only 14 fatal accidents causing 15 deaths. Of these, how-

ever, two of the accidents had, strictly speaking, no connection with the use of electricity in or about mines, though they were reported to, and investigated by, the inspector of the district. In one which occurred at New Great Rocks Quarry (Derbyshire) the deceased—who was a labourer—was on the roof of a building with the foreman deciding what repairs were required, when he either fell against or took hold of two live wires and was killed. In the other, two men each received a fatal shock from a live stay wire supporting the poles of a 3,000-volt three-phase transmission line about half-a-mile distant from the Lower Duffryn Colliery in South Wales. It appears that additional poles were being erected between the original poles in order to carry larger conductors, and the night before the accident an intermediate pole had been fixed adjacent to a pole where a line took a turn at right angles, in such a way that an undue strain came upon the cross-arm which canted, causing one of the insulators to be drawn from its support and allowing the conductor to come in contact with a stay wire supporting the pole, and by way of cradle—or we suppose guard wires—made a metallic connection with the next post where the men were killed. The leakage caused the pole to char, and the smoke being observed by some men engaged excavating lower down the mountain side, the foreman sent one of the men to investigate, and this man evidently came in contact with a live stay wire and was killed. Shortly after, another of the workmen, going for tools, had to pass the place, and he, too, received a fatal shock—no doubt while trying to rescue the first man. Evidently the great strain due to overhead wires had been under-estimated by the colliery people, and this accident may at least serve to draw their attention to the necessity of having these particularly strong—with braced corner poles, and as few stay wires as possible. Overhead lines are, and will be more so in the near future, an important part of the colliery installation, and they deserve more attention than they have hitherto received. The other overhead transmission lines of the company were all fitted with the Merz-Price leakage cut-out apparatus, and this device has since been applied to this line. We would strongly recommend other colliery proprietors who have important overhead transmission lines, to fit this really useful piece of protective apparatus if they have not already done so.

Although these accidents, as already stated, cannot be said to have any bearing upon the use of electricity in mines, yet they were quite rightly reported and investigated. If, however, we leave them out, the figures for 1911 directly comparable with the figures for 1910 are: 12 accidents, resulting in 12 deaths, or nine fewer fatalities in 1911 than in 1910, which is a distinct improvement, though the number is still regrettable, when one considers that most of them at least might have been prevented had the installation been laid down and worked with that care and attention which its importance demands.

Of the 12 fatal accidents then, 11 were due to electric shock, whilst the remaining one was due to ignition of fire-damp by electricity in an underground motor room. According to districts, five occurred in Scotland, two in Newcastle, three in Durham, one in South Wales, and one in the Midland and Southern district.

In the Scotland district four of the accidents were underground and one on the surface, and, in addition seven persons were injured (six underground and one on the surface). As compared with 1910, the Inspector for the district, speaking of underground accidents only, says:—"This is a decrease of one fatal and six non-fatal accidents," but adding the fatal "surface" accident, the number of fatalities is exactly the same. The Inspector fully bears out the views we have repeatedly expressed when dealing with colliery electrical accidents, for he says:—"Several of the accidents, if certain means had been taken by the officials, or more care had been exercised by the persons in charge of and working the machinery, would, in all probability, have been prevented, and I, therefore, give a . . . detailed description of them . . . so that the suggested precautions may be fully considered. Such precautions will, I trust, be adopted where they apply by those in charge of electric installations."

Two of the accidents were in connection with coal-cutting machines, and raise the question as to "whether a pressure

which would be unlikely in case of accident to have fatal results, should not be used for all portable motors wherever it is possible."

We have previously expressed the view that all portable motors, such as are fitted to coal-cutters, should be of low-voltage, and it is encouraging to find an Inspector supporting this view. He (the Inspector) says: "Both accidents took place on medium pressure alternating current systems, and in both cases had the pressure been transformed to, say, 200 volts at the nearest convenient point to the portable motors, and if the neutral point of the transformer windings on the secondary side had been earthed, the persons who were unfortunately killed could not have received shocks of more than 130 volts to earth, and, therefore, would probably not have been killed. The two fatal shocks were, in fact, received from three-phase alternating-current systems of 550 volts in one case and 500 volts in the other. Mr. Nelson (Electrical Inspector), when making inspections in the division, has recommended the system, and I have also suggested that it should be adopted at several collieries, but objections have been raised that the size of the coal-cutting machines would be increased, and that the trailing cables would be so heavy as to become unwieldy."

These objections were, however, mainly imaginative, for careful inquiries put to the makers of coal-cutting machines elicited the reply that the increase of size would be trifling, and that the height—which is the chief point to be considered in a coal-cutter, would *not* be increased; and as regards trailing cables, the weight due to the increase of size could be met by making them shorter, and using a larger number of junction or "gate-end" boxes for a given length of face. And, as the Inspector points out, "This latter would, in many cases, be an advantage rather than the reverse, as, instead of a long length of trailing cable dragging along the pavement of a face, a greater length of cable would be in the gate roads, where it could be properly suspended," or at least, properly protected. "I venture to think that it behoves everyone connected with the use of electricity for portable motors in mines to give this suggestion their careful consideration. If the system were given a trial, it would, I feel sure, be found that the supposed objections do not exist, with the great advantage, from a safety point of view, that very few, if any, fatal accidents would occur on portable machinery." The italics are ours, and we hope that both colliery managers and manufacturers will give these words the serious attention they deserve.

As to the accidents, one occurred at Bredisholm Colliery and the other at Bardykes Colliery. In the first the supply is on the three-phase system, at a pressure of 3,000 volts, and from a sub-station at the top of No. 2 pit the current is carried below ground to a transformer at the shaft bottom, where it is reduced in pressure to 500 volts, and carried in by a distance of about 600 yards to a coal-cutting machine. The deceased was killed by an electric shock received probably from the coal-cutter of the haulage rope. At the time of the accident, there were two faults on the 500-volt distribution system, (a) a fault on one phase due to a breakdown of insulation a few feet from the transformer, (b) a second fault on a second phase due to the same cause at the coal-cutter. The frame of the latter was earthed by means of armouring of the trailing cable, and that of the main cable to earth-plates sunk at the surface, and there was a set of fuses at the gate end box in the coal-cutter circuit set to blow at about 80 amperes. The resistance of the armouring of the trailing cable was, when tested after the accident, found to be 6 ohms. The first of the two faults probably accelerated the appearance of the second by making the system temporarily a system with one phase at earth potential, as this made a connection to earth of some resistance probably very low. The fault at the coal-cutter caused another phase to be earthed, and the resistance between the two faulted phases would be made up of the resistance to earth of each of the faults plus the resistance of the armouring of the trailing cable and the main cable. Thus the resistance in the armouring of the trailing cable alone was such that to pass a fault current of 50 amperes a pressure of 300 volts or more may have arisen on the coal-cutter frame, a condition of things which clearly explains the accident.

At the Bardykes Colliery the current is also generated on

the three-phase system at 500 volts, and armoured cables are used throughout, except the trailing cables, which are provided with a fourth core for the purpose of earthing the frame of the coal-cutter to the armouring on the main cables. A coal-cutting machine had been left standing for about 15 minutes with the end to which the trailing cable was attached directly under a break in the roof from which a small stream of water was falling on to the trailing cable plug or attachment to the machine. This caused a breakdown of the insulation of the leads, and the frame of the machine to become "live," and the deceased man who was in contact with it, received a fatal shock. On investigation it was found that the pin which was provided with a collar for the purpose of making the "earth" connection when screwed into position, was too long, and the collar could not be screwed tight, and the earth connection was therefore not efficiently made, and as soon as the fault developed the accident occurred.

We are inclined to think there is an impression in connection with colliery working, that anything will do for an earth connection, and we are afraid that too much reliance is being placed upon the armouring of cables—and more especially when long lengths are considered—as necessarily they must fail if any heavy current is to be passed. It would have been interesting to know in the case of the Bredisholm accident, if the resistance of the trailing cable alone was 6 ohms, what the total resistance was. As we have frequently pointed out, it does not follow that because the armouring may be in contact with the walls of the mine, it is, so to speak, making by these contacts paths for the easy dispersal of leakage current through the strata to the "earth plates" which are sunk at the surface, but the armouring itself may—and in most cases we venture to think it does—form the only path for leakage current, and, consequently, if this should be high in resistance, as was the case in this instance, naturally it cannot be looked upon as a perfectly safe method of "earthing" any system. As the Inspector says: "It is obvious that if the resistance of the earth wire to the coal-cutter had been a fraction of an ohm, say, 0.6 ohm instead of 6 ohms, the fuse protecting the circuit would have been called into operation, and, almost certainly, without danger to the men, as the fuse would have blown before the pressure on the coal-cutter frame could have become dangerous."

As regards the other accident, it is not, we think, the first time an accident has occurred through a fault in the connecting bolt, or, at any rate, in the "efficiency" of the connection; and then, as the Inspector points out, "the plug should not have been allowed to be under the stream of water. Any unearthed machine frame not perfectly water-tight would become alive in these circumstances, and those in charge should have taken steps to protect the machine from the water by temporary means, or, if that were impossible, they should at once have switched the current off," and as regards the defect in the clamp pin, "these are matters which should be constantly inquired into by the higher officials and electricians," with which we agree, but it is just one of these little things which the "higher" officials have no time to deal with, and it would be much more satisfactory to instruct the man in charge of the machine not to put it to work unless every little detail was in perfect order, or if something goes wrong not to start the machine again until it is put right.

At Devon Colliery, where a road repairer was killed, three-phase current is generated at 650 volts, and the system is entirely insulated from earth. The current is carried underground by an armoured cable, and from a distribution box near the shaft a three-core unarmoured Dialite cable is carried into the seam to a distribution and switch-box, and from this box three single-core unarmoured Dialite cables are carried to two gate end boxes into two districts where coal-cutting machines are in use. The coal-cutter frames were earthed through a fourth core in the trailing cable to the gate end boxes, and from these 7/16 galvanised iron wires with soldered joints were carried from each district and joined together near the distribution box, and from thence continued by only one wire to a copper earth plate 2 ft. x 2 ft. x 1/4 in., to which it was bolted by a lug. The plate was placed in a clear water hole 6 ft. by 4 ft. by 3 ft. deep, and a good flow of water passed over it on its

way to the shaft. In moving the cables to carry out some repairs, one of them by some means or other "was hanging on top of the earth wire," and deceased was seen "twisted with his arm over the earth wire." Evidently the insulation of the cable had broken down, as "on the day following, or two days after the accident, Mr. Masterman found the cable had a hole 3/4 in. x 3/4 in. deep in it, the copper was pitted, and the insulation was also burned. A galvanometer test on the earth wire gave continuity, but the galvanised wire which was in the water-hole at the earth plate was extensively corroded. There were 9 ft. of wire under water, and some parts were worse corroded than others. He broke off one strand in bending the wire, the length of which was about 3 in., but the worst and, I think, the vital part was close to the lug, as four of the strands were eaten through and the remaining three looked less than 1/8 in., one of them being nearly half eaten away." Again, "the accident was due to the earth wire not being of sufficient capacity to disperse the leak without danger. The earthing system would have been more satisfactory if the earth cables had had greater conductivity . . . and if in addition to the earth plate below ground, the cables had been taken to a plate sunk at the surface." The italics are ours, and here again the impression that anything will do for an earth wire seems to have existed, and we may suppose that by putting the earth plates in running water, certainty of perfect "earth" would be doubly assured. To bury plates in a pond, whether of still or running water, is not necessarily ensuring good earth conditions, but often the reverse, and whatever was the reason for putting the earth plates below ground? And why should they mix up their cables with (1) an armoured shaft three-core cable; then (2) an unarmoured three-core cable; and (3) finish up with three single-core cables?

(To be continued.)

## LEGAL.

LITHOLITE, LTD., v. TRAVIS.

IN this case, Mr. Justice Joyce heard a motion in the Chancery Division on Friday, February 7th, to restrain the defendant from disclosing trade secrets or secret processes which came to his knowledge while in the employ of the plaintiffs as their works manager at Hackney Grove, and to restrain him from infringing plaintiffs' copyright in their catalogue or price-list of standard litholite and litholite articles.

MR. HUGHES, K.C., on behalf of the plaintiffs, said this was a serious case. The plaintiff company made electric fittings of a substance known as litholite. This was not a patent, but was made by a process known only to themselves, and they had a very large trade in bushes, handles, and other insulating appliances. In October, 1908, they employed Mr. Thos. Travis, the defendant, as their works manager, and a formal agreement was entered into in November, by which Mr. Travis agreed "to make over any new processes discovered by him during the time of his service or three years afterwards, and not to disclose any (of the plaintiffs) trade secrets, or secret processes of manufacture, or to use them apart from the company." Under that agreement, Mr. Travis worked for three years—until, in fact, he had acquired a full knowledge of the plaintiffs' business. That he had no such previous knowledge was shown by a letter written when applying for the post in 1908. In that, Mr. Travis said, "As I do not possess experience practically in your business, I would be the more zealous to acquire full and early competence." In January, 1912, Mr. Travis left the plaintiffs' employ, and it would appear that it then occurred to him to form or promote a company for the purpose of taking advantage of the knowledge he had acquired. Accordingly, in May, 1912, Insulators, Ltd., was incorporated, with a nominal capital of £2,000, of which Mr. Travis held £1,250 or £1,350, and two Manchester men named Carney and Smith held the rest. The office of the company was Hyde Road, West Gorton, Manchester. With that company, Mr. Travis entered into an agreement to act as manager, and to disclose all knowledge he had of the manufacture of electrical apparatus and details of manufacture. It was clear from the evidence that the company had manufactured electrical apparatus of the same substance as plaintiffs' manufacture, and which they called litholite. Further than that, the defendant company had copied the catalogues or price list of the plaintiff company and made use of the copies.

HIS LORDSHIP: What do they say about that?

MR. HUGHES: What is said is that the knowledge Travis is making use of on behalf of Insulators, Ltd., is not knowledge acquired in the service of the plaintiffs, though I think, that can hardly be true in view of his letters.

An affidavit by Mr. Alexander Russell, of Faraday House, was read, in which the deponent said that on chemical analysis he found the litholite made by Insulators, Ltd., to be made of the same ingredients, in substantially the same proportions, as that produced by the plaintiffs.

Proceeding, MR. HUGHES also read an affidavit filed by the defendant Travis, in which he said he had not disclosed any secret process, and it was not true that litholite was manufactured by the plaintiffs by a secret process; further, that litholite had been used by one Charles Heese, who had described it in a posthumous work as made of sawdust, dried blood, and bichromate of potash; and that in a catalogue issued by the plaintiffs themselves, litholite had been described as made of earthen, resins, and fossil guma. Further, that recipe of litholite was contained in a book published as early as 1886.

An affidavit in reply by Mr. Walter Theodore Hunt, of the plaintiff company, was also read by Mr. Hughes. In this Mr. Hunt said that plaintiffs' insulating material was not made of sawdust, dried blood, and potash, nor of earth's resins and fossil guma, as Mr. Travis inaccurately asserted to have been stated in a catalogue. The catalogue in question showed, said Mr. Hunt, that the insulating material made by his company was compounded of silicas carefully selected, fossil resins, &c., and the recipe did not appear in the book referred to.

MR. SHAW COOPER, on behalf of the defendant, argued that the process of manufacturing litholite was common knowledge such as he was entitled to use; and with regard to such a matter the agreement was not binding since it would be in restraint of trade if defendant should be restrained from using any process which was common property.

HIS LORDSHIP: Why? You are taken in to work certain processes for your employer, and you promise you won't use them apart from the employment. However, that may be a question for the trial.

MR. SHAW COOPER said that in the Technico Chemical receipt book published in 1886 and reprinted in 1895, there was a recipe for litholite used, in fact, by the defendant. This gave the components as mineral wax, asbestos, and tar. It was admitted that both the litholites were made by the same process, but this process was not a secret. In the letters of 1908, no doubt, Mr. Travis said he had no practical knowledge, but he had chemical knowledge which he might always make use of. There was no inconsistency between these statements.

HIS LORDSHIP: He has stolen part of his late employer's catalogue.

MR. SHAW COOPER denied that this was stolen; all that the man had done was to copy to save himself expense. However, he would not resist an injunction as to the catalogue. As to the other things, no injunction should be granted.

HIS LORDSHIP, in giving judgment, said, in his view, Mr. Travis was a very clever and unscrupulous person, and on the evidence the plaintiffs had proved quite enough for an interlocutory injunction. Defendant had certainly stolen part of the plaintiffs' catalogue, and, he believed, had violated the plaintiffs' secrets. On the usual undertaking as to damages in case his Lordship should prove to be quite wrong in his opinion (as he might be), and in case the defendant might succeed at the trial, he would grant an injunction.

#### THE OSRAM LAMP WORKS, LTD., v. THE ORA LIGHT CO.

In the Chancery Division on Friday, February 7th, Mr. Justice Swinfen Eady had before him a motion in this action.

MR. GRAY said it was a motion for an injunction. The parties had agreed that the motion should be treated as a trial of the action, and there should be an injunction by consent.

HIS LORDSHIP: An injunction for what?

Counsel for defendants said that he was instructed to agree to an injunction during the continuance of the letters' patents in the terms of the notice of motion, restraining defendant company from selling any lamps which were infringements of plaintiffs' patents, the motion to be treated as the trial of the action.

HIS LORDSHIP: That is an end of it then. Defendants pay the costs?

Counsel: Yes.

HIS LORDSHIP: Very well, treat the motion as the trial of the action; a perpetual injunction, and defendants to pay costs. Also an inquiry as to damages.

#### THE OSRAM LAMP WORKS, LTD., v. LOUIS SCHLOSS & CO.

In the Chancery Division, on Friday, February 7th, Mr. Justice Swinfen Eady had before him a motion in this action to restrain infringement of plaintiffs' patent rights in regard to electric lamps.

MR. GRAY appeared for the plaintiffs, and said that he understood the defendants wanted a fortnight's adjournment to get evidence from abroad.

HIS LORDSHIP: Where from?

MR. FROST, for the defendants, said they desired to obtain evidence from Brussels and Italy. The defendants in this case were not the manufacturers of the lamp complained of, "The Edna." They were under the impression that the filament of the lamp was manufactured by a firm in Brussels, but they had since discovered that it was in fact made in Milan. He (counsel) was assured that the filaments in question were made by a process quite outside the plaintiffs' patents.

HIS LORDSHIP allowed the matter to be adjourned for a week.

#### EDINBURGH TRAMWAY ACCIDENT VERDICT SET ASIDE.

In the First Division of the Court of Session, judgment was given in the application for a new trial by the Edinburgh and District Tramways Co., Ltd., in the action against them by a domestic servant for damages in respect of injuries. When the case was tried by Lord Hunter and a jury, a verdict was returned for pursuer, and the damages were assessed at £350. The First Division held that the verdict could not be allowed to stand, and assozied the defenders.

The LORD PRESIDENT held that it was pursuer's own negligence that led to the accident. On the question of expenses, the Court appealed to the company not to move for expenses, and counsel for the company agreed.

#### GLASGOW TRAMWAY ACCIDENT CLAIMS.

LORD DEWAR, in the Court of Session, has approved an issue for the trial by jury of an action by a vanman against Glasgow Corporation for £500 damages for personal injuries. Pursuer, whose van was run into by a car, attributes fault to the driver, while defenders deny liability, and allege that pursuer was not keeping a proper look out. In another action brought by a Govan riveter, the Corporation is sued for £1,000. The contention is that the car which knocked him down was going at an excessive speed.

#### HUGHES v. HOBART ELECTRIC MANUFACTURING CO.

JUDGE ALLEN, at Nottingham County Court, gave judgment for the defendants in an action brought by Mr. H. K. Hughes, of Nottingham, against the Hobart Electric Manufacturing Co., of America and London.

Plaintiff, who claimed £4 3s. 8d. for goods delivered, stated that he was formerly the tenant of a shop in St. Peter's Gate, Nottingham. He intended to leave the premises at the last March quarter-day, and the defendant company desired to enter the premises a fortnight before quarter-day. Mr. Forbes Leith, who described himself as the northern manager of the company, told Mr. Hughes that they wanted to take the shop as soon as possible, and plaintiff said he would forgo the fortnight's rent if Leith would give him the order to execute the lighting. To this Leith agreed, and the lamp, which was the subject of the present claim, was fixed, but when plaintiff sent his invoice to the company, they repudiated it, and referred him to Mr. Leith.

For the defence, MR. WRIGHT, the European manager of the company, stated that Leith was never their northern manager, and had no authority to order goods on behalf of the company. He was their district sales agent, and when witness found he had put up a plate describing himself as manager, he instructed him to take it down. He had no authority to pledge the company's credit.

#### WINDING-UP PETITIONS.

THE Rapid Magnetizing Machine Co., Ltd., petitioned in the Companies' Court, before Mr. Justice Swinfen Eady, on Tuesday, for the compulsory winding up of the Polack Manufacturing Co., Ltd. As there was a possibility of plaintiffs being paid, his Lordship allowed the petition to stand over for a month.

On Tuesday, in the Companies' Winding-up Court, Mr. Justice Swinfen Eady had before him the petition of the British Westinghouse Electric and Manufacturing Co., Ltd., for the compulsory winding up of the Garnant Anthracite Collieries, Ltd. Mr. Copping, for the respondent company, said the directors were in Paris, and they had hopes of reactivating the company. The petition was dismissed, without costs.

## BUSINESS NOTES.

**Fifty Years' Success in New Zealand.**—The story of the experiences of pioneers who went out to seek their fortunes in other lands many years ago, meeting privation and difficulty, and having to rough it, subsequently climbing over their difficulties, seizing opportunities, and building up a big fortune, always affords absorbingly interesting reading. And in these days of foreign and Colonial trade expansion, when nearly every other man appears to think that in order to get "on" he must get "out" of the country, interest in such achievements is not likely to lessen. We confess to feelings of admiration and almost envy at the progress of one of these pioneers and his associates, which we have been privileged to read in a brochure, "1862-1912," telling the story of the rise and progress of the firm of A. & T. Burt, Ltd., of New Zealand, which was issued on the occasion of their jubilee. Mr. Alexander Burt, the present chairman of the concern, went out from Scotland to Victoria in 1859, when 19 years of age, and after vicissitudes of many kinds, including gold-fever intervals, he started in New Zealand a small 15 ft. x 20 ft. workshop (plumbing and zinc working), being joined shortly after by a brother. The brochure tells of the advances, works extensions, new branches, engineers' shops, copper shop, lead-pipe making, core winding, iron-moulding shops, fitting shops, and so on, leading on to, or forming part of, the widespread business that the firm has to-day in Dunedin, Auckland, Wellington, Christchurch, Timaru

Invercargill, Port Chalmers and London. The directorate consists of five "Burts," including the founder already named. The capital of the concern is £100,000. The firm are the New Zealand agents of Messrs. Siemens Brothers Dynamo Works, Ltd., to whom we are indebted for the loan of this interesting book, and for whom Messrs. Burt secured the Auckland Corporation electrical contract (£33,000), which is now in hand. The firm's electrical department was opened 10 years ago, and our readers who know something about the electrical development that has been and is proceeding in New Zealand, will not be surprised to learn that this department has gone ahead by leaps and bounds. The firm's workshops at Dunedin, of course, have their own electrical power installation.

**Italy.**—According to *Il Sole*, a Venetian financial group, at the head of which is Commendatore Nicolo Spada, has completed the studies for the construction of an electric tube railway under the lagoon, with the view of uniting the city of Venice with the Lido—the long belt of lowland separating the lagoon from the Adriatic. The object of the scheme is to relieve the congestion of population in the city and counteract the constant rise in price of land, by the utilisation of the building land, which will be rendered available on the Lido. The course taken by the tunnel will be in the direction of the Giudecca, the largest of the islands in the lagoon, connection with which will also afford an opening for the expansion of the population outwards. When realised the tube will necessarily lessen the navigation dues now paid by shipping crossing to the Lido, but this will be set off by the increased demand for energy from the city's generating station at Cellius, which will ensue.

**Reduction of Capital.**—MILLER & SONS, LTD.—A petition for confirmation of reduction of capital from £30,000 to £18,447 has been presented. Notice appears in our advertisement page.

**Book Notices.**—*Manuel Pratique de Soudure Autogène.* By R. Granjon and P. Rosenberg. Paris: Office Central de l'Acetylene. Price 5 fr.—Naturally, this book deals only with acetylene welding, but it does so in a very complete fashion. The nature and properties of the blow-pipe flame, the various applications of autogenous welding, the manipulation of gas bottles and acetylene generators, the welding characteristics of the different metals, welding machines, &c., are all fully treated of, with numerous illustrations of the wonderfully clever work that is regularly accomplished with the oxy-acetylene flame. Anyone who is concerned with welding or cutting with the blow-pipe will find this book both interesting and instructive, and our only regret is that it is marred by a brief, but wholly unjustifiable and untrue, attack on electric welding.

*Annuaire International de l'Acetylene.* 1912. Price 3 fr.—This annual, by the same authors and publishers as the foregoing, contains a mass of information relating to acetylene and calcium carbide, in all their varied applications. The use of acetylene for lighting purposes is very fully dealt with; owing to the keen competition of electricity and coal gas, not a score of examples of public supply of acetylene exist in the United Kingdom, and the places named in the list given in the *Annuaire* are almost all villages of one or two thousand inhabitants. Our consumption of carbide for all purposes in 1911 was about 16,000 tons, an increase of 2,000 tons; the only factory making carbide in this country is that at Thornhill, with a production of 2,000 tons per annum. The principal producers of the world are Sweden and Norway, with a joint output of 52,000 tons a year, and the United States, 50,000 tons; next come France, 32,000; Switzerland, 30,000; Italy, 28,000; Austria-Hungary, 22,500; Spain and Portugal, 18,000; and Canada, 12,000 tons a year. The world's production in 1910-11 was 268,700 tons, exclusive of carbide for the manufacture of cyanamide, of which 20,000 tons was produced. A table of costs of various illuminants is given, accompanied by the remark, regarding electric lamps, that the candle-power falls off rapidly, and that this is an important consideration in view of the high cost of metallic-filament lamps. The writer of this libel ought to be aware that the candle-power of metallic-filament lamps falls off very little indeed, and that of arc lamps not at all.

*Annuaire du Bureau des Longitudes pour l'Année 1913.* Paris: Gauthier-Villars. Price 1 fr. 50.—This year the *Annuaire* contains, in addition to the astronomical data, tables relating to geography, statistics, metrology, &c., but not physics and chemistry, which will appear next year. One of the special articles is by Commandant Ferrié, on the application of wireless telegraphy to the transmission of time, which has in recent years assumed great importance. By this means comparisons of time at different places can be made to an accuracy of one or two hundredths of a second.

*Recherches sur la Commutation dans les Dynamos à courant continu.* By A. Mauduit. Paris: Dunod & Pinat. Price 9 fr.—In this work the author embodies a critical discussion of the theory of commutation together with the details and results of his own investigations. The first part deals with the development of the theory, from the work of Reid to the Arnold equation, and the successive steps in the elucidation of the numerous problems and difficulties met with in the endeavour to reconcile the phenomena observed in practice with the conclusions derived from theoretical principles. In the second part the author shows how he has endeavoured, by separate investigation of the many variable factors met with in the complex operation of commutation, to arrive at definite laws governing the relations of these and to deduce working formulae for the guidance of the designer. He finds that contact resistance plays a much less important part in commutation than is generally supposed, and that consequently the accepted theories, based upon inaccurate hypotheses, lead to results of no great practical value.

*The Arbitration Clause in Engineering and Building Contracts.* By E. J. Rimmer, Barrister-at-Law. London: Constable & Co. Price 2s. net.—This little book states that the powers of an engineer under a contract for engineering or building works have been seriously undermined by recent decisions in the Court of Appeal and the House of Lords. The author considers the effect of these decisions, and suggests modifications which may be made in engineering contracts for the better security of the settlement of disputes by arbitration.

*Electric Power Transmission by Aluminium Conductors.*—By issuing this pamphlet, which brings together in convenient form a mass of information relating to the electrical uses of aluminium, the British Aluminium Co., Ltd., have benefited not only themselves and their clients, but also all engineers who are concerned with overhead transmission lines. The cost of aluminium conductors at present prices is about 10 per cent. less than that of copper conductors, and consequently the use of aluminium is extending in all parts of the world; the development of water-powers, which are usually situated far from large centres of population, tends to increase the importance of the subject, and many concerns of the first magnitude have adopted the metal for very extensive transmission undertakings. Particulars regarding the physical characteristics of aluminium wire, very fully detailed and compared with those of copper, are followed by tables of standard sizes, resistance and weight. The regulations laid down by various Governments for overhead lines are then given, and the restrictive effect of an excessive factor of safety is referred to, a value of three being recommended (used in France, Germany and Austria), instead of five, as specified by our Board of Trade; a factor of safety of two is often used in the U.S.A. and Canada, where probably more aluminium lines are used than in any other part of the world. The torsion-sleeve joint is recommended. Other tables are given which facilitate the calculation of transmission lines, as well as charts and diagrams, and data are included showing the relative costs of copper and aluminium lines, complete with towers and insulators, &c. The pamphlet will prove to be a valuable work of reference.

*Abstract Bulletin of the Physical Laboratory of the National Electric Lamp Association, Cleveland, Ohio, U.S.A.* Vol. I, No. 1. From the Laboratory.—This is the first published collection of abstracts covering all the researches carried out in the Laboratory from its inception, in 1908, to the summer of 1912, under the supervision of the director, Mr. E. P. Hyde, and is intended to bring together the principal results that have been obtained, the abstracts being fairly lengthy and fully illustrated. References are given to the various journals in which the original papers (28 in number) were published *in extenso*, so that those who desire more complete information will have no difficulty in obtaining it. The researches deal with a wide range of phenomena in connection with light and radiation in general, visual acuity, photometry and other matters relating to light and illumination, and represent a vast amount of original investigation of the highest order. The issue of this useful summary of the results obtained cannot fail to be of great service to those interested in illuminating engineering.

*L'Année Electrique, Electrotherapie et Radiographique.* By Dr. Foveau de Courmelles. 1913. Paris: Ch. Béranger. Price 3 fr. 50.—This annual review is now in its thirteenth year, and constitutes a summary of all the new facts and developments which have occurred during the past year in the electrical field. It is divided into chapters, each of which deals with a separate subdivision of the science, covering all its domestic and industrial applications, as well as the use of electricity in therapeutics, references being given to the publications from which the information is derived, so that those who desire further details on any point can readily obtain them. Its scope is cosmopolitan, and as a handy record of the year's progress, it certainly fills a niche of its own, its popularity being attested by its arrival in its "teens."

*The Engineer's Year-Book of Formulae, Rules, Tables, Data, &c., for 1913.* By H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 12s. 6d.—Some things are never appreciated at their true value until one is deprived of them, and from personal experience we can apply this saying to "Kempe's Year-Book," for having recently suffered the loss of our office copy, we have had it borne in upon us, more than ever before, that we cannot do without it. That we are not alone in this conviction is shown by the fact that the year-book is now in its 20th year of publication; it is quite a bulky volume, containing nearly 1,600 pages and over 1,250 illustrations. Much matter has been cut out, but still more has been added, and the process of division into sections, begun two years ago, has been continued, although it has involved, for instance, the rearrangement of the whole of the "Steam" section, which now consists of six parts. The part which relates to steam turbines has been entirely rewritten by Mr. H. L. Guy. There are new sections on Roads, Marine Diesel Engines and Legal Notes for Engineers, all by specialists, whilst very many existing sections have been revised and some have been largely extended. A novel feature is a summary of engineering progress during 1912, and, by special permission of the Engineering Standards Committee, abstracts of a large number of the Committee's specifications have been included.

To review the contents of this standard work would be as arduous as it would be superfluous; clearly it needs no recommendation. We shall be content, therefore, with saying that we give a hearty welcome to the new issue.

*Sell's Directory of Registered Telegraphic Addresses.* London. 25s.—As many of our readers know, this work is published annually, and is compiled from Official Lists supplied by the authority of the Postmaster-General. The 1913 edition contains 2,500 pages of names, postal addresses, telegraphic addresses, trades and telephone numbers. This year it contains the first Official List of the new "Indicator" words for London Telegraphic Addresses. In

addition to ordinary changes in style and in addresses of Registrants, there are about 20,000 "Indicators" added, necessitating the alteration of as many telegraphic addresses. An Alphabetical Index of the Registered Telegraphic Addresses in use throughout the United Kingdom forms Section II of the volume, and each address bears a reference to Section I where the names, postal address and full business particulars will be found. A useful division of the book is that containing a classification of trades for the whole country. There are over 3,000 separate Trade Headings, under which are arranged in alphabetical order about 100,000 British firms according to their respective trades or professions. The publisher has also added a representative list of Colonial and foreign firms, arranged by countries and towns, with their trade and cable address. The preliminary pages contain notes on Business Prospects for 1913; and one on the Post Office, 1911-12. To the business man the recital of the list of contents of the book is sufficient without any further commendation.

*The South African Mining Directory and Monthly Handbook of Chief Officials of the Mines.* Johannesburg: The South African Mining Directory, Ltd. No. 1. November, 1912. 7s. 6d.—The usefulness of this publication must be obvious from its title. To all interested in electrical and engineering trade with South Africa a frequently revised list of names of mine buyers, managers, engineers, electrical engineers, secretaries, &c., can hardly fail to be of value, in view of the changes that are taking place every month. There is an alphabetical list of mines on the Rand, also of "Outside" Transvaal and Natal gold mines, Natal collieries, copper companies, South African railways, Johannesburg municipalities, industrial concerns, and their chief officials. We notice a full list of the engineering officials and staff of the Victoria Falls and Transvaal Power Co., Ltd.

We have received a copy of the first number of a new American monthly contemporary, *The Lighting Journal*, which is edited by Norman Macbeth, and published at 10 cents per copy by the Lighting Journal Co., of 50, Church Street, New York. A number of useful articles relating to electrical and gas illumination—"everything between the meter and the eye"—appear in this number (January).

"Characteristics of Induction Type Alternating-Current Watt-hour Meter." By A. Ohya and R. Mitsuda. 1912. Tokyo: The Electro-Technical Laboratory.

"Mine Fires and How to Fight Them," by James W. Paul; "Accidents from Falls of Roof and Coal," by G. S. Rice; "Coal Mine Accidents in the United States, January to August, 1912," by F. W. Horton; "Training with Mine-Rescue Breathing Apparatus," by J. W. Paul; "Smoke Abatement and City Smoke Ordinances," by S. B. Flagg; "Ignition of Gas by Standard Incandescent Lamps," by H. H. Clark; "Methods for the Determination of Water in Petroleum and its Products," by I. C. Allen and W. A. Jacobs; "An Investigation of Explosion-Proof Motors," by H. H. Clark; "Comparative Fuel Values of Gasoline and Denatured Alcohol in Internal-Combustion Engines," by R. M. Strong and Lauson Stone. Washington: Government Printing Office.

"Journal of the American Society of Mechanical Engineers." February, 1913. New York: The Society. Price 35 cents.

"Bulletin of the American Institute of Architects." Vol. XIII, No. 3. October, 1912. Washington: The Institute.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 2. January 31st, 1913. With index to Vol. XVI. Milan: Stucchi, Ceretti & Co. Price L. 150.

"Bulletin of the Imperial Institute." Vol. X, No. 4. December, 1912. London: John Murray. Price 2s. 6d. net.

"Charter, Bye-Laws and List of Members of the Iron and Steel Institute, 1913." London: The Institute. Price 1s.

"The New Steam Tables." By C. A. M. Smith and A. G. Warren. 1913. London: Constable & Co., Ltd. Price 4s. net.

"Annual Report of the International Electrotechnical Commission, 1911." London: Waterlow & Sons, Ltd.

"Journal of the South African Institution of Engineers." Vol. XI, No. 6. January, 1913. Johannesburg: The Institution. Price 2s.

*Proceedings of the American Society of Civil Engineers.* Vol. XXXIX, No. 1. January, 1913. New York: The Society.

*Bulletin de la Société Internationale des Electriciens.* Vol. II, No. 20. December, 1912. Paris: Gauthier-Villars. Price 2 fr. 50.

*Boletín de Ingenieros.* Vol. III, No. 4. December 16th, 1912. Mexico: Departamento de Ingenieros de la Secretaría de Guerra.

"Science Abstracts," Sections A and B. Vol. 16, part 1. January 31st, 1913. With indexes to Vol. 15. London: E. and F. N. Spon, Ltd. Price 1s. 6d. each.

**Electrical Manufacturing in Japan.**—The Shibaura Seisakujo Ironworks, at Shiba, Tokio, which doubled its capital to £200,000 in 1911 by combining its interests with those of the General Electric Co. of the United States, at the same time devoting itself to the manufacture of electric appliances, has met with such a heavy demand for its productions that the directors have now thought it necessary to increase the company's capital to £500,000.

**Mazda Lamps for Stage Lighting.**—The initial strength and long life of the Mazda lamp under most severe conditions of service are well shown by an incident which recently occurred at the Theatre Royal, Elephant and Castle; many of the drawn-wire lamps supplied by the B.T.H. Co. to the theatre are still in use after two years, burning an average of three hours a day, in spite of great vibration. The manager had 88 put in a stage batten some time ago, and in fixing it the whole iron frame was accidentally dropped about 10 ft. Only one bulb and seven filaments were broken. A similar incident occurred

some months ago at the Prince of Wales Theatre, Birmingham. One of the scene-lighting battens containing 100 Mazda lamps was being raised, when the ratchet on the winch slipped. One side of the batten dropped a distance of about 5 ft., and then the ratchet re-engaged with a jerk. The lamps were unlighted at the time, and were, therefore, in their most fragile condition; but when they were switched on, it was found that not one had been injured.

**Installation Contracts.**—The following are some of the works that are being executed by MESSRS. HELLYAR & SONS, LTD., of Barnes, S.W.:—

The "Firs," Chesham Bois,—Electric lighting installation.  
St. James's Vicarage, Bury St. Edmunds,—Extensions to electric light installation.  
Alterations to electric light plant at Rowallen, Haslemere, Surrey.  
Temperature control, for the United Newspapers, Ltd., 12, Salisbury Square, E.C.  
Two switchboards, for Messrs B. S. Lloyd & Co., King Street, E.C.  
The "Beaufort Arms" Hotel, Monmouth, Wales,—Complete plant, lighting, heating and bell installation.  
Electric light installation in the Church, North Camp, Aldershot.

**Catalogues and Lists.**—THE BRITISH ALUMINIUM CO., LTD., 109, Queen Victoria Street, London, E.C.—Four-page illustrated list relating to the casting of aluminium and the properties of metal for foundry work.

THE ELECTRIC CONSTRUCTION CO., LTD., 9, New Broad Street, London, E.C.—Four-page illustrated list No. B/317, containing description and tabulated prices of E.C.C. cinematograph motor-generators for C.C. and A.C. supply.

MESSRS. RIEHLE BROS.' TESTING MACHINE Co., Philadelphia, Pa., U.S.A.—Illustrated and other leaflets concerning the Riehle testing machines for chains, cement, road materials, &c.

MESSRS. CARSON & EVANS, 3, Fenchurch Buildings, London, E.C.—Postal card relating to their ebonite and vulcanite; also a folder giving particulars of a new and cheaper material known by the name "Carvanite," for meeting requirements where a lower priced material than ebonite or vulcanite is wanted.

MESSRS. EASTMAN & WARNE, 241, Acton Vale, London, W.—Small leaflet describing the "Belenus" electrically-heated branding irons.

THE ELECTRICAL CO., LTD., 122-124, Charing Cross Road, London, W.C.—New 20-page illustrated price list of their "Aegma" drawn wire lamps. Some notes on lamp manufacture are given. Also a folder entitled "Under Association Rules," stating a number of points in favour of the "Aegma" lamp. Wall showcard (approximately 10 in. x 15 in.) to advertise their "Aegma" drawn-wire lamps.

THE LEA RECORDER Co., 32, Deansgate, Manchester.—Two illustrated circulars: W1, giving a description of Lea's patent integrator for totalising the flow of water over V notches and weirs and W2 showing one of these apparatus supplied to the New South Wales Government for measuring up to 20,000 gallons per hour.

THE BRIMS DOWN LAMP WORKS, LTD., Kingsway House, London, W.C.—We have received a set of eight picture postcards illustrating the various uses of "Wirum" lamps—including street, shop, ship and dock lighting, train and tram lighting, also private house and public building illumination.

THE BRITISH L.M. ERICSSON MANUFACTURING CO., LTD., Beeston, Nottingham.—40-page catalogue (Section "H") in expanding binding cover. It contains excellent half-tone illustrations, descriptive notes, dimensions, weights, and code-words, of inter-communication telephone instruments of all types and sizes. Relay boxes, junction boxes, and cable are also particularised. A section of eight pages in the front of the book gives, in neat tabular form, prices of the different items listed. A line to which special attention is directed is the type H K 100 secret intercommunication table telephone for metallic circuits.

MESSRS. M. K. COOPER & Co., 27, Oswald Street, Glasgow.—A number of illustrated folders and leaflets relating to the following: The "Regina" electric cleaner, the "Regina" pneumatic sweeper, the "Thor," electric home laundry machine, and the "Shaler" electro stove and electropod.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—New publicity literature in their standard form and style as follows:—No. 397 (40 pages) fully illustrating and particularising a variety of overhead line material; No. 393 (eight pages), starting rheostats for C.C. motors; No. 394 (four pages), A.C. prepayment watt-hour meter (single-phase house service); No. 396 (four pages), overhead trolleys; No. 391 (four pages), electric flat-irons; No. 390 (four pages), brake magnets; No. 392 (four pages), electric soldering, branding and burning tools. Advance proof of new price list describing very fully, with illustrations, the B.T.H. hand-operated starting compensators.

MR. H. MOSS, 116, Horton Grange Road, Bradford.—Folder, (with 1913 calendar on front page) giving hints to electricity users; also a leaflet relating to country house lighting, describing the two-cylinder "Pelapone" lighting set.

THE BIRMINGHAM MANUFACTURERS' SUPPLY CO., 17, Easy Row, Birmingham.—The firm are wholesale distributing agents for Messrs. F. J. Bayley & Co. (Mr. F. Sumner Bayley is a principal in the firm), and they have issued a brochure giving some particulars of "Ssub" (suet and tallow substitute), and its applications as a lubricant, and also testimonials from users. Any reader can, by applying, have a 10-lb. tin free for trial purposes.

THE STELLING TELEPHONE AND ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—Illustrated revised price list relating to their Sterling "permitted exploders" for shot-firing in coal mines, quarries, &c.

THE METALLIC SEAMLESS TUBE CO., LTD., "Meta" House, Corporation Street, Birmingham.—Postal card showing, and giving prices of, "Meta" electric irons.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., 38 and 39, Upper Thames Street, London, E.C. Twelve-page list containing full technical description, illustrations, prices, &c., of their new double enclosed lamp arc lamps for A.C. for the lighting of large areas, such as streets, docks, or works.

**Edmundson's Showrooms.**—The showrooms of EDMUNDSON'S ELECTRICITY CORPORATION, LTD., in Tot Hill Street, Westminster, form a good example of what can be done by the actual suppliers of electrical energy to popularise the use of electricity. We understand that practically every reliable device for heating and cooking is on view, and can be demonstrated on circuit to customers, while lamps, fittings and glassware for electric light installations are shown in great variety. In the cooking section there are various types of electric ovens. The individual electric kettle, with detachable heating element, is shown in several styles, whilst electric irons of various weights may be seen and handled. There is a fine selection of radiators on view, embodying practically every available design of luminous, hot bar and convector types, a specially cheap radiator known as the "Edmund," being on sale at a very low price, proving that the production of electrical apparatus is being cheapened. An interesting part of the display at the present time is the collection of fittings and shades, from the purely



EDMUNDSON'S SHOWROOM.

decorative type with silk shades, to the more modern varieties in which beauty and efficiency are combined by the use of Holophane glassware. Many examples of this are shown in a special window display which has recently been arranged. Holophane reflectors are shown, with a card demonstrating their efficiency, stating the reflected candle-power given at various angles. In addition, a 10-in. reflector and a bank unit direct their light directly into the eyes of the passer-by, demonstrating both light intensification and effective direction. A number of "Household" types of Holophane are also shown, as well as the new Holophane inverted fitting, with a 100-C.P. "Wotan" lamp. Another item of interest is a semi-direct lighting unit which has a Ceonix bowl, an opalescent glass richly marked in amber, giving, when lighted, a delicate rose tint to the lighting. This set has a high lighting efficiency, as the bowl reflects a large proportion of the light, and is accurately shaped to ensure even distribution. There is also a show of "Wotan" and tantalum drawn-wire lamps, which is made all the more effective by an illuminated tower lent by Messrs. Siemens Bros. Dynamo Works, Ltd., Dalston, which demonstrates the complete range of "Wotan" lamps in bell-shaped bulbs, from  $\frac{1}{2}$  to 100 C.P. We reproduce a photograph of the interior of the showroom.

**Trade Announcements.**—THE BALDWIN ENGINEERING SUPPLY CO., LTD., have opened offices and stores at 39, Victoria Street, Westminster, for the supply from stock of electrical accessories, wires, carbons, conduits and fittings, &c.

THE LIVERPOOL FITTINGS Co. have recently fitted up and opened a showroom at 55, Renshaw Street, Liverpool, for the sale of electric light fittings, heating and cooking apparatus, Holophane glassware, vacuum cleaners, &c.

MESSRS. JULIUS SAX & CO., LTD., of 24A, High Street, New Oxford Street, London, W.C., announce that their telephone numbers are now Regent 2101 and 2102.

**Bankruptcy Proceedings.**—W. LONGDON and V. G. COBB (trading as Longdon & Cobb), electrical engineers, 101A, Derby Road, Nottingham. The first meeting of creditors herein was held at the Official Receiver's office, 4, Castle Place, Park Street, Nottingham, last week, when the statement of affairs showed liabilities amounting to £291, and assets estimated at £45, leaving a deficiency of £246. The failure was attributed by the debtors to want of capital and bad debts. It appeared that the debtors started

trading in partnership towards the latter end of March, 1912, at the above address. Their capital consisted of stock and book debts and other assets of the business formerly conducted by Longdon, which were valued at about £350, less outstanding debts, about £300, leaving a surplus of £50 to be credited to Longdon as his share of the capital. The debtor, Cobb, put in a capital of £150 in cash, and a sum of £30 cash was put in by a relative of Cobb. The drawings of the partners were to be 40s. and 30s. a week respectively for the first 12 months, and afterwards an equal share of the profits. Until February, 1908, the debtor, Longdon, worked as a journeyman electrical engineer, but at that date he started trading on his own account in Cromwell Street. He removed three months later to 101A, Derby Road. A private meeting of the creditors was held in November, but negotiations for the payment of a composition fell through, as the debtors were unable to find the necessary security. Several creditors questioned the debtors regarding the disposal of furniture and effects, and the meeting then terminated.

CHARLES SPENCER NORTHCOLE, electrical engineer, 67, Stanthorpe Road, Streatham, London.—Receiving order made December 10th, on a creditor's petition. First meeting of creditors February 19th, at 132, York Road, Westminster Bridge Road, S.E. Public examination February 27th, at Court House, Wandsworth.

**For Sale.**—The Aberdeen Royal Asylum has for disposal two Crossley gas engines, Dowson gas-producing plant, and two dynamos. The Sunderland Corporation has for disposal a quantity of steam-driven generating plant. See our advertisement pages in this issue.

**Dissolutions and Liquidations.**—PROVINCIAL ELECTRICAL CO. LTD.—This company is winding up voluntarily, with Mr. T. B. Scattergood, Edmund Street, Birmingham, as liquidator. A meeting of creditors is called for February 11th.

ELECTROLYTIC APPARATUS SYNDICATE, LTD.—A meeting will be held on March 10th, at 34, Norfolk Street, Strand, W.C., to hear an account of the winding up from the liquidator, Mr. W. Renison.

LUMB ELECTRICAL BLEACHING CO., LTD.—A meeting is called for March 18th, at Prudential Buildings, Queen Street, Nottingham, to hear an account of the winding up from the liquidator, Mr. W. B. Winnicott.

## LIGHTING and POWER NOTES.

**Atherton (Lancs.)**—The B. of T. has formally approved of the placing of overhead lines for the supply of electrical lighting to various large residences in the Westhoughton district.

**Australia.**—The W.A. Government having bought the Perth tramways, and the City Council having purchased the Electric Lighting Co.'s undertaking, an agreement has now been arrived at for establishing a Government power plant for both purposes. A 9,000-kw. plant for three-phase generation is proposed, at a cost of £162,000; working independently, a new tramway station would cost £100,000, and a new electric lighting station £132,000. A report on this scheme is being prepared by Mr. C. H. Merz and Mr. Wilson.

**Balderton (near Newark).**—The Parish Council of the village (population, 2,824) proposed to proceed with a scheme to light the streets with electricity from a supply provided by Messrs. Simpson, Ltd., ironfounders. This was last March, and the electors sanctioned an expenditure of £650. Meantime, the price of trade materials has gone up 25 per cent., and the Council proposed to substitute aluminium for copper wire, and wooden standards for steel, in order to effect a saving. A parish meeting was then demanded by a requisition of ratepayers, and a resolution protesting against the Council's action in altering the original scheme, was passed last week. The L.G.B. has written stating that it will raise no objection to the altered proposals. It now remains to be seen whether the Parish Council will carry out the scheme before the election is held in March.

**Bath.**—At the meeting of the Surveying Committee on Monday, the Street Lighting Committee submitted three schemes for the further conversion of gas lamps to electric lighting, and it was decided to carry out one scheme, costing £140 immediately, and to provide in the estimates for the others, costing £127 and £94 respectively.

**Birmingham.**—The B. of T. has made an order for cesser of powers of the Shropshire, Worcestershire and Staffordshire Electric Power Co. as to the part of the area which has been included in the enlarged Birmingham city area. The portions include Handsworth U.D., Yardley R.D., and a portion of the U.D. of King's Norton and Northfield.

**Bolton.**—The Electricity Committee has received applications for supplies of electric current to the following mills:—Messrs. Slater & Co., Little Bolton Bleachworks; Messrs. R. Eatwistle & Co., Lincoln Mill; the Victoria Mill, Nelson Street; and Messrs. Winder & McKean, Bradford Mill.

**Burton-on-Trent.**—A sub-committee has been appointed to prepare and bring up a final report as to the establishment of an electricity showroom.

**Canada.**—The preliminary report of the Hydro-Electric Commission for the working during 1912, shows a total revenue of \$511,801.88, and expenditure amounting to \$466,635.43; the surplus has been set aside as depreciation reserve. The loads during the quarters of the year were: 43,149 H.P., 58,326 H.P., 64,306 H.P., and 80,723 H.P. The total capital expended was \$4,168,824, including \$2,256,129 on transmission lines, \$1,322,806 on transformer stations, \$542,088 for right-of-way, and \$17,803 on distributing stations.

**Continental Notes.**—**GERMANY.**—The Kreis Council of St. Gear has empowered the Committee to sign a contract with the A.E.G. for the electric lighting of the whole district. Extensive enlargements of the power station at the State salt mines at Bleichrode are to be carried out, and the Prussian Budget disbursements include a fresh instalment of £10,000 for the purpose. The power station at Memel, which is the property of the Memel Light Railway Co., is to be converted into a bulk supply station, with a view to supplying light and power to the whole of the district, including the City of Memel. A high-pressure network is to be installed.—*Elektrische Nachrichten.*

**NORWAY.**—The Norwegian Government has raised a loan of 365,000 kroner for the improvement of the Port of Narvik; among the improvement works contemplated is the erection of a power station. The occasion affords opportunities for the supply of electrical material, including probably electric cranes, &c.

It is proposed to build a hydro-electric station with a capacity of 200,000 H.P., which will be worked by the State, and will supply current to Christiania and Western Norway. The station, which will be situated in Numedal and will utilise the Nore Falls, 420 metres high, will be equipped with 11 20,000-H.P. and two 10,000-H.P. turbines. The current will be employed to work the railways, in the first place, and for lighting, &c.—*Journal Pratique de l'Electricité.*

**Darwen.**—Speaking at a meeting last week, Councillor Jepson said that during the year to meet increased local electricity demands, new plant had been installed at the works. A large number of consumers had been connected requiring current chiefly for power purposes, and the inquiries were coming in freely. New consumers connected during the year would mean an increase in units sold of 1,150,000 units per annum, and the output for power purposes had been trebled during the last 12 months.

The Darwen Spinning Co. has made application to the Corporation for a supply of electricity for motive power.

**Derby.**—Considerable discussion took place at a meeting of the T.C. on a request of the E.L. Committee for a grant of £13,500 for the purchase of certain plant required in connection with the rearrangement of the electric power station. The Committee proposed to scrap two small machines of 200 kw. and install one that would bring the capacity up to 7,450 kw. It was anticipated that the new machinery, after allowing £800 for interest and sinking fund, would effect a saving of £2,000 per annum. Councillor Green characterised it as only half a scheme at the best, and the works as a white elephant. The site was unsuitable. Any private firm could compete with the Corporation in making electricity, and he himself was beating it in the prime cost of production. Aldermen Hart and Fisher both condemned the idea of raising the money required by means of a loan. The former pointed out that the outstanding debt on the undertaking was £230,000, of which £50,000 was in respect of machinery. The Council rejected amendments directed against the suggestion to obtain a loan for the plant. The Committee's recommendations were approved, and the question was referred to it of the best means of dealing with the money.

**Dundee.**—The new sub-station at Larch Street will be in operation in a few days, and the excavations on the site for Carolina Port main generating station extension are well in hand, and pile driving will be started immediately.

**East Sussex.**—The C.C. has decided to oppose the Bills of the Mid-Sussex Electric Light Co. and the Crowborough District Gas and Electric Light Co.

**Epsom.**—The U.D.C. has agreed to supply current to the B. of G. for the workhouse buildings at 1d. per kw.-hour for power, with a minimum quarterly consumption of 3,000 units, and ½d. per kw.-hour for all over 12,000 kw.-hr. per annum; for lighting, a flat rate of 3d. on a guaranteed annual consumption of 10,000 units, will be charged.

**Galashiels.**—A Committee of the T.C. has had a meeting with a deputation of manufacturers interested in the introduction of electricity for power purposes. The question of the T.C. taking up the matter, or consenting to the installation being undertaken by a local company, was discussed. The whole question was remitted to a Special Committee for further consideration.

**Gillingham (Kent).**—The T.C. has decided to give a supply of current to the proposed new cement works to be established in the town at 62½d. per kw.-hour for the first million kw.-hr. per annum and 6d. per kw.-hour beyond; the amount of energy to be supplied is to be not less than 2½ million kw.-hours per annum, and the contract is to be for five years. The new cement works are being erected by Mr. J. R. Featherby.

**Grimsby.**—We have received from Mr. W. A. Vignoles, the borough electrical engineer, a copy of the second edition of his 'Electricity Consumers' Guide,' an 18-page booklet in five sections, giving such information as the inquiring consumer may want, bearing on systems of charging, probable cost, wiring,

suggestions for lighting, heating, cooking, &c. We congratulate the author on paragraph 16, which reads, "Great care should be taken to get rid of old gas pipes . . . this will entirely prevent any chance of a leakage of gas occurring."

**Harrogate.**—The T.C., on Monday, decided to apply to the L.G.B. for a loan of £6,250 for extensions to the electricity plant.

**Hastings.**—The manager of the Gas Co. having disputed the alleged saving of £91 during 1912 by the substitution of electric light for gas at the Hastings Workhouse, the chairman of the Electricity Committee was questioned at a meeting of the Corporation. He said the profit to the ratepayers by laying the mains to the workhouse was at present not less than £140 a year, that in five years' time, when the Guardians have paid off their loan for installation, the net saving to the ratepayers will be at least £230 a year.

**Hove.**—According to the *Express*, the voting in connection with the Bill for acquiring the local electricity undertaking resulted in 1,384 for and 1,015 against proceeding with the matter.

**Kendal.**—The Electricity Committee has decided that the manager be instructed to prepare an estimate for the installation and fittings for street lighting in the borough.

**Kettering.**—The Management Committee of the Kettering and District General Hospital has decided to have the electric light installed at the institution at a cost of about £200.

**Liverpool.**—The report submitted by Mr. Harold Dickinson, city electrical engineer, at the meeting of the Corporation, on January 5th, states that during the past year the reconstruction of the Lister Drive No. 1 station, consequent on the replacement of the high-speed engines by turbines, had made fairly satisfactory progress, and during the latter part of the year two sets of direct current turbo-generators, each of 2,000-kw. capacity (British Westinghouse), and one 3,500-kw. turbo-alternator set (British Thomson-Houston) had been put into commercial service. The remaining 3,500-kw. turbo-alternator on order would shortly be delivered, thereby increasing the capacity of No. 1 station from 8,000 to 11,000 kw. Dealing with the second portion of the reconstruction scheme, involving increased boiler plant to deal with the increased size of generating units, Mr. Dickinson advocated water-tube boilers, and said it would be possible to lay down four generating sets of 5,000 to 6,000-kw. capacity each, instead of two of 3,500-kw. each, and by this means postpone the necessity for erecting a new power station. The estimates included the displacement of two batteries of Lancashire boilers (seven boilers to each), which would cover half the reconstruction scheme; but the Committee would probably prefer to commence with only one battery, which would provide ample steam for 1913 for the No. 1 station, the cost being approximately £24,500. With the provision suggested, there would be ample capacity of plant to provide for the load during 1913; but further generating plant should be provided of 5,000 to 6,000 kw. capacity for the winter of 1914, and in view of the long period taken by the contractors for delivery, he considered that the order should be placed for the plant as early as possible. Regarding Pumpfields Station, which was being run less efficiently, Mr. Dickinson recommended that transforming plant supplied with high-tension energy from Lister Drive, should be installed, which would enable Pumpfields to be shut down for the greater part of the year.

The annual accounts of the electricity department show a total revenue for the year ended December 31st last of £285,803, and a balance carried to net revenue account of £169,292, which, with interest accrued, amounted to £172,363. Interest and sinking fund absorbed £65,615 and £55,628 respectively; £1,048 was transferred to reserve and £20,000 to renewals, and the balance of £30,071 was contributed to the general rate. The reserve fund amounts to £178,508, and the unexpended balance of the renewals fund to £120,000. The outstanding capital expenditure amounts to £1,560,000.

**London.**—**WESTMINSTER.**—The Works Committee reports having had under consideration the question of the Council's contract with the Charing Cross Electricity Supply Co., for lighting the parish of St. Martin-in-the-Fields, under which the Council has the option to determine the contract at the end of the fourteenth year of the contract, viz., on September 17th next, provided notice be given on or before March 17th; and if the option is not exercised the contract will run for the full period of 21 years. The Committee states that the termination of the contract in the fourteenth year would, by Clause 14 of the contract, entail the purchase by the Council of lamps, fittings, conduits, mains, service lines and all other apparatus then in use, but not distributing mains used for general supply. 124 lamps are lighted and maintained by the company under the contract, and the payment per lamp is as to 101 lamps, £28 per annum, and as to 23 lamps, £27 10s. per annum, these rates being inclusive of all capital charges, except for the columns, which are the property of the Council. The price now paid by the Council for lighting and maintaining (exclusive of capital charges), 1,800-C.P. gas lamps is £15 10s. per lamp per annum, and for 3,000-C.P. gas lamps £22 per lamp per annum, under a five years' contract. The company has offered to improve the lighting of the area by substituting flame arc lamps, provided the Council contributes one-half of the cost, estimated at £1,488. The purchase price for the property is £10,726, and the company has been asked to furnish further details of this price. Concluding, the Committee states that before considering further, it has directed that competitive tenders for the public lighting of the streets now lighted under the contract be invited

from the electric light companies having powers of supply in those streets, and from the Gas Light and Coke Co.

**LEWISHAM.**—The B. of G. on Monday decided to install the electric light at the infirmary in place of the present gas. A report of a special Committee, stated that experimental lighting of certain wards by the South Metropolitan Gas Co., and the South Metropolitan Electric Light and Power Co., had resulted in its coming to the unanimous opinion that the electric light was far preferable upon the grounds of better lighting, cleanliness, healthiness and general convenience. During last year, £83 had been expended in the infirmary on mantles, burners, globes, &c. The present system of lighting by gas necessitated the whole of the wards, rooms and offices being whitewashed every year, and the wages alone paid to labourers for this work amounted to £160 odd. The chairman of the Sub-Committee, in his observations on the subject, said that in the wards lighted by gas the lights were turned on by means of switches attached to the walls, and worked similarly to the electric switches. This plan seemed at first to be a very excellent one, but in practice they were very disappointing, and probably a source of danger, for it was found that often when the light was switched on, or supposed to be switched on, all that happened was an escape of gas and no light, owing to the by-pass having gone out. On one occasion no less than 15 lights were out. This was, no doubt, owing in a great measure to the draughts which were unavoidable in such institutions. The system was an untried one in large institutions, and has the disadvantage that the light must be full on or not at all. The cost of the electric current, though a little more than gas, compared favourably. The chairman pointed out that the system of gas lighting tried was the best the gas experts could suggest. A test was made under equal conditions, lasting just three hours, the number of lights in each case being 24. The cost of the gas was at the price at present charged, and the electric current was 3d. a unit. The cost of gas used in three hours was 5'2d., and that of the electricity was 5'55d., a difference of '35d. It might be questioned if this could be correct. It was true that the gas company had stated it was prepared to quote special terms for gas, but had made no definite offer. The Board had also to consider the cost of mantles, which last year was over £83. The cost of installing electric light would be £800. The question of lighting the workhouse by electricity was adjourned to the next meeting.

**BATTERSEA.**—The electrical engineer advises a further extension of plant at the central generating station in order to cope with next winter's demand. Accordingly, an additional boiler with mechanical stoker, pipework, gearing, &c., and a condenser circulating water pump is to be provided at an approximate cost of £3,275, and tenders are to be invited therefor.

**Manchester.**—On behalf of the ratepayers in Cavendish Street and Stretford Road—two important shopping thoroughfares—representations have been made to the Lighting Committee of the Corporation in reference to a better method of lighting such thoroughfares by means of an electric installation, and the Committee has instructed Messrs. Newbigging & Pearce to prepare and submit a joint report on the subject of the public lighting of roads, streets, courts and passages in the city.

A section of the central area was deprived of electricity from about 9.30 to 11 o'clock last Friday night. Two of the principal newspaper offices were affected. According to an official statement by Mr. S. L. Pearce, the chief engineer, made on Saturday, the fault occurred on only one of the 16 sections into which the whole of the central area is divided. Apart from the two newspaper offices, not a single inquiry was received from any consumer until an hour after the trouble arose. Mr. Pearce stated that the division of the area was made about eight years ago, and Friday's occurrence had shown how wise the policy was.

**Nelson.**—A Sub-committee of the Electricity Committee has interviewed representatives of four firms of cotton manufacturers on the question of a supply of current from the Corporation mains for loom-driving. The firms in question would be prepared, subject to satisfactory tests, to accept the terms offered by the Committee. What the terms were did not transpire, and Mr. Dinsdale said the proposed step was so important that if he were chairman of the Committee he would not like to accept the responsibility of letting it go through without open discussion. The chairman replied that the Committee was unanimous, and the only question at issue was one of price. Applications had been received in respect of 1,760 looms, and it was essential to get the business through without delay.

An inquiry was held on the 6th inst. by the L.G.B. relative to the proposal to borrow £2,000 for electricity purposes. No opposition was raised.

**Newport (Mon.).**—In connection with the report which is being prepared by the electrical engineer upon the subject of the extension of the generating plant, the different types of plant in operation in other parts of the country are to be inspected. The engineer has submitted a scheme for the improvement of the lighting of Caerleon Road. This scheme provides for 14 500-C.P. lamps, each consisting of five 100-C.P. lamps, and showed that the annual revenue, if the same amount were paid as for existing arc lamps, viz., £16 per lamp, would be £224. The lighting would be done from overhead wires, and the tramway standards would be utilised instead of erecting lamp columns. The gas company also submitted a scheme for improving the gas lighting of the portion of Caerleon Road in question, using the "Parkinson lamp" with twin inverted burners, which, if adopted, would make the approximate cost. £65 per annum, as against £42 for the existing gas lamps. The cost of the lanterns would be £2 3s. for

each lamp. The Electricity Committee has instructed the engineer to provide a series of four electric lamps, and asked the Gas Co. to demonstrate with four of the improved type of gas lamps suggested by it.

**Orsett.**—The L.G.B. has intimated to the B. of G. that, speaking generally, it is not disposed to approve of the installation of plant for the production of current for lighting the Workhouse buildings. The Guardians, however, have decided to reply that the Workhouse is isolated from any large town, that there are no means of obtaining electricity without it being generated on the premises, and that they believe that electricity is the cheapest and best system of lighting.

**Osulton Broad.**—The U.D.C. has, by 8 votes to 4, declined an offer to purchase the undertaking of the Electric Lighting Co. for £2,000; £1,100 for inside and outside plant, meters, goodwill, &c., and £900 for outside mains, meters, goodwill, &c.

**Peterborough.**—The T.C. has received the sanction of the L.G.B., to a loan of £1,000 for mains.

**Rochdale.**—In December last the Corporation sought the sanction of the L.G.B. to loans of £15,000 and £30,000 for extensions at the electricity works. On Wednesday, last week, the Gas and Electric Committee decided to ask the L.G.B. to sanction the borrowing of an additional £30,000 for extensions to the building, and boiler and general plant. The necessity for the extension is urgent, and the Committee decided to advertise for tenders straightaway, in order that no time should be lost.

**Rotherham.**—The electrical engineer has been instructed to report upon the question of providing additional generating plant. Sketch plans have been approved for extending the tram-car sheds in Rawmarsh Road.

**St. Helens.**—The L.G.B. has forwarded to the T.C. sanction to a loan of £3,873 for excess expenditure on mains, £1,133 for similar expenditure on services, rotary converters, boilers, &c., £500 for sub-station buildings, £3,800 for cables, £600 for sub-station equipment, and £1,900 for transformers.

**Salford.**—Improvements which are being effected at Salford Docks, include the installation of six electric cranes to lift 2 tons. One of the new cranes was tested last week. The order has been given to Messrs. Higginbottom & Mannoek, who are also supplying eight 30-cwt. electric cranes for No. 8 Dock.

**Sheffield.**—The Electric Lighting Committee recommends the T.C. to apply to the L.G.B. for a loan of £130,860 for extensions. The sum includes £62,800 for buildings, &c., and £58,800 for boilers, pipework, turbo-alternators, and switchboard.

**Shipley.**—Messrs. G. A. White & Co. have asked the U.D.C. to supply current for power to their proposed new shed on the Shipley Fields estate, but the Council has replied that at present it cannot undertake the supply.

**South Shields.**—Mr. Ellis, the borough electrical engineer, informs us that energy for outside arc lighting will in future be charged 2d. instead of 4d. per kw.-hour, and for domestic power (1½d.) will be charged at the heating and cooking rate of 1d. per kw.-hour. Also that practically the whole of the street lighting has been brought up-to-date, by the adoption of 12-ampere Exello arcs in place of the 94 old type arcs—four 12-ampere Metroflam magazine lamps being also in use at points distant from the arc lamp routes, in order to save attendance costs; 475 incandescent lamps have been fitted with 32 instead of 16-C.P. metal lamps, and in a number of other cases 50-C.P. metal lamps have superseded 32-C.P. lamps. The headquarters of the electricity department will shortly be removed to new offices directly opposite the municipal buildings, and a showroom will be provided there.

**Stockport.**—Mr. J. Welsh, speaking at the T.C. meeting on February 5th, drew attention to the decision of the Electricity Committee to supply electricity at a flat rate of 1½d. per kw.-hour, less 5 per cent. for lighting and power purposes, and expressed the hope that the question of reducing the general price for electric lighting (3½d.) to the ordinary consumers would receive consideration. Alderman Hopkins said he hoped the Committee would consider the question of giving special treatment to seven-day consumers of electricity, to those people who used electricity all the year round. Alderman Ball (chairman of the Electric Committee) said the questions raised would be considered in March. He agreed that people who used electricity for long hours, seven days of the week, were entitled to consideration.

**Stoke-on-Trent.**—The T.C. is considering the advisability of having the Market at Tunstall lighted by electricity. The estimated capital cost of the scheme is £550, and the annual cost of lighting and upkeep about £150.

**Tasmania.**—The City of Hobart is now lighted by electricity, supplied from a temporary steam station pending the completion of the hydro-electric company's scheme; gas lighting having been superseded.

**Tunbridge Wells.**—The Corporation has referred the report of the borough electrical engineer with respect to the replacement of the small generating sets, to its consulting engineers, Messrs. Horace Boot and Partners.

**Walsall.**—The position of the Corporation's electricity undertaking is causing grave anxiety at the present time, and the matter was discussed at Monday's meeting of the T.C. The loss on the concern last year amounted to no less than £3,853. The reserve fund is only £1,594, and assuming this amount is utilised for the reduction of the deficit, it still leaves considerably over £2,000 to come out of the pockets of the ratepayers. Recently the Council appointed a Committee to thoroughly investigate the position of the undertaking and to report as to the best means of placing it upon a sound footing. It was then found that, for some time, the department had been completely disorganised, owing to alterations, extensions, repairs, &c. The Committee also found that the plant was working altogether inefficiently, that the fuel consumed was inferior, and that, generally speaking, the coal strike had had a great deal to do with the unsatisfactory working. In order to maintain supplies, fuel had to be purchased at an increased price, whilst the inefficient working of the plant was attributable to the fact that there had been delay in completing the alternating-current plant and making it ready for use. Furthermore, it was discovered that, as a result of the reduction in price of current for traction purposes, there had been a decrease in revenue of over £800. The outcome of the whole matter is that, at Monday's meeting of the Council, the members were recommended to call in an electrical and mechanical expert to report fully upon the undertaking. They were also recommended to take into consideration the advisability of increasing the price of electric current. After receiving the report of the consulting engineer, the recommendations were adopted by the Council.

**Warwickshire.**—The C.C. has decided to oppose the Bill of the Coventry T.C. for powers to supply electricity in the parishes of Ellesley, Binley, Coundon, Keresley, Stoneleigh, Walsgrave-on-Sowe, Willenhall and Wyken.

**Wolverhampton.**—The following figures show the growth of the Corporation's electricity works during the past three years:—The output has increased from 7,072,114 units to 11,544,636 units; the capacity of the additional generating plant installed amounts to 3,500 kW.; the station costs have decreased from 476d. per unit to 345d. per unit; the gross profit has increased from £16,891 to £24,042; and the net profit has increased from £3,401 to £7,079.

**York.**—The recommendation of the Electricity Committee to extend the electricity works and plant, at a cost of £30,000, has been confirmed by the City Council. It was stated, in reply to critics who complained that Messrs. Rowntree were favoured with special terms, and that the extension was needed for the latter's convenience, that the firm took more electricity than all the other consumers, including the tramways, put together, and that they were prepared to take another 750 kW. per annum with a guarantee. They had had a contract for a year, the result being that the undertaking was £3,000 better off than in the previous year.

## TRAMWAY and RAILWAY NOTES.

**Abertillery.**—The U.D.C. has decided to oppose in Parliament the Western Valleys (Monmouthshire) Railless Electric Traction Bill.

**Australia.**—The Cabinet has approved the underground electric railway project for Sydney (N.S.W.), and the work is to be started immediately.

**Batley.**—A deputation from the Dewsbury Electricity and Tramways Committee is to meet a Committee of the Corporation, on the 20th inst., to discuss the question of the proposed line of tramways to Staincliffe.

**Bolton.**—The new Corporation tramways repair sheds were opened on February 5th by the chairman of the Tramways Committee. The works include the following departments: Wheel and truck shop, fitted with an overhead travelling crane capable of lifting 7½ tons, a wheel lathe, wheel press, and two hydraulic jacks; electrical repair shop, with pits over the whole area; paint shop; body shop, with basement for the suction pipes to the pneumatic dust-removing installation; turning and fitting shops, with an overhead runway and trolley tracks; smithy, offices, &c. A traverser has been laid down to serve the wheel and truck, electrical, paint and body shops, and an overhead runway and trolley tracks have been laid along the main passages. The whole of the machinery is electrically driven. Dining, billiard and club rooms have been provided for the staff. The work has been carried out under the superintendence of the borough engineer. In opening the building, Alderman Miles mentioned that the estimated cost was £20,000.

**Royton and Crompton.**—Subject to the approval of the B. of T., the Oldham T.C. has agreed to lease the tramways in the urban areas at Royton and Crompton for 21 years. Oldham will pay Royton U.D.C. a rental of £3,677 per annum and Crompton U.D.C., £1,294 a year.

**Bradford.**—The tramway tracks in several sections of the system are to be renewed, at an estimated cost of £21,836. This sum includes the doubling of the track at Great Horton, for

which the sanction of the Board of Trade is to be obtained. Tenders are to be invited for carrying out the foregoing work, including the provision of steel poles for the equipment of trolley vehicle routes.

**Bournemouth.**—The T.C. has confirmed a proposal to introduce a Sunday service of tramcars, from 2.0 to 10 p.m., and to pay the employes engaged on such work at the rate of time and a quarter.

**Brighton Railway Electrification.**—Speaking on the advantages of electrical working on the Brighton Co.'s suburban railways, Lord Bessborough, chairman of the company, at the recent general meeting, said: Prior to the establishment of electrical services there were 496 trains working in and out of Victoria Station in the day. At the present time 739 trains a day were worked. At London Bridge the steam trains working in and out prior to electrification numbered 663 a day, but now 901 trains a day passed in and out. The average number of passengers carried each year on the South London line since electrification was over 4½ millions more than the number carried in the last year of steam working, or 14,000,000 more passengers during the whole period. The Victoria and Crystal Palace electrical services began 18 months ago, and in that period there had been an increase of nearly 4,000,000 passengers. The London Bridge and Crystal Palace services had been in operation for six months, but even in that time they had obtained an increase on this section of over 319,000 passengers. The cost of the maintenance of the whole of the overhead equipment, since it was first erected, had been £2,927, which worked out at the low figure of £21 per mile per annum, and the other conditions of maintenance were equally satisfactory. He went on to refer to the company's decision to extend the electrical working to the greater portion of its remaining suburban lines, particulars of which were given on page 176, and stated that the contracts will shortly be made with the Metropolitan Carriage Co., for the motor coaches, and with Messrs. Blackwell, for the overhead construction. The works will take four years to complete, but it is anticipated that an important part will be in use within 18 months.

**Bristol.**—It has been decided to request the Tramways Co. to remove the centre tramway poles between Bath Bridge and St. Augustine's Bridge, on the ground that they constitute an obstruction to traffic in their present positions. The cost of carrying out the work is put at £1,700.

**Continental Notes.**—GERMANY.—In connection with the projected electrification of the Berlin municipal and suburban railways, 26 members of the Budget Commission of the Prussian House of Deputies recently made a visit of inspection to the Bitterfeld-Dessau electric railway and the power station at Muldenstein, which is undergoing enlargement for the purposes of the projected electrification.—*Elektrotechnische Nachrichten.*

RUSSIA.—The town of St. Petersburg proposes to issue a £7,000,000 loan, half this amount being required for electric tramway extensions in the city.

**Croydon.**—The Tramways Committee recommended the B.C. on Monday to seek powers to extend the Addiscombe tramway to South Norwood, *via* Woodside, at an estimated cost of £28,102. The scheme provided for a double track over nearly the whole route, and for the purchase of five cars. Powers were obtained for this extension in 1905, but were allowed to lapse. The chairman of the Committee contended that the great growth of the neighbourhood justified the expansion, which would follow the principle adopted by the L.C.C. of linking up various dead ends. Addiscombe was their best paying route, and he was sure of further profit. The widespread talk about motor-buses being about to "wipe out" tramcars he attributed to party motives in connection with the L.C.C. elections. All the information that he had pointed to tramcars being run more cheaply than motor-buses, even if the price of petrol came down by two-thirds. However, it would take two or three years to carry out the scheme if adopted. If, in the meantime, motor-buses came over the route—and he believed there would not be enough traffic to maintain both services—the Council could reconsider the position. Councillor Hussey moved the reference back. Strong fears of motor-bus competition were expressed by several members, and one described the chairman's attitude as a direct invitation to motor-bus companies. Councillor Umney advocated railless traction, estimating that the cost would not be more than £10,000. The voting was a tie of 24 votes on each side, and the Mayor (Councillor S. Rogers) gave his casting vote for the reference back.

**Dewsbury.**—The General Purposes Committee of the Corporation has recommended that the Parliamentary Committee apply for a prov. order for powers to construct a tramway from the present terminus of the Dewsbury and Ossett tramways across the Market, and a junction with the Spen-Valley Light Railway, with running powers over the respective lines, for the purpose of linking up the proposed Shaw Cross and Westborough tramways. It was also decided that, subject to the approval of the Batley Corporation, powers should be obtained for carrying the Westborough tramway system from the borough boundary at Dewsbury Moor to Staincliffe.

**Doncaster.**—The Rural District Council has decided to oppose the Mexborough and Swinton Tramways Bill, which is to provide for the establishment of a railless traction system, the ground of objection being that the cars are injurious to roads.

**Folkestone.**—The T.C. has sealed a petition against the Folkestone and District Railless Traction Bill. A similar course has been taken by the neighbouring Urban Councils at Cheriton and Sandgate.

**Glasgow.**—At an early date the T.C. will be asked to consider a recommendation by the Statute Labour Committee for the erection of a new bridge—making four in all—over the River Clyde, in the centre of the city. For years back, since the inauguration of the trolley-car system, in fact, the congestion on the main thoroughfares has become very marked, and is yearly increasing through the lengthening of car routes and the augmentation in the number of cars. The proposed bridge, if the Committee's recommendation is approved, will be immediately to the west of the present Jamaica Bridge, over which the heaviest of the north and south traffic passes, and will be utilised as a relief to several of the routes converging near that point. The convener of the tramways, in a recent speech, promised a handsome contribution, if not the whole cost of a relief bridge, if such a structure was erected to the satisfaction of his committee.

**Hastings.**—On Friday the Corporation passed formal resolutions adopting a petition to Parliament in opposition to the Hastings Tramways Bill which is being promoted in Parliament, and authorising the expenditure of the necessary money for opposing the measure. The object of the promoters of the Bill is the substitution of overhead wires along the entire front of the town and Robertson Street (the chief business thoroughfare) for the existing Dolter system, which has for some time past been considered unsatisfactory. At the instance of the Corporation, a B. of T. Inspector has been down and made certain suggestions to the company. Frontagers are practically unanimous against overhead wires, which they contend would effectually ruin the Front line. The resolutions to oppose were carried by 30 votes to 5.

**London.**—HACKNEY.—The Woolwich B.C. has been informed that the Hackney Council will co-operate with it and with the Lewisham B.C. in opposing the L.C.C. Bill so far as it has reference to running railless trolley vehicles.

**Manchester.**—The Tramways Committee has decided to construct a double track along Slade Lane, Levenshulme, a growing suburban district. The Tramways Committee is also in the market for a number of motor-buses.

**Midland Railway Electrification.**—According to the *Daily News*, the Midland Railway Co., since the acquisition of the Southend and Tilbury line, with joint use of Fenchurch Street Station, has taken up consideration of the development of its London suburban traffic. The company is bound by the Act permitting the taking-over of the Tilbury and Southend line to equip the latter for electric working within seven years. The first step in this direction will be the extension of the present electric train service from Barking to Upminster and the running of through electric trains to that point from the underground system. Consequent on this alteration the company now contemplates the electrification of the line formerly known as the Tottenham and Forest Gate Railway, running from Kentish Town to East Ham, where the main line between Tilbury and London is joined. The main line from Kentish Town to St. Pancras will also be equipped for electric working. At the same time it is proposed that the line to St. Albans, passing through Mill Hill, shall also be electrified, and a junction made with the extended Golder's Green tube at Colin Dale, just beyond Hendon.

**Newport (Mon.).**—On various grounds the T.C. will oppose the Western Valleys Railless Electric Traction Bill.

**N.-E. Railway Electrification Schemes.**—The North-Eastern Railway Co. is about to electrify the section of line from Shildon, in Durham, to Middlesbrough-on-the-Tees, a distance between 18 and 20 miles, and embracing 50 miles of track. Energy will be supplied by the Newcastle-on-Tyne Electric Supply Co., in conjunction with the Cleveland and Durham County Electric Power Co. The contract for the electrical equipment for the first 10 locomotives, which are to be constructed at the N.-E. Railway locomotive works at Darlington, has been placed with Messrs. Siemens Bros. The contracts for the sub-station plant are said to have been placed with the British Thomson-Houston Co., and the cables with the British Insulated and Helsby Cables, Ltd. The line is largely used for mineral traffic, and the trains to Newport average over 900 tons in weight; the reverse traffic consists principally of empty trains of 350 tons weight.

**North-Western Railway Electrification.**—The new local line between Willenden and Watford was opened for traffic on Monday, with a temporary steam service, pending the carrying-out of the electrical scheme, in connection with which considerable progress is being made. The contract for the power station at Stonebridge Park is about to be let, and the tunnel work in connection with the extension of the Bakerloo tube to Queen's Park has been commenced.

**Oxford.**—The T.C. has passed a motion authorising the Tramways Committee to make application for the payment of fines and penalties due to the Corporation, by reason of the failure of the National Electric Construction Co. and the City of Oxford Electric Tramways, Ltd., to carry out the electrification of the tramways.

**Sheffield.**—The highways surveyor has been instructed to put in hand the work of doubling the length of single tramway track near Woodbank Crescent on the Woodseats section as early as practicable. The track in Flat Street is to be extended to the bottom of Sycamore Street. Tenders are to be obtained for two negative boosters for the Kelham Island power station and for 1,000 tons of tramway rails. In connection with the alteration of the road levels at the junction of Spring Vale, Howard Road, and Upperthorpe, part of the tramway track is to be renewed.

**South Lancashire.**—At a meeting of the Worsley District Council, held on Monday, a plan was submitted by the South Lancs. Tramways Co. for a short length of tramway in Manchester Road, Walkden, connecting with the proposed new tramway through Little Hulton.

**South Shields.**—At a meeting of the T.C. on the 5th inst., the question of extending the tramways from Laygate to the low entrance to Tyne Dock was dealt with in a report of the Tramways Works Sub-Committee, which, after considering a report from the tramways manager, stated that it was unable to recommend the extension along the route suggested. The Tramways Committee recommended that the Sub-Committee's decision be confirmed. The Mayor, in moving the adoption of the report, said that no undertaking could afford to put down a service for working men only, and he, after making a study of the suggested new route at all times of the day, could testify that it was practically deserted after 5 p.m. Mr. Sykes commented on the importance of tapping the traffic in the Corstorphine district, and moved that the matter be sent back to the Committee for further consideration. Eventually the amendment was negatived, and the report was adopted.

**Stockport.**—At the T.C. meeting on February 5th, consideration was given to a report made by the tramways manager upon the effect of the alterations of tramway fares. The report showed that, compared with the corresponding period of the preceding year, the aggregate increase of revenue for the period under review was £2,049 on the sections concerned. Alderman Sharples, the chairman of the Tramways Committee, said there was no doubt there had been a loss. Traffic had increased on all sections, but the reduced fares had resulted in a loss. He hoped this circumstance would not be taken as an inducement to reduce fares further without consideration of what the result might be.

**Walsall.**—The working of the Corporation's tramways for the past year shows a net profit of £3,392, which is to be carried to the reserve fund after a payment of £500 to the borough fund in aid of the rates. The Tramways Committee has also notified the Finance Committee that it is proposed to make a contribution from the estimated profits of the tramway undertaking in relief of the rates for 1913 to the amount of £1,000 (in addition to the £500 mentioned), to be paid in two instalments before December 31st next.

**West Hartlepool.**—A statement which has just been prepared, for the information of the members of the West Hartlepool T.C., shows that the total capital expenditure by the Corporation on the tramways is £66,943. The arbitration expenses in connection with the Foggy Furze lines amounted to £1,858, of which counsel's fees were £1,124, and expert witnesses £636. The costs of the case in the King's Bench Division regarding the purchase of the same were returned at £112, and in the Court of Appeal £136.

## TELEGRAPH and TELEPHONE NOTES

**Australia.**—A correspondent of the *Times* says that wireless stations are now operating in the six State capitals, as well as on Thursday Island and at Port Moresby.

**Hong Kong.**—The Government has sanctioned the installation of wireless telegraphy at Hong Kong, and as stations will also be erected at Singapore and in North Borneo, ships equipped with wireless will be able to maintain communication with the land at all points within these limits.

**Ice Dangers in the Atlantic.**—It is reported that negotiations are passing between the Government and the principal Atlantic steamship lines with a view to stationing in the ice region a vessel which will have a very powerful installation of wireless telegraphy, and will report to stations on the American coast and to Atlantic liners crossing the ocean the positions of icebergs or other dangers to navigation.

**Imperial Wireless System.**—On Wednesday last week the Select Committee on the Marconi contract further examined Mr. W. R. Lawson, who communicated to the Committee the names of the brokers and dealers most largely concerned with transactions in the company's shares, and discussed methods of identifying the persons for whom they had acted. The witness said there was no doubt that the largest transactions had been foreign. He said that his articles in the *Outlook* and the *National Review* were written at the request of the editors, and that his references to Ministers in the former were not intended to constitute charges against them. He thought some of the expressions he had used were unfortunate.

He held that Mr. Godfrey Isaacs, by reason of his relationship to the Attorney-General, was able to get better terms than other companies, though he did not suggest that the Attorney-General interfered with the negotiations in any way. He had found no definite grounds for making any charges against Ministers.

On the following day Mr. Lawson said that if he were writing the articles again he would not employ the same language in regard to Ministers. He made no effort to find out whether there was any foundation for the rumours connecting Ministers with dealings in the shares, and he agreed that the charges should not have been made without evidence.

On Monday the Hon. W. Guinness, M.P., chief proprietor of the *Outlook*, and the editor of that paper, Mr. E. Oliver, were examined. The former expressed regret if anything in the articles could be taken as suggesting improper financial conduct on the part of Ministers. He considered that certain sentences were very regrettable. He had not the slightest doubt as to the personal honour of the Postmaster-General. Mr. Oliver denied that he ever looked upon the articles as charging Ministers with personal corruption. He thought they were a most valuable series. If he had foreseen the appointment of the Committee, he would not have published the articles.

On Wednesday, the examination of Mr. Oliver was continued and concluded; Mr. L. J. Maxse, editor and proprietor of the *National Review*, was then called, and on his refusal to divulge the names of persons from whom he obtained information regarding the rumours that Ministers were financially interested in the Marconi contract, because it would be a breach of confidence, the Committee resolved to report him to the House of Commons. No further sittings will be held until the next session.

Mr. Godfrey Isaacs addressed a letter to the Secretary of the Post Office, in reply to that of the Postmaster-General, stating that the Marconi Co. felt morally entitled to ask that the agreement should be considered as no longer binding on either party. In addition to the other matters to which he referred in his previous letter, the company had been obliged to reserve, for nearly a year, the sum of £300,000 to enable it to carry out the work. Having taken counsel's opinion, the company was advised that it was now entitled to intimate that, unless the Postmaster-General was in a position to confirm the contract by March 1st next, the company would treat the contract as at an end. The company, however, was reluctant to take this course, and requested further consideration of its letter of January 15th.

**Italy.**—A scheme has been submitted to the *Consigli dei Ministri*, for the expenditure of £4,500,000, spread over several years, on the systematisation and extension of the Italian telephone networks. The projected operations comprise the building of many new up-to-date exchanges, great additions to the network in each city, and its entire conversion to the underground system. The automatic and semi-automatic systems are also to be largely introduced.—*Telegrafia e Telefonica*.

**Japan.**—The negotiations for the purchase by the Government of the submarine cables between Nagasaki and Shanghai, and between Tsuruga and Nagasaki, are reported to have been completed.

**Norway.**—The Marconi Co. has consented to the prolongation from March 1st to July 1st of the period during which Norway must decide with regard to the proposed contract for the establishment of a wireless service to America.

**Suffragist Outrages.**—On Friday and Saturday last week, telegraph and telephone wires between Coventry and Birmingham, near Dumbarton, and between Glasgow and London were cut by suffragists, and the underground cables to Glasgow were also put out of order.

**The Telephone Transfer.**—The Postmaster-General is appealing against the award of the Railway and Canal Commissioners with regard to the cost of raising capital, which was assessed at £247,189, and on minor matters.

**Underground Cables.**—In reply to a question in Parliament, Mr. H. Samuel stated that the total length of the main underground routes was 1,197 miles in England, and 133 miles in Scotland. The total expenditure under the Post Office votes, and the telephone capital account, had been about £2,100,000. The expenditure on the routes in the two countries had been approximately proportionate to the mileage.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—March 3rd. Service materials, for the U.D.C. electricity department. See "Official Notices" to-day.

**Ashton-under-Lyne.**—February 19th. H.T. switch-gear, water softening plant, steam, exhaust and feed pipes, tanks, &c., for the Corporation. See "Official Notices" January 31st.

**Austria.**—PILSEN.—February 21th. Tenders are required for one 30-H.P. three-phase motor with accessories, one 5 H.P. ditto, two electric nut-grinding machines, two portable electric drilling machines for holes up to 50 mm. diameter, two ditto for holes 30 mm. diameter, one portable circular saw with electric drive, one electric polisher, and other machinery. Particulars, forms of tender, &c. K. k. Staatsbahndirektion, Pilsen, Austria.

**Australia.**—VICTORIA.—February 21st. Four 1,500-kw. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

**WESTERN AUSTRALIA.**—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" January 10th.

February 27th.—Buildings and boiler-house equipment, turbo-alternators and rotary converters, for a Government power station at Perth. See "Official Notices" January 21th.

**SYDNEY.**—March 17th. Motors for the City Corporation.

**SOUTH AUSTRALIA.**—March 5th. One section of a common-battery switchboard, for the P.M.G.'s department. See "Official Notices" January 31st.

**COMMONWEALTH GOVERNMENT.**—Darwin power station, about 2,000 kw. Equipment to comprise Diesel oil engines and accessories and overhead travelling crane, alternators and exciters, and switch-board.

**NEW SOUTH WALES GOVERNMENT RAILWAYS.**—March 5th. Twelve single-phase transformers, and one 12½-kw. generator. Specifications 388 and 389 (2s. 6d. each) from Electrical Engineer's Office, 61, Sydney.

**Balearic Islands.**—February 18th. The municipal authorities of Vallamosa are inviting tenders for the concession for the electric lighting of the town during a period of five years.

**Belfast.**—February 24th. Stores and materials for one or three years, for the City electricity department. See "Official Notices" January 31st.

**Bicester.**—Electrical installation for the U.D.C. area. See "Official Notices" to-day.

**Blackburn.**—February 15th. Materials for a year, for the Corporation Electricity Department. See "Official Notices" January 31st.

**Bolton.**—February 24th. Materials and stores, for the Corporation Tramways Department. See "Official Notices" February 7th.

**Bournemouth.**—February 20th. Stores for a year, for the Corporation tramway department. Mr. I. Bulfin, General Manager, Lansdowne.

**Bradford.**—The Chairman and Deputy Chairman of the Corporation Electricity Committee have been authorised to purchase an electrical photo-copying apparatus, for reproduction of plans, &c., at a cost of £60.

**Brussels.**—February 19th. Tenders are invited for the supply of train lighting material for the State railways, as per Cahier des Charges Special No. 758. Particulars, Salle de la Madeleine, Brussels.

February 25th.—Tenders are required for the supply of electric meters required for the public service. Particulars, Maison Communale, Ixelles-les-Bruxelles, Belgium.

**Canada.**—The Hydro-Electric Power Co. of Ontario, propose shortly to call for tenders for the materials for the construction of 125 miles of double-circuit 110,000-volt transmission line, and the necessary equipment for sub-stations for the transforming of 20,000 H.P. from the line to 13,200 volts. Various types of apparatus will be considered. The tenders will be called for in March. Address, Continental Life Building, Toronto.

**Croydon.**—February 24th. Sinking artesian well and supply of pump, for the Corporation electricity works. See "Official Notices" to-day.

**Darlington.**—February 17th. One 1,000-kw. steam turbo-alternator, one 750-kw. and one 250-kw. rotary converter, and one water-tube boiler, for the Corporation. See "Official Notices" January 31st.

**Derby.**—February 19th. One 2,000-kw. turbo-alternator, for the Corporation. See "Official Notices" February 7th.

**Durban (Natal).**—February 24th. Corporation Tramways. Supply, f.o.b., of six miles of B.S.S. flat-bottom Vignoles tram rails, together with fish-plates, bolts and nuts, copper bonds and dog spikes. Specifications and forms of tender, £2 2s. returnable, from the agents, Messrs. Webster, Steel & Co., 2, East India Avenue, Leadenhall Street, London, E.C., to whom tenders have to be sent.

**Edmonton.**—February 26th. Electric lamps for the B. of G. Mr. F. Shelton, clerk, The Grange, White Hart Lane, Tottenham.

**Egypt.**—March 31st. Section des Municipalites invites tenders for electric light installation at Damietta. For further particulars see this column for January 24th.

**Finchley.**—February 17th. One 300-B.H.P. oil engine, coupled to a 200-kw. E.C.C. generator, for the U.D.C. See "Official Notices" February 7th.

**Gloucester.**—Stores for a year, for the Corporation Light Railways Committee. Mr. L. Johnston, General Manager, Bristol Road.

**Halifax.**—February 17th. Stores and materials for a year, for the Corporation electricity department. See "Official Notices" January 31st.

February 17th.—Stores and materials for tramways department for 12 months. Tramways Engineer, Tramways Office, Skiroot Road.

**Hornsey.**—February 24th. Electricity meters, cables and cable stores, for the T.C. See "Official Notices" February 7th.

**Hilford.**—February 25th. Stores for a year, for the U.D.C. electricity department. See "Official Notices" February 7th.

**India.**—February 18th. High and low-tension switchboards, for the Bombay, Baroda and Central India Railway. See "Official Notices" January 31st.

**Leeds.**—February 19th. Coal and general stores for a year, for the Corporation electric lighting department. See "Official Notices" January 24th.

February 17th.—The City Tramways Committee invites tenders for electrical sundries and engineers' furnishings, and for the reconstruction of certain portions of tramway track.

**London.**—BERMONDSEY.—February 17th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" January 24th.

L.C.C.—February 25th. Electric wiring of the Camberwell and Cresse Road car-sheds. See "Official Notices" January 31st.

February 25th.—Two 8,000-kw. turbo-generators, with condensers, &c., three 1,500-kw. rotary converters, nine transformers for rotary converters, and two starting transformers. See "Official Notices" to-day.

February 26th.—Electrical installation at Leipzig Road Elementary School, Camberwell, S.E. See "Official Notices" to-day.

The Highways Committee is to invite tenders for the supply of 2,200 track insulators and 3,200 porcelains in connection with electrical repairs and renewals of tramway lines, from selected firms.

**FULHAM.**—February 19th. Electrical and engineering stores for a year, for the B.C. See "Official Notices" February 7th.

**ST. PANCRAS.**—March 4th. Arc lamp carbons, for the B.C. See "Official Notices" February 7th.

**MARYLEBONE.**—February 26th. Stores and materials for a year, for the B.C. Electricity Department. See "Official Notices" February 7th.

**SHOREDITCH.**—February 24th. Two economisers (Green type), for the B.C. electricity department. See "Official Notices" to-day.

**STEPNEY.**—March 17th. Boilers and boiler house accessories, turbo-alternators, condensers, accessories and switchgear, for the B.C. See "Official Notices" to-day.

**Manchester.**—February 18th. General stores for a year, for the Corporation tramways department. See "Official Notices" January 31st.

February 18th.—Motor-buses complete, for the Tramways Committee. Mr. J. M. McElroy, manager.

February 19th.—Providing and fixing electric light fittings at George Leigh Street Municipal School, Ancoats. Returnable deposit £11s. Mr. C. H. Wyatt, Director of Education, Education Offices, Deansgate.

**Neath.**—March 3rd. One 400-kw. high-speed engine, direct-coupled to a two-phase alternator, and accessories, for the R.D.C. See "Official Notices" to-day.

**Newport (Mon.).**—March 4th. Electric light fittings for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

February 22nd. Stores for a year, for the Corporation Electricity and Tramways Committee. See "Official Notices" to-day.

**Oldham.**—February 21st. Two 500-kw. motor-alternators, for the Corporation. See "Official Notices" February 7th.

**Rochdale.**—Engine room extension, new boiler house, &c., turbo-alternator, condensing plant, motor-alternator, water-tube boilers and boiler house equipment for the Corporation. See "Official Notices" February 7th.

**South Africa.**—A new electric main hoist is required for the Village Deep gold mine. The Cape Town Municipality will be purchasing for suburban extensions during the next six months, 33 miles of aerial braided wire, 15 miles of vulcanised rubber wire, one mile of concentric high-tension cable, and 1,100 yd. of three-core high-tension cable.—*British and South African Export Gazette.*

**South Shields.**—February 17th. Uniforms, for the Corporation tramways department. See "Official Notices" January 31st.

**Stockton-on-Tees.**—February 19th. Stores for a year, for the Corporation Electricity Department. Electrical Engineer.

**Swansea.**—Electric light installation at new Y.M.C.A. premises. G. Moxham, architect, 18, Castle Street, Swansea.

**Swindon.**—March 8th. General stores and materials for a year, for the Corporation electricity and tramways departments. See "Official Notices" to-day.

March 10th.—One 500-kw. mixed-pressure turbine and condensing plant, boiler feed pump and pipework, and one switchboard panel and cables, for the Corporation. See "Official Notices" to-day.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

**Walthamstow.**—February 28th. Four double-deck tramcars complete with magnetic-brake equipments, for the U.D.C. See "Official Notices" February 7th.

**Warlingham.**—February 24th. Electric light sundries for the Mental Hospital, for Croydon T.C. for a year. Mr. F. C. Lloyd, Town Clerk, Town Hall, Croydon.

**Warrington.**—March 5th. Motors and transformers for a year, for the Corporation. See "Official Notices" to-day.

**Wigan.**—February 24th. High-tension, three-core feeder cable, transformer and switchgear, for the Corporation. See "Official Notices" to-day.

**Wimbledon.**—March 5th. Stores and materials, for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

**Wrexham.**—March 1st. Stores for a year, for the Borough Electrical Engineer's department. See "Official Notices" to-day.

## CLOSED.

**Australia.**—According to *Tenders (Mining and Engineering Review)*, the following contracts have been placed.—

P. M. G.'s DEPARTMENT, QUEENSLAND.—Five tons hard-drawn copper wire, £97 1/8s. per ton.—British Insulated & Helsby Cables, Ltd.  
N. S. W. PUBLIC WORKS DEPARTMENT.—Electric passenger lift at Mr. Robinson's shops, George Street, North Sydney, £500.—Standard-Waygood, Ltd.

**Belfast.**—The Harbour Board has accepted the tender of Messrs. George Russell & Co., Ltd., amounting to £8,725, for the construction at Alexandra Wharf, of an electric derrick crane capable of lifting 120 tons.

**Bradford.**—The Corporation Electricity Committee has accepted the offer of Messrs. Electromotors, Ltd., to supply two 10-H.P. direct-current low-speed motors required for the stoker drive at Valley Road electricity works.

**Burnley.**—The Tramways Committee has accepted the tender of the United Electric Car Co., at £153 per car, for the conversion of 14 wind-shield cars to top-cover cars.

**Canterbury.**—The T.C. has accepted the tender of Mr. S. Terry, Canterbury, for electrical engineering work for the ensuing half-year.

**Colchester.**—The T.C. has accepted the tender of Messrs. H. G. Merry & Co. for 300 tons of Shirebrook nutty slack for the electricity works, at 15s. 0½d. per ton.

**Dewsbury.**—The Electricity and Tramways Committee has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for new boilers.

**France.**—After comparative trials of a number of types of motors, the Compagnie des Tramways de l'Est Parisien has placed an order with the Société Anonyme Westinghouse for 100 50-H.P. No. 307 type motors; also for the new type of Westinghouse non-automatic multiple control equipments.

**Heworth.**—The R.D.C. has accepted the tender of Messrs. R. Farr & Sons, of Doncaster, for the installation of telephones at the Isolation Hospital, at £47.

**Horsham.**—The U.D.C. has accepted the tender of Messrs. Heenan & Froude for mechanical hoppers for the refuse destructor, at £122.

**Italy.**—The Ganz Electricitats Gesellschaft, of Budapest, has secured a contract for the construction of an electric railway about 20 miles long, between Angera, on Lake Maggiore, and Varese.

**Liverpool.**—The Corporation has just placed an order with Halley's Industrial Motors, Ltd., for a petrol motor-tower wagon chassis for use in connection with the maintenance of tramway conductors.

**London.**—The following tenders have been accepted by the Metropolitan Water Board for the undermentioned supplies.—

British Insulated and Helsby Cables, Ltd.—Aluminium cable, 611,	
Hensley's Telegraph Works Co.—Paper-insulated lead covered cable and joint boxes, 488,	
Edison & Swan United Electric Light Co., Ltd.—500 drawn-wire metal-filament lamps, at 1s. 7½d. each.	

L.C.C.—The Highways Committee has accepted tenders of the British Insulated and Helsby Cables, Ltd., and Messrs. Brecknell, Munro, & Rogers, Ltd., at £123 and £113 respectively for overhead fittings.

The following tenders were received for number plates for indicating the routes of cars on the Council's tramways:—

Venner's Signs, Ltd. . . . .	(accepted)	£8.85
Bresh Electrical Engineering Co., Ltd. . . . .		6.0
Hurst, Nelson & Co., Ltd. . . . .		7.46

A contract has been entered into with Messrs. Quilliam Bros. for five Collins electric point turners, for £425, "subject to no payment being made until the saving in expenses effected by their use is equivalent to the cost of the machines." This is in place of a contract placed last October with Messrs. S. Stone & Co., who are agents only.

During the Christmas recess the Education Committee received tenders as below:—

<b>CAMBERWELL, N.—L.C.C. Chamberwell School of Arts and Crafts.—Ex-tension—Electric Lighting—</b>			
A.E.G. Electric Co., Ltd.	.. ..	(withdrawn)	£903
Tredegar & Co.	.. ..	(accepted)	912
G. Weston & Sons, Ltd.	.. ..	.. ..	938
E. Lawrence & Sons, Ltd.	.. ..	.. ..	1,061
C. H. Cathcart & Co.	.. ..	.. ..	1,345
<b>KENNINGTON.—Vauxhall Street School—Electric lighting—</b>			
Tredegar & Co.	.. ..	(accepted)	£434
G. Weston & Sons, Ltd.	.. ..	.. ..	454
A.F.G. Electric Co., Ltd.	.. ..	.. ..	484
W. C. Tackley & Co., Ltd.	.. ..	.. ..	499
E. Lawrence & Sons, Ltd.	.. ..	.. ..	580
C. H. Cathcart & Co.	.. ..	.. ..	570
British Economical Lamp Co., Ltd.	.. ..	.. ..	770

**Manchester.**—Various committees of the Corporation have accepted the following tenders:—

Manchester Steam Users' Association.—Periodical inspection and insurance of four water-tube boilers, superheaters and economisers at Stuart Street station.  
 Tudor Accumulator Co., Ltd.—Testing battery at the cable stores, Ardwick.  
 British Electric Transformer Co., Ltd.—Requirements of a.c. balancers during the period ending December 31st, 1913.  
 British Insulated and Helsby Cables, Ltd.—Requirements of additional sizes of fuse boxes during the period ending June 30th, 1914.  
 Siemens Bros. & Co., Ltd.—Paper-insulated cable.

**Newcastle-on-Tyne.**—A contract for tramcar meters for Newcastle-on-Tyne tramways, has been received by Messrs. Ferranti, Ltd.

**Newcastle-under-Lyme.**—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for cables for extensions.

**North-Eastern Railway.**—Messrs. Siemens Bros. have secured the contract for the electrical equipment (motors, gears, control equipments, &c.) for the ten electric freight locomotives to be used in connection with the electrification of North-Eastern Railway Co.'s mineral line between Shildon and Newport (Middlesbrough).

**Nuneaton.**—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for a water-tube boiler for the electricity works, at £800.

**Rotherham.**—The T.C. has placed an order with the R.E.T. Construction Co. for the supply of two trolley vehicles, at £765 each. The tender of Anderton & Beaton has been accepted, at £298, for installing electric light at Kimberworth Schools, plus 12s. 6d. each for any extra points required.

**Salford.**—The Corporation Electricity Committee has authorised the purchase of two overload circuit breakers for the new battery, from Mr. Bertram Thomas, at £90.

**Sheffield.**—The T.C. has accepted the tender of Messrs. John Brown & Co., Ltd., for 600 steel tramcar tires, at 26s. per tire. The tenders of the Staveley Coal and Iron Co., Ltd., for 10,000 3-in. cast-iron cable pipes, at £6 10s. a ton, and of Messrs. W. Marlow & Sons, at £1,780, for foundations for three new boilers, chimney base, &c., at the Neepsend power house, have also been accepted. The contract with Messrs. Marsh Bros. for the maintenance of the internal telephone system at the Council's hospitals is to be extended for a further period of 12 months.

**Stone (Staffs.).**—The U.D.C. has accepted the tender of Messrs. Blackburn, Starling & Co. for the electric light installation at the sewage works, at £108.

**Stretford.**—The tender of Messrs. Veritys, Ltd., has been accepted by the U.D.C. for a 15-H.P. totally-enclosed interpole motor

**Sunderland.**—The T.C. on Wednesday accepted the following tenders:—

British Insulated and Helsby Cables, Ltd.—550 yd. of L.T. cable and 5,000 yd. of T.T. cable.  
 Ferranti, Ltd.—50 meters.

**Tonbridge.**—The U.D.C. has accepted the tender of Messrs. Switchgear & Cowans, Ltd., for alterations and additions to the switchboard at the electricity works, at £147.

**Walsall.**—The T.C. has placed an order with Messrs. Babcock & Wilcox, Ltd. (£290), for a mechanical stoker at the generating station.

**West Ham.**—An offer of the Glasgow Railway Engineering Co., Ltd., has been accepted by the T.C. for the supply of 200 cast-steel tram wheels and tires, at £4 1s. 6d. each. The Council's contracts with the Fuller Electrical Co. for semi-enclosed a.c. motors, and Messrs. Baxter & Caunter for Credenda conduit, are to be extended for a further period of 12 months, as is also the contract with the Armorduct Manufacturing Co. for wires and cables, at the present price up to 7/14 size, and above at from 5 to 15 per cent. advance, according to size.

**Wolverhampton.**—Owing to a breakdown, No. 1 motor-generator is to be repaired by the Electric Construction Co., Ltd., for £400, and No. 2, by the same company, for £57. A new canal boat is to be purchased at an estimated cost of £75.

**FORTHCOMING EVENTS.**

**Physical Society**—Friday, February 14th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Annual general meeting.

**Junior Institution of Engineers**—Friday evening, February 14th.—At 39' Victoria Street, S.W. Paper on "Electrical Installations in Metal Conduit with Special Reference to Earthing," by Mr. F. H. Taylor.

Saturday, February 15th.—At 6.30 p.m. At the Hotel Cecil. Annual dinner.

**Institution of Mechanical Engineers**—Friday, February 14th. At 8 p.m. Annual general meeting. Paper on "Modern Condensing Systems," by Mr. A. E. L. Scanes.

**Association of Mining Electrical Engineers (West of Scotland Branch)**—Saturday, February 15th. At 4.30 p.m. Meeting at the Royal Technical College, Glasgow.

(Newcastle Branch)—Wednesday, February 13th. At 7 p.m. At the Armstrong College, Newcastle. Lecture on "The Development of Mechanical Power in the Mines of the North-Eastern Coalfield—a Comparison and a Contrast," by Mr. R. Nelson (H.M. Electrical Inspector of Mines).

**Institution of Electrical Engineers (Scottish Section)**—Saturday, February 15th.—At 7.30 p.m. At the Grosvenor, Glasgow. Annual smoking concert.

(Western Section)—Monday, February, 17th. At 4 p.m. At the Merchant Venturers' Technical College, Bristol. Address on "Some Uses of the Strotoscope," by Prof. D. Robertson. At 6.30 p.m. At St. Stephen's Restaurant, Bristol. Dinner.

(Manchester Students' Section)—Tuesday, February 19th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Time Limits," by Mr. H. R. Constantine.

(Students' Section)—Wednesday, February 19th. At 7.45 p.m. At the Institution, Embankment, W.C. Paper on "Some Problems of Electricity Supply," by Mr. G. W. P. Page.

**Birmingham and District Electric Club**—Saturday, February 15th. At 7.30 p.m. At the Swan Hotel, Birmingham. Annual dinner.

**Illuminating Engineering Society**—Tuesday, February 18th. At 8 p.m. At the Royal Society of Arts. Paper on "The Use of Shades and Reflectors," by Messrs. J. G. Clark and V. H. Mackinney.

**North-East Coast Institution of Engineers and Shipbuilders**—Friday, February 21st. At 7.30 p.m. At the Lido and Phil, Newcastle. Lecture on "Surface Combustion," by Prof. W. A. Bone.

**Royal Institution**—Saturday, February 22nd.—At 8 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir. J. J. Thomson. (Lecture III.)

**THE ELECTRICAL ENGINEERS (LONDON DIVISION).**

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, February 17th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, February 18th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, February 20th.—"C" Company. Company training, 7 to 10 p.m.

Friday, February 21st.—"D" Company. Company training, 7 to 10 p.m.

Saturday, February 22nd.—"A" and "B" Companies (Right Half Battalion). Week-end training at Dover. Dress:—Service dress, putties and great-coats. No arms will be taken. Parade at Victoria Station, L.C. and S.E. line, at 1 p.m.

"C" Company—Week-end lorry run. Parade at Headquarters at 2 p.m. Dress:—Service dress, putties and great-coats. Headquarters will be open from 10 a.m. till 12 noon for regimental business.

(Signed) J. H. S. PHILLIPS, Major,  
 For Officer commanding L.E.E.

**NOTES.**

**Parliamentary.**—SHEFFIELD CORPORATION BILL.—As stated in the ELECTRICAL REVIEW of last week, the House of Lords passed a new sub-clause in the Sheffield Corporation Bill dealing with electrical fittings. Lord Southwark, who moved the new clause, stated that it was by way of a compromise.

On Monday the Bill again came before the House of Commons, when Mr. Maclean proposed that the House should agree with the Lords in the amendment.

Mr. Pointer said that since the matter was last before the House there had been the usual negotiations, and, ultimately, driven by force of time, the Corporation agreed to the clause as it had been read. He did not know whether what it meant was fully appreciated. It meant that while it appeared on the surface that the Corporation had agreed to the compromise, in reality they had given everything away. Let any member of the House judge what he would do in the circumstances. If he were going to have electric light installed in his house, and had the idea of employing the Corporation to do the work, the Corporation could only carry the wires so far as the ceilings and walls, and then he would have to call in a private trader to finish the task. Every one of them would be inclined to give the order to the man who could complete the transaction right through. Therefore, while, on the face of it, it looked like a compromise, in fact, the Corporation had undoubtedly given all the work to private traders. He viewed that with

regret, but they were driven right to the tail end of the session, and if they disagreed with the Lords' amendment, and the Bill went back again to the Lords, it would be lost, and the Corporation would sacrifice improvements to the value of over £100,000, because of the exigencies of time, therefore, he proposed to offer no opposition to the amendment. The question was then put and agreed to.

**PARLIAMENT AND WAR OFFICE CONTRACTS.**—In Saturday's Parliamentary Papers Mr. Touche asked the Secretary of State for War if he would say whether the German cable used at Tidworth and Bulford camps was being insulated with re-manufactured rubber or partly so. Col. Seely replied that it was understood that a certain amount of re-manufactured rubber was used in the outside vulcanised covering of the cable, which was mainly for mechanical protection for the pure rubber inner covering. The rubber used was subjected to mechanical tests and found quite satisfactory. Replying to Mr. Touche on Tuesday, Mr. Baker said that there had been no other War Office contracts given out in respect of other works, besides those at Tidworth and Bulford, in which German cable had been used.

Mr. Touche then asked the Secretary of State for War to say whether the inspectors representing the War Office were present throughout the manufacture at Eschweiler, Germany, of the cable for the Army camps at Tidworth and Bulford, or did they merely inspect and test the completed cable; and was the former practice followed in respect of cable manufactured for War Office use in this country?—Mr. Baker said the inspectors tested the cable during the course of manufacture, and again on completion. The same practice was adopted in respect of cable manufactured in this country.

Mr. Touche further asked whether there was any clause in the specifications for the work at Tidworth and Bulford Camps in which the German cable was employed, requiring the use of pure Para rubber only and excluding the use of re-manufactured rubber?—Mr. Baker replied that there was no such clause, but it was specified that the layer next to the conductor was to be of pure rubber, and the other two of vulcanised rubber. The quality of the whole was covered by a mechanical test.

**Manchester Electro-Harmonic Society.**—The next concert of this society is to be held on Friday next, February 21st, at the Albion Hotel, Manchester, with Mr. S. L. Pearce in the chair. We have received an advanced copy of the programme, from which we gather that those present will be regaled with a splendid selection of items—violin, cello, vocal solos and humorous selections, the artistes being as follows:—Solo violin, Mr. J. Sedgwick Bridge; solo cello, Mr. J. H. Foulds; soloist (bass), Mr. Hamilton Harris; entertainer, Mr. Wilfrid Ludlow; pianist and accompanist, Mr. E. Bennett North. It is expected that there will be present quite a large attendance of local gentlemen who are intimately connected with the electrical trade, and we would urge our readers in and around the Manchester district to make arrangements to support the society on this occasion. Seeing that during the evening there will be five intervals of ten minutes or more each, between 7.30 and 11 o'clock, in which one can fraternise and converse to his heart's content, there will no doubt be a large company present, and the event should be a very popular one.

**Annual Socials and Dinners.**—**NORWICH.**—On Friday last the employés of Messrs. Laurence, Scott & Co. were entertained at dinner, the chair being taken by Mr. Cecil Wilson, who apologised for the absence of his co-directors, Mr. R. Laurence and Mr. W. H. Scott. The vice-chair was occupied by Mr. W. Alcraft, who proposed "Success to Laurence, Scott & Co., Ltd.," and took the opportunity of welcoming Mr. Gilbert Scott. Mr. Alcraft congratulated the directors upon the large amount of business in hand, and said that 1912 had been the hardest year so far experienced at the works. A kindly feeling existed between the directors and the employés, and half wages had been paid to those who had been unable to work during the Norwich August flood. The chairman, in responding, said recent coal and transport strikes had caused great concern to the directors, who had, however, at considerable difficulty and expense, managed to obtain a sufficient supply of coal and materials to keep the works going. Business had scarcely recovered from the effects of the strikes, when the works were disorganised by the August flood. Fortunately, the actual damage done was relatively small, but there was much loss of time and consequent delay in the completion of orders. The firm had now an extraordinary amount of work in hand, including orders for the British Admiralty and the Navies of Spain, Chile, Brazil, Turkey and Japan. Other toasts followed.

**LONDON.**—The fourth annual dinner of the Admiralty Superintending Electrical Engineers' staff took place on Saturday last at the Café Monico, Piccadilly, W. The toast of "The Chairman" was entrusted to Mr. W. McClelland, who referred to his sterling qualities and his long and pleasant association with him. The toast was received with acclamation, and drunk with musical honours. The chairman, Mr. C. H. Wordingham, M.I.C.E., replied in a humorous speech. During a pleasant evening the vocal abilities of some of the staff were "unearthed." The arrangements were carried out by a Committee, consisting of Messrs. Green, Shaw, Mortimer, Graham, Broomfield and Skinner (hon. secretary).

**KIRKCALDY.**—About 300 employés and friends of the Kirkcaldy tramway and electric lighting departments were present at the tenth annual social and dance on 5th inst.

**LONDON.**—The second annual dinner of the Central Electric Athletic Club was held at the Eyre Arms Hotel, Wellington Road, N.W., last Saturday evening. In the absence of Mr. F. J. Walker,

owing to slight indisposition, the chair was taken by Mr. S. T. Dobson, supported by Messrs. D. T. Powell, W. E. Rowland, F. Napier, W. J. D. Partridge, T. Brice, W. Burgess, W. Pummell, S. Green and H. Stephens. The hall was well filled by members of the staff and their friends, numbering about 70. The chairman alluded to the regrettable absence of Mr. H. P. Gaze, who was recuperating in Switzerland, and gave the toast of "The King," which was suitably honoured. The prizes were then distributed, H. P. Gaze being again the winner of the "Leaf Challenge Cup," and A. W. Law, the runner-up. The Donagel Badge was won by J. K. Wells, S. G. Rhodes and H. Cope being second and third respectively. The concert which followed was arranged by Mr. H. Morton, and was much enjoyed, the artistes being Miss Winifred Mansfield, Mr. Dick Dudley, the Concillano Trio, Messrs. H. Morton and J. Clayton, D. T. Powell, W. Cornell, H. Pummell, D. Edwards and F. Lawson, the accompanist being Mr. James Swift.

**LONDON.**—On Saturday last Messrs. Rawlings Bros. entertained about 400 of their employés and their wives and friends at their annual social gathering. We have it on very good authority that everyone present realised that the true democratic spirit reigned supreme and, as Mr. W. R. Rawlings, who presided, stated, the success of the firm in all its various departments was attributable to the loyalty of the employés. During the evening refreshments were served and a high-class entertainment was provided, Mr. Arthur Hill with his "marionette" and "wally" shows, and also his son of less than seven years of age, gave a very fine entertainment. Fine renderings on the piano and violin were given by Mr. W. Hazel and Mr. Conrad Benjamin respectively. Mr. Bert Finch and Mr. Bert Russell amused the audience with humorous songs, and Mr. Frank Heritage again appeared with his cello. Miss Margaret Ward Smith, contralto, and Mrs. Rowden, wife of one of the directors, gave a fine rendering of sentimental songs, while Miss Gladys Ely held the audience spell-bound with clever character sketches. Miss Evelyn Key acted as accompanist.

**CHESHIRE.**—At the Brooklands Hotel, Cheshire, on Saturday, 8th inst., the employés of the Record Electrical Co. Ltd., held their first annual dinner. The master was exceedingly good, including as guests the London office staff and the directors of the company. The chairman of the company, Mr. C. W. von Roemer, toasted "The King," being followed by Mr. A. James, who proposed "The Company." For the latter, Mr. Record, in replying, expressed his great pleasure at the good feeling shown by the invitation given to the directors to be present at the works dinner. The chief of the testing department, Mr. J. H. Care, toasted "The Directors," and advised all to work for collective benefit rather than for individual gain. Mr. von Roemer, in replying, referred to the advance and success which had attended the company's efforts since its incorporation. The "Star" turn of the evening was introduced when the works superintendent, Mr. W. G. Dymont, toasted "The Office Boy." The concert which followed afforded much amusement, members of the staff and works showing their talent in various directions: the entertainment finished with a quintette rendered by "Sum Sparkes." A few words from Mr. T. J. Boorne, the commercial manager and director, brought the proceedings to a close.

**LEICESTER.**—The works and office staff of Messrs. Gent & Co., Ltd., Faraday Works, Leicester, held their third annual social and dance on Tuesday last week at the Queen's Hall. An excellent concert programme, provided by the works "artistes," was followed by dancing, and over 200 of the employés and their friends spent a most enjoyable evening. The "Shop Social," originally held to celebrate the firm's commencement upon the construction of the largest electric clock in the world, now shares with the "Shop Holiday" the distinction of being an annual fixture.

**Foreign Trade in January.**—Compared with the figures for January, 1912, the trade returns for last month show a continued advance, both in imports and exports. The former increased in value by 4½ millions sterling, or 63 per cent., the exports by over 5 millions sterling, or 12½ per cent., and the re-exports by about 1½ millions sterling, or 11½ per cent. The figures relating to electrical trade in comparison with those for the corresponding month of 1911, are as under—

	IMPORTS.
Electrical goods and apparatus (other than machinery and uninsulated wire) ... ..	£136,192, a decrease of £3,804
Machinery ... ..	£673,727, an increase of £158,780
	EXPORTS.
Electrical goods and apparatus (as above) ... ..	£368,618, an increase of £93,627
Machinery ... ..	£3,112,474, an increase of £445,832

**Fatalities.**—**ST. JUST.**—An inquest was held on 6th inst. into the death of a boy named Wallis, aged 15, of Botallack, who was killed on the previous evening by catching hold of a live wire on the Botallack mine property. He was employed in the carpenter's shop at Levant mine. From the evidence given it appeared that near the Nineveh section of Botallack, the overhead wires crossed the road near a stile, and one of the wires had sagged to within 2 ft. of the ground. Wallis was seen to catch hold of it and move it out of his way, and he dropped to the ground immediately. Another boy (Maddern) went to his assistance, and he likewise fell. The path was a public one, and there was no fence under the wires to prevent their falling to the ground. The supply was at 440 volts, received from the Hayle power station

Mr. A. Climas said that when he arrived on the scene the boys were unconscious, and artificial respiration was applied, with success in the case of Mattern, but it was applied for an hour in the case of Wallis without effect. The coroner said that he could not understand why the Urban District Council did not have the public path protected from the wires, and Mr. Climas, in reply, said that he understood that such a protection had not to be placed over an ordinary path. The mine wire was down, because some telephone wires passing beneath it had become entangled with it for some unaccountable reason. That caused a short, and burnt the wire through. A verdict of "Accidental Death" was returned.

**DUBLIN.**—On the 6th inst. an inquest was held in Dublin on the remains of Edward Blance, 43, who was killed by contact with an electric wire in the works of Messrs. Dennehy, motor engineers. It appeared that Blance was assisting in putting a motor into the garage when it came into contact with an electric wire which was hanging down from the supply leads to a lamp. The wire, which was insulated to within  $\frac{1}{2}$  in. of the end, touched the brass of the wind screen. Blance fell down unconscious. It seemed that on other occasions the end of the wire had been lapped up and insulated. The jury found that Blance died from shock caused by the wire, and added that the wire was not properly protected.

**Electricity on the Rand.**—Mr. J. W. Kirkland, President-Elect of the South African Institute of Electrical Engineers, in proposing a toast at the annual dinner of the Institute last month, said: It must be admitted to be a fact that electricity has at last come into its own on these gold fields. As evidence of this, we have at present serving the greatest gold mines in the world with electric power what is destined to be, in the near future, the largest electric power supply company in the world. Within a very short time the output of the Victoria Falls and Transvaal Power Co. will be greater than that of any other single power company, the second being the Commonwealth Edison Co., which, in Chicago, serves a population of almost 3 million people. The men connected with the Victoria Falls and Transvaal Power Co. have been, and are now, the backbone of our local Institute. Later, according to a report in the *South African Mining Journal*, Mr. Kirkland said: "Electricity is being called upon here to work larger hoists and larger air compressors, and to be led more extensively underground than anywhere else, and the difficulties attendant upon these new problems will be met here locally, and, to a very considerable extent, by the men who are, or at least who ought to be, members of our Institute."

**A Large Electromagnet.**—It is proposed to provide the Sorbonne with the largest electromagnet in the world. It is claimed that an electromagnet of the kind described will permit of discoveries of the highest importance for the future of humanity.

**Electrical Trades Union.**—On Tuesday, February 18th, at 9 p.m., a lecture will be delivered by Mr. John Potter (London District Secretary of the E.T.U.) at the Princess of Wales, corner of Belsize Road and Abbey Road, N.W., under the auspices of the North-Western Branch of the Electrical Trades Union. Subject, "Foreign Policy from a Worker's Point of View." Questions and discussion will follow. All electrical workers are invited.

**Electrolytic Copper in Rhodesia.**—According to the *South African Mining Journal*, a copper smelting plant on the Siemona & Hlalske electrolytic process is to be installed in Northern Rhodesia, which will ultimately be capable of dealing with 200 tons of ore per day. Enormous quantities of high-grade ore have been located in the mines concerned, and the process has been experimentally proved suitable for dealing with it.

**A Loughborough Celebration.**—A Loughborough correspondent informs us that a number of the office staff of the Brush Co., who have recently been suddenly dismissed, held a dinner and smoking concert on 6th inst., to celebrate the event, at the Central Hotel. We have received a copy of the unique menu card prepared for the occasion.

**Football.**—The undefeated football team of the Witton Works of the General Electric Co., Ltd. successfully upheld its reputation against the G.E.C. London Head Office team, in a match played last Saturday, February 8th, at Nestanglo Sports Club Grounds, Elmer's End. The weather conditions left nothing to be desired, and the large number of enthusiastic supporters of both teams who turned out were treated to a quick, snappy game, which called forth cheers and applause for many of the players. The resulting score was:—Witton, 5 goals; G.E.C. Head Office, 3 goals. In the evening, an enjoyable dinner and entertainment were provided, at which the "boys from Witton" were guests. The festivities took place at "The Mitre" Restaurant, in Chancery Lane, under the chairmanship of Mr. Balchin. About 70 gentlemen were present. Members of both teams, as well as other members of the G.E.C. staff, furnished the vocal and instrumental music; amongst these were Messrs. Jones, Hall, Balchin, Knight, Plumley, Haughton, Mace, Copley, Bryam, Hudson, Orton and others. Mr. Muir, the honorary secretary of the G.E.C. Football Club, laboured diligently to make the occasion a success.

**Manchester Engineers' Club.**—A general meeting of the members of the Manchester Engineers' Club was held on Wednesday, the 5th inst. The chairman (Mr. Daniel Adamson) presided, and there were about 100 members present.

The Committee presented a report comprising a statement of the business done, with proposals for the future. The chairman stated

that at the present time 570 members had been enrolled, and that applications had been received from about another 100 persons. The funds in the bank standing to the credit of the club were £2,600. The number of members who had guaranteed payment of their subscriptions for a further term of four years ensured an income sufficient to pay the rent of the club premises for the same period. The response from life members had been very encouraging.

To get over any difficulty in connection with the licensing laws, it was resolved that a limited company be formed with a capital of £3,000 in £1 shares, which should have power to borrow money upon debentures. The company will sub-let the furnished premises to the club through trustees for the club appointed by the Committee, the rent charged by the company to be sufficient to pay the rent as stated in the lease, interest on debentures and on share capital, and the small expenses of the company. In order to utilise the available funds of the club, it is proposed that the club shall, through their trustees, take up shares or debentures in the company to the extent of about £1,500. This will leave about £1,500 to be provided by means of subscriptions for shares and debentures, and members will have an opportunity of subscribing for these.

The premises which the Committee has agreed to take are situated in Bridgewater Buildings, in Albert Square. The premises have been used in the past as a club, but they are to be entirely refurbished and suitably decorated.

It was resolved, on the recommendation of the Committee, "that the time limit for admission of original members without entrance fees be extended at the discretion of the Committee, so long as not more than 600 members (exclusive of losses by resignation or otherwise) are so admitted, nor the time for such admission made later than the formal opening of the club premises." It was intimated that if the share capital of the proposed new company was forthcoming at an early date, the club would be opened in May next.

**Inquiries.**—A correspondent asks for the names of makers of the Hailwood No. 1 miner's electric lamp, and the Oldham emergency electric lamp. Makers of the "Sterling" organ-blowing fan and of the "Century" A.C. motor are asked for.

**Institution and Lecture Notes.**—ASSOCIATION OF ELECTRICAL STATION ENGINEERS.—The second general meeting was held at 69, Fleet Street, London, E.C., on Thursday, February 6th, and the attendance exceeded 50. The secretary reported that excellent progress had been made since the previous meeting, and that arrangements were being made for similar meetings in other important centres in the United Kingdom (which would be duly advertised). Application forms had been circulated to all inquirers, and were being steadily returned, filled in and with application fee. The latter, the secretary stated, was of great importance, as the "Association" was very short of funds, and the quick return of all application forms with fee would be much appreciated. The interest aroused by the forming of the A.E.S.E., he said, was now world-wide, and inquiries from British electrical engineers abroad wishing to become members were being received, even from as far off as Brazil. After receiving the report of the secretary, the meeting proceeded to appoint a committee of 20, and it was agreed that it should be only provisional, and should meet as soon as possible to examine application forms and to institute propaganda work. It was agreed that the annual subscription should be 10s. 6d., payable half-yearly, with an entrance fee of 2s. 6d. The question of qualification of members led to a very long discussion, and as it was found difficult to define exactly what constituted the training and experience of a qualified man for the various positions covered by the A.E.S.E., it was decided to let the Committee judge each application on its merits. With regard to provincial branches, the secretary stated that already a few gentlemen had undertaken the duties of district secretaries (*pro tem.*) in some important centres. It was agreed that funds should be supplied to branches for propaganda purposes, &c. The Committee is to make arrangements at once with a chartered accountant with regard to the finances of the A.E.S.E. A meeting of the Committee was to take place on Tuesday, February 11th.

A meeting was held on Friday, February 7th, at the Grosvenor Hotel, Dublin (at which 20 gentlemen were present) to consider the advisability of forming a branch of the above "Association" in Dublin. A number of suggestions were made, and were forwarded to the central organisation in London, and a meeting is to be held to-day, February 14th, to consider the replies from London; subject to these being satisfactory, it was decided to form a branch at once.

**SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS.**—Last month Mr. J. W. Kirkland was appointed president of this Institute. Mr. J. H. Rider, in his valedictory address (as reported in the *South African Mining Journal*) urged members to come forward and read papers and take part in discussions. Unless they were prepared to do so, the value of such institutions was greatly reduced. Every engineer should disseminate his knowledge and experience, and he (Mr. Rider) was convinced that an engineer gained much more than he apparently lost by a free exchange of ideas with his fellows. Further, experience had taught him that he who kept his ideas strictly to himself seldom rose in his profession. If all members of scientific societies freely exchanged experiences, and were neither afraid nor ashamed to get up in a discussion and speak of their difficulties and troubles, the result would be that each individual member would only "give away" his own little bit, and he would receive in exchange the "little bits" of all the other members, and surely the whole was greater than its part. In conclusion, Mr. Rider gave the following advice to electrical engineers:—"Take every opportunity to improve your knowledge and experience, accommodate yourself to the circumstances in

which you find yourself placed, and, above all, be absolutely loyal to your employers and those who may be your official superiors. Do not try to get on too quickly, and, when the opportunity comes, do not be slow to seize it. Don't slacken off your energies because your reward seems to be a long time coming, and, if it should never come in the manner in which you desire, you will have the best of all rewards—the satisfaction of having done your duty."

THE INSTITUTION OF ENGINEERS AND SHIPBUILDERS in Scotland and the INSTITUTION OF NAVAL ARCHITECTS have arranged a joint summer meeting, to be held in Glasgow on June 21th, 25th, 26th and 27th. The details of the programme have not yet been arranged, but the majority of the meetings will be held in the rooms of the Scottish Institution.

INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).—A meeting of the Section was held on Tuesday evening last, when a paper was read by Mr. H. Clifford Palmer on "Advertising Electricity." A discussion followed, to which Mr. Palmer replied.

On Wednesday, at Leeds, a paper was read by Mr. T. Harding Churton on "Some American Electric Plants." A discussion followed.

At the Institution dinner, on February 6th, M. Grosselin, President of the Société Internationale des Electriciens, conveyed to the members an invitation from his Society to visit Paris next May. The invitation has been accepted by the Council of the Institution, and, as soon as sufficient details are available, a circular on the subject will be sent to the members. At present it is proposed that the visit should take place during the last week in May, and that it should last three days, the time being given partly to the reading and discussion of papers and partly to visits to works and places of interest, and a banquet.

INSTITUTE OF METALS.—The annual general meeting will be held at the Institution of Mechanical Engineers, Storey's Gate, S.W., on Tuesday and Wednesday, March 11th and 12th. Among the papers to be read on the latter date are the following:—Dr. G. H. Bailey on "Corrosion of Aluminium"; Mr. Alexander Siemens on "Metal Filament Lamps."

In the course of a paper on "Electricity in Relation to the Architect's Practice," read by Mr. R. N. Tweedy before the ARCHITECTURAL ASSOCIATION OF IRELAND last week, Mr. Tweedy said that in the Dublin shops the lighting arrangement was so atrocious that they only saw the light and not the object.

**Protection from X-Rays.**—It has long been known that silk can be loaded with various metallic salts, and advantage is taken of the fact in commerce to sell silk which is sometimes weighted with as much as 150 per cent. of tin salt. A more legitimate use of this absorptive power of silk is described by Mr. C. Ainsworth Mitchell, in *Knowledge* for February, who says that M. L. Droit has found that by using certain lead salts for the weighting, a silk fabric may be rendered opaque to the passage of X-rays. For example, a material thus prepared by treatment of the silk with lead phosphotannate and other salts contained 68 per cent. of mineral matter, including 34 per cent. of lead oxide, 24 per cent. of tin oxide, 8 per cent. of phosphoric anhydride, and 2 per cent. of lime and alkali. Slight discharges of X-rays were practically arrested by two layers of this fabric, while six layers were found a sufficient protection to the skin against the action of an ordinary discharge of medium strength. This fabric had the same protective effect as a sheet of copper 0.041 mm. in thickness, and had the great advantage of flexibility, even when used in a thickness of several layers.

**An Oil Turbine.**—A description was recently published in *The Syren* of a turbine invented by Messrs. Gavan and Leon Inrig, which is of the internal-combustion type, and is fed with oil. The turbine is of the double-flow pattern, with an admission port at the centre, the drums and casing taking the form of two truncated cones united at their narrow ends by a short cylindrical portion. Compressed air at high temperature and 960 lb. per sq. in. is forced in through the port, followed by a charge of oil, which ignites as in the Diesel engine; water is then sprayed into the combustion-chamber, and is immediately vaporised, the hot gases and steam expanding through the blading. It is stated that owing to the use of steam the blading is not exposed to an excessively high temperature; in fact, the casing is lagged to retain the heat. A turbine of 65 H.P. is under construction.

**Educational Notes.**—Gifts amounting to £150,000 have been presented to the Bristol University for extensions by Messrs. G. A. and H. H. Wills and £20,000 by Mr. W. M. Wills. Their father, Mr. H. O. Wills, gave £100,000 to the University in 1908.

**Business Announcements.**—Messrs. Berry, Skinner and Co., of Oozells Street, Birmingham, will represent Messrs. Nalder Bros. & Thompson, Ltd., in the Midland district in future, and, for the convenience of local customers, they will shortly hold a stock of instruments in current demand.

**Transmutation of Matter.**—Recent researches conducted by Sir W. Ramsay, and by Prof. N. J. Collie and Mr. H. Patterson, indicate that, under certain conditions, helium and neon are produced by the electric discharge in an X-ray bulb containing hydrogen at low pressure. The experiments have been carried out independently with extreme care, and the investigators express confidence in the results. On the other hand, Prof. Sir J. J. Thomson, who has been engaged in similar work, considers that the neon and helium are derived from the glass or the electrodes employed, as the production ceases after a few days, but recommences if the electrodes are changed.

**Appointments Vacant.**—Junior assistant engineers, for the Newcastle-upon-Tyne Electric Supply Co. Ltd. (10s.) see our advertisement pages in this issue.

**Remote Control of Street Lamps.**—In a communication to the Institution of Electrical Engineers, by Mr. W. Duddell and Messrs. Handcock & Dykes, a new system for the control of public and private lamps, meters, transformers in substations &c. by means of tuned selective relays actuated by resonance with a "ripple" of alternating current injected into the distributing mains, is described. To-day the system is to be demonstrated in operation on the mains of the Egham and Staines Electricity Co.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—On the recommendation of the Wolverhampton Corporation E.L. Committee, the following advances in salaries are being made to members of the technical staff: MR. STUBBS, technical and general assistant, from £160 to £200 per annum; MR. DUDLEY, maintenance engineer, £135 to £160; MR. BELLHOUSE, boiler house superintendent, £125 to £150. MR. FORDER, engine room superintendent, £120 to £150; and MR. PLATT, junior assistant, £85 to £101, such increases to be retrospective, as from October 1st last.

West Hartlepool Council has appointed MESSRS. RENDLE and LINDSEY, at present acting as shift engineers, as joint station engineers.

Gillingham (Kent) T.C. has appointed MR. F. TUTT, of Gravesend, and MR. F. KNELL, of Sheerness, as shift engineers at the electric lighting works.

**Tramway Officials.**—The Tramways Committee of the Sheffield T.C. has recommended that the salary of MR. A. R. FEARNEY, general manager, be increased from £800 a year to £900 forthwith, with four subsequent annual increments of £25 to a maximum of £1,000.

The recommendation of the Oldham Tramways Committee that the salary of MR. DUGDALE, the general manager, be increased from £350 to £400 per annum, was adopted by the T.C. on February 5th by 20 votes to 13.

**General.**—MR. H. F. PARSHALL stated at the half-yearly meeting of the Central London Railway last week that he was retiring from the board to accept the position of consulting engineer to the whole of the Underground interests. During the period in which he has occupied the chair of the Central London Railway, he has acted not only in the capacity of chairman of the railway, but also as managing director and consulting engineer, having, in fact, absolute control of the railway from every point of view. The operating expenses have been largely reduced, and the efficiency of the railway greatly increased. Mr. Parshall, in resigning his position as chairman and accepting the position of consulting engineer to the Underground interests as part of his general practice, is now enabled to give, as formerly, his whole time to his private consulting practice, and to give his undivided attention to the numerous railway and power projects with which he is associated.

MR. J. W. BUCK, late of Messrs. Siemens Bros. Dynamo Works, Ltd., Upper Thames Street, E.C., has been appointed sales manager to the Baldur Engineering and Supply Co., Ltd., of Westminster.

COUNCILLOR JAMES LINDSAY has intimated his resignation from the membership of the Leith Corporation E.L. Committee. Mr. Lindsay, it is stated, disapproved of the Committee's action in forming a management sub-committee.

MR. BERNARD L. MYER has resigned the position of chief electrical assistant with Messrs. Sloan & Lloyd-Barnes, consulting electrical engineers, of Liverpool, which he has held for the past nine years, and has taken over the management of the electrical and engineering department of Messrs. Fred. Wilkins & Brother, Ltd., 27-35, Duke Street, Liverpool, who specialise in the electrical, mechanical and fire equipment of theatres and picture-dromes, and also carry on a large general electrical engineering business. Mr. Myer invites firms to send him new catalogues and price lists for wiring accessories, motors, cables, conduits, &c.

We learn that the Shanghai municipal electrical engineer will be in this country in June next in connection with orders for two additional 5,000-kw. turbo sets.

At the Tramways and Light Railways Association's convention at Swansea last year, MR. DE TURCKHEIM, the secretary of the Association, was presented with a clock. We are informed that a plate has now been fixed to this clock, bearing the following legend:—

Presented to A. DE TURCKHEIM, by the members of the Tramways and Light Railways Association, as a token of esteem and an appreciation of his organising genius.

Swansea, June, 1912.

On Monday evening a gold hunter watch was presented by the staff of Messrs. Crompton & Co., and one or two old Cromptonians, to MR. ALAN WILLIAMS, upon the occasion of his leaving the company's service and starting business for himself. The presentation, which took place at Salisbury House, E.C., in the presence of the staff, was made by Mr. E. Reeves, the joint manager of this company, who wished Mr. Williams all success in his future career. Mr. Williams stated that the handsome present would always remind him of the happy relationship which had existed between himself and the other members of the staff for so many years.

MR. JAMES MEIKLE, electrical engineer, recently of the Glasgow Corporation Electricity Department, has now become associated, as a partner, with the firm of Robert Semple & Co., mechanical and electrical consulting engineers, 30, Buchanan Street, Glasgow, and will be pleased to receive particulars, catalogues, &c., from electrical manufacturers.

MR. H. S. KENNEDY has been appointed to the position of manager of the marine department of Messrs. Siemens Bros. Dynamo Works, Ltd., and will now be stationed in Glasgow. He has been with the firm for a number of years.

**Obituary.**—MR. GEORGE F. HARDEN.—We deeply regret to learn of the death of Mr. George F. Harden, which occurred on Thursday, the 6th inst., at the very early age of 34. After serving his apprenticeship with Messrs. Scott & Mountain, Mr. Harden joined Messrs. Crompton & Co., Ltd., in 1901, and was later on sent to Glasgow in charge of the firm's branch office there. Subsequently he was moved to a position in the sales department at the head office at Salisbury House, E.C., and finally took over the sales department for the London district. In the beginning of 1912 he was attacked by tuberculosis, and after undergoing open-air treatment, he eventually placed himself in the hands of a specialist in Scotland, under whose care he made a wonderful recovery. Unfortunately, shortly after Christmas he took cold, which went to his lungs, and owing to his power of resistance having been so very much weakened after a year's illness, he was unable to fight the inflammation which was set up in his lungs, and gradually sank and died after three weeks' illness. He leaves a widow and small boy. Both at Glasgow and in London Mr. Harden made a very large circle of friends owing to his genial and breezy manner, and we are sure that this intimation of his death will be received by them with a sincere sense of loss.

A correspondent writes:—"By the death of Mr. Oliver Firth, of Horsforth, Yorks., a gentleman has been removed who was once well known in electrical circles by reason of his connection with the engineering trade and in the manufacture of dynamos."

## NEW COMPANIES REGISTERED.

**International Cold and Power (Charles Tellier Processes) Co., Ltd.** (126,868).—This company was registered on February 4th, with a capital of £20,000 in 20 shares (12,000 preference), to carry on the business of mechanical engineers and constructors, electricians, suppliers of electricity, liquid air, motor or motive power, and artificial cold, ice merchants and manufacturers, refrigerating storekeepers, &c., and to adopt an agreement with E. L. Hienle. The subscribers (with one share each) are:—W. P. Welbered, 41, Russell Road, Kennington, W., chairman; E. F. Doune, 56, George Street, E.C., manager; E. Leary, Spencer House, South Place, E.C., secretary; G. M. Evans, Woodstock, Broadstairs, retired banker; E. B. M. Perowce, 5, Guildhall Chambers, E.C., solicitor; G. F. Heard, Holmwood, Devonshire Road, Merton, managing clerk; J. Cooper, Rushmore, Godmaysa Vale, Muswell Hill, N., clerk. Minimum cash subscription, seven shares. The number of directors is not to be less than three or more than 12; E. L. Hienle is the first director; qualification (except first director), £100; remuneration, 15 per cent. of the surplus profits remaining after payment of a dividend on preference shares, divisible. Registered by E. B. M. Perowce, 5, Guildhall Chambers, E.C.

**City of Las Palmas Water and Power Co., Ltd.** (126,916).—Registered February 8th, by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital, £120,000 in 24 shares. Objects: To supply the port and town of Las Palmas and neighbourhood with water and electricity, to acquire the concession granted to Bernardo de la Torre by the Municipality of Las Palmas, Grand Canary, and to adopt an agreement with the Las Palmas Syndicate, Ltd., and the Bernardo de la Torre. The signatories (with one share each) are:—J. Barde, 7, Walcot Gardens, Kennington, S.E., accountant; W. R. Tompkins, Morecroft House, 10, Brentford Road, St. Albans, clerk; C. Anning, Ellerslie, Sylvan Road, Snarborough, clerk; W. R. Smith, 6, Lawley Street, Lower Clapton, N.E., clerk; A. G. Mount, 88, Narford Road, Clapton, N.E., clerk; E. J. Burrows, 44, Hereham Road, South Tottenham, clerk; S. A. Sharpe, 205, Friars Road, Dulwich, S.E., cashier. Minimum cash subscription, two shares. The first directors (with one share each) are:—D. P. Taylor, 22a, Oriol Road, Bootle, electrical engineer; D. Brown, 41, Pembroke Road, Bootle, ironfounder and engineer. Private company. The number of directors is not to be less than three or more than six. The first are D. P. Taylor, D. Brown and R. Tilley; qualification, 50 shares. Registered office, 22a, Oriol Road, Bootle. Solicitors, Ashby & Clothier, 8, Cook Street, Liverpool.

**Havana Development Syndicate, Ltd.** (127,068).—This company was registered on February 8th, with a capital of £21,000 in 20,000 ordinary shares of £1 each and 20,000 deferred shares of 1s. each, to promote any company for the acquisition of all or any of the property, rights and liabilities of the company, to construct, equip, maintain and work steam electric or motor railways, tramways, omnibuses, or other vehicles for the carriage of passengers and goods, &c., in Cuba or elsewhere. The subscribers (with one share each) are:—L. A. Bartlett, 53, Camilla Road, Bermuda; S. E., secretary; J. A. Mattana, 7, Lordship Park, N., secretary. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; qualification, 50 shares; remuneration, £50 per annum. Registered office, 1, London Wall Buildings, E.C.

**Bootle Electrical Co., Ltd.** (126,985).—This company was registered on February 6th, with a capital of £1,500 in 15 shares, to take over the business carried on by T. P. Taylor, at 22a, Oriol Road, Bootle, as the "Bootle Electrical Co." The subscribers (with one share each) are:—D. P. Taylor, 22a, Oriol Road, Bootle, electrical engineer; D. Brown, 41, Pembroke Road, Bootle, ironfounder and engineer. Private company. The number of directors is not to be less than three or more than six. The first are T. P. Taylor, D. Brown and R. Tilley; qualification, 50 shares. Registered office, 22a, Oriol Road, Bootle. Solicitors, Ashby & Clothier, 8, Cook Street, Liverpool.

**Leeds Private Telephone (New System) Co., Ltd.** (126,997).—This company was registered on February 5th, with a capital of £1,000 in 10 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—F. T. Jackson, 143-5, Great Portland Street, W., agent; T. H. Walker, 57a, Holborn Viaduct, E.C., printer. Private company. The first directors are F. T. Jackson (permanent chairman and managing director) and T. H. Walker. Registered office, 2, Basinghall Square, Leeds.

**Reitments, Ltd.** (127,002).—This company was registered on February 5th, with a capital of £3,000 in 21 shares, to carry on the business of manufacturers and producers of electric filament lamps, &c. The subscribers (with one share each) are:—W. Lee, 23, Blenheim Road, Bedford Park, land agent; C. B. James, Holme House, Norbury, accountant. Private company. The number of directors is not to be less than two or more than eight; the first are not named; qualification, £100; remuneration as fixed by the company. Registered office, 60, Haymarket, S.W.

## CITY NOTES.

### Mersey Railway Co.

THE half-yearly ordinary general meeting was held on Tuesday, at the offices, Worcester House, Walbrook, E.C., Mr. J. Falconer, M.P., in the chair.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 231), said it was a great satisfaction to the board to be able at the end of the half-year to again record that substantial progress had been made by the company as regarded its volume of traffic, its receipts, and also its net revenue. That steady increase in those three particulars had been maintained ever since they had adopted electrical traction for the line. It was now practically 10 years since they first commenced electrical working, and during that time the receipts had increased practically to the extent of £60,000 per annum. Their receipts during this last year were practically £60,000 more than they were in 1902, which was the last complete year of steam working. Comparing the last half-year of steam working with the half-year under review, it would be found that the number of passengers carried had increased from 3,500,000 to 8,111,000, an increase of 4,750,000, or 141 per cent. The receipts had increased from £29,470 to £59,651, an increase of £30,000, equal to 102 per cent. It was interesting to compare the figures for the past year with the corresponding period of 1911. It was true that there was a strike in 1911, but it was satisfactory to note that the passengers carried, apart from season ticket-holders, were 12,745,000, as against 11,940,000, which was an increase of about 672 per cent. The receipts had increased from £109,947 in 1911 to £115,926, equal to about 5'44 per cent. The expenditure had only increased from £59,115 to £60,765, an increase of £1,315, which was almost entirely due to an increase in the price of coal. The net revenue had increased from £50,532 in 1911 to £55,158 in 1912, an increase of £4,626, or 9'15 per cent. The important question for the debenture-holders was as to the amount available for payment of interest upon the debentures. After providing the full payment of the interest on the first debenture stock amounting to £26,774, there remained £18,060. That was sufficient to pay the interest on the 1866 stock in full, and also on the 1871 stock and to pay £2,179 per cent. upon the 1882-3-5 3 per cent. stock, or within 2/3 per cent. of the full amount to which that stock was entitled. He thought the shareholders and debenture-holders would agree that it was gratifying that they should have been able to pay the interest upon those debenture stocks in the way they had. They still had the "B" debenture stock to face before they reached payment upon the preference shares. The amount of that stock was £282,354, and the amount required to meet the interest, which was 3 per cent., was £8,470. The length of time which it would take before they were in a position to pay interest upon that stock would, of course, depend upon the rate of progress they made in the future. It had never been their habit to attempt to prophesy—all he could say was that every year had confirmed the board in the view that there was a great volume of traffic to be served by the railway, and that they had adopted the right policy in giving what they thought was the best railway service in the United Kingdom.

The HON. R. C. PARSONS, M.A., seconded the motion.

Replying to questions, the CHAIRMAN said that during the month that had elapsed since the accounts were closed, the returns showed further reasonable expansion. They had no reason to believe that the limit of expansion had been reached, and the shareholders were in quite as good a position as the board to form a judgment on that matter. They could do a very largely increased traffic with comparatively very little additional capital expenditure. The generating plant was more than ample for any expansion of traffic which was likely to come for a considerable time.

The report was adopted.

**W. T. Henley's Telegraph Works Co., Ltd.**—Subject to audit, the directors have decided to recommend a dividend payable on March 1st next, on the ordinary shares at the rate of 15 per cent., free of income-tax, including the interim dividend of 5 per cent. paid August 31st last.

**South Metropolitan Electric Light and Power Co., Ltd.**—The transfer books and register of members will be closed from February 15th to 28th, for the preparation of warrants for dividends payable on 28th inst.

**Newcastle and District Electric Lighting Co., Ltd.**—The directors recommend a final dividend of 3 per cent. for the last half of 1912, making 3 per cent. for the year.

**Underground Electric Railways Co. of London, Ltd.**

THE directors report that for the half-year ended December, 1912, the net revenue from investments and properties (including general interest), after deducting general expenses and including balance brought forward, amounted to £278,007, and the interest charges on £1,730,000 4 per cent. bonds of 1913, absorbed £11,336, leaving a surplus of £236,671. Out of this will be paid on March 1st, 1913, interest at the rate of 6 per cent. per annum on £1,273,000 6 per cent. first cumulative income debenture stock for six months ending December, 1912, £38,190; interest at the rate of 6 per cent. per annum, plus income-tax, on £6,136,050 6 per cent. income bonds of 1918 for six months ending December, 1912, £195,486, carrying forward £2,996. The income for the half-year shows an increase of £122,671 over that for the corresponding half-year of 1911, but a true comparison is not possible on account of the substantial alteration in investments.

The Metropolitan District Railway Co. continues to show a steady expansion in receipts, with a slight increase in working expenses, due largely to the increased price of coal and to increases in the wages of the staff.

The London Electric Railway Co. shows an increase in earnings and also in working expenses, the latter due to higher prices of coal and increase in the wages of the staff. The construction of the Charing Cross and Paddington extensions is progressing rapidly, and it is expected that both will be opened for traffic in the autumn. Work has also been commenced on the Queen's Park extension, and on the installation of escalators at Oxford Circus Station.

The London General Omnibus Co., Ltd., has substantially increased its fleet of motor-omnibuses, and shows a satisfactory expansion in earnings.

The Associated Equipment Co., Ltd., has been formed for the purpose of manufacturing equipment and repair parts for the various undertakings allied with the company. It owns a large factory at Walthamstow, to which extensive additions are being made. It also owns all the debenture stock and ordinary shares of the Metropolitan Steam Omnibus Co., Ltd.

The annual report and accounts of the London United Tramways, Ltd., for 1912 are not yet published, but it is not expected that the results of the year's working will show much, if any, improvement over the previous year.

After giving particulars of Parliamentary Bills, the report goes on to refer to the amalgamation or consolidation schemes entered into with tramway and omnibus companies, and certain underground electric lines.

In the balance-sheet "stocks, shares, and other property," stand in the books at £13,502,622, and consist of stocks and shares in associated companies, as well as lands and buildings.

The item "calls unpaid," which formerly appeared in the balance-sheet, has been eliminated, as all of the capital has been paid up. Most of the securities and shares of the company are now held by British investors. In view of this fact, the American directors have come to the conclusion that the management of the company should in future be wholly in the hands of the board of directors residing in Great Britain. They have therefore resigned their seats, and Mr. W. M. Acworth and the Right Hon. C. B. Stuart-Wortley, K.C., M.P., have been elected to the board. In parting from their American colleagues, the directors desire to express their high appreciation of the valuable services rendered by them to the company in the past.

The meeting is called for February 24th.

**Electrical and Industrial Investment Co., Ltd.**

THE report of this company for the seven months from June 1st to December 31st, 1912, as published in the financial Press, states that the company was capitalised mainly by debenture-holders and shareholders of the City of Birmingham Tramways Co. subscribing for debenture stocks and shares in this company, under a scheme of conversion by which this company acquired the investments of that company, comprising, among others, a large proportion of trustee securities. A reserve was provided in securities by that company to meet the depreciation of the trustee securities and of some of the other investments taken over. All the trustee securities and some of the others have since been realised, and the loss on realisation has been borne by the reserve. The directors have acted on, and propose to adhere to, the principle of adding to the reserve any profits made on sales of any of the company's investments, and of charging against the reserve any losses on realisations. The balance account at December 31st, 1912, was £23,195. The directors have power to issue debenture stocks to an aggregate amount not exceeding the subscribed share capital of the company, and they propose to issue further debenture stocks of the company accordingly. The revenue account shows a profit, after paying all administration expenses, of £11,325. The interest on the debenture stocks amounts to £2,970, and the dividend on preference shares to £3,411, leaving £1,943. This balance would admit of a dividend on the ordinary shares at the rate of 4½ per cent. per annum. The directors, however, are of opinion that it is better to strengthen the company by defraying the whole of the preliminary expenses, amounting to £1,629, out of the first profits, carrying forward the balance of £3,314.

**Mather & Platt, Ltd.**—The directors announce a dividend at the rate of 10 per cent. per annum, with a bonus of 2 per cent., both free of tax, less the interim dividend of 5 per cent. already paid.

**Stock Exchange Notices.**—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Manassas Tramway and Light Co., Ltd.—300,000 ordinary shares of £1 each fully paid, Nos. 1 to 300,000 (special application).

Pacific Power and Light Co.—\$5,000,000 5 per cent. first and refunding mortgage 20-year gold bonds, International series, Nos. 1 to 5,285 and 5,301 to 5,610 of \$1,000 each.

Sao Paulo Electric Co., Ltd.—£1,880,000 5 per cent. 10-year first mortgage bonds, in lieu of the scrip.

The Committee have appointed a special settling day as under:—  
Wednesday, February 19th.—Universal Cheap Cables, Ltd.—20,000 shares of £1 each fully paid, Nos. 1 to 20,000.

And ordered the undermentioned securities to be quoted in the Official List:—

Commercial Cable Co.—£14,146 additional sterling 500-year 4 per cent. debenture stock.

**Chloride Electrical Storage Co., Ltd.**—The directors recommend, out of the undivided profits, an interim bonus of 7s. 6d. each on the ordinary shares, to be satisfied by the issue and *pro rata* allotment of 19,344 new shares, making 73,250 of these shares outstanding.—*Financial Times*.

**Telegraph Construction and Maintenance Co., Ltd.**—In addition to the interim dividend of 5 per cent. paid in July last, there is announced a further dividend of 10 per cent., together with a bonus of 12s. per share, making 20 per cent. for the year. This compares with 17½ per cent. for 1911.

**Blackpool and Fleetwood Tramroad Co.**—The half-yearly meeting was held at Manchester on Tuesday, Mr. Geo. Richardson presiding. The chairman said that the result of the half-year's working was very satisfactory, especially considering the state of the weather.

**Willans & Robinson, Ltd.**—The report states that the accounts for the year to June 30th show a balance against profit and loss of £52,191, of which £31,310 represents book adjustments, the result of a special scrutiny of fluctuating assets instituted by the directors when the bank loan was arranged. The balance of £20,881 represents the trading loss for the year after including provision of £8,337 for depreciation, £9,378 for debenture interest, and £892 for the upkeep of Queen's Ferry Works, a total of £18,607.—*Financier*.

**Dublin United Tramways Co. (1896), Ltd.**—The directors report that the accounts for the half-year to December 31st show available for division £63,852. It is recommended that dividends be paid for the half-year at the rate of 6 per cent. per annum (less income-tax) on both the preference and ordinary shares. £10,000 is to be set aside towards the renewal of permanent way, £2,000 to accident insurance reserve, and £5,000 to reserve and renewals fund, leaving £11,257 to be carried forward.

**Prospectus.**—*Hydraulic Power and Smelting Co., Ltd.*—There has been offered for subscription this week (the list was to close last Tuesday) an issue of £475,000 5 per cent. first mortgage debentures at 95 per cent. in this company, which was formed in 1911 to acquire the share capital of the following companies:—Aktieselskabet Tysefaldene; Norsk Elektrisk Metalindustri Aktie selskap; Trollhättans Elektrothermiska Aktiefölag.

**Central Electric Supply Co., Ltd.**—In their annual report, the directors state that an agreement for the supply in bulk under the London Electric Supply Act, 1908, has been entered into with the Chelsea Electricity Supply Co., Ltd. Energy has been supplied to the Westminster Electric Supply Corporation, Ltd., the St. James's and Pall Mall Electric Light Co., Ltd., and the Chelsea Electricity Supply Co., Ltd., to an amount of 24,328,750 units. After making a full allowance for sinking fund and depreciation, the net balance for 1912 is £4,999, plus £5 brought forward, leaving to be dealt with £5,004. A dividend at the rate of 5 per cent. on the ordinary shares for the year absorbs £5,000, leaving £4 to carry forward. A 3,000-kw. high-pressure turbo-generator has been added to the plant during the year. Mr. Marlborough R. Pryor has been appointed a director of the company.

**The Promotion and Flotation of Limited Companies.**—According to a lecture delivered on the 11th inst. in the City by Mr. H. W. Jordan, F.I.D., an advance print of which was sent to us, it would appear that out of 138,000 companies registered under the 1862 Act, some 80,000 have become defunct, leaving, approximately, 58,000 with a paid-up capital of about £2,450,000,000. In 1912, 7,666 companies were registered representing a capital of £173,819,037. Commencing with a brief sketch of the history of companies, the lecturer discourses pleasantly upon various matters under such titles, *inter alia*, as "purpose of formation," "freak companies," "invalid articles," "formation" (steps to be taken on the registration of a company), but the paper is obviously not intended for the professional secretary, whose varying and onerous duties and responsibilities, by the way, are ever on the increase. Though many improvements have been effected in the Companies' Acts, now codified under the name of "The Companies' (Consolidation) Act, 1908," there seems, in many cases, to be room for a greater pressing home of the all-important element of responsibility in accepting and dealing with public money.

### St. James's and Pall Mall Electric Light Co., Ltd.

The directors report for 1912 shows that the connections have increased from 13,975 kW. to 14,609 kW., and 11,044,768 units were supplied to consumers. The Central Electric Supply Co. Ltd., has declared a dividend of 5 per cent. on the ordinary shares, in respect of which a sum of £2,500 will in due course be payable to this company. As stated in last year's report, it is intended to continue the equipment of the Carnaby Street works with transformers and accumulators to deal with an increase in H.T. supply from the Grove Road works. To meet the consequent obsolescence of steam generating plant, special provision for depreciation has again been made in 1912, and the directors have also carried a sum of £4,500 from net revenue account to the credit of contingency fund. The net profits for 1912, applicable to dividends on shares, amount to £26,946, plus £2,294 brought forward, less interim dividend paid in August last for half-year ending June 30th, at the rate of 7 per cent. on preference shares, £3,500, and 10 per cent. on ordinary shares, £10,000, leaving £15,740 to be dealt with. It is proposed to pay a dividend at the rate of 7 per cent. on the preference shares for the second half-year, requiring £3,500, and a dividend on the ordinary shares for the second half-year of 5s. per share, making, with the interim dividend paid in August last, a total of 10 per cent. for the year, £10,000, leaving £2,240 to carry forward. The directors regret the death of Sir John H. Morris, K.C.S.I., and they have elected Mr. F. J. Walker to a seat on the board, and have appointed him managing director of the company. The meeting is called for February 18th.

Units generated and purchased	13,909,052
Quantity utilised—Private supply	11,044,768
Used on works	372,853
Total	14,417,121
Expended in distribution	2,491,931
Total connections in kW., December, 1912	14,609

### Central London Railway Co.

THE meeting of this company was held on February 6th at the Holborn Restaurant, Dr. H. F. Parshall presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 231), said that during the half-year the expenditure on capital account had been £63,148, chiefly in connection with the Liverpool Street extension, which alone had amounted to £37,941. The estimated expenditure on the Liverpool Street extension during the present year was £44,000, and for subsequent years £1,000. On the Ealing and Shepherd's Bush extension, the estimated expenditure for the present year was £61,000, and for subsequent years £30,000, and that together with the provision for additional rolling stock £6,000, and an amount for subsequent years of £69,000, gave a total of £211,000. To meet the anticipated capital expenditure, they had unissued debenture stock, amounting to £160,000, and a balance at the credit of capital account of £112,978, a total of £272,978. They had carried 18½ million passengers, which, as compared with the same period of last year, showed an increase of 613,000, and the increase in receipts amounted to £5,222. That, together with the increase in miscellaneous receipts, gave a total increase in receipts of £5,903. Against that, there was an increase in working expenses of £2,632, principally accounted for by the extra cost of working the Liverpool Street extension. It would be seen, therefore, that the net revenue showed an increase of £3,271. It was very satisfactory to note that the Liverpool Street extension, which was opened on July 29th last, had contributed mainly to that increase in passengers and receipts. The actual bookings at Liverpool Street for the five months preceding the date of the balance-sheet accounted for 1,626,000 passengers, with £10,200 receipts. The Broad Street portion of the extension, which was opened on October 10th last, had contributed 161,000 passengers, with £1,184 receipts. That gave a total for the extension of £11,384. A great increase in the Broad Street traffic was anticipated as soon as the lifts were ready for use. They had already been tested, and would be expected to be running in ten days. The gross receipts for the half-year amounted to £144,455, as against £138,552, and after deducting working expenses, which amounted to £76,328, there was a balance of net revenue of £68,127. That compared with £64,856 for the corresponding period of the previous year. The amount brought forward from last half-year was £23,776, general interest amounted to £6,530, and the amount reserved from the last half-year to meet the dividend of the deferred stock was £6,462, giving a total net revenue of £104,895. After providing for debenture interest and other payments amounting to £19,475, there was an available balance of £85,420, as compared with £83,170 last year. The interest on the 4½ per cent. preference stock amounted to £10,800, less amount charged to capital under the Act of 1909, £4,060. There was, therefore, a total balance available of £78,680, and from that sum dividends on the undivided ordinary stock at the same rate as last year, namely, 3 per cent., and of 4 per cent. on the preferred ordinary stock and 2 per cent. for the whole year on the deferred stock, were recommended, absorbing £51,462. That left a balance to be carried to the next half-year of £27,218, as against £26,151. The whole of the permanent way was being renewed, and a system of automatic signalling was being installed; all of this work was well in hand and was being proceeded with as rapidly as possible. Proceeding to refer to the recent proposals of the Underground Electric Railways Co. of London, Ltd., which were fully explained at a meeting of shareholders in December last, he said that holders of over 75 per cent. in the aggregate of the ordinary, preferred ordinary, and deferred ordinary stocks, had accepted that offer, and the Underground Co. had intimated that

the offer was now binding upon them. Under the trust-deed between the Underground Co. and Messrs. Glyn, Mills, Currie and Co. and two of their directors, namely, Viscount St. Aldwyn and Sir H. Babington Smith, remained on the board to represent the interests of the guaranteed stockholders; the Hon. A. H. Mills also remained as a director. Mr. R. Fleming, Lord Knollys and Lord Rathmore, had retired, and Lord George Hamilton, Sir Herbert Jekyll and Mr. Albert H. Stanley, having been nominated by the Underground Co., have been elected in their places. In accordance with the new arrangements, his own resignation had been tendered to take place after the meeting, when it was proposed to elect Lord George Hamilton as the new chairman.

VISCOUNT ST. ALDWYN seconded the motion, and the report was adopted.

### Smithfield Markets Electric Supply Co., Ltd.

SIR H. S. LEON, Bt. (chairman), presided on Friday at Winchestr House, E.C., over the fifteenth ordinary general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 234), said that £2,847 had been spent on capital account during the year. This included a part of the cost of the new generating plant, and since their report had been issued, three of these new machines had been brought into use, so that the balance of the cost when the fourth one was erected would be charged to the capital account of 1913. Last year he alluded to what were termed physical difficulties on account of the Diesel engines, but those difficulties had been surmounted, and it was hoped that, if all went smoothly, their income would be considerably increased as the result of this heavy expenditure. Turning to the revenue account, it showed a small increase in the gross profit. There had been some money spent out of revenue on improvements of a special nature in connection with their installations entirely for the benefit of their customers, which had already proved itself very well spent. The gross revenue showed a slight falling off, almost entirely due to a smaller demand for power, perhaps on account of the cold summer. It would also be remembered that the Dock strike of last summer dislocated trade and injured the particular business from which they derived some part of their revenue. Their competitors, the gas company, had been very active in the markets, and it spoke well for the popularity and manifest advantages of electric lighting that they had so far been able to hold their own. It seemed to him remarkable that anyone could prefer gas to electricity, even if they had to pay double the price for electricity. The net profit was equal to 6 per cent. more than last year, after having placed £400 to the debenture stock redemption fund, and £500 to depreciation account, while the amount available for dividend was £2,154. The board, therefore, recommended the payment of a 2 per cent. dividend, the same as last year. They might have to borrow a little money to pay for the new plant, but the board intended this debt to be only of a temporary nature, and repayment of it would be made as the company could afford to do so. He desired to emphasise the importance of having a considerable sum in cash as working capital, for they must be in a financial position to face the gas competition as well as to effect any improvements which might come along, so as to reduce the cost of generation. As a matter of fact, they had had an increase in the number of lamps installed last year, in spite of the gas competition, but the revenue from them was not so large, owing to the varying conditions of trade in the market. The electric lighting bills of their customers were much more closely examined than they used to be, and while the aggregate of trade was larger, the profit was smaller. He thought that was the general tendency of trade in every branch throughout the country, and in the long run he did not think it would do any damage to them or anybody else.

MR. E. SCHENK seconded the motion, and the report was adopted without discussion.

**Official Announcements re Companies.**—The following are to be struck off the register within three months, unless cause is shown to the contrary:—

Bertius Light Cure Institute, Ltd.  
 Carnarvonshire Electric Traction Syndicate, Ltd.  
 Empire Electric Light and Power Co., Ltd.  
 Improved Electric Supplies, Ltd.  
 Ozmission Syndicate, Ltd.

**National Gas Engine Co., Ltd.**—The directors report that for the year 1912 the net profit, after providing amply for depreciation of buildings, tools, &c., and allowing for management salaries and income-tax, was £91,238. An interim dividend for the six months to June 30th, amounting to £28,500, being at the rate of 5 per cent. per annum on the preference shares, and 7½ per cent. per annum on the ordinary shares, was paid on July 31st, 1912, leaving £62,738 plus £5,769 brought forward, making £68,506 to be dealt with. The directors recommend a final dividend at the rate of 5 per cent. per annum on the preference shares, and 7½ per cent. per annum on the ordinary shares, both less income-tax, for the six months ended December, 1912. This will absorb £28,500, and leave £40,006, out of which the directors propose to place £21,200 to the reserve fund (making it £30,000), to write off the formation expenses £8,867, and to carry forward £9,939. Mr. Kenneth S. Prescott has been elected to the board.

**Bristol Tramways and Carriage Co., Ltd.**

The directors' report for 1912 shows that the gross receipts were £369,614, and the working and general expenses and renewals £301,412, leaving a net revenue of £68,202. From the net revenue the following have been distributed, viz. interest for the year on 4 per cent. and 4½ per cent mortgage debenture stock, and on deposits and bankers' interest, £23,860; interest (carried to reserve fund) on investments realised for capital outlays, £2,693; dividend on 4 per cent. preference shares for the year (subject to income-tax), £18,833; interim dividend at the rate of 4 per cent. per annum (subject to income tax), for the half-year ended June 30th, £9,417; and it is proposed to appropriate the balance as follows—Final dividend for half-year at the rate of 4 per cent. per annum (subject to income-tax), £9,417; addition to reserve fund for contingencies and renewals, £4,083. The interest on investments, and amounts from income-tax claims adjustment, have been carried direct to the credit of the reserve fund, which totals £241,289. With the addition now proposed of £4,083, the reserve fund will be further augmented to £245,372. The receipts from the tramways department show an increase of £5,390, or about 2½ per cent., whilst those of the carriage department have increased by £27,666, or 26 per cent. The total number of passengers carried during the year on the company's cars and motor-omnibuses was 52,370,515, as compared with 49,561,001 in the previous year, an increase of 2,809,514.

The expansion of the company's general motor carriage business is continuous. The business at the branches in Bath and Weston-super-Mare is increasing daily, and further developments are intended; moreover, the branch established during the past year at Cheltenham has succeeded in fulfilling the public requirements so admirably, that another one will be forthwith opened in the adjoining city of Gloucester. The company have recently been appointed by H.M. Postmaster-General as contractors for the carriage of the mails by motor vehicles for three services, between Gloucester and Bath, Cardiff and Birmingham respectively, and a further service between Bristol and Chipping Sodbury. This is in addition to the contract for Bristol local mails held for years past by the company. New motor-omnibus routes will be opened in and around Bristol, whilst the daily excursion traffic for Bristol and the West of England will be further developed in the ensuing summer. Fifty high-class cars for private hiring are being built at the company's works, and more will be added to the stock. An additional number of commercial vehicles will also be provided to meet the increasing demand. The motor building and repairing works at Brislington (covering upwards of four acres) are partially occupied, and will be completed in June next. The installation, comprising machinery and automatic tools of the most recent invention, is designed to yield an output of about 300 new motor-omnibuses, cabs and other vehicles each year, as well as to enable all repairs to the company's rolling stock and privately-owned cars to be executed under most economical conditions. During the past year the directors have purchased, for the sum of £1,600, the undertaking of the Clifton Rocks Railway Co., constructed at a cost of £30,000. The railway can be profitably worked by the company and made available as a convenient link for those passengers who travel by the vehicles now or at any future time to be worked by the company in and around Clifton and Hotwells.

The recent Insurance Act received much consideration by the directors, who found that if the company elected to carry out the literal requirements of the Act, the employees would be injuriously affected, and placed in a much inferior position to that they had occupied under their provident society, which had been fostered by the company for many years past. The directors, therefore, formulated a scheme for an "Approved Society," embracing only the company's employees, and this received the immediate and hearty approval of the Insurance Commissioners. Occasion was taken to still further enlarge the benefits so that the employees are now secured such advantages as are enjoyed by few, if any, similar employments in the kingdom.

The Employees' Superannuation Fund, wholly subscribed by the company and its directors, now amount to £29,115. The substantial provision now existing, and which will continue to be made for old age or other incapacity, is much appreciated by the employees.

The meeting is called for February 19th.

**Paisley District Tramways Co.**

THE directors' report for the half-year ended December 31st, 1912, shows that the revenue was £30,056, and the expenses were £17,622, leaving £12,433; less general interest, £265; interest on debentures, £1,600; debenture sinking fund, £750, leaving £9,818, plus £1,996, brought forward, making a balance of £11,814. Out of this, £3,000 has been placed to general reserve account; £3,750 to dividend for the half-year on the 5 per cent. cum. pref. shares; £1,000 to preference share sinking fund; £1,620 to dividend at the rate of 2 per cent. per annum for the half-year on the ordinary shares; £2,444 being carried forward. The traffic receipts show an increase of £1,113 and the expenses an increase of £1,794, as compared with the receipts and expenses for the corresponding half-year of 1911. The increase in expenses was mainly due to running additional services, heavier charges for maintenance and for local rates. Four additional cars were purchased during the half-year.

Half-year ended.	Miles open.	Passengers.	Traffic receipts.	Average fare.	Car. mileage.	No. of cars.
June, 1911	17.58	6,009,072	£26,130 19 2	1.04d.	659,021	56
Dec., 1911	17.98	6,297,093	28,736 4 11	1.04d.	638,632	56
June, 1912	17.98	6,697,679	28,479 17 4	1.04d.	619,550	56
Dec., 1912	17.98	6,862,053	29,819 11 9	1.04d.	644,373	60

**City of Buenos Ayres Tramways Co. (1904), Ltd.—**

The directors' report states that the annuity payable by the Anglo-Argentine Tramways Co., Ltd., has been received, and the net revenue for the year to December 31st amounted to £66,592. Interim dividends have been paid for the nine months ending September 30th, absorbing £46,500, leaving a balance of £20,092. The directors recommend (says the *Financier*) that a final dividend of 1s. 3d. per share (making 5s. per share—5 per cent. per annum—less income-tax) be paid for the year, absorbing £15,500; that £4,500 be transferred to general amortisation fund, and £92 carried forward.

**Northampton Electric Light and Power Co., Ltd.**

THE report for 1912 says that the company's undertaking is making satisfactory progress. Lamps and motors have been added (to the equivalent of 29,426 32 watt lamps), making a total equal to 16,887 lamps. The increase in n.o. of motors is 563, making a total of 2,725 n.o., and of this 2,280 are hired from the company. The mains added were 1 mile 671 yards in extent, making a total of 29 miles 1,618 yards. In addition to this, new feeder ducts have been laid in various directions, the increase amounting to 2 miles 311 yards. The output of electricity has been 3108,113 units compared with 2,497,871 in the previous year, being 25 per cent. increase. The maximum load on plant was 1,956 kw. (25 per cent. increase) and the load factor 181. The coal strike occasioned some additional expenditure for fuel. There has been a reduction in the price of current for lighting. Eight cottages in Fetter Lane, adjoining the company's property, have been purchased. A considerable addition to the generating plant will be made during 1913, and to meet the cost of this a further issue of debenture stock is contemplated. The general depreciation account has been increased by £5,200 (out of which certain specific items have been written down, as shown by the balance-sheet), also £375 has been written off motors, and £1,560 added to reserve. The sum of £750 will be required for the dividend on the 5 per cent. preference shares, and the directors propose that 7 per cent. per annum should be paid on the ordinary shares for the half-year (making 6 per cent. for the year), absorbing £2,450, leaving £2,045 to be carried forward.

**Electrical Distribution of Yorkshire, Ltd.**

THE directors report that the accounts for the year 1912 again show steady and satisfactory progress. The net profit for the three years ending December 31st is as follows:—1912, £1,903; 1911, £1,317; 1910, £515. The profits up to the end of 1911 enabled the company to write off formation, preliminary and working expenses amounting to £128, to pay a dividend at the rate of 4 per cent. per annum, and to carry forward £319, which, added to the profit for 1912 of £1,903, makes a disposable balance of £2,252. The directors recommend a dividend, free of income-tax, for the year 1912 at the rate of 6 per cent. per annum on the ordinary shares, amounting to £1,101, putting to reserve £600, making it £1,000, carrying forward, subject to any remuneration voted to the directors, the balance of £518.

Applications were made to the Board of Trade for provisional orders for electric lighting in Ardsley, Darton and district, Goole and district, Rothwell and district, and Wombwell and Worsborough. All these Orders have now been confirmed by Parliament. During the year there has been a steady growth in the use of the company's supply, and a large number of consumers have been added, and further demands for energy continue to be received.

Applications for 3,135 ordinary shares of £1 each have been received during the year. Only £4,865 of the authorised capital remains unapplied for. In order that shareholders may have the first opportunity of taking this up, an application form is enclosed with the report. In order to provide for extensions in the districts in which a supply is now being given, and to commence the development of the new districts before referred to, further capital is required. An extraordinary meeting will be held on February 25th for the purpose of increasing the nominal capital of the company from £25,000 to £50,000 and the borrowing powers from £5,000 to £10,000.

The directors report the death of Mr. John Nevin, a director from the inception of the company.

The meeting will be held on February 25th at Leeds.

**STOCKS AND SHARES.**

Tuesday Evening.

It is certainly true to say that there is very little business doing round the Stock Exchange as a whole. None of the markets are anything like active, and what trade comes in is mostly of the patchy order. Dear money; new issues; foreign politics; booming trade; these are some of the considerations which militate against the Stock Exchange, and for the time being there seems to be little indication of conditions altering. The first relief is expected to come from the Near East, but even there the belligerents are putting up a more strenuous fight than anybody thought they would do.

Amongst the new issues which fall naturally into the markets these notes are concerned with, is one that will, perhaps, make its appearance within a few days—if it is not already out before we are. The emission will probably take the shape of 5 per cent. debentures in the Las Palmas Water and Power Company; and the last proof prospectus which we saw of this bears date September 2nd, 1912. Particulars are available of the coming issue of the Cedar Rapids Manufacturing and Power Company which is to be offered to the holders of the Montreal Light, Heat and Power and the Shawinigan Water undertakings. Eight and a-half million dollars of 5 per cent. Cedar Rapids bonds are to be offered at 90, with a bonus of 25 per cent. in common stock.

The Railway market suffers from neglect. A good deal of attention is being turned to the stocks of the trade lines in consequence

of the unexpectedly good dividends just declared, and interest in Undergrounds has abated correspondingly. Metropolitan are  $\frac{1}{2}$  higher; Districts  $\frac{1}{2}$  down. London United Tramways Preference dropped to  $\frac{1}{2}$ , and a rally to 5 leaves them 10s. down on the week. Underground Electric ls. shares braced up to 14s.  $\frac{1}{2}$ d., which is not quite so good as they were a fortnight ago. The Ordinary fell to  $\frac{1}{2}$ , the report, on this week, being considered rather disappointing. Great Northern and City Preferred shares recovered  $\frac{1}{2}$  after their fall of  $\frac{1}{2}$  last week, for it is now supposed that the scheme for absorption of the Tube by the Metropolitan Company will be duly confirmed. Shrewd opinion looks for the Great Western to enter into a much closer working alliance with the Metropolitan than is already the case; and should this come about, it would naturally add strength to the position of the Underground Railway. Central London issues are unchanged, and City and South London remains at 38. The City Company's Preference stocks have all shed 2 points, while the 4 per cent. Debenture crumbled to 98, these movements being in company with a variety of falls that have taken place amongst Home Railway pre-ordinary stocks during the past week.

British Electric Traction stocks have eased off to some extent, and Metropolitan Electric Trams Ordinary are flat at the nominal price of 31 32. There is little market left in these, for the Company is becoming merged virtually into the London and Suburban, the Ordinary shares in which are quoted at 7s. 6d., while the Preference are 13s. East London Ordinary stock is a better market at 9 $\frac{1}{2}$ .

English Electricity Supply shares are somewhat featureless, but it is worth noticing that City of London Ordinary are up a further 5s. to 17 $\frac{1}{2}$ , the rise being accompanied by rumours—as vague as ever—that something was "up" besides the price of the shares. The tip goes round that Cities are remarkably cheap at 18 $\frac{1}{2}$ , but we heard the same thing repeated with, if anything, rather more emphasis when Cities stood at 23. St. James's Ordinary eased off  $\frac{1}{2}$  on the report, which shows the net profit to be a little less than that for the previous 12 months. Smithfields have been offered, and the price slumped from 32s. 6d. to a sovereign, the dealers being anything but anxious to buy the shares. Several lines of South London Ordinary shares have changed hands within the last few days, and there are speculative investors who regard the shares as cheap, having regard to the position of the Company and the return which is available from the shares.

Mexico City is said once more to be in the throes of revolution, and, by reason of this, most of the stocks and shares which have any connection with Mexico have given way. Mexican Light and Power Common stock fell 2, Monterey bonds 1, Mexico Trams 1 $\frac{1}{2}$ , the bonds  $\frac{1}{2}$  to 1, and so on. There was not a great pressure to sell, quotations being marked down more as a measure of precaution than as a reflection of sales. Rio Seconds are lower to the extent of  $\frac{1}{2}$ . Brazilian Traction Common shares dropped to par. British Columbia Deferred is a point lower; and Shawinigan Water, now that the Cedar Rapids scheme is out, fell 4 points to 146 middle, Montreal stock retaining its high figure. The Anglo-Argentine group is steady, but the First Preference, at any rate, can be bought more cheaply than the official quotation would seem to indicate: since the actual price at the time of writing is 4 $\frac{1}{2}$ —4 $\frac{3}{4}$ , it appears an absurdity to quote it as 4 $\frac{1}{2}$ —5 $\frac{1}{2}$  in the Stock Exchange Official List. City of Buenos Ayres Trams are a shade harder, and Para Debenture stock improved slightly.

The excitement in connection with Marconis has been less evident, though there is plenty going on still in the shares. The price keeps most of its last week's rise, and Canadians shot up to 18s. 6d. bid before reacting a few pence. Americans and Spanish have been better in sympathy. So far as can be ascertained, the market impression prevails that if the Company were able to nullify the agreement with the Government, it would be in a position more favourable for securing good terms. Meanwhile, the evidence being given before the Commissioner is followed with the keenest interest.

National Telephone Deferred shrinks continually, last week's recovery being but a check to the steady fall. The price has dipped to 92 $\frac{1}{2}$ , and as the Company's books close finally on the 25th inst., the time should not be far off when all doubts are set at rest as to what proprietors of National Telephone Deferred stock are likely to get in exchange for their present holding. The secretary wrote to the Stock Exchange authorities the other day, however, saying that he could assign no definite date when the information would be available. The matter, of course, rests in the hands of the Post Office, because the latter has appealed against part of the recent award. Outside Marconis and National Telephones, the market is idle and stagnant. Anglo-American Deferred fell  $\frac{1}{2}$ , and Commercial Cable 4 per cent. Debenture has moved on to a basis of 5 per cent. return to the investor. Beyond this, there are no quotable changes.

The chief movement amongst Manufacturing Companies' issues is a drop of 7 in Brush  $\frac{1}{2}$  per cent. First Debenture stock, lowering the price to 42 $\frac{1}{2}$ . This drop is based on the offering of a small parcel, and it will be noticed that the yield on the stock now amounts to 10 per cent. on the money, while the company's Second Debenture returns over 14 per cent. It is scarcely necessary to say that this observation is not made with the idea of inducing staid investors to buy Brush Debenture of either class to put away with their gilt-edged securities. Henley's Ordinary are  $\frac{1}{2}$  up, and Telegraph Constructions rose 10s.; while Aron Preference put on  $\frac{1}{2}$  upon notice being drawn to the manner in which these manufacturing companies are flourishing, and to the substantial percentage that the Aron shares yield to a buyer at the present figure. Rubber shares are dull, and the putting up of about 900 tons at the auctions this week in Mincing Lane had the effect of depressing to a slight extent the price of the commodity.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, February 12th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
■ Acid, Hydrochloric .. .. per cwt.	5/-	..
■ " Nitric .. .. per lb.	22/-	..
■ " Oxalic .. .. per lb.	23/-	..
■ " Sulphuric .. .. per cwt.	5/6	..
■ Ammoniac Sal .. ..	42/-	..
■ Ammonia, Muriate (large crystal) per ton	£29 10	..
■ Bleaching powder .. ..	£6 5	15s. inc.
■ Bisulphide of Carbon .. ..	£18	..
■ Borax .. ..	£17 10	£1 inc.
■ Copper Sulphate .. ..	£23	£2 10 dec.
■ Lead, Nitrate .. ..	£29 10	..
■ " White Sugar .. ..	£27 10	..
■ " Peroxide .. ..	£23	..
■ Methylated Spirit .. .. per gal.	2/6	..
■ Potassium Bichromate, in casks .. ..	83/-	..
■ Potash, Caustic (88/90 %) .. .. per ton	£22 10	..
■ " Chlorate .. .. per lb.	84/-	..
■ " Perchlorate .. ..	44/-	..
■ Potassium, Cyanide (98/100 %) .. .. (for mining purposes only)	74/-	..
■ Shellac .. .. per cwt.	72/6	..
■ Sulphate of Magnesia .. .. per ton	£4 10	..
■ Sulphur, Sublimed Flowers .. ..	£6 10	..
■ " Recovered .. ..	£5 10	..
■ " Lump .. ..	£5	..
■ Soda, Caustic (white 70/72 %) .. ..	£10 5	..
■ " Chlorate .. .. per lb.	83/-	..
■ " Crystals .. .. per ton	£3 5	..
■ Sodium Bichromate, casks .. .. per lb.	8d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£93	£2 dec.
b " Wire, in ton lots .. ..	£112	..
b " Sheet, in ton lots .. ..	£120	..
p Babbitt's metal Ingots .. ..	£88 to £145	..
c Brass (rolled metal 2" to 12" basis) per lb.	82d.	½d. dec.
c " Tube (brazed) .. ..	84d.	¼d. inc.
c " " (solid drawn) .. ..	94d.	¼d. inc.
c " Wire, basis .. ..	84d.	¼d. dec.
c Copper Tubes (brazed) .. ..	113d.	..
c " " (solid drawn) .. ..	113d.	..
g " Bars (best selected) .. .. per ton	£23	23 dec.
g " Sheet .. ..	£23	29 dec.
g " Rod .. ..	£23	29 dec.
d " (Electrolytic) Bars .. ..	£26	..
d " " Sheets .. ..	£73	..
d " " Rods .. ..	£81	..
f Ebonite Rod .. .. H.C. Wire per lb.	93d.	..
f " Sheet .. ..	4/9	..
n German Silver Wire .. ..	1/10	..
h Gutta-percha, fine .. ..	7/- to 8/-	..
h India-rubber, Para fine .. ..	4/8	4½d. dec.
l Iron Pig (Cleveland warrants) .. per ton	64/8	7d. dec.
l " Wire, galv. No. 8, P.O. qual.	£14	..
g Lead, English Pig .. ..	£17 2 6	£1 5 dec.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. per hot.	£7 15	6/6 inc.
c Mica (in original cases) small .. per lb.	6d. to 8s.	..
c " " " medium .. ..	8/6 to 6/-	..
c " " " large .. ..	7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. ..	3/6 to 4 6 nom.	..
p Phosphor Bronze, plain castings	1/2	½d. dec.
p " " rolled bars & rods	1/2	..
p " " rolled strip & sheet	1/2	..
o Platinum .. .. per oz.	185/-	..
o Silicon Bronze Wire .. .. per lb.	113d.	..
Steel, Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. ..	£226 to £227	£5 10 dec.
n " Wire, Nos. 1 to 16 .. .. per lb.	2/8	½d. dec.
p White Anti-friction Metals .. per ton	£45 to £228	£2 12 dec.
k Zinc, Sh't (Vielite Montagne bnd.)	£30	..

Quotations supplied by—

- a G. Boor & Co.
- b The British Aluminium Co., Ltd.
- c Thos. Bolton & Sons, Ltd.
- d Frederick Smith & Co.
- e F. Wiggins & Sons.
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- h Edward Till & Co.
- k Bolling & Lowe.
- l Morris Ashby, Ltd.
- l Richard Johnson & Nephew, Ltd.
- m W. T. Glover & Co., Ltd.
- n W. P. Ormiston & Sons
- o Johnson, Matthey & Co., Ltd.
- p W. F. Dennis & Co.

**W. T. Glover & Co., Ltd.**—The directors (says the *Financier*) have declared a dividend for the year of 5 per cent. per annum on both the cumulative preference shares and the ordinary shares, and in addition a bonus of 2 $\frac{1}{2}$  per cent. on the ordinary shares. They also recommend the allocation of £6,500 to the debenture redemption fund and the transfer of £5,000 to the reserve fund, carrying forward about £8,000. The first mortgage debenture redemption fund will then stand at £33,000, the second mortgage debenture redemption fund at £24,000, and the reserve fund at £20,000.

**Continental.**—FRANCE.—A new company has lately been formed in Paris (24, Boulevard des Capucines) with a capital of £48,000, and the title La Société des Ateliers de Constructions Electriques de Delle.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 11th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 11th.	Rise or Fall	Present Yield p.c.
Bournemouth & Poole, Ord. . . . .	10	1911. 61	93-104	..	5 4 9	Kennington & Knightsbridge, Ord	5	9 81	78-84	..	5 10 9
Do. 4 1/2 % Pref. . . . .	10	4 1/2	82-93	..	4 12 4	Do. 4 % Deb. . . . .	Stock	4 4	90-93 rd	..	4 6 0
Do. Second 6 % Pref. . . . .	10	6 6	10-104	..	5 14 3	Kent Elec. Power, 4 1/2 % Deb. . . . .	Stock	4 1/2	76-80 rd	..	5 12 6
Do. 4 1/2 % Deb. Stock . . . . .	Stock	4 1/2	96-98	..	4 11 10	London Electric, Ord. . . . .	8	2 1/2	1 1/2-2	..	3 15 0
Brompton & Kensington, Ord. . . . .	6	10 01	84-93	..	5 6 8	Do. 6 % Pref. . . . .	5	5 6	5-6 1/2	..	5 11 7
Do. 7 % Cum. Pref. . . . .	5	7 7	84-90	..	8 17 9	Do. 4 % First Mort. Deb. . . . .	Stock	4 4	80-92	..	4 7 0
Central Electric Supply, 4 % (Genr. Deb.)	100	4 4	95-98	..	4 1 8	Metropolitan . . . . .	5	4 4	84-4	..	5 0 0
Charing Cross, West End & City	5	5 51	42-64	..	4 17 7	Do. 4 1/2 % Cum. Pref. . . . .	5	4 1/2	44-43	..	5 0 0
Do. 4 1/2 % Cum. Pref. . . . .	5	4 1/2	42-64	..	4 12 4	Do. 4 1/2 % First Mort. Deb. . . . .	Stock	4 1/2	17-17 1/2	..	4 10 0
Do. " City Undertaking )	5	4 1/2	43-43	..	5 2 10	Do. 8 1/2 % Mort. Deb. . . . .	Stock	8 1/2	84-86	..	4 1 5
Do. 4 1/2 % Cum. Pref. )	5	4 1/2	43-43	..	5 2 10	Midland Electric Corporation	100	4 1/2	98-101	..	4 9 1
Do. Do. 4 % Deb. . . . .	100	4 4	92-94	..	4 5 1	4 1/2 % First Mort. Deb. . . . .	5	5 5	42-44	..	5 2 7
Chelsea, Ord. . . . .	Stock	4 1/2	43-54	..	4 15 3	Newcastle-on-Tyne 5 % Pref., Non-Com.	100	5 5	90-102	..	4 17 7
Do. 4 1/2 % Deb. . . . .	10	8 8	17-18 1/2	+ 1/2	4 6 6	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	10	8 6	97-102	..	5 11 7
City of London, Ord. . . . .	10	8 8	124-134	..	4 9 0	Notting Hill, 6 % Non-Com. Pref.)	5	7 2	61-68	..	5 8 11
Do. 6 % Cum. Pref. . . . .	10	6 6	116-120	..	4 3 4	Oxford . . . . .	5	10 10 1	74-74	..	4 16 7
Do. 6 % Deb. . . . .	100	4 1/2	100-102	..	4 8 3	Do. 7 % Pref. . . . .	5	7 7	62-74	..	4 8 6
Do. 4 1/2 % Second Deb. . . . .	100	4 1/2	111-112	..	4 19 9	Do. 8 1/2 % Deb. . . . .	100	8 1/2	84-87	..	5 3 1
County of London, Ord. . . . .	10	6 6	112-124	..	4 4 1 1/2	Smithfield Markets, Ord. . . . .	5	2 2	12-12	..	6 3 1
Do. 6 % Pref. . . . .	10	6 6	104-106	..	4 8 8	South London, Ord. . . . .	4	5 5	22-22	..	5 0 0
Do. 4 1/2 % Second Deb. . . . .	Stock	4 1/2	98-101	..	4 8 8	Do. 5 % First Mort. Deb. . . . .	100	5 5	97-100	..	6 12 0
Edmundson's, Ord. . . . .	£3	Nil	34-35	..	Nil	South Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	4 1/2	96-99	..	4 11 3
Do. 8 % Cum. Pref. . . . .	5	Nil	34-35	..	Nil	Do. 4 1/2 % First Mort. Deb. . . . .	100	4 1/2	98-101	..	5 2 0
Do. 6 % Non-Cum. Pref. . . . .	5	Nil	34-35	..	Nil	Urban, Ord. . . . .	£3	Nil	1-1	..	5 8 1
Do. 4 1/2 % First Mort. Deb. . . . .	100	4 1/2	92-95	..	5 5 11	Do. 5 % Cum. Pref. . . . .	5	2 2	28-34	..	5 2 0
Folkestone . . . . .	5	5 5	42-64	..	5 17 1	Do. 4 1/2 % First Mort. Deb. . . . .	100	4 1/2	85-88	..	5 8 1
Do. 5 % Cum. Pref. . . . .	5	5 5	42-64	..	4 17 7	Westminster, Ord. . . . .	5	10 10	82-84	..	4 5 9
Do. 4 1/2 % First Deb. . . . .	100	4 1/2	90-92	..	4 17 10	Do. 4 1/2 % Cum. Pref. . . . .	5	4 1/2	44-44	..	
Hove . . . . .	5	9 8 1/2	73-82	..	5 12 6						

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. . . . .	5	6 6	54-52	..	5 6 8	Monterey Ry. Light & Power, } 100	5 5	85-83	-1	5 13 8	
Calcutta, Ord. . . . .	5	8 7 1/2	62-74	..	5 19 4	5 % 1st Mort. Deb. } 100	8 9 1/2	240-245 xd	..	3 13 5	
Do. 5 % Pref. . . . .	5	5 5	44-48	..	4 16 5	Montreal, Lt., H. and Power . . . . .	\$600	5 5	10-20	..	
Calgary Power, 1st Mort. Bds. Canadian Gen. El. Com. . . . .	100	6 6	92-94	..	5 6 5	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	Stock	10 10	217-227	..	4 8 0
Do. 7 % Pref. . . . .	\$100	7 7	112-124	..	5 13 0	Do. 6 % Non-Cum. Pref. . . . .	Do.	6 6	108-111	..	5 5 8
Cordoba Lt., Power and Tl., Ord. . . . .	100	5 5	96-99	..	5 1 0	Do. 5 % Deb. Stock . . . . .	Do.	5 5	100-102	..	4 18 0
Do. 5 % Deb. . . . .	100	5 5	96-99	..	5 1 0	Roy. Electric Co., Montreal, 4 1/2 % 1st Mort. Deb. . . . .	100	4 1/2	100-102	..	4 8 3
Elec. Lt. and P. of Cochinbamba, 6 % Bonds	100	8 8	93-95	..	8 6 4	Shawinigan Water, Capital, Do. 5 % Con. 1st Mort. Bonds	\$600	5 5	144-148	-4	3 7 7
Elec. Supply Victoria, 5 % 1st Mort. Bonds	100	5 5	90-93	..	5 7 6	Do. 4 1/2 % Per. Deb. . . . .	Stock	4 1/2	100-102	..	4 7 10
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$600	5 5	95 1/2-97 1/2	..	5 2 7	Toronto Power, 4 1/2 % Deb. . . . .	Do.	4 1/2	98-99	..	4 9 7
Kalgoorlie Elec. P. and L., Ord. . . . .	10 1/2	Nil	75-77	..	Nil	Vers Cruz Lt., P. and T., 5 % 1st Mort. Deb. . . . .	100	5 5	91-94	..	5 6 5
Do. 6 % Pref. . . . .	5	6 6	75-77	..	9 15 2	Victoria Falls Power, Pref., West Kensington Power and Lt., 1st Mort. 6 % Gold	100	6 6	105-107	+1	5 12 2
Kamistiquia Power, 5 % G. Bs. Madras, Ord. . . . .	\$600	5 5	103-104	..	4 16 2						
Melbourne, 5 % 1st Mort. Deb. Mexicon El. Lt., 5 % 1st M. Bds. Mexicon Lt. & Power, Common Do. 7 % Cum. Pref. . . . .	100	5 5	101-104	..	4 16 2						
Do. 7 % Cum. Pref. . . . .	\$100	7 7	105-109	..	6 8 5						
Do. 5 % 1st Mort. Gold Bds. . . . .	..	5 5	94 1/2-95 1/2	- 1/2	5 3 8						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph . . . . .	10	4 4 1/2	7-7 1/2	..	6 0 0	Monte Video Telephone, Ord. . . . .	1	6 6 1/2	13-15	..	5 13 0
Do. 5 % Deb. Red. . . . .	Stock	5 5	97 1/2-99 1/2	..	5 0 6	Do. 5 % Pref. . . . .	1	5 5	90-95	..	5 14 8
American Telep. & Teleg., Cap. Do. Collat. Trust . . . . .	\$100	4 4	91-93	..	4 6 0	National Telephone Dir. . . . .	Stock	6 6	90-95	-4	4 10 8
Anglo-American Telegraph . . . . .	Stock	8 8	66 1/2-67 1/2	..	4 8 11	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	94-94	..	4 9 10
Do. 6 % Pref. . . . .	Do.	6 6	110 1/2-111 1/2	..	5 7 7	Oriental Telep. and Elec. . . . .	1	8 8	13 1/2-13 1/2	..	4 18 5
Do. Def. . . . .	Do.	80/-	24 1/2-24 1/2	..	6 1 3	Do. 6 % Cum. Pref. . . . .	1	6 6	13 1/2-13 1/2	..	4 8 11
Anglo-Portuguese Tel., 5 % 1st Mort. Deb. . . . .	100	5 5	102-104	..	4 16 2	Do. 4 % Red. Deb. . . . .	Stock	4 4	88-90	..	4 8 11
Chili Telephone . . . . .	5	7 7	74-77	..	5 3 3	Pacific and European Tel., 4 % Genr. Deb. . . . .	Do.	4 4	97 1/2-99 1/2	..	4 0 5
Commercial Cable, 8 1/2 % Deb. Cuba Telegraph . . . . .	Stock	4 4	73-80	-1	5 0 0	Renter's . . . . .	10	10 10 1/2	11 1/2-11 1/2	..	8 10 2
Do. 10 % Pref. . . . .	10	10 10	16-17	..	5 17 8	Submarine Cables Trust . . . . .	Cert.	6 6	127-130	..	4 12 4
Direct Spanish Telegraph, Ord. Do. 10 % Cum. Pref. . . . .	5	4 4 1/2	23-23 1/2	..	5 6 8	Telephone Co. of Egypt, 4 1/2 % Deb. Red. . . . .	Stock	4 1/2	97-99	..	4 10 11
Direct United States Cable . . . . .	10	5 5	64-72	..	7 2 10	United River Plate Telephone . . . . .	5	8 8	77-77 1/2	..	5 4 1
Direct W. India Cable, 4 1/2 % Reg. Deb. . . . .	100	4 1/2	99-101	..	4 9 0	Do. 6 % Cum. 1st Pref. . . . .	5	5 5	10-10 1/2	..	4 8 11
Eastern Telegraph, Ord. Stock Do. 8 1/2 % Pref. Stock . . . . .	Stock	7 7 1/2	132-135	..	6 3 8	Do. 5 % Cum. 2nd Pref. . . . .	10	6 6	94-100	..	6 0 0
Do. 4 % Mort. Deb. . . . .	Do.	4 4	96-98	..	4 1 8	Do. 5 % Debs. . . . .	100	5 5	101-103	..	4 17 1
Eastern Extension . . . . .	10	7 7 1/2	13-13 1/2	..	5 8 8	Western Telegraph, Ltd. . . . .	10	7 7 1/2	132-133	..	5 2 9
Do. 4 % Deb. . . . .	Stock	4 4	96-97 xd	..	4 2 6	Do. 4 % Deb. . . . .	Stock	4 4	84-86	..	4 3 4
Ebas and B. Africa Tel., 4 % (Mts. Db. Mauritius Sub.)	95	4 4	98-101	..	8 19 8	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	97 1/2-100 1/2	..	4 10 0
Globe Telegraph and Trust . . . . .	10	6 6 1/2	103-104	..	5 10 4						
Do. 6 % Pref. . . . .	10	6 6	122-123	..	4 13 2						
Great Northern Telegraph . . . . .	10	18 18	28 1/2-30 1/2	..	5 18 0						
Indo-European Telegraph . . . . .	25	13 13	67-69	..	5 10 2						
Mackay Companies Common . . . . .	\$100	5 5	85-89	..	5 12 4						
Do. 4 % Cum. Pref. . . . .	\$100	4 4	62-72	..	5 11 1						
Marconi's Wireless Telegraph Do. 1 % Cum. Partic. Pref. . . . .	1	20	47-47 1/2	..	4 7 9						
			52-54	..	4 5 0						

\*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. | Interim Dividend. † Bs. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 11th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 11th.	Rise + or Fall	Present Yield p.c.
Bath Trams, Pref. Ord. . . . .	1	1911. Nil	Nil	..	£ s. d.	Metropolitan Railway Consol. . .	100	1911. 12	58½-64 xd	+ ½	£ s. d.
Do. 5% Pref. . . . .	100	5	5	..	6 8 1	Do. Surplus Lands . . . . .	100	2½	61-63 xd	..	4 6 0
Do. 4½% Deb. . . . .	100	4½	4½	..	5 11 1	Do. 8½% Deb. . . . .	100	8½	86-88	..	8 17 9
Brit. Elec. Trac., 6% Pref. . . .	100	..	..	..	..	Do. 8½% Prof. . . . .	100	8½	83-85 xd	-1	4 2 4
Do. Do. Deferred . . . . .	100	..	..	..	..	Do. 8½% Con. Pref. . . . .	100	8½	83-85 xd	..	4 2 4
Do. Do. 8% Cum. Pr'l. . . . .	100	6	6	..	6 14 1	Metropolitan District Ord. . . .	100	Nil	40½-41	..	Nil
Do. Do. 7% Non-Cum. Pr'l. . . . .	100	..	..	..	..	Do. 6% Deb. . . . .	100	6	189-141	..	4 4 0
Do. Do. 6½% Perp. Deb. . . . .	100	5	5	..	5 6 3	Do. 4% Deb. . . . .	100	4	93-95	..	4 2 6
Do. Do. 4½% 2nd Deb. . . . .	100	4½	4½	..	5 12 8	Do. 4% Prior Lien . . . . .	100	4	99-101	..	3 19 8
Central London Railway, Ord. . .	100	8	8	..	4 13 0	Do. 4½% First Pref. . . . .	100	4½	89-91	..	4 18 11
Do. Pref. . . . .	100	4	4	..	4 13 0	Do. 8½% Gld. . . . .	100	8½	75-77 xd	..	4 10 11
Do. Def. . . . .	100	2	2	..	2 8 2	Metropolitan Elec. Trams, Ord. .	1	6	57	..	5 16 4
Do. 4% Deb. . . . .	100	4	4	..	4 0 0	Do. 5% Pref. . . . .	1	5	5	..	5 14 3
City & South London, Ord. . . .	100	12	12	..	3 11 5	Do. 4½% Deb. . . . .	100	4½	89-92	..	4 17 10
Great Northern & City, Pr'l. Ord	100	5	5	..	4 11 9	Do. 5% Deb. . . . .	100	5	94-97	..	5 3 1
Hastings Trams, 8% Pref. . . . .	100	8	8	..	4 11 9	Potteries, Ord. . . . .	1	8½	7	..	6 19 4
Do. 4½% Deb. . . . .	100	4½	4½	..	6 1 7	Do. 5% Pref. . . . .	1	5	5	..	5 2 8
isle of Thanet Trams, 5% Pref. .	5	2½	2½	..	4 15 8	Do. 4½% Deb. . . . .	100	4½	85-88	..	5 14 4
Do. 4% Deb. . . . .	100	4	4	..	5 0 0	South Metro. Trams, 6% Pref. .	1	8	..	..	7 7 8
Lancashire United, 5% Deb. . . .	100	5	5	..	6 5 0	Do. 4% Deb. . . . .	100	4	65-70	..	6 14 4
London Elec. Railways, 4% Deb. .	100	4	4	..	4 2 6	Underground Elec. Railways . .	10	..	..	..	Nil
London United Trams, 5% Pref. .	100	Nil	..	..	..	Do. Gen. Con. 5% Bonds . . . .	100	5	114-113½	+ ½	5 5 9
Do. 4% Deb. . . . .	100	4	4	..	5 11 1	Do. 4½% Bonds . . . . .	100	4½	98-100	..	4 10 0
						Do. 8% Income . . . . .	100	14	95-96	..	5 14 4
						Yorkshire (West Riding), Ord. .	6	Nil	..	..	Nil
						Do. 5% Pref. . . . .	5	8	31	..	4 12 4
						Do. 4½% Deb. . . . .	100	4½	80-84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . . .	5	5½	5½	..	5 7 4	La Plata Elec. Trams, Ord. . . .	1	Nil	..	..	..
Do. 2nd Pref. . . . .	5	5½	5½	..	5 14 8	Do. Pref. . . . .	1	6	..	..	8 0 0
Do. 4% Deb. . . . .	100	4	4	..	4 8 9	Lisbon Elec. Trams, Ord. . . . .	1	6	6½	..	4 16 0
Do. 4½% Deb. . . . .	100	4½	4½	..	4 9 6	Do. 8% Pref. . . . .	1	8	1	..	4 16 0
Do. 5% Deb. . . . .	100	5	5	..	4 19 6	Do. 5% Deb. . . . .	100	5	91-96	..	5 5 8
Auckland Trams, 5% Deb. . . . .	100	5	5	..	4 17 1	Madras Elec. Tr. (1904), Deb. . .	100	5	101-103	..	4 17 1
Bombay Elec. B. & Trams, Pref. .	100	6	6	..	5 0 0	Manaco Trams & Lt., 1st Deb. . .	100	5	87-90	..	5 11 1
Do. 4½% Deb. . . . .	100	4½	4½	..	4 11 18	Manila Elec. R. and Lt., Bonds	\$1000	5	1004-102½	..	4 17 7
Do. 5% 2nd Deb. . . . .	100	5	5	..	5 1 0	Mexico Trams Com. . . . .	\$1000	7	109-112	..	6 5 0
Brazilian Traction Light and Power	\$100	..	..	..	..	Do. Gen. Con. 5% Bonds . . . .	100	5	95-97	..	5 3 1
						Do. 8% Bonds . . . . .	100	8	100-102	..	5 17 8
Brisbane Trams Invt., Ord. . . .	5	8	8½	..	5 6 8	Para Elec. Rlys. & Lt., Ord. . .	5	10	10½	..	6 5 0
Do. 5% Pref. . . . .	5	5	5	..	4 15 8	Do. 6% Pref. . . . .	5	6	4½-5½	..	5 11 7
Do. 4½% Deb. . . . .	100	4½	4½	..	4 7 5	Do. 5% 1st Deb. . . . .	100	5	98½-100½	+ ½	4 19 6
B. Columbia Elec. Rly., Del. . . .	100	8	..	..	5 11 1	Perth (W.A.) Elec. Tr., Ord. . .	5	10	105-113	..	3 14 5
Do. Pref. Ord. . . . .	100	8	8	..	4 16 9	Do. 5% 1st Deb. . . . .	100	5	105-108	..	4 12 7
Do. 5% Pref. . . . .	100	5	5	..	4 11 9	Rangoon El. Tr. & Sup., Pref. . .	5	6	6½-6½	..	5 0 0
Do. 4½% 1st Mort. Deb. . . . .	40	4½	4½	..	4 7 5	Do. 4½% 1st Deb. . . . .	100	4½	97-99	..	4 10 11
Do. 4½% Vancouver Deb. . . . .	100	4½	4½	..	4 7 5	Rio de Janeiro Trams, 1st Mort. } Do. 5% Mort. Bonds . . . . .	100	5	102-103	..	4 17 1
Do. 4½% Con. Deb. . . . .	100	4½	4½	..	4 5 0	Sao Paulo Tram, Lt. and P. } Do. 5% 1st Deb. . . . .	\$600	5	104-106	+ ½	4 14 4
Calcutta Trams, Ord. . . . .	5	7	7½	..	4 17 0	Singapore Trams, 5% Deb. . . .	100	5	86-93	..	5 11 1
Do. 5% Pref. . . . .	100	5	5	..	4 10 0	Southern El. Tr. B.A., 5% Deb. .	100	5	97-99 xd	..	5 1 0
Do. 4½% Deb. . . . .	100	4½	4½	..	4 10 0	Un. Elec. Trams Monte Video . .	5	7	6½-5½	..	6 1 9
Cape Electric Trams . . . . .	1	2½	..	..	..	Do. 8% Pref. . . . .	100	8	6	..	5 11 7
City Buenos Aires Trams (1904)	5	5	5½	..	4 6 11	Do. 5% 1st Deb. . . . .	100	5	95-102	..	4 18 0
Do. 4% Deb. . . . .	100	5	5	..	5 0 0	Winnipeg Elec. Rly., 4½% Deb. .	100	4½	100-103	..	4 7 5
Colombo Elec. Tr. & Lt., 5% Deb.	100	5	5	..	5 8 1						
Havana Elec. Rly., 5% Bonds	\$1000	5	5	..	4 17 1						
Kalgoolie Elec. Trams . . . . .	1	Nil	..	..	Nil						
Do. 5% A Deb. . . . .	100	5	5	..	5 18 8						
Do. 6% B Deb. . . . .	100	6	8	..	80-88						

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	6	..	..	8 0 0	Crompton & Co. . . . .	8	Nil	..	..	Nil
Do. 6% Pref. . . . .	1	6	6	..	7 2 2	Do. Deb. . . . .	100	6	55-67	..	9 15 6
Babcock & Wilcox . . . . .	1	28	14½	..	3 18 8	Diek, Kerr . . . . .	1	6	Nil	..	6 17 2
Do. Pref. . . . .	1	6	6	..	4 0 0	Do. Deb. . . . .	100	4½	95-98	..	4 11 10
British Aluminium, Ord. . . . .	1	Nil	..	..	..	Edison & Swan, A, 2½ paid	5	Nil	..	..	Nil
Do. 6% Cum. Pref. . . . .	1	Nil	..	..	..	Do. fully paid . . . . .	5	Nil	..	..	Nil
Do. 5% Prior Lien Debs. . . . .	100	5	5	..	5 6 5	Do. 4% Deb. . . . .	100	4	61-65	..	6 3 1
Do. Deb. Btk. . . . .	100	5	5	..	5 11 1	Do. 5% Second Deb. . . . .	100	5	72-75	..	8 18 4
B.I. & Helsby Cables . . . . .	5	6	8	..	5 17 6	Electric Construction . . . . .	1	2½	82	..	5 14 4
Do. Pref. . . . .	5	5	5	..	4 10 0	Do. Pref. . . . .	2	7	1½-2 xd	..	7 0 0
Do. Deb. . . . .	100	4½	4½	..	4 6 7	Greenwood & Batley, Pref. . . .	10	7	7	..	8 5 8
British Thomson-Houston, Deb. .	40	4½	4½	..	4 11 5	Do. Deb. . . . .	100	6	82-94	..	6 4 2
British Westinghouse, Pref. . . .	8	Nil	..	..	Nil	General Electric, Pref. . . . .	10	6	5	..	8½-102
Do. Deb. . . . .	100	4	4	..	6 11 2	Do. Deb. . . . .	100	4	90-95	..	4 4 8
Do. 5% Prior Lien . . . . .	100	6	6	..	5 16 6	Hensley, Ord. . . . .	5	17	51	..	6 8 8
Brown, Lindsay, Ord. . . . .	1	..	..	..	..	Do. Pref. . . . .	5	4½	4½	..	4 7 5
Do. Pref. . . . .	1	..	..	..	..	Do. Deb. . . . .	100	4½	101-103	..	4 7 5
Brush, 7% Pref. . . . .	2	Nil	..	..	Nil	India-Rubber, G. & T. . . . .	10	..	7½	..	6 16 4
Do. 5% Prior Lien Deb. . . . .	100	5	5	..	6 8 2	Do. Pref. . . . .	10	6	5	..	4 17 7
Do. 4½% Deb. . . . .	100	4½	4½	..	7 10 0	Telegraph Construction . . . . .	12	17½	51	..	6 13 5
Do. 4½% Second Deb. . . . .	100	4½	4½	..	14 1 4	Do. Deb. . . . .	100	4	4	..	4 1 8
Callender's Cable . . . . .	5	15	10½	..	6 7 8	Williams & Robinson . . . . .	1	Nil	..	..	Nil
Do. Pref. . . . .	5	5	5	..	4 17 7	Do. Pref. . . . .	5	Nil	..	..	Nil
Do. Deb. . . . .	100	4½	4½	..	4 10 0	Do. Deb. . . . .	100	4	4	..	6 15 7
Casner-Kellner . . . . .	1	20	20	..	5 5 0						
Do. Deb. . . . .	100	4½	4½	..	4 4 11						

\* Unless otherwise stated, all shares are fully paid. † Interim dividend.

### THE LOWEST TENDER.

THE usual system, almost invariably adopted, of placing contracts with the lowest tenderer, though doubtless the simplest, is often not the best either for the customer or the contractor. A small but recent example of its defects is characteristic. A small country-house job, comprising a 5-B.H.P. oil engine of specified make, dynamo, 350-a.h. battery, switchboard, main cable, and wiring in screwed conduit for some 120 lights, was tendered for by four firms. Three were firms of repute, specialising in country-house work; and their tenders were respectively £453, £122 and £397—keen competitive prices. The fourth tender was sent in by a local firm of "electrical contractors," and their price was £280. And they went one better than the specification by offering a larger battery and a direct-coupled instead of a belt-driven set.

It is obvious that the successful tenderers—needless to say, the local firm got the contract—have either made a big mistake which will result in a serious loss, or it is their deliberate intention to scamp their work and hoodwink the consultant—not a difficult thing to do, as a rule. Such is the case too often, when contracts are placed with the lowest tenderer, who finds himself faced with the alternative of a loss on the job or a profit at the expense of his employers' interests.

A better system is not inconceivable. Each tender submitted is necessarily nothing more than the tenderer's approximation to the true cost, plus a definite profit. It is a mathematical axiom that the average of a number of approximations will tend to be more correct than any individual approximation. Obviously, then, if, instead of placing a contract with the lowest tenderer—who, as often as not, is the lowest tenderer because he has made a mistake—it were given to the tenderer whose price was closest to the average of all the prices submitted, the chances are it would be secured by the tenderer whose price was the fairest for the work required. He would thus gain a reasonable profit, and would have no incentive to save money on the quality of his work at the expense of the employer. At the same time, prices would be no less competitive than at present, as clearly the man who quoted an inflated price would stand as little chance of success as he who quoted too low a figure. Indeed, prices would tend to become more reasonable in all cases. The "cutter" would not cut, because he would know it would be useless, and the man who now submits a high price rather than risk getting the job at an unprofitable figure, would be inclined to quote lower than he would otherwise, knowing that, if he got the job at all, it would be at a fair figure.

In the example given above, the sum of the four tenders is £1,552, which, divided by the number of tenderers, gives an average of £388. The successful tenderer, had the method outlined herein been adopted, would have been he who quoted £397, which, on the face of it, is a fair price—albeit not a "fat" one—and one which would enable him to give the employer better value for his money than he is likely to get from the lowest tenderer.

To take another instance: an asylum wiring job recently advertised for public tender. The results were published in the technical papers. Thirty-two firms competed, comprising some of the best known London firms, with others of less repute. Prices ranged from £2,304 to £987, and the contract was given to a firm whose price was £993.

The average of these tenders is £1,398, and the nearest tender to this figure was one of £1,400. Twenty-two out of the 32 tenders were within 20 per cent. of the average. The architect's estimate was £1,270. The highest tender was nearly £1,000 more than the average, and the lowest more than £500 less.

Clearly it is unreasonable to suppose that the figure which secured the order was the correct one, and that the 22 firms who quoted figures approximating to the average—£500 higher—were all wrong. It is more probable that the lower tenders represent mistakes as great in one direction as those made by the tenderers who submitted prices of £2,000 and more. Consequently it is more than likely the successful contractor has found himself faced with the usual deplorable alternative, of either suffering himself, or making the employer suffer.

It is too much to hope that such an equitable system of choosing tenders as that herein outlined will be adopted by public bodies, who are notoriously conscienceless. It would be something if they could be induced to rule out those tenders which are so much less than the average as to show they are based on either a mistake or a deliberate intention to evade the specification. As it is, contracts are too often placed on obviously erroneous prices, the soulless public body caring nought for the loss which the contractor must inevitably suffer if their engineer, on whom they rely to see that the specification is properly carried out, is successful in enforcing it. Which he very rarely is.—H. R. T.

### AN APPARATUS FOR SIGNALLING THUNDERSTORMS.

[BY OUR BERLIN CORRESPONDENT.]

THE first attempt to investigate atmospheric discharges by a method related to radio-telegraphy—viz., by means of a Branly tube or coherer—was made as far back as 1895-6 by the Russian physicist, Prof. Popoff. An insulated aerial wire directly connected to one pole of the coherer was used in this connection, the other pole (in accordance with a practice later adopted by Marconi) being joined to the ground. Prof. Popoff thus was able to ascertain that atmospheric discharges, on account of their oscillatory character, would excite the coherer, thus enabling thunderstorms to be recorded by means of a Morse apparatus or bell signal.

On the same principle is based the storm indicator designed by the Telefunken Co., but the arrangement of connections differs considerably from the original plan.

As seen from fig. 2, a spark gap *F* and a coil *S* connected up to the earth conductor *E* are inserted into the aerial wire *L*. The coherer *F<sub>r</sub>* and a blocking condenser *C* are arranged in parallel with the coil, the relay circuit, which comprises the cell and the relay coils *s*, *r*, being branched off, as usual, from the condenser. The secondary circuit

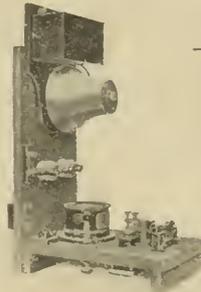


FIG. 1.

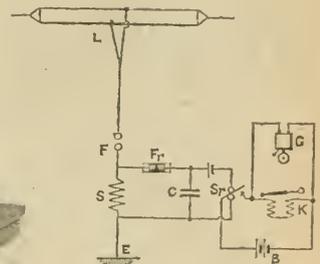


FIG. 2.

of the relay contains a battery *B*, which, on the relay contact being completed, actuates a tapper *K* and a recording apparatus (in the present case a single-stroke bell *G*).

The spark gap having been adjusted to a spark distance of a few tenths of a millimetre, a series of sparks will pass, thus exciting the coherer and sounding the bell as soon as there are any charging phenomena in the atmosphere. Feeble atmospheric accumulations, that is to say, far distant thunderstorms, will result in a slow charging of the aerial wire, and accordingly in the passage of sparks at considerable intervals. Since the signal bell is sounded in the very rhythm of spark discharges, the sequence of sound allows the distance of the thunderstorm from the recording apparatus to be gauged. In the place of the single-stroke bell, a Morse recorder with self-disengaging paper tape can be connected up to the apparatus, thus marking each passage of a spark by a point on the tape. If the speed at which the paper is unwound be known, the distance of the thunderstorm can be gauged by measuring up the paper tape and counting the number of points recorded thereon.

GRAPHS IN A CABLE-SHIP DRUM-ROOM :  
NOTES FOR JUNIOR ASSISTANTS.

BY EDWARD RAYMOND-BARKER.

(Concluded from page 240.)

86. When the writer contrived a device which, by means of the relative movements of two co-adjacent logarithmic scale lines, would indicate cable slack percentages straight

centre is utilised for—*inter alia*—a useful table at once recognised as relating to matter dealt with in 49, viz., taut-wire measuring-wheel *revs. per min.*, and equivalents in N.M. *per hour*.

88. An over-lying movable logarithmically-scaled disc of transparent celluloid, with all graduations and figures inscribed in bright *red*, moves concentrically over a lower cardboard disc similarly graduated and figured in *black*.

89. Thus, the *black* figures and scale lines on the lower disc are seen through the upper and transparent disc, which is inscribed with *red* figures and scale lines. This



FIG. 8A.



FIG. 8B.

off, he naturally found that it developed, in the main, into an ordinary logarithmic disc calculator, though one with novel constructional features.

87. Figs. 8A and 8B show a home-made hand-inscribed experimental form of transparent disc calculator (13 in.

facilitates quick coincidence of any scale-division on the upper disc with any on the under-lying disc, the upper-disc *red* figures contrasting sharply with the lower-disc *black* ones.

90. Also, the relation of one set of scale divisions to the

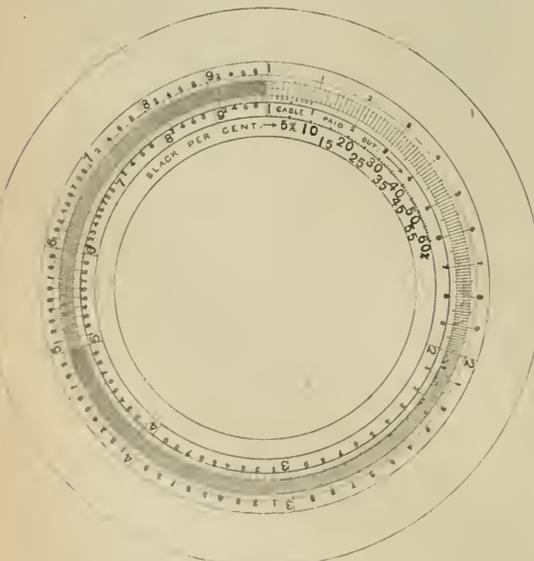


FIG. 9A.

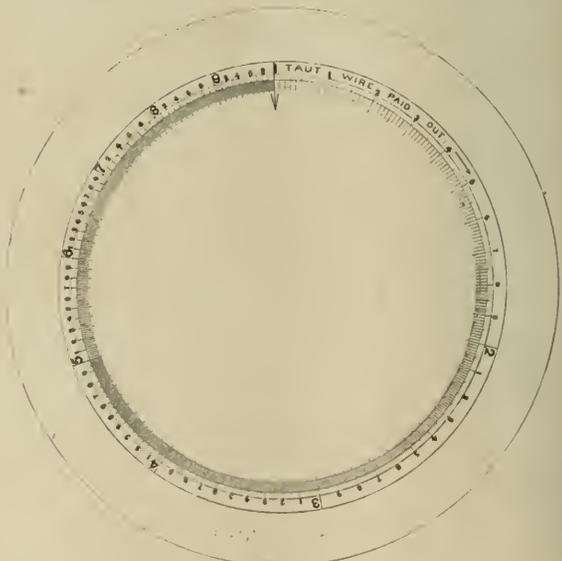


FIG. 9B.

diameter); 8A shows the upper and transparent disc, with its index set to *unity*; 8B shows index set to 10 per cent. The spare space between the working parts and the disc

other can be observed, not only between the outer and inner divided scales, as is ordinarily done, but—owing to the transparency of the upper disc—right through the upper set

of red figures and scale divisions, to the black scale-lines of the under-lying cardboard disc on which the upper disc is superimposed. In this case, therefore, comparison is made between circular logarithmic scales of equal circumference, instead of between an outer circle and a smaller inner circle.

91. The *black* figures on the lower disc represent *cable* values; the *red* on the upper transparent disc, the *taut-wire*.

Example.—(See fig. 8A.)

By turning the upper disc on its centre, let, say, 7.6 (*taut-wire* knots) be set to 8.36 (*cable* knots). The red index on the upper transparent disc will then point to 10 per cent. cable-slack, shown in black figures on the underlying cardboard disc.

92. Conversely, granted the necessity for, say, 10 per cent. cable slack over any particular distance, on the index

due to the great difficulty experienced in printing *red* on celluloid.

97. Figs. 9A and 9B show respectively the lower (opaque) and the upper (transparent) working discs.

98. Fig. 10 shows the entire transparent disc calculator mounted in a wooden case, opened out on hinges, to expose the calculator and some tabulated figures already referred to. (See 87.)

99. Experience goes to show that a very reliable calculator of this kind could be made with its upper disc of glass. The engraved lines would be on the lower surface, so as to be in close contact with the underlying opaque disc, to the avoidance of parallax. Unfortunately, glass work of this kind is very costly.

100. There remains celluloid. This material, however, under the heat attending the process of printing is not free from molecular changes conducive to a greater or less degree

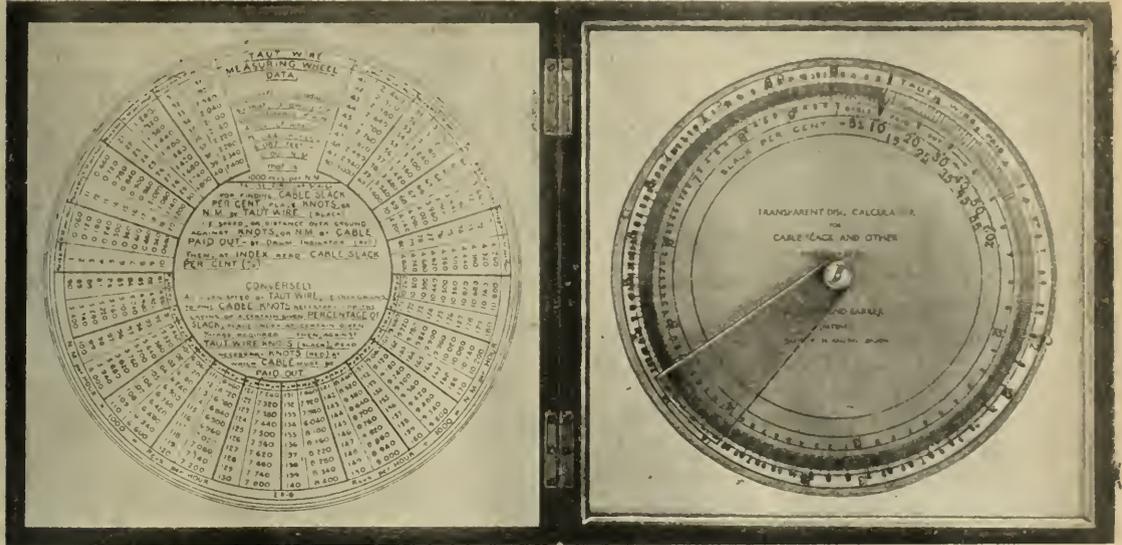


FIG. 10.

being set at 10 per cent., all relative *taut-wire* and *cable* speed-rates—for 10 per cent. slack—will be found set severally to each other. For instance—

8.5 knots <i>taut-wire</i> is set to 9.35 <i>cable</i> .
7.6 " " " " 8.36 "
5.5 " " " " 6.05 "

93. The transparent-disc calculators here illustrated are not seen to advantage, as the prints, of course, do not show the striking contrast between the *black* and the *red* scales and figures.

94. A transparent-disc calculator may be made with inner and outer circular scales respectively for *taut-wire*-wheel revs. per min. and *cable*-drum revs. per min. These equivalents would be in line with their several scale-divisions, as in the calculator board, fig. 7. The said circular spaces would be of white matt-surface celluloid, so that temporarily required *revs. per min.* could be pencilled in, to be erased, when done with, at the end of an expedition.

95. Or, if graph methods be preferred throughout, a disc calculator for, say, all *three* drums on a given ship, may have the *revs. per min.* equivalents permanently recorded; radiating in line with the corresponding scale-divisions. In that case, the correction percentages for various cable circumferences would be obtained from the curve in fig. 4, applied by slide-rule, and addition to the drum-revs. per min. values. (See 38, 48 and 83.)

96. Figs. 9A, 9B and 10 severally show the detail and the general appearance of a transparent-disc calculator of more or less standardised form. The relative positions of the *black* and the *red* series of scale-lines and figures are the reverse of those in figs. 8A and 8B; this circumstance being

of warping; so success in this direction has not exactly reached finality.

101. Enough has been written to show some points of interest pertaining to graphs, &c., in the drum room. The writer hopes, at some not long-distant date, still further to develop this subject in fresh directions.

### Aluminium in European Electrical Undertakings.

—According to a report by M. E. D'Hoop, Director of the Technical Service of the Brussels Tramways Co., presented to the Christiania Congress (1912) of the Union de Tramways et de Chemins de Fer d'Intérêt Local, the use of aluminium cables in Europe is developing; eight undertakings have them in use, namely, Copenhagen Municipal Tramways, Geneva Tramways Co., Lausanne Tramways, Lyons Tramways and Omnibus Co., Nuremberg Municipal Tramways, Nogentais (Paris) Co., the Paris General Omnibus Co., and the Société Nationale des Chemins de Fer Vicinaux, of Belgium. Some of the cables used for low pressure exceed 1,000 sq. mm., the maximum mentioned reaching 1,700 sq. mm. section. The Siemens-Schuckert firm report the installation of a cable with a single aluminium conductor for single-phase current at 60,000 volts, on the Muldenstein-Bitterfeld section of the Prussian State Railways. All who have adopted these cables state that they are satisfied with them, and no practical drawbacks have been experienced: the making of the joints and connections, however, necessitates the exercise of special care. There is an advantage in using aluminium for cables of large section for continuous current; in some instances the economy thus secured exceeds 14 per cent. According to a formula worked out by the Copenhagen tramways, the use of aluminium is advantageous when the price of aluminium in £ per ton is lower than 2.08 x price of copper - 30. This formula evidently assumes equality of the price of the other materials used in the manufacture of cables. Independently of the question of price, aluminium cables have the advantage, in the case of very high pressures, when it is necessary to augment the section of the conductors in order to increase the dielectric rigidity,

## PROCEEDINGS OF INSTITUTIONS.

## The Use of a Large Lighting Battery in Connection with Central Station Supply.

By F. H. WHYSALL, A.M.I.E.E.

*(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Manchester, January 28th, and London, January 23rd, 1913.)*

THIS paper is, for the most part, based on the results obtained over two complete years' working of the 12,000 ampere-hour battery installed at the Manchester Corporation Electricity Works, Dickinson Street, in March, 1910. This battery was at the time of its installation the largest ever constructed, and has a maximum discharge capacity of over 15,000 amperes.

Before so large a battery could be recommended, the saving to be effected by its use had to be most thoroughly and carefully examined.

The object of the present paper is to show to what extent the predictions as to its use have been fulfilled, and what relief has been obtained in the cost per unit supplied. The battery has thoroughly justified itself during this period, and the figures in this paper should tend to encourage other engineers of central stations to go and do likewise.

The battery consists of 210 cells, each cell containing 38 positive and 39 negative plates 20½ in. wide × 29 in. deep. The positive plates are of the Planté formation, 0·4 in. thick, cast in one piece, but the negative plates are of the improved box type, 0·31 in. thick, composed of half grids securely riveted together, the spaces between them being filled with active material. Specially treated wooden separators are employed between adjacent plates, and a free space of 8 in. is left at the bottom of the cell for the accumulation of deposit.

The cell boxes are of pitch pine lined with lead, the outside dimensions of each box being as follows:—Length, 6 ft. 1½ in.; width, 2 ft. 2½ in.; height, 3 ft. 4½ in.

The following are the guaranteed performances of the cells:—

Maximum discharge rate, 15,000 amperes.
One-hour discharge rate, 8,400 amperes (3,000 kW.).
Charging rate, 4,100 amperes.
Maximum charging rate, 6,500 amperes.
" voltage, 2·75 volts per cell.
Ampere-hour efficiency, 90 per cent.
Watt-hour efficiency, 66 per cent. at 1-hour rate (8,400 amperes).
" " 75 per cent. at 3-hour rate (3,900 amperes).
Final voltage per cell, 1·67 volts at 1-hour rate.
" " 1·78 volts at 3-hour rate.
Weight of each cell and acid complete, 2 tons 19 cwt.
" complete battery, 620 tons.
Floor space occupied, 5,966 sq. ft.

The chief advantage attached to the use of regulating cells is that the output of the battery is not limited by the capacity of the boosting plant; and in cases where a battery is used as stand-by, regulating cells have distinct advantages over boosters. On the other hand, with large batteries the switchgear for regulating cells becomes, with its connections, a very cumbersome piece of apparatus.

The chief duty of the Dickinson Street battery is to take 3,000 kW. off the lighting peak. It is also looked upon as a stand-by. But its chief duty is load-leveling; and it was, therefore, decided to have three hand-regulated reversible boosters, and to run them in parallel at times of maximum discharge. At other times, one or two would be used as required. It may be noted, however, that such importance is attached to the question of overload in emergency, that it is the universal custom on the Continent to use regulating cells in all central station batteries.

Short-circuiting switches are provided for all booster bus-bars, these switches being used to cut out the boosters under breakdown conditions, or when boosters are not required—for instance, on Sundays, when the battery does the whole of the lighting load for the greater portion of the day. The lighting load is much bigger than the traction load, and for some time it has been found more economical for that reason to confine the use of the battery to the lighting load.

The boosters are of the Turnbull-McLeod automatic reversible type, and were manufactured by the Lancashire Dynamo and Motor Co. They have equalising rings to every turn of the armature windings, on account of the heavy circulating currents, and the yokes of the boosters are laminated. Each booster is capable of a maximum boost of 5,600 amperes at 80 volts for a few minutes.

A diagram of connections is shown in fig. 1.

Two substantial circuit-breakers are inserted in the main cables as close as possible to the battery house. These circuit-breakers are of the magnetic blow-out type, and are capable of carrying 15,000 amperes continuously. Each is enclosed in a separate concrete cubicle, so as to entirely shield it from all other parts of station, and each is electrically and independently operated from the switchboard by means of solenoids. The circuit-breakers are non-automatic, and are provided with a suitable controller to show by means of signal lamps on the operating panels whether the circuit-breaker is closed or open. The large circuit-breakers on the main switchboard are of a similar type, but mechanically operated from the front of the panels. The circuit-breakers themselves,

however, are also enclosed in concrete cubicles. The switchboard circuit-breakers are automatic.

Bus-bars of aluminium have been employed throughout.

In a typical winter-load curve at the time of the installation of the Dickinson Street battery, the load-factor works out at 32 per cent., and was expected to be improved to 43·5 per cent. In figs. 2 and 3 we have typical summer and winter-load curves since the installation of the battery; it will be noted that the load factors obtained are actually much greater than those anticipated, and are respectively 67·5 per cent. and 49·1 per cent.

In fig. 4 a chart is given showing the effect of load factor on coal consumption and works costs at Dickinson Street and Bloom Street works.

Dickinson Street is now considered an old station, and the largest units in Dickinson Street and Bloom Street stations are of not more than 1,800-kw. capacity. The observed coal consumption per unit—of the combined stations—has been down to the low figure shown on the chart. The lowest figure for a monthly observation per unit generated since the installation of the battery is 2·66 lb., and per unit sent out 2·79 lb., the difference being accounted for by units used at the works and units lost in the battery. The commercial efficiency of the battery was for the first year 70·6 per cent., and for the second year 71·1 per cent.

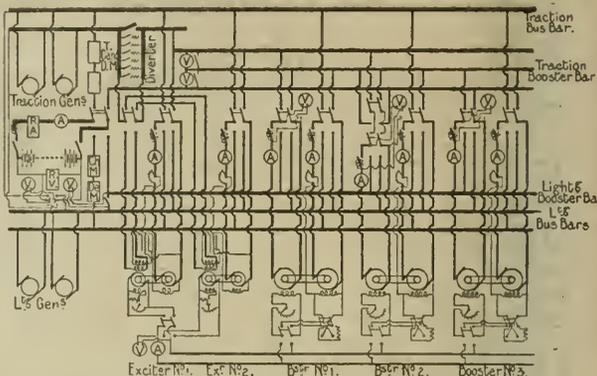


FIG. 1.—DIAGRAM OF BATTERY BOARD CONNECTIONS, DICKINSON STREET.

It is quite unfair to consider a battery capable of saving only the standby represented by its one-hour rating capacity. In a storm-load the maximum demand (ignoring traction) was 44·5 per cent. greater than the boiler capacity at the commencement of the darkness; and the battery was able to take care of the rising load ahead of the extra boilers which had to be got into commission. Without the battery it would have been impossible to get these extra boilers up in time, and would have meant practically a total failure of supply unless some portion of the load could have been cut off. The actual costs came out as follows:—

3,000-KW. BATTERY AT 1-HOUR RATE OF DISCHARGE, INCLUDING BOOSTERS AND SWITCHGEAR.

Storage battery ... ..	£15,034	7 years.	Loan period.
3-motor booster combination ... ..	2,776	15 "	" "
Switchgear ... ..	1,757	15 "	" "
Buildings ... ..	2,000	20 "	" "
Total ... ..	£21,567		

Estimated expenditure required to provide equivalent steam plant ... ..	£51,000
Actual cost of battery plant ... ..	21,567
Difference in capital expenditure ... ..	£29,433

Steam plant: £51,000 to be repaid in, say, 20 years:—	
(Interest, 3½ per cent., sinking fund, 3½ per cent.)	£3,698
Battery plant: £21,567 to be repaid in 10 years:—	
(Interest, 3½ per cent., sinking fund, 3½ per cent.)	£2,642
Saving in capital charges per annum in favour of battery ... ..	£1,056

COMPARISON OF COST PER KILOWATT OF CAPACITY.

	Estimated.	Actual.
Generating plant ... ..	£17 0 0	£16 16 6
Battery ... ..	6 13 4	7 3 9

In these days of turbo-driven units, the capital cost might be taken at a lower figure.

Costs compiled from the latest actual figures available are estimated by the author as follows:—

	Total cost per kw.
Land ... ..	£0 5 6
All buildings (including offices) ... ..	3 13 0
Land for railway, railway complete and locomotive ... ..	1 9 0
Coal and ash plant ... ..	0 1 0
Marine boilers with superheaters, including economisers, coal and ash chutes, scraper and stoker driving ... ..	2 13 0
Foundations and flues for marine boilers ... ..	0 9 0
High-pressure steel pipes and covering, including valves (main range not included) ... ..	0 2 6
Turbo-alternator and condensing plant, pipework for condensing plant and motor-driven fans ... ..	3 5 6
Foundations for turbo-alternator and air ducts ... ..	0 4 0
Pipework for turbo-alternator, including circulating water pipes, atmospheric exhaust pipes and valves ... ..	0 5 0
Natural-draught cooling towers ... ..	0 13 0
Foundations for cooling towers ... ..	0 5 0
High-tension cable ... ..	1 8 0
Converting plant, including switchgear ... ..	2 0 0
<b>Total ... ..</b>	<b>£16 16 6</b>
<b>Total plant installed ... ..</b>	<b>66,500 kw.</b>

Mr. Snell's figure of £12'26 per kw., given in his book on "Power House Design," does not include items in the author's estimate, amounting to £5 4s., which would bring up the cost per kw. on his estimate to £17'16.

It would seem, therefore, that, for peak-load duty of two hours (which averages out at the 1-hour rate of discharge for the battery)

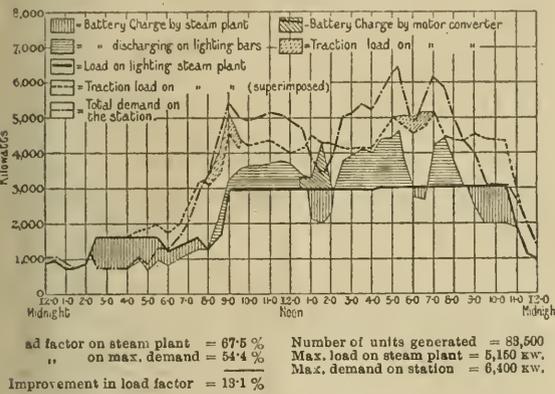


FIG. 2.—SUMMER LOAD CURVE.

the cost per kilowatt can be safely estimated at £17, which leaves a margin of £9 16s. 3d. in favour of the battery.

It is necessary when considering the cost of generation of peak-load units to take into consideration the fact that the most uneconomical units are reserved for this duty, and quite rightly so, also

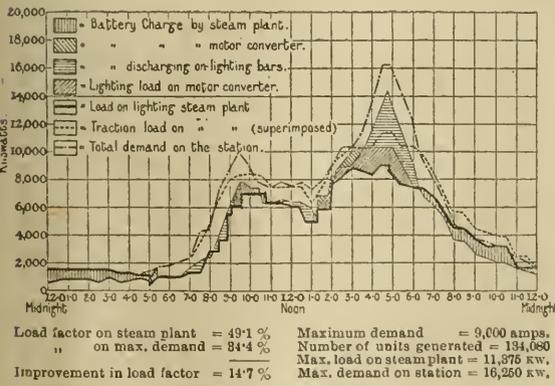


FIG. 3.—WINTER LOAD CURVE.

that these peak-load sets will not be run at their most economical load; consequently, the steam consumption will be high. Bare fuel cost per 1,000 kw. standby for this peak-load duty the author has estimated at £1 8s. per day. But we have seen that it is unfair to credit the battery with standby savings on its bare capacity only. Our 3,000-kw. battery gave a yearly standby saving of £1,554.

There is an actual saving on running fixed charges on the station when a battery is put in; at Dickinson Street there are now 22 fewer men for an increased demand since the installation of the battery. Comparing bare fuel cost per unit generated, and crediting the battery with a commercial efficiency of 70 per cent., we get a

cost per unit (reckoning 2'5 lb. of coal per unit at 12s. 6d. per ton) of 0'237d. against a cost of 1'55d. taken from the actual results shown on the load-factor curve for 8 per cent. load factor. The peak-load units discharged by the battery since its installation, calculated at the rate of five complete discharges per week—March 31st, 1910, to March 31st, 1912—are 1,560,000, and represent an annual saving of £8,531. This takes no account of the morning discharges and load levelling duty during the rest of the day commonly called "buffering," whereby each set on load is kept running at its most economical output.

The improvement in load factor on the units generated, observed monthly over two years, is approximately 74 per cent., and the value obtained from the chart is 0'08d. on 304 million units, this represents a saving of £10,166. This is the actual improvement due to the battery, and should cover both the other estimates and include the saving due to the buffering effect as well.

Year.	Output to feeders.	Coal used.	Average price of coal.	Increase in coal cost, 1910 and 1911.	Total cost per unit output to feeders.	Saving in 1910-11 against 1909.	Total value of saving effected by battery with coal at 10s. 11d. Commercial efficiency.
1909.							
No battery..	kw. hours..	Tons.	s. d.	£	0'368	£	£
1910.			10 11	—	—	—	—
With battery	29,042,985	89,418	11 0	164	0'306	7,620	7,784 70'6

NOTE.—Calorific value varies between 13,500 and 14,000 B.T.U.'s per lb.

In the table the actual saving on works costs for one complete year's working is given. The maker signed a contract to maintain the battery at its rated capacity for a term of 15 years

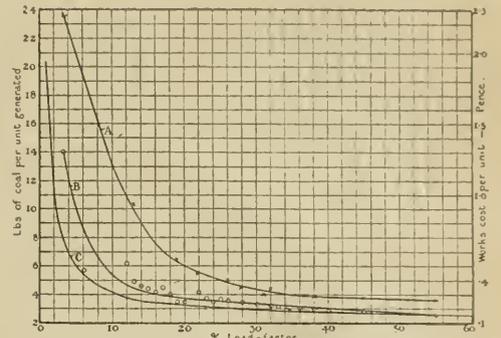


FIG. 4.—EFFECT OF LOAD FACTOR ON COAL CONSUMPTION AND WORKS COSTS.

for the sum of £1,250 per annum, which is 8'3 per cent. per annum on the purchase price. This maintenance is included in the works costs.

A recording ammeter and voltmeter are essential in order to see that overcharging or overdischarging does not take place. Charging is continued under normal conditions at Dickinson Street 10 minutes after gassing point is reached, before both daily discharges, and for 2 hours once each week, generally on Saturday, and preceding the day (Sunday) when a complete discharge at the 10-hour rating is usually taken out of the battery.

The efficiency of the battery for the day is units output ÷ units input, including booster units, which we term the "commercial efficiency."

The daily load curves are considered the most important records taken, because the value of a battery depends more on the way it is used than on anything else. A special battery book is kept, giving details of cell defects and their treatment (for which a 1,000-ampere portable "milking" booster is used), daily gassing, weekly overcharge, and all specific gravities and voltages of individual cells once each week after the weekly overcharge. Three pilot cells are used to serve as a guide to the state of charge, and the specific gravities of these cells are taken every half-hour for the station log sheet, which is the general record of the working of the station usually found in use at most central stations.

The capacity of the battery varies at various rates of discharge, and without these pilot-cell readings it would be exceedingly difficult at times to gauge the exact state of the battery.

It is now being recognised that, provided the battery is installed to reduce generating plant, it is a sound commercial proposition when considered in connection with a large lighting load.

Too much has been made in the past of the supposed inefficiency of batteries: as a matter of fact, 70 per cent. to 75 per cent. commercial efficiency can be maintained with care; and if this were not so, efficiency is the least important attribute of peak-load plant, and especially so in the case of a battery. In effect the battery is charged at power rates and discharged at lighting rates. If some of our large consumers on public supply mains only realised this, they would install batteries of their own, buy

current at power rates, and cheapen their own lighting supplies by arranging with the supply authorities for a "restricted-hour" supply, i.e., they would take no current from the mains at peak-load time.

It does not matter how short a period of time during the day or the year a supply is demanded, there must be plant installed to meet it, and it has been found that for all duty of less than 8 per cent. daily load factor, i.e., of less than two hours' demand during the 24 hours of the day, it most certainly pays to make storage battery provision. Beyond this point we must look to advantages other than direct saving in capital cost and running charges to justify the extension of the principle.

The author tenders his best thanks to Mr. S. L. Pearce, the City Electrical Engineer of Manchester, for facilities allowed and permission for the inclusion in this paper of data from official reports, and for the publication of facts and figures concerning the Manchester Corporation electricity works; also to Mr. E. A. Hilton for assistance in getting out the diagrams. The author would also like to make it quite plain that the opinions expressed in the paper are his own personal opinions.

#### DISCUSSION AT MANCHESTER.

MR. S. J. WATSON said it was worth considering whether large batteries should be put in the generating station, or in connection with the distribution system. In connection with polyphase transmission schemes, the sub-stations where the A.C. supply was converted to D.C. would be the places in which to put the batteries. He thought the fairest system of rating a battery was on the basis of a two-hour rating, because the primary use of a battery was in connection with peak loads; the ordinary peak in the winter months lasted about 1½ hours, and a two-hour capacity would last through any peak that was likely to occur. The battery in Manchester had been installed at a cost of about £17 per kW. on the basis of a two-hour rating. On the score of cost the generating plant and the battery were almost identical. With the battery there were no standby losses; it was in this connection that the principal saving on a battery arose. Regarding the question of using boosters or regulating cells, the use of a regulating switch enabled one to deal promptly with any sudden emergency which required heavy discharges; if the battery were floating on the bars without the use of boosters, the pressure dropped when a heavy discharge occurred, and it would be almost impossible to switch the boosters in, whereas with regulating cells the operation was very simple. Wherever a large battery was in use it should undoubtedly be always kept on the bus-bars, so that in emergency there was the full capacity to rely on. He considered that a battery at its two-hour rating should have the capacity of the largest unit in the station. The efficiency of a battery really mattered very little, because the load which was supplied from it was only a percentage of the total.

MR. ALDERMAN WALKER said the period allowed for repayment of loans on large turbo-generator sets was being reduced from 20 years to 17 years; the difference was to the good of the battery. With regard to the question of consumers having a battery on their own premises and having it charged at power rates, he thought the author perfectly justified in this idea.

MR. E. C. MCKINNON said one American company had individual contracts with the largest supply companies to maintain their batteries for 10 years, and during that period the battery might be discharged 150 to 200 times, but not more than 40 times during any one year. The loan period for a battery (seven years) was altogether unreasonable. The battery at the end of its life was still worth 25 per cent. of its original price as scrap metal. The commercial efficiency of the Manchester battery was rather low, indicating that the battery was overworked, and that possibly the charge was stinted. With a new battery it was possible to obtain a falsely high efficiency, but only at the expense of the plates. Maintenance should be based on the amount of work that the battery was called upon to do, and this was the system employed in the States.

MR. P. P. WHEELWRIGHT said that in rushing up boiler plant a considerable amount of smoke was thrown out, which was very liable to cause trouble in the city, whereas if a battery were in use a greater time could be taken to bring up the boilers and so reduce this tendency. He had had three batteries before the one now in use, which was the only one that had ever done any honest work. The previous batteries had always to be nursed until the time when they were required, and when this time came the batteries would not work. When the present battery was installed, the makers told them to do their worst with it, and it would always work well. They had done this, and for the past four years the maintenance of this battery had been very low, and it had experienced the roughest time a battery ever had.

MR. S. L. PEARCE said he took it that, generally speaking, they agreed that the scheme was sound, and that the conclusions drawn by the author in his paper had been justified. There had been an undoubted saving in the cost of coal consumed, viz., £3,348. There was, in addition, a saving of £1,056 on capital as between the steam scheme and the battery scheme. This gave a total of £4,404. If, from this figure, the capital cost incidental to the battery itself were deducted, there was still a saving of £2,000, which, if it had been the only saving, would still have justified the scheme. The losses incurred in the battery and booster were more than covered by the coal saving. The total units lost were approximately 700,000, and the coal saving to cover those losses was more than four times greater. With present-day knowledge, the figures of capital for Stuart Street were possibly on the high side; they were drawn up at the end of 1907. Taking the battery on a two-hour rating, and reducing the estimates on the steam plant, there was practically no saving on capital. The question of switchgear gave

rise to more anxiety than anything else in connection with the battery. It was decided that this switchgear should be treated as a high-tension board, and therefore, as the author had pointed out in his paper, the cubicle construction was adopted, and the isolation of all leads where possible. They had a system of remote-controlled circuit-breakers, which were fitted in the battery room alongside the battery. With regard to the loan periods, the L.G.B. seemed to be drawing the strings tighter and tighter. Seven years only was allowed for this storage battery, and to-day they only got 15 years for generating and sub-station plant; the term for boilers had also been reduced from 17 to 15 years.

MR. C. L. E. STEWART, referring to Mr. Wheelwright's remarks, said that he also had a small battery which had a very rough time, and it was doing remarkably well. It ran on traction load, the efficiency was very good, and it was in very good condition after being in use for four years. It was working up to its full one-hour rating either way every two or three minutes. With regard to the record of overdischarge, the easiest way of judging it was for the switchboard attendant to watch the voltmeter chart. Records were well worth keeping.

MR. E. THOMAS said it was interesting to see that apparently it was not appreciated until comparatively recently that a battery had very great advantages from a cost point of view when considering large stations like Manchester. Seeing what the Americans gained by using very much larger batteries, it seemed that it might be advantageous for us to go further than we had already done.

MR. W. CRAMP said he noticed that the makers had signed a contract to maintain the battery at its rated capacity for 15 years. In dealing with batteries he had found that makers objected to maintain a battery at its rated capacity throughout the maintenance period, but they would guarantee 85-90 per cent. of its rated capacity at the end of the maintenance period. The load factor improvement was estimated to save £10,166, whereas the estimated saving from standby value, and in cost of generation, was given as £5,821. Was the difference between these two figures due to the "buffering" effect?

MR. F. H. WHYSALL, in reply, said that in the case of a large D.C. system the advantage was in favour of putting a large battery down at the generating station. In the case of a three-phase system with sub-stations, the best place was the sub-station. He considered that a one-hour rating to carry over the peak was sufficient. The stand-by boilers were not under steam at all. With regard to the difficulty in all paralleling boosters under breakdown conditions, there was a large margin, and, failing this, arrangements were made whereby the battery could be put on load without boosters. Integrating wattmeters were fitted to register the input and output of the battery, but they were only used to indicate the state of the charge. A recording voltmeter was also in use as recommended by another speaker for the same purpose. A quicker method of estimating the residue was wanted than running a plainmeter over the chart; the pilot cell reading gave the information at once. The author believed that the oftener a battery was charged and discharged, the better it was for the battery, provided the operations were carried out with due care. The proposal that the maintenance charges should be based on the number of charges and discharges in a given time was another innovation, and he did not think that would be suitable for the requirements of his station. Mr. Pearce had shown that even putting the problem at its lower level, they could expect £2,000 saving. He was perhaps too optimistic in crediting all the saving shown to the battery; the circumstances at Dickinson Street were peculiarly favourable to a battery. The cutting down of loan periods by the L.G.B. influenced the figures shown in favour of the battery.

#### DISCUSSION IN LONDON.

MR. J. S. HIGHFIELD, in opening the discussion, referred to the importance of the battery, in view of the security it gave to other sources of supply. It relieved other plant and mains, and represented a saving in capital; in most cases a good case could be made out for it. The use of a battery on peak loads was rather opposed to the stand-by idea, and a compromise was necessary; but even then it was worth adopting. The best method of control was to use a hand-controlled booster for charging and discharging, with a short-circuiting switch to save the booster from destruction. Booster construction was a matter of careful design, as the machines had to stand large overloads. He agreed with the author's figures for efficiency; he always took 74 per cent. himself. He thought that a better system of charging users for maintenance could be introduced, as the present method penalised the careful user.

MR. E. C. MCKINNON suggested that people would be too optimistic after reading the paper; it should not be thought that the author's efficiencies could be repeated everywhere. Engineers were realising the usefulness of the battery, and adopting it for this reason.

MR. A. M. TAYLOR said he disagreed with the figures taken for interest and sinking fund, since in the case of a large station like Manchester it should not be necessary at all to go to the Local Government Board for a loan on behalf of the battery, but the same might be paid for out of surplus profit; then, again, as regards maintenance, he was satisfied that it was distinctly cheaper for the Corporation to maintain the battery itself, provided that it was not going to be worked too heavily. He fully agreed with a saving of £4 4s. per day for the five summer months on account of the boilers which had not to be kept under steam on the chance of a storm-cloud, but he was not quite sure whether an additional £4 4s. credited on account of the regular peak available from the battery should be added to the above £4 4s. Supposing, however, that this was not included, the saving on the first heading was only reduced by £460, and as regards the other

sum of £630, he (Mr. Taylor) quite agreed with this. So that in any case under the most unfavourable estimate he had £460 + £630 = £1,090, with a possible figure of £1,551. As regards the next stage in the coal bill, the cost per unit turned out by the steam plant during the peak load was 1'55d., and the cost of each unit put into the battery at night time (to be used for the peak on the day following) was only 0'237d., the saving therefore being 1'31d. on every unit turned out during the peak. Taking the number of units turned out during the peak as 1,560,000, the author obtained the tremendous annual saving of £8,534. (Mr. Taylor ventured to think, however, that the author had made a slip as to the number of units, which would appear to be those taken for two years instead of one year.) The saving was really prodigious, because adding to the sum of £8,500 (the author's figure) the additional sum of £1,090, there was a total of over £9,500, saved in coal alone. This sum capitalised at 5 per cent. was equivalent to an investment of £180,000. In the present case, the capital cost was approximately £22,000, and the interest, sinking fund, and maintenance of this investment would be of the order of £3,800, whereas the coal saving *alone* is shown to be at least £9,000, *in addition to which* there should be added the saving on the capital cost of generating plant, representing £1,000 per annum, and a saving in the wages at the generating station representing another £1,500 per annum, besides increased efficiency of generation during the day. The value of the battery as a standby could not be overrated. On a three-minute rating it could be taken as £2 10s. per kilowatt, and the floor space on the same rating at one-twentieth of a square yard per kilowatt. Some engineers had recently expressed the opinion that storage batteries would be of very little use in the future on account of the large development of the alternating-current load. From the figures given it was clear that the battery would well bear the handicap of the additional cost of the inverted rotary, and still show a very large margin of saving. This applied more to the case of a large A.C. system, where numerous rotary converter sub-stations were employed for supplying direct current into the feeder networks. In such a case, a failure of the A.C. supply caused a tremendous overload upon any D.C. generating plant on the system. As regards the question of the employment of boosters, as against regulating cells, Mr. Taylor believed that it would be found that boosters provided with automatic short-circuiting switches, would permit of rapid discharge rates being regularly employed, and of any emergency discharge rate being taken care of with safety. It must be borne in mind, in comparing boosters with regulating cells, that in any case a booster had to be provided for the charging of the battery, so that one had to balance the cost of boosters, on the one hand, as against that of boosters plus regulating cells on the other, with the additional disadvantage that some parts of the battery were discharged at different rates to others, and the heavier the discharge rate employed, the worse this disparity became, with consequent additional trouble in maintenance.

Mr. E. S. JACOB disagreed with the method of comparing capital charges on batteries and steam plant; in the case of the former these charges would be reduced to nothing after ten years, and this was equivalent to a double saving after that in comparison with steam plant, the cost of which was spread over 21 years. Then the battery had a scrap value of 25 to 30 per cent. of its original value, while steam plant had practically none. In regard to maintenance contracts, everybody said they used their battery well, and all would ask for low rates.

Mr. W. FENNELLSaid a small battery was as large proportionally in a small plant as a large one on a big system. The short loan periods allowed by the L.G.B., and having to write off the capital cost in seven years, often killed a battery scheme; the makers would contract for the maintenance of the full battery output for ten years. It was difficult to understand the home preference for boosters as against automatic regulating switches. In his own station they had been running all their gas engines on full load, owing to shortage of plant, and on one or two occasions when a set came off suddenly the automatic switch in connection with the battery operated so smoothly that the consumers were unaware of the occurrence.

Mr. P. V. McMAHON showed some curves of a battery sub-station on the City and South London Railway, in which the batteries took 50 per cent. of the sub-station load.

Mr. ROGER T. SMITH said the author referred to batteries with steady charge and discharge over periods of hours; it might be of interest to refer to their use on traction loads where rapid charge and discharge occurred over periods of minutes. The Great Western Railway supply from Park Royal station was to two sub-stations, each with a battery in parallel with motor-converters. At the time of heavy load (6 p.m.), the maximum load at the power station with the battery in use was 2,720 kW., and without it, 3,870 kW., three generating sets being in use in the former case and five in the latter. The improvement in the daily load factor on the steam plant, comparable with the author's figures, was some 17 per cent., but it depended on the amount of the total load going through the battery, which should be 15 or 20 per cent. The variation in the traction load was 300-3,000 kW., and the lighting load variation was very much less. The batteries allowed of a machine load factor of 85 per cent., and during periods of heaviest load of 95 per cent., being obtained; although the traction load varied 1,000 per cent., there was no difficulty in keeping a plus or minus 4 per cent. variation on the lighting bus-bars. The battery had for six years been considered a stand-by to the A.C. side, as suggested by Mr. Taylor. It would need 66 per cent. more steam plant if the batteries were dispensed with, and entail a greatly increased steam consumption.

Mr. C. P. SPARKS thought it was a difficulty that batteries were

so soon outgrown with increasing loads. The railway sub-station referred to by Mr. McMahon took a steady load of 400 kW., although 800-1,000 kW. loads were dealt with; the plant load factor was about 95 per cent.

Mr. A. HURT referred to the heavy current battery regulating switch, and showed views of typical switches in use on the Continent. One of these having 29 contacts, was motor-operated and designed for a normal current density of 500 amperes per sq. in. on the brushes, with large overload capacity. Such switchgear could be automatically controlled from a distance. (Mr. A. M. Taylor, interposing, said Continental makers appeared to be reluctant to supply such switches for really large currents; in Birmingham they were offered a switch for 6,000 amperes instead of 17,000 amperes, but a booster could be short-circuited with impunity.)

Mr. WHYSALL, replying, said the battery at Manchester was partly regarded as an emergency battery, and they found usually that when it was most fully discharged the load was falling rapidly. The excellent results shown during the first year were obtained when the battery was quite new. During a sudden storm the battery held the load until the steam plant was got running, and in this way its usefulness was much more than its size indicated. The 10-year period was to the disadvantage of the battery; its life was much longer than that, and the Manchester maintenance contract was for a period of 15 years. In his opinion, an emergency battery should have a regulating switch, but a peak-load battery should have a booster combination. As regards Mr. Sparks's remarks the battery should be extended as the load grew.

### Physical Society.

At the meeting on January 24th, 1912, a paper, entitled "The Resistance of Electrolytes," by Messrs. S. W. J. Smith and H. Moss, was read by the former.

Some experiments upon this question were exhibited before the Society in 1911. In these a modification of Wien's method was used—the optical telephone being replaced by a vibration galvanometer—and the conclusion was drawn from them that the resistance of an electrolyte varies to an easily perceptible degree with the frequency of the alternating currents to which it is subjected. It is, however, unsound to use the method unless it is shown that the effects of leakage through the electrolytic condensers can be neglected or allowed for.

The authors have used a method which depends upon simultaneous measurement of the voltage between the ends of a tube containing the electrolyte and of the current passing through it. The former was measured by means of an Ayrton-Mather electrostatic voltmeter connected to auxiliary electrodes, and the latter by means of a Duddell thermo-galvanometer.

In the cases examined it was found that the resistivity of the electrolyte was constant within 0'05 per cent., whether steady currents or currents of any frequency up to 2,300 alternations per second were used.

A paper on "The Electrical Conductivity and Fluidity of Strong Solutions" was read by Mr. W. S. Tucker.

The author carried out a series of experiments to determine if there were any definite relation between conductivity and fluidity in the case of calcium chloride solutions. The feature of these determinations was the simultaneous observation of viscosity, electrolytic resistance and temperature.

The results obtained suggest that no reliance can be placed on ionisation data derived from electrical conductivity observations.

### Institution of Electrical Engineers.

#### ANNUAL DINNER.

On Thursday, last week, the annual dinner and reunion of the Institution was held at the Hotel Cecil; the president, Mr. W. Duddell, F.R.S., occupied the chair, and the company included nearly 400 members and guests. Unfortunately, a number of the latter, including Vice-Admiral Prince Louis of Battenberg and Sir Alfred Keogh, were prevented from attending.

After the loyal toasts, Mr. HERBERT SAMUEL, M.P., the Postmaster-General, proposed "The Institution of Electrical Engineers," claiming that he was at the head of probably the largest electrical enterprise in this country. The Post Office, he said, owed much to electrical engineers, and was grateful for the assistance rendered to the development of electrical science by the Institution; the Post Office, however, possessed a highly qualified staff of its own, which had developed many ingenious devices, and occasionally accomplished the remarkable feat of transmitting two conversations simultaneously over one telephone wire. His department was indebted also to the Institution for the loan of its state building on the Embankment for the Conference on Wireless Telegraphy last year, which had made a deep impression on the delegates.

The electrical engineers had built up a great and growing industry; it was stated recently in the House of Commons, in answer to a question, that in 1903 our exports of electrical machinery were valued at £437,000, while those of the United States were worth £1,064,000; in 1911, our exports had increased to £1,791,000, and those of the United States to £1,739,000, showing that we had made remarkable progress. If capital represented the pocket and labour the hand, the professional men were the brains of the electrical industry. When recently the Government were engaged in the difficult task of forming a technical Committee to inquire into the merits of the various systems of wireless telegraphy, the first name that occurred to them was that of the President, Mr. Duddell, whose colleagues included two ex-presidents

of the Institution, and one ex-president of the two sister bodies. Mr. Duddell was himself the inventor of the "singing arc," which formed the basis of one of the systems, but so great was their confidence in his impartiality that their only fear was lest, through excess of conscientiousness, he should be biased against that system.

MR. DUBDELL, in responding, reminded his hearers that when the Institution was founded in 1871, the only important application of electricity was that of telegraphy. Since that date, electricity had invaded the domain of all the sister sciences, and had become intimately interwoven with our daily life and every department of industry; it was involved in the vital processes of our bodies, and it was now thought that even "mass" was only a manifestation of electricity in motion. That day their membership was 7,300, a development of one hundredfold in 41 years, and that was not the limit. In 1907 there were half a million people employed in the electrical industries in this country, or 14 per cent. of the whole number engaged in engineering. When the results of the new census were published next year, he believed a great increase in these figures would be recorded.

PROF. JOHN PERRY proposed the health of "The Guests," alluding to the tremendous amount of practical intellect and successful achievement which they represented. He would like the guests to know that the scientific engineer always talked shop and thoughtshop—he had other interests, but that was his predominating interest. The study of history was important as a guide to the future, but now they had applied science which must be taken into account as an important factor in making history. He urged the guests to encourage a scientific spirit in their subordinates and to oppose the inertia which existed in all Government departments. Remarking that no sign of electrical knowledge in olden times had been discovered by the archaeologists, Dr. Perry said it was certain that our ancient forerunners had no big engines—if they had had any, they would not have left us an ounce of coal.

SIR H. B. BUCKLEY, Lord Justice of Appeal, in responding, briefly commented on the vast developments of electrical science in connection with commerce, agriculture, and other industries. Within the last 50 years, he said, the spread of knowledge had been prodigious; and in that branch of knowledge which was concerned with industry, no study had had more influence on the development of human society than the study of electricity. Probably it would be found that at the root of all things lay one simple law which gave rise to all the various phenomena of Nature—perhaps the law of vibration. They knew how to catch electricity and how to use it, but who knew what it really was?

The PRESIDENT invited the representatives of foreign institutions to address the company, and M. GROSSELLIN, President of the Société Internationale des Electriciens and of the Société des Ingénieurs Civils de France (6th Section), said that in the past the French presidents had rarely been able to accept the invitations of their English confreres; in France it was not customary for societies to give annual dinners, so that the French presidents could not return the hospitality offered them. It would be of great benefit if they could hold together a meeting of English and French engineers to exchange ideas; this year the Société Internationale hoped to hold such a conference in Paris in May, for which a programme of visits to works, &c., would be arranged, and he hoped that many of the members of the Institution would be able to be present—they would be heartily welcome.

HERB GEHEIMRAT CHRISTIANI, President of the Verband Deutscher Elektrotechniker, and past president of the Elektrotechnischer Verein, Berlin, conveyed the best wishes of those societies for the development and prosperity of the Institution. He referred to the visit of Dr. Kapp to Germany, when he presented a portrait of Faraday to Dr. Budde, President of the International Electrotechnical Commission, and expressed the gratitude and good wishes of Dr. Budde to the Institution. He concluded by remarking that the Verband was about to enter into similar close relations with the Austrian and Swiss Societies, and that such international relationships could not be too highly valued; he hoped their friendship would prove lasting.

The company then adjourned to another room, where friends foregathered and conversation was maintained up to a late hour.

Music was provided during the evening by the "Imperial Orchestra." The programme was closely adhered to, the speeches being comparatively few and brief, and thus there was ample time for the reunion, one of the principal social events of the Institution's year, and one which is highly appreciated by the members.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### "Chain-Pull" Switch Lampholders.

THE GENERAL ELECTRIC CO., LTD., have brought out a "chain-pull" switch lampholder with a movement which is extremely gentle and reliable. The construction of the lampholder differs considerably from that of any other on the market. Ease of pull is secured by means of a spring ratchet movement. A steatite holder is provided for the chain, which is detachable, and permits longer or shorter lengths to be used as required. The movement is surrounded by a protecting porcelain wall. Barrel terminals are provided, which facilitate wiring. The plungers are particularly massive. These holders are supplied in a variety of styles, and are very inexpensive.

THE BRITISH THOMSON-HOUSTON CO., LTD., of Mazda House, Upper Thames Street, E.C., are also supplying a chain-pull holder of similar design.

### Adjustable Eccentric.

The accompanying illustration, fig. 1, shows an adjustable eccentric, which MR. JOHN JARDINE, of Nottingham, is now offering. The eccentric has been used in connection with the various classes of machinery made by Jardine's for over 20 years, but hitherto has never been offered as a separate item by them.

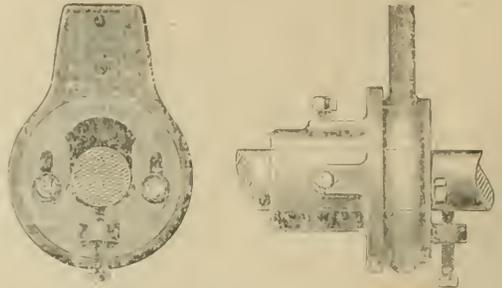


FIG. 1.—JARDINE ADJUSTABLE ECCENTRIC.

Through several inquiries and orders for it, they have now decided to place it on the market. Any throw can be obtained from zero to the maximum, and can be adjusted to a nicety by the set-screw. It will be seen that the eccentric is a useful piece of mechanism, and is suitable for a variety of applications.

### Fixing Contacts in Springs.

Fig. 2 shows a simple, but effective, device invented by MR. S. E. SRAWLEY, of 67, Ronald Street, Old Swan, Liverpool, for cutting off contacts for springs and simultaneously inserting them in the latter. The little bits of wire are easily lost, and are difficult to handle, causing loss of time; by this method, however, waste of material and time is avoided, and a considerable saving of cost is effected, which is not to be lightly regarded, in view of the immense numbers of spring contacts that are called for nowadays. In the figure A is the punch holder, B a steel cutting-off plate, C a steel guide plate, D a steel die, E a pin for the wire to rest on with spring, F a steel ram, which is pressed against the plate H by the rod G to

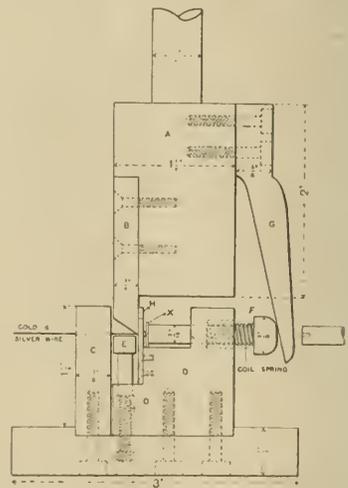


FIG. 2.—DEVICE FOR FIXING CONTACTS IN SPRINGS.

tighten the wire in the spring N, with the aid of the bush shown, which makes a ring in the spring round the wire. If a double-headed contact is required, a hole is made in the ram F, as indicated in the inset. The wire is put through C and H, the spring is placed on the wire, and the press is then pulled down, when F pushes the wire into position, B cuts it off, and at the same time the wire is fixed in the spring. The advantages of this method, compared with that of cutting the wire into little bits, picking up those that are not lost with tweezers and putting them in a die, and then riveting the wire in place with a hammer, are obvious.

### Westminster Electric Cookers.

We illustrate in fig. 3 the No. 3 electric cooker of the WESTMINSTER TOOL AND ELECTRIC CO., Suffolk House, Laurence Pountney Hill, London, E.C. It comprises a complete equipment for a family of eight persons, consisting of three boiling plates, grill, oven and hot cupboard. The overall dimensions are 25 in. width × 21 in. length × 36 in. height, the oven measurements (internal) being 14 in. width × 13 in. length × 21 in. height. The design of this cooker is understood to embody the results of a large experience. The sides and back of the cooker are porcelain-

enamelled—looking like tiling. The oven is enamelled inside and thoroughly lugged. The top plate is of polished steel, fitted with two 8-in. diameter and one 6-in. diameter boiling plates, each with three heats. The grill is 12 in. x 8 in. The hot cupboard on the top of the oven is fitted with a drop-down door, forming a shelf. The oven door is fitted with a ventilator and a glass panel, enabling

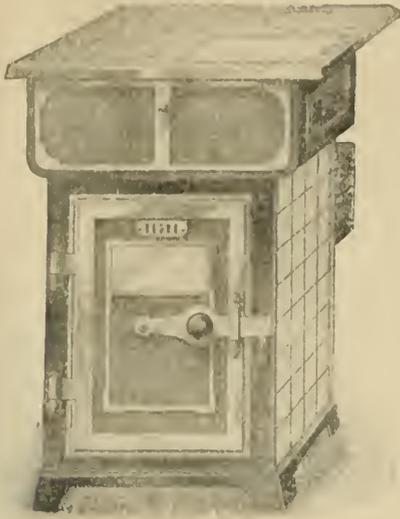


FIG. 3.—No. 3 WESTMINSTER ELECTRIC COOKER.

the contents of the oven to be examined without opening the door. All connections are brought to a connection box at the back of the cooker.

The power consumption is stated as follows:—Oven, 2,200 watts; 8-in. diameter boiling plates, 1,200 watts; 6-in. diameter boiling plates, 800 watts; grill, 1,100 watts; all with three regulations.

**Electrical Window-Cleaner.**

MR. O. E. FOX-ADAMS, of 125, Constantine Road, Hampstead, has devised and patented a rotary brush for cleaning windows, which should be of considerable use for shops, warehouses, hotels, railway trains, &c. It resembles the electric hair-brush, in that it consists of a cylindrical brush or swab, driven by an internal electric motor, the armature shaft being held in a fork, while the field magnet system rotates, carrying with it the brush. A diagrammatic section

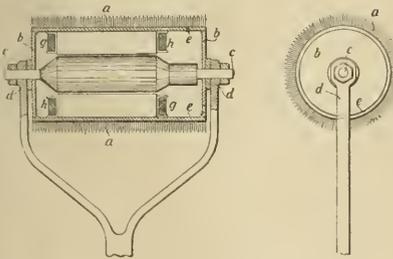


FIG. 4.—ELECTRICAL WINDOW-CLEANER.

and end view are given in fig. 4. The inventor's chief difficulty was to find a motor combining sufficient strength with the necessary lightness; having accomplished this, and adopted aluminium as far as possible in the construction of the framing, &c., to reduce the weight to the minimum, he has succeeded in producing a tool with which windows and similar surfaces can be quickly polished with the least expenditure of labour.

**Electrical Treatment at Bradford Hospital.**

At the last quarterly meeting of the Bradford Hospital Fund (Incorporated), held on Thursday at the Infirmary, it was reported that the work of the electrical department was on the increase. In 1,243 cases electrical methods had been used to locate various fractures of limbs and other ailments of patients who came to the infirmary. Dr. Mitchell had charge of the electrical department, and he had attended to 3,582 cases during the past year.

**FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.**

**AMENDMENTS.**

ST. VINCENT.—In connection with the recent Canadian-West Indies reciprocity arrangements, the Government of St. Vincent have drafted a new tariff differentiating between goods from foreign countries and goods from the United Kingdom, Canada and Newfoundland, and giving preferential rates of duty to the latter. This new tariff is to come into force at a date which will subsequently be notified; meanwhile the following information will be of interest to our readers:—

	Preferential rates.	General rates.
Lamps ... ..	10 % ad val.	12½ % ad val.
Electric machinery and electric dental appliances of all kinds not specifically exempted from duty ...	10 % ad val.	12½ % ad val.
Wire ... ..	10 % ad val.	12½ % ad val.

The following goods are to be admitted free of duty, irrespective of their origin:—Machinery, and any parts or fittings thereof not imported for sale, which the Governor in Council may consider to be likely to further the introduction of any new industry or the improvement of any existing industry; medical and surgical instruments, appliances and apparatus imported by any duly qualified medical practitioner for his own use in the exercise of his profession; telegraph wire, telegraphic, telephonic and electrical apparatus and appliances of all kinds for communication or illumination, including all material for the use of the West India and Panama Telegraph Co., and any telegraph company (wireless or otherwise) recognised by the Government.

BRAZIL.—The new Consular invoice regulations for goods shipped to Brazil laid down in the Budget for 1912, have been repealed.

ST. LUCIA.—A new ordinance passed by the Government of St. Lucia provides that no person shall establish any wireless telegraph station or install or work any apparatus for wireless telegraphy in any place or on board any ship registered in the Colony, except under, and in accordance with, a licence granted for that purpose by the Governor. Also no person shall work any apparatus for wireless telegraphy installed on any merchant ship whether British or foreign, while that ship is in the territorial waters of the Colony, otherwise than in accordance with prescribed regulations.

**INTERNATIONAL ELECTROTECHNICAL COMMISSION.**

CONSIDERABLE practical progress has resulted from the meetings of the Special Committees of the I.E.C. held in the Town Hall, Zürich, from January 13th to the 19th.

The meetings, to which about 12 nations were invited to send special delegates, were presided over by Dr. W. Wyssling (Symbols), M. E. Huber-Stockar (Rating), and Dr. H. Zoelly (Prime Movers), three Swiss being chosen, as the Commission adopts the plan of choosing, as the president of the Committee, one of the members of the National Committee of the country in which the meetings happen to be held. Symbols were first dealt with, and a long discussion took place as to the relative importance of distinguishing between vector and scalar quantities and between electric and magnetic quantities. The Germans urged very strongly that the whole of the script alphabet should not be taken up for the sake of a very few magnetic quantities; if these were made to differ, in the actual symbol, from the corresponding electric quantities the script characters would be set free for vectors which they say will, to an increasing extent, be employed for the practical solution of alternating-current problems. The majority of the delegates, and especially the French were, however, against the German proposal, being of opinion that, from the point of view of electro-technics alone, it was imperative to be able to distinguish between electric and magnetic quantities. It may be that this subject has not received as much consideration in the National Committees as it merits. With a few additions and notable modifications, such as Maxwell's D for electrostatic flux-density instead of B, the Paris proposals of last May were agreed to. Should, therefore, the proposals of the Pan-German Society, the A.E.F. (Anschluss für Einheiten und Formelgrössen) find favour ultimately, generally speaking, the symbols proposed would not be confused, as the letters would not be identical for electric and magnetic quantities.

The rating question occupied three whole days of strenuous but most amicable discussion. The British views were ably put forward by Dr. Gisbert Kapp and Dr. R. T. Glazebrook, C.B., the latter especially interesting himself in the proposal for an international standard for copper, the exact form of which is to be decided, in consultation, by the four National Laboratories of America, France, Germany and Great Britain: the result will form a special publication of the I.E.C. Dr. Kapp was much assisted by Mr. A. R. Everest, the official representative of the B.E.A.M.A., and the co-operation of the British manufacturers was duly appreciated.

Modifications and new proposals had been received from several National Committees, and, although occupying much time, their consideration has rendered the present proposals more complete, and much more likely of acceptance by the industry, as a whole, than were the Paris proposals of March last; it should not, however, be forgotten that at Paris nothing concrete was before the Committee.

Several interesting proposals have been made which differ from the rules as at present adopted by different countries, but seeing that the delegates are also members of the local Committees that responsible for the national rules, there is every likelihood of the proposals, finding their way gradually into the local rules. The I.E.C. proposals, finding their way into the local rules, and not the temperature rise, the former being the damaging factor; the "cooling air" is to be recommended instead of the "surrounding air," as, under modern methods, what really has to be taken into account is the air going into the machine, which is not necessarily the surrounding air. Then the maker is not to be held responsible for the proper working of a machine if it is made to carry a continuous overload, so that if a man orders a 1,000-k.v. machine, he must not expect it to carry 1,500 kw., without paying for it; of course, momentary peaks, as they do not materially affect the temperature, are not included under overloads. A basis of comparison of various tenders is also proposed on the principle of an extra 10° C. permissible temperature.

Detailed reports will be issued by the central office of the I.E.C. without delay, and it should be noted that the proposals of these Committees are to be submitted for the consideration of the various National Committees with a view to ratification at the next plenary meeting of the Commission, to be held in Berlin from September 2nd to 6th this year.

The Italian Society of Electricians has decided to adopt the recommendations of the I.E.C., as and when promulgated and to recommend their employment in all international specifications for electrical machinery, and to suggest that when the necessity arises in international contracts for an arbitrator, he shall be chosen by the president for the time being of the I.E.C.

The general arrangements for the comfort and entertainment of the 25 delegates were admirably attended to by the Swiss Committee and the Swiss Society of Electricians, the president of which, Prof. Jean Landry, came from Lausanne to preside at the official banquet.

The wisdom of the Turin meeting in appointing these small international committees to discuss actual details and formulate definite proposals has amply justified itself. The work of the Zürich meetings will undoubtedly be of real practical value to the industry, for when finally adopted at Berlin it will form the basis of international specifications for machinery to be used in all foreign trade.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 2,125. "Electric lighting." M. S. OKEN. (Convention date, January 26th, 1912, United States.) January 27th. (Complete.)
- 2,128. "Electrically-controlled gas valves." A. Sr. J. COORE. January 27th. (Complete.)
- 2,136. "Control of electric motors for driving screw propellers." SIEMENS SCHUCKERTWERKE G. & R. H. (Convention date, January 27th, 1912, Germany.) January 27th. (Complete.)
- 2,139. "Combined automatic locking device and detachable lamp-cap for locking bayonet type electric lamps and the like, to their holders." H. T. WORRELL. January 27th. (Complete.)
- 2,146. "Terminal connections for aluminium and similar conductors." L. W. CURTIS. (Convention date, February 16th, 1912, United States.) January 27th. (Complete.)
- 2,152. "Devices for electrocuting animals." H. SMITH. (Convention date, February 3rd, 1912, United States.) January 27th. (Complete.)
- 2,165. "Methods and apparatus for producing elongated electric arcs." F. H. A. WIRKOLASEL. January 27th. (Complete.)
- 2,170. "Electromagnet typewriters." J. SCHNYDER. (Convention date, January 29th, 1912, Germany.) January 27th. (Complete.)
- 2,184. "Receiver for submarine signalling." SIGNAL GFS. m.b.H. (Convention date, November 30th, 1912, Germany.) January 27th. (Complete.)
- 2,185. "Receiver for submarine signalling." SIGNAL GFS. m.b.H. (Convention date, December 18th, 1912, Germany.) January 27th. (Complete.)
- 2,198. "Devices for closing and disinfecting telephone mouthpieces and other articles." M. DICINSON. January 27th. (Complete.)
- 2,199. "Apparatus for electrocuting animals." H. SMITH. (Convention date, February 17th, 1912, United States.) January 27th. (Complete.)
- 2,214. "Method and apparatus for the production of elongated electric arcs for the treatment of gases." F. H. A. WIRKOLASEL. January 27th. (Complete.)
- 2,215. "Disinfecting apparatus for telephones and the like." L. BLOCK. (Convention date, March 13th, 1912, United States.) January 27th. (Complete.)
- 2,223. "Remote-controlled electrical circuit-breaker." S. WHIPP, C. W. D. BOWNE and F. WHIPP. January 27th.
- 2,238. "Electrical condensers of the variable type." A. E. WATKINS. January 29th.
- 2,247. "Metal-sheathed insulated electric conductors." F. J. RIDDALL and H. S. FURNEAUX. January 29th.
- 2,261. "Electric thermal control for use in connection with electrical heating, cooking and ventilating apparatus." J. McKAY and J. DOREY. January 29th.
- 2,269. "Electrodes for electric accumulators." H. F. JOEL, SEN. (Divided application on 21,443, October 25th, 1912.) January 29th.
- 2,295. "Commutators for controlling electrically operated mechanism." A. BROWN. (Convention date, April 9th, 1912, Germany.) January 29th. (Complete.)

- 2,302. "Selecting devices for telephone systems." A. KATZ. (Convention date, January 29th, 1912, Germany.) January 29th. (Complete.)
- 2,322. "Electric sounding recorder." P. G. SHWELL and W. G. BENNETT. January 29th.
- 2,356. "Electric lamp-holder." J. S. HOLMES. January 29th.
- 2,363. "Electric-driven vacuum-cleaning apparatus." W. W. R. F. GRIFFITHS and WIZARD DUST EXTRACTOR CO., LTD. January 29th.
- 2,372. "Electric safety lamps for mines." T. ATTWATER. January 29th.
- 2,395. "Process of making alkaline gelatinous electrolyte." G. S. ENOLZ. (Convention date, October 8th, 1912, United States.) January 29th. (Complete.)
- 2,396. "Double copper oxide plate and process of producing same." G. S. ENOLZ. (Convention date, October 8th, 1912, United States.) January 29th. (Complete.)
- 2,397. "Telephone systems." W. J. RICKETS. (Addition to 4,282 of 1911.) January 29th. (Complete.)
- 2,402. "Electric batteries." C. D. GALLOWAY, JUN. (Convention date, February 1st, 1912, United States.) January 29th. (Complete.)
- 2,409. "Selecting devices for telephone and other systems." SIEMENS BRÖS. and Co., LTD. (SIEMENS & HALSKE Akt.-Ges., Germany.) January 29th.
- 2,418. "Electric controllers." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 29th.
- 2,423. "Means for connecting an electric cable to the detonator wires of mining cartridges." N. FIELD. January 29th.
- 2,424. "Method and means of connecting electric conductors to terminals." N. FIELD. January 29th.
- 2,445. "Electro-thermostats." W. R. RIDINGS. January 30th.
- 2,453. "Electric lighting sets for motor-cars, motor-boats and air craft." F. HALL. January 30th.
- 2,469. "Storage battery charging." L. J. SIMON, A. F. ROBERTS and E. H. CHADWICK. January 30th.
- 2,471. "Arrangement for the static transformation of three-phase alternating current into one-phase alternating current having the treble frequency of the primary current." P. SPINELL. January 30th. (Complete.)
- 2,492. "Lie-saving appliances for electrically and mechanically-operated vehicles." G. R. HEISER. January 30th.
- 2,507. "Welded receiver." V. ANDERSON. (Convention date, April 3rd, 1912, United States.) January 30th. (Complete.)
- 2,508. "Method of reducing telephonic disturbances." O. B. BLACKWELL and G. A. ANDERGO. (Convention date, April 11th, 1912, United States.) January 30th. (Complete.)
- 2,509. "Power system for automatic switches." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) January 30th. (Complete.)
- 2,514. "Electric lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 30th.
- 2,538. "Positive plates for electric accumulators and means for insulating such plates and other electrical accumulator plates from their cells." H. H. DABSON. January 31st.
- 2,577. "Electric furnace with electrodes running through the receptacle for the charge, and means in the upper part for cutting off the gases." A. HELFENSTEIN. (Convention date, February 4th, 1912, Austria.) January 31st. (Complete.)
- 2,588. "Gas controllers, electric time switches, and the like." G. O. H. HORSTMANN, E. H. HORSTMANN, A. HORSTMANN and W. T. EDGAR. January 31st.
- 2,610. "Telephone systems." E. A. GRAHAM and W. J. RICKETS. January 31st. (Complete.)
- 2,612. "Selective signalling system." R. N. HILL. (Convention date, March 21st, 1912, United States.) January 31st. (Complete.)
- 2,636. "Means for interlocking electric switchgear with lids of boxes." H. HIRST and J. STRACHAN. February 1st.
- 2,638. "Collectors for electric currents." C. C. WILSON and BROWN-MACKENZIE SIGNAL CO., LTD. February 1st.
- 2,639. "Primary electric batteries." A. P. MANCHESTER and H. M. SPOONER. February 1st. (Complete.)
- 2,657. "Electric transformers." C. ASH & SONS & CO., LTD., A. B. JONES and W. G. LEE. February 1st. (Complete.)
- 2,700. "Control system for automatic switches." TELEPHON APPARAT FABRIK E. ZWISLOCKI & Co. G.m.b.H. (Convention date, March 15th, 1912, Germany.) February 1st. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

ENUMERATION OF TELEPHONE CALLS. S. D. Williams. 28,007. December 18th.

1912.

- ELECTRICAL ATTACHMENT FOR MOTION PICTURE MACHINES. G. E. Ward. 18,072. August 6th.
- HAND-REGULATED ELECTRIC ARC LAMPS OR PROJECTORS. R. Rigby. 19,099. August 20th.
- CONNECTION APPARATUS FOR ELECTRIC CIRCUIT CONDUCTORS. T. E. Murray. 19,536. August 26th. (February 9th, 1912.)
- ELECTRIC LOCOMOTIVES, MOTOR-BOATS AND THE LIKE. Maschinenfabrik Oerlikon. 19,890. August 31st. (September 23rd, 1911.)
- SEATS OR HOLDERS FOR CONNECTING CURD PLUGS FOR TELEPHONE EXCHANGES AND SIMILAR APPARATUS. Siemens Bros. & Co., Ltd., and E. A. Peithory. 21,346. September 26th.
- ARRANGEMENTS FOR OBTAINING SPARELESS COMMUTATION IN ROTARY CONVERTERS COUPLED TO ALTERNATING-CURRENT BOOSTERS. Siemens Schuckertwerke Ges. 28,285. October 11th. (November 14th, 1911.)
- CONNECTORS FOR ELECTRIC CONDUCTORS. British Thomson-Houston Co. (General Electric Co.) 25,775. November 9th.
- DIFFERENTIAL ARC LAMP WITH INCLINED CONVERGING ELECTRODES. Korting and Mathieson Akt.-Ges. 26,318. November 16th. (December 22nd, 1911.)
- SOLENOID COIL FOR ALTERNATING-CURRENT ARC LAMPS. Korting & Mathieson Akt.-Ges. 27,034. November 25th. (December 3rd, 1911.)
- ELECTRIC STORAGE BATTERIES. J. T. Niblett. 819. January 10th.
- SIGNALING LAMPS. H. J. JOWETT. 923. January 12th.
- VAPOR ELECTRIC LAMPS. F. BOUSSON and Guesnier. 991. January 12th.
- ELECTRIC BATTERY LAMPS. A. Hunte and H. Hunte. 1,013. January 13th.
- HOLDERS FOR ELECTRIC LAMPS. A. R. Muller. 1,166. January 15th.
- ELECTRIC IMITATION CANDLE LAMPS. F. J. Wilson and Candolite Co. 1,178. January 15th. (Cognate application, No. 1,173 of 1912.)

# THE ELECTRICAL REVIEW.

VOL. LXXII.

FEBRUARY 21, 1913.

No. 1,839.

## ELECTRICAL REVIEW.

## THE SETTLEMENT OF TRADE DISPUTES.

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Ber's).

# 1913 EDITION

Ready.

H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.

At a time of piping industrial peace when both trade unions and employers appear to be content to live in harmony, the Government has thought it wise to consider what steps may be usefully taken to prevent the outbreak of war in the future. The longer a truce of this kind endures, the more bitter is war likely to be when it does, in fact, break out. When the crest of the wave of prosperity has fallen, and it becomes necessary for employers to retrench, we may expect the strike to become the order of the day—and the disputes which may then occur will be all the longer and all the more strenuously fought, if the war-chests have been filled to repletion.

With a view to seeing whether there is anything to be gained by tearing a leaf out of the Canadian book, the Government recently sent Sir George Askwith to the Dominion, in order that he might inquire into the working of the Lemieux Act (The Industrial Disputes Investigation Act of Canada, 1907.)

The simple purpose of the Act is to ensure the recognition of the interests of the public, as a third party, in trade disputes, and the insistence that that third party, through the Government, shall have a voice in regard to a dispute affecting its interests, and, according to the Act, before a stoppage of work takes place. In practice the recognition extends to cases arising before or after a stoppage of work. The actual interference with the parties in the settlement of their differences is sought to be reduced to a minimum by the Act being confined to industries whose uninterrupted continuance is of high importance to the well-being of the nation (mining, railways, shipping and other public utilities); and to a brief suspension of the right to stop, as distinct from a complete prohibition of stoppage.

The Act requires that any dispute arising in connection with the class of industries named shall be submitted to a board of conciliation and investigation, with a view to arriving at a settlement before a strike or lock-out can be legally brought about. It also stipulates that at least 30 days' notice of an intended change affecting conditions of employment with respect to wages or hours shall be given, and that pending the proceedings before the Board, in the event of such intended change resulting in a dispute, the relations to each other of the parties to the dispute shall remain unchanged, and neither party shall do anything in the nature of a lock-out or a strike.

It will be seen that this is not a measure for compulsory arbitration; it only endeavours to postpone a stoppage of work in certain industries for a brief period and for a specific purpose. It does not prohibit a strike or lock-out if it is found that no recommendation can be devised which is acceptable to both sides. Since the Act was passed 132 disputes have been referred for adjustment, and in only 15 of them were strikes not averted or ended.

The Act, it appears, was originally very much opposed by the Western coal miners and railway men. It is still

opposed by the miners and their Unions, but the railway men now approve of it. The employers in Canada also seem to approve of it. Indeed, the figures above mentioned are the best possible evidence that the Act has caught on in the Dominion.

Having examined a number of persons in Quebec, Vancouver, Ottawa, and Montreal, as to the working of the Act, Sir G. Askwith is of opinion that it might be applied in some form or other in this country. In his report, which has been published as a Parliamentary paper, he writes:—

I consider that the forwarding of the spirit and intent of conciliation is the more valuable portion of the Canadian Act, and that an Act on these lines, even if the restrictive features which aim at delaying stoppage until after inquiry were omitted, would be suitable and practicable in this country. Such an Act need not necessarily be applied in all cases, but neither need it be confined to services of public utility. It could be generally available in cases where the public were likely to be seriously affected. Without the restrictive features, it would give the right not only to conciliate but fully to investigate the matters in dispute, with similar powers in regard to witnesses, production of documents and inspection, as are vested in a Court of record in civil cases, with a view, if conciliation fails, to recommendations being made as to what are believed to be fair terms. Such an Act, while not ensuring complete absence of strikes and lock-outs, would be valuable, in my opinion, alike to the country and to employers and employed.

While we frankly admit that there are few men better qualified to form an opinion on these questions than Sir George Askwith, we are of opinion that with him the wish is father to the thought. The stubborn attitude of the English Trade Union, which brooks no interference with the alleged right of the worker to throw down his tools as and when he chooses, appears to militate against the prospects of successful legislative interference.

It is difficult to express much more than a pious hope that the Act which has proved serviceable in Canada would be of any use in this country. No foundations for such a structure have ever been laid down in England. So far from penalising those who break their contracts, the tendency appears to be to tolerate and condone every violation of the usual obligations which exist between employers and employed, and to extend the right of free speech to every protagonist who can catch the ear of the mob. Here is an extract from Mr. Keir Hardie, speaking at South Shields on December 22nd, 1912:—"The Parliamentary Committee of the Trade Union Congress was considering proposals. . . . One proposal was that on a given date every organised worker in every trade should stop working when the eight hours were up. *No strike. . . . Simply at the end of the eight hours down tools. If that came to a lock-out, well and good.* It is an important non-resistive proposal which the employer classes would find it very difficult to resist." Our Canadian brethren have apparently examined the down-tool policy, and have found it wanting. The tree of Conciliation has been planted, and is found to flourish, in the virgin soil of our great Dominion; but so long as the Keir Hardie type of man is at large to advocate the policy of the sudden strike and to stir up strife between employers and employed, legislation to enforce industrial peace will continue to be futile.

Ever since the year 1875 the trend of all legislation which affects trade unions has been in one direction: complete emancipation of the unions from every kind of legislative and ministerial control. They have already secured a partial reversal of the Osborne judgment. Is it likely that the demagogue, who makes his living by fomenting strife between employer and employed, will consent to any new legislation which will tend to prevent those disputes which are the be-all and the end-all of his existence?

## TRAMWAY LABOUR CONDITIONS IN AUSTRALIA.

THE end of last year saw what was practically the close of the greatest labour fight in which electric tramway employes have been engaged. Although a strike formed one of the side issues in the early stages, the main interest centred in a trial in the Australian Commonwealth Arbitration Court

lasting 93 days, in which no lawyers took part. The battle was for improved conditions of service, and although the men have not obtained, by any means, all that they desired or asked, they have been awarded terms which for any undertaking in this country would have been deemed fatal to commercial stability. In one respect the case promises to be historic. It is, we believe, the first time that a duly authorised court has embodied the principle of preference to Unionists in a legal award.

The case has been argued with great ability by the representatives of both employers and employes, though what the fight has cost in the withdrawal of managerial supervision on one side, and the preparation and prosecution of their case on the other, the balance-sheets of the respective organisations alone can show. The principal features of the fight have been from time to time summarised in our columns. The passing of the Australian Arbitration Act was followed by the establishment of a Men's Union having branches in all the different States. Members of this Union claimed the right to wear their membership badges while on duty. This caused trouble at Brisbane, where the right was disputed by the Tramway Co., and led to a strike which eventually spread to all trades, and a sort of general deadlock prevailed for a time. Matters settled down, and the company resumed work, employing non-unionists. A lawsuit was commenced against the company, and it was eventually decided that the men were within their legal rights in wearing their Union badge. As at the time when the decision was given the company had none of the members of the Men's Union in their employ, it was a rather fruitless victory.

Meantime the Union formulated a long list of demands, not merely covering increased wages, but practically claiming control of the manner in which the undertakings should be worked, and presented this list simultaneously to the 11 principal undertakings in the Commonwealth. Sydney being under Government control was not concerned in the dispute. Naturally the claims were refused. On the ground of there being a dispute extending beyond the bounds of a single State, the case came before the Federal Arbitration Court at Melbourne, Mr. Justice Higgins presiding. Lawyers do not appear in this Court, the cases being presented by the parties concerned. For 93 days, extending from March 4th to December 21st, the case went on, and the results are now to hand. In nine cases the parties finally arrived at arrangements outside the Court, which have since been embodied in binding agreements. If these have not been completed, awards on the basis of the principal agreement have by this time come into operation.

In the case of the remaining two undertakings—Adelaide and Brisbane—no agreements could be arrived at, and awards have been made by the Judge, which, under the Act, are binding on the parties. It should be said that the jurisdiction of the Court to decide this dispute has been questioned, and may yet be the subject of further proceedings. The men asked for a wage of 11s. per day of eight hours for all drivers and conductors, with percentage increases of 10 per cent. and 15 per cent. for various States. They have been awarded 8s. 6d. per day for the first year of service, 9s. for the second year, and 9s. 6d. for subsequent years. They asked that only 10 per cent. of the total number of drivers and conductors should be employed on broken shifts; the award has fixed the percentage at 20 per cent., or such proportion as may be decided by a Board of Reference, consisting of representatives of both sides. The men asked for 21 days' holiday per year on full pay; they are awarded 14 days on 12 days' pay. The men demanded preference for members of their organisation in all undertakings; it has only been granted in one case, namely, at Brisbane. These terms vary in the case of the agreements, but are common to the awards, which in themselves differ in other minor points.

It would be interesting to know what would be the effect on the financial position of prominent British undertakings, if the awards were operative in this country. At Adelaide the tramways belong to a trust, composed of the local municipal authorities, and by law a certain sum has to be set aside annually for sinking fund. The fares are at present so high that increases are inadmissible. The present deficiency is about £15,000 per annum, and the new con-

ditions impose about a further £11,000, or additional rates in the various townships of from 2d. to 1½d. in the £.

The terms of the awards seem to us to be so severe that to a large extent they defeat their object, and, inasmuch as they interfere with the proper function of the manager, to be positively mischievous.

As regards the insertion of legal preference for the members of the Union, we cannot too strongly condemn the principle. It seems to us to introduce a new weapon of oppression into our industrial life. It is true that the Judge tried in the phrasing of the award to limit its objectionable features, and it is also true that every opportunity was given the company to avoid its insertion by agreeing not to discriminate against the Men's Union, but these facts do not, in our opinion, justify its adoption. We do not think it will bridge the gulf which in the last few years has appeared between the company and its workers, and we feel that it sets a precedent which will increase rather than lessen the friction which so often exists between employer and employé, and which it is the duty of the State to minimise by holding the scales of justice evenly between the parties. We hope, in the interests of the peaceful industrial development of the Commonwealth, that our fears may prove groundless.

#### Standardisation of Electrical Apparatus.

WE are fully aware of the danger of standardisation in any growing industry, owing to its tendency to prevent the adoption of improvements, but the electrical industry cannot be referred to, even by its bitterest enemy, as being still in its infancy.

A number of things in the electrical world have been standardised with great benefit to all concerned, but there is, in our opinion, need for further standardisation, especially in connection with domestic appliances. Electricity has invaded the home, and is doing far more than gas could ever do to minister to our comforts.

The manufacturer, contractor, supply authority, and the consumer, are all affected by the present lack of uniformity which exists in almost all electrical apparatus. The cause is to be found in the immense improvements that have been made in design. The manufacturers have no definite rules to go on; each one acts as he thinks best, and everyone suffers to a certain extent. The general public feel that electrical repairs are expensive, for a complete new apparatus has generally to be bought, instead of its being easily possible to replace the actual part broken. It is because one maker's fuse-clip or plug will not fit another maker's fuseboard or socket that so many electricity consumers allow their installations to get into a deplorable condition before going to the expense of completely new apparatus.

A short article elsewhere in this issue points out some typical cases of electrical apparatus that could with advantage be dealt with by the British Engineering Standards Committee and the Manufacturers' Association.

Electric lighting has benefited largely, for example, by the fixing of definite standards for lampholders, and we regret that it has not been possible in the case of electric lighting and power to fix the pressure of supply and the periodicity at one or two figures that would meet all conditions.

#### The Association of Electrical Station Engineers.

ONE of the most useful and important functions of a newspaper, whether technical or otherwise, is to facilitate the free and open discussion of all subjects which lie within its scope, and thus to enable its readers publicly to commune with one another with a view to the common welfare. By no other means is it possible to open up communications between persons who do not know one another, and are often not even aware of each other's existence, but who nevertheless possess interests in common and desire to find their fellows.

It has, therefore, been a source of pleasure to us that

with the aid of our "Correspondence" columns, as the result of a discussion arising out of a letter on an allied subject from a chief engineer, and extending over some three months—a discussion often somewhat irrelevant and sometimes bitter, but always turning on the grievances of the junior staffs of electricity works—the members of those staffs have been brought into touch with one another, and a new Association has been formed to voice their views and to safeguard their interests. An excellent start has been made. Within a few weeks of the first announcement of an address to write to, which appeared only in our columns, some 4,000 replies were received by Mr. Ebben, the enthusiastic and energetic hon. secretary, and a large number have already intimated their intention of joining the Association. The main objects of the latter are to raise the status of the staffs of electricity works and to improve their wages and prospects. The Association is in no sense hostile to the chief engineers, some of whom, we believe, have already signified their approval of its aims and have promised their support, and we trust that, under wise and discreet management, it will soon establish itself on a sound basis and become a prosperous and beneficent institution.

This is now the third Association which has originated directly from correspondence in our pages, its elder brothers being the Electrical Contractors' Association and the Association of Mining Electrical Engineers, both of which have amply justified their existence and have done work which could have been accomplished by no other agency; and we look to the new Association to follow in their footsteps.

#### Limited Partnerships.

NOT much advantage appears to have been taken of the Limited Partnership Act since it was passed in 1907, as, during the five years of its existence, only some 491 firms have been registered, limiting the liability on £1,335,597 of capital. Its suitability to small trading businesses or concerns indicates, perhaps, its principal advantage, and the slow progress of the Act is no doubt due, to some extent, to certain imperfections therein and to the facilities for the registration of private companies. As is well known, every partner is liable jointly with the other partners, and in Scotland, severally also for all debts and obligations of the firm incurred whilst he is a partner, and in England he is also severally liable in certain events. The Act of 1907, which was framed upon the Continental law, confers the benefit of limiting the liability of a limited partner in a business to the contribution which he makes to the partnership in either money or property, just as the liability of a shareholder in a limited company is limited to the amount payable on his shares. Such a partner is thus enabled to participate in the profits of a business without being liable (beyond the extent specified) as a partner.

**April 16th—The Benevolent Dinner.**—The annual festival dinner of the Electrical Trades Benevolent Institution will be held at the Trocadero Restaurant on Wednesday, April 16th. Mr. George Sutton, of W. T. Henley's Telegraph Works Co., Ltd., will preside, and it is hoped that there will be a very large gathering of those interested in the welfare of the electrical trade benevolence movement. We trust that our readers will keep the date free, and in these "better times," of which we hear so much, will prepare to ensure a record "collection."

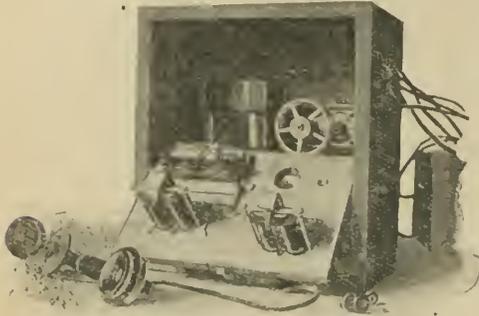
**The National Insurance Act.**—The Bradford Chamber of Trade has occasioned considerable stir among shop assistants by issuing to all the retailers' associations of the city copies of a form of agreement, by which the assistants signing it expressly relieve their employers of any legal liability for payment of wages during "absence due to sickness or any other cause." The position taken up by the Chamber is that it has been advised that, in the absence of such an agreement, employers are legally liable to pay full wages during absence due to sickness, notwithstanding the provision made for employed persons by the National Health Insurance Act and the Workmen's Compensation Act—until they have formally terminated the engagement by giving the customary notice, and that it would be a most unpleasant thing to have to give notice to a sick or disabled person. The shop assistants, however, object to the agreement in question, and, upon advice from the headquarters of the National Shop Assistants' Union, are resisting it.

**BRITISH ANTARCTIC EXPEDITION  
TELEPHONES.**

The following brief description and photographs of the telephone equipment taken to the Antarctic by Capt. Scott's Expedition will be of interest to our readers.

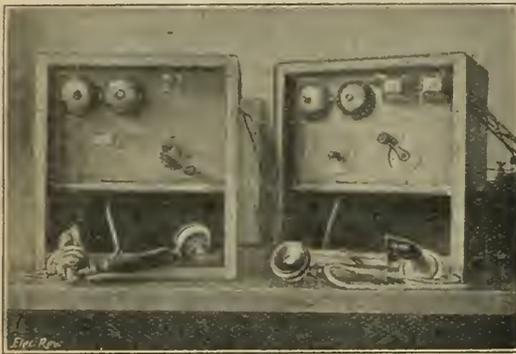
The installation was supplied by the National Telephone

On account of the extremely low temperatures to which the instruments would be exposed, it was impracticable to use any form of dry cell for local batteries, and after several experiments it was decided to make use of a 24-volt battery, forming part of the scientific equipment of the expedition, as a common battery for the different speaking circuits, in which the receivers and transmitters were in series in the line. This arrangement had the advantage of great simplicity, and with Ericsson hand-microtelephones was found to



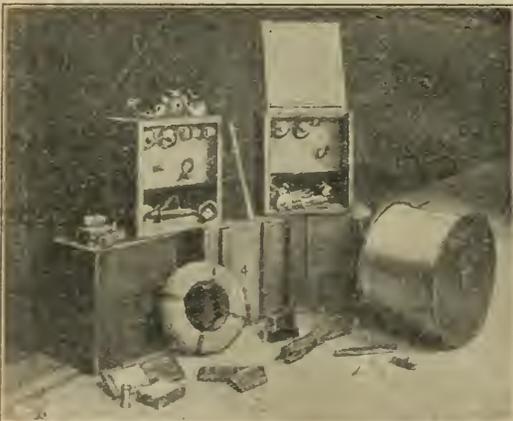
INSTRUMENT NO. 1, SHOWING INTERIOR.

Co., in order to enable communication to be maintained between the winter living quarters and the outside



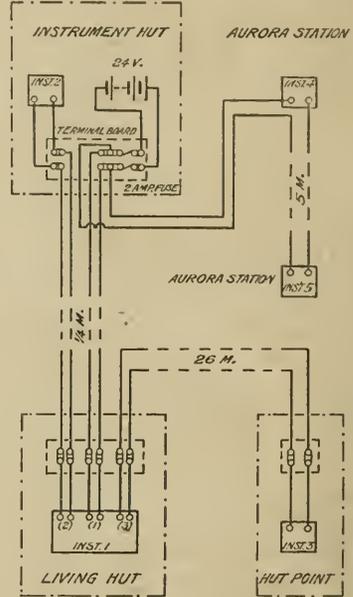
INSTRUMENTS NOS. 1 AND 2.

stations of the expedition. Five stations were provided for—the Living Hut, Instrument Hut, Hut Point, and two



TELEPHONE APPARATUS, SPARES, AND ONE DRUM OF ALUMINIUM WIRE.

Aurora Stations—and the instruments for these stations were numbered respectively from 1 to 5. The Aurora Stations were to be set up for observations of the Aurora Australis, and for this reason were required only to intercommunicate, while the living quarters were required to communicate with both Hut Point and the Instrument Hut.



CONNECTIONS BETWEEN STATIONS.

give good transmission. The ringing was by magneto-generators. Each instrument was self-contained in a stout wooden case, to obviate the necessity of packing for transport.

The line wire was of bare hard-drawn aluminium, No. 19 s.w.g., supplied by the British Aluminium Co. The question of weight was of great importance, and as the conductivity and strength of the wire would be improved by the temperature conditions of the polar regions, this material was selected. The total length of wire carried was about 75 miles, wound upon six iron drums, suitable for mounting on sledges, from which it would be laid direct on the ground. The go and return wires were specified to be not less than 6 ft. apart, and it was considered that the clean, dry snow would be an excellent insulator, even on the longest lines. For jointing the wire aluminium McIntyre sleeves were provided.

**NOTES FROM CANADA.**

[FROM OUR SPECIAL CORRESPONDENT.]

AMONG the news items from Western Canada are the following:—

In Saskatchewan the town of Prince Albert will probably spend about £40,000 on a new electricity works of an up-to-date character; the purchase of two 300-h.p. boilers has already been authorised as an extension to the existing plant.

It is likely that the Government of the aforementioned province will set aside a considerable sum of money for the purpose of carrying out further research work on the subject of the utilisation of the lignite deposits for power purposes.

The town of Saskatoon is considering the establishment of a municipal electricity works.

At Brandon, in Manitoba, the civic power committee is considering the erection of an electricity works, presumably water-driven, at some few miles outside the city.

In an article on the "Engineering Outlook for 1913," the *Canadian Engineer* gives, among other things, information substantially as follows:—

The London and Port Stanley Railway, which is owned by the City of London, Ontario, will probably be electrified at a cost of \$900,000.

The town of Souris, Manitoba, anticipates installing an electric-light plant, at an estimated cost of \$40,000.

Two new units are to be erected at the Winnipeg hydro-electric plant at Point du Bois, and a new transmission line is to be built thence to the city. The total cost will be about \$1,000,000.

Extensions to the tramway system in Lethbridge, Alberta, are contemplated; the cost is estimated at \$15,000. At Medicine Hat, Alberta, it is proposed to spend \$75,000 on extension of the electric lighting and power plant.

During January, Owen Sound, North Bay, Beaverton, Clinton, Elmira, Goderich, Peterboro, Stayner and Winchester all voted in favour of obtaining power from the Hydro-Electric Power Commission of Ontario, and collectively authorised the spending of \$347,000 for the purpose of erecting sub-stations and constructing their own overhead distributing systems for street and house lighting and power supply.

This Commission is now calling for tenders for materials required for 125 miles of 110,000-volt transmission line and the sub-station plant required for transforming 20,000 H.P. from this voltage down to 13,200 volts.

Particulars of the former may be obtained, the writer understands, from the Board of Trade Offices in London.

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

### Electrical Engineers in India.

I read with much interest the letters which appeared in recent issues of your valuable paper. May they be a warning to those who apply for positions in India and the Far East.

Your correspondents, like myself, must have been "had." It can hardly be expressed in milder terms, as I signed a contract and came out here on Rs. 250 per month (£16 13s. 4d.) plus free quarters.

At home one often hears of cheap living in India, but I can assure you that even a bachelor on the above salary cannot associate with the European population and keep out of debt. Those who emigrate are generally men whose ambition cannot find enough scope in the Old Country, and these are the men who sign the contracts placed before them, little knowing their poverty-stricken fate. A little advice like that given in recent issues of your paper cannot but be appreciated, and should act as a warning.

No engineer should ever come to India under £30 per month.

### Another Engineer in India.

### Arc Lamps for the Outside Lighting of Shops, &c.

I must say Mr. Fennell's article on flame arc lighting from low-voltage mains has given many engineers food for thought; this system I consider a good way out of the difficulty of fighting the "shops across the road," if one's Committee can be persuaded to launch out in such a non-productive scheme.

It evidently meets the object it was intended for—namely, to retain the outdoor lighting; but why should he be so generous as to supply 1,500 C.P. against his competitor's 1,000 C.P. at the same figure, when it is common knowledge that the efficiency of a mantle drops considerably? Again, his capital cost of a 25-kw. motor-generator (£150) is, I consider, far below the prices of to-day.

Perhaps it would be interesting for me to detail the system I have adopted without any capital charges. This being but a small town, under 10,000 population, and having a progressive gas company to contend with, I am supplying three shops from one series of five flame lamps, and in another case two shops using five flame lamps across 250 volts.

The shops in the first instance are: Gents' mercer, using two out, one in; grocer, one out; china shop, one out. In the second instance the two shops are owned by the same man, but are about 50 yards apart, one shop using two out and the other two out, one in. By this means I am able to get a good revenue at 5d. per unit, and I do not supply or maintain the lamps or carbons.

The lamps are of the "Excello" type, by the Union Electric Co., single pair of carbons type, taking 6 amperes each. They were not all erected at the same time; in fact, only recently I added one to make up the series of five.

It is, of course, essential to select your shops, as all do not close at the same time, or on the same day. For instance, a butcher closes his shop on a Monday instead of in the middle of the week, and tobacconists', sweet, paper, chemists', and cycle repair shops do not close for a half holiday, or are not compelled to by the Early Closing Act, therefore these shops and their like must be avoided.

I must say the system here is overhead throughout, which simplifies matters considerably.

A. Preston.

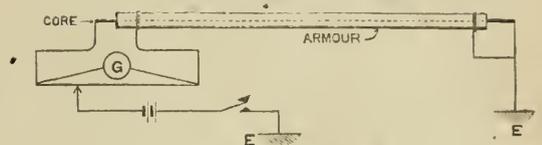
Ammanford Electric Supply,

February 17th, 1913.

### Testing the Continuity of Earth Conductors.

With reference to the difficulty encountered by "Continuity," I beg to suggest the following method of comparing the resistance of the earth conductor and metallic covering with the resistance of the conductor.

For example, we will take an underground three-core feeder with the armour as the earth conductor.



Disconnect at each end, and then couple one core to the armour with a well-applied bond and earth the connections at this point.

Proceed as in taking a loop test and find the ratio of the armour to the core resistance.

Instead of earthing to existing earth plates or other connections, one of the other cores can be used to represent earth during the test.

A simply constructed bridge will answer this purpose well.

Rotor.

In reply to Mr. Kivlen and others on this interesting subject, they seem only to question the continuity of cable armouring. That is not the only important point; other things, such as pumps, haulages, starters, oil switches and short-circuiting appliances in constant use and usually earthed to the armouring are a better subject for discussion, especially as regards testing Rule 14 (c) (i). I am not "up against it"; I have all the latest appliances for detecting and testing for leakages, and I know how to use them.

I should like to give Mr. Kivlen an instance: I have a 3,000-volt A.C. plant, and use it at 2,000 volts underground and on the surface. I have an armoured cable from the sub-station on top buried in damp soil for 300 yards before reaching the mouth of the slant; down the slant it travels for 500 yards, wet all the way, and usually covered by a few "falls" at the bottom: here you supply pumping motors, carry your earthing from the armouring to the motor frame, starter, oil switch, pump, then on to another and another pump, and more starters and switches. Every pump is dead earth in itself by reason of its suction pipes, delivery pipes, and damp surroundings; you go on with your cable to an electric haulage mounted on iron girders in damp masonry, this haulage drawing trams (iron) with steel rope on iron rails, with always 6 in. of water on the roadway, and in many places the tar cord is gone off the armouring.

D

Now, Mr. Kivlen, how would you test my earthing system for continuity, and how would you prove that my earthing system is effective, when you already have a dozen or two, what we will call, natural earths? You cannot put your pumps or pipes up on insulators to test the continuity of your own system, or get an independent test on your haulage earthing, and yet one day you may be disconnecting your pipes, &c., for some reason, and find your pump "alive," because your earth was not effective, and you could not test it, owing to having so many natural earths. If you have two pumps, both pumping from the same sump, they will be connected by pipes, water, &c., and you will get continuity without earth wires: so when you put on earth wires, how are you going to test them? The resistance is never two hours alike.

Last week I had a pillar oil switch frame "alive," and thanks to the "earth," it knocked my switch out. But was it my earth, or as the pillar stands in a wet place, did it have its own earth? These are the plain facts an ordinary colliery electrician has to face, and an answer to these may be very beneficial to many, as we all like to comply with the Act in every detail.

H. Field.

South Wales, February 15th, 1913.

#### Association of Electrical Station Engineers.

As the formation of the above Association has created general interest amongst electrical station engineers all over the United Kingdom and abroad, an account of what has been done and future arrangements would no doubt be of interest.

At the last general meeting a provisional organising committee was appointed with Mr. Chas. F. Wade as chairman, and Mr. W. A. Jones, A.M.I.E.E., vice-chairman. This Committee has examined all applications for membership received prior to February 11th, instituted some enormous propaganda work, and has endeavoured to put the Association on a sound financial and business-like basis.

A number of very enthusiastic and energetic gentlemen in the provinces are forming branches, and have been very successful; full reports are not yet to hand, but preliminary details are very encouraging. There is still scope for those gentlemen who have plenty of spare time and surplus energy to devote them to obtaining members and forming branches in those districts where there are none at present.

According to the last published Government census of production (taken in 1907) there were about 22,000 men employed in the electric supply business in the United Kingdom. Estimating roughly that about one-third (7,333) of these would be eligible for membership of the A.E.S.E., and allowing for increase to 1912, there should be about 10,000 men available for membership.

Of these we are in touch with about 4,000; a few, however, have decided on the policy of "wait and see" how the Association shapes. Now, if all of these 4,000 men would become members, and also the majority of them would obtain only two more members each, then . . . . . but, perhaps, I am too sanguine.

As soon as a good number of branches are formed it will be arranged that each shall appoint representatives (proportional to number of members) to attend a conference to draft rules and make general arrangements, &c., agreeable to the majority; the expenses of this conference will be paid from the central fund of the A.E.S.E.

The information bureau is to be an important section of the "Association," the business of which will be to compile and give information to members with regard to situations and conditions prevailing in the various districts; also it is hoped to assist employers who wish to obtain *qualified men*, provided, of course, that they are prepared to pay a salary compatible with the qualifications necessary for and the responsibility of the position. This section has aroused great interest, especially amongst British electrical engineers abroad, and a good number of these men have expressed a wish to become members of the Association.

Some question has been raised as to the attitude of employers, &c., to the A.E.S.E., but a perusal of the electrical Press of the last few months will show that they (the employers, &c.) have been advocating co-operation and com-

bination at every possible opportunity. The result has been conferences, &c., between the British Electrical and Allied Manufacturers' Association, Municipal Electrical Association, Institution of Electrical Engineers, and the Electrical Contractors' Association. The object of all these associations is the betterment of the condition of the electrical industry, and it seems that they are agreed that it can only be done by co-operation between manufacturers, contractors, and electric supply engineers, &c.

This is a good example to those of us who have not yet become chief engineers, and imitation is the sincerest form of flattery.

Considering that active steps to form the A.E.S.E. were only taken during the Christmas week of 1912, the results (about 4,000 inquiries to date) are astounding; but, like Oliver Twist, I ask for more, and hope the other 8,000 gentlemen who have not yet taken an active interest in the A.E.S.E. will do so at once, and thus we shall be able to better the conditions of that section of the electrical profession for which the A.E.S.E. has been formed.

W. J. Ebben,

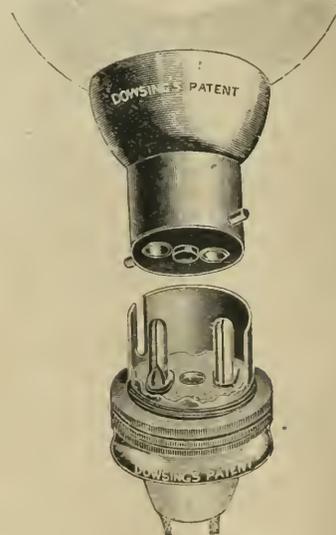
Hon. Sec., Association of Electrical Station Engineers.

7, Vernon Road, London, E.,

February 17th, 1913.

#### Screw Caps for Radiator Lamps.

Referring to the letter in your issue of February 14th signed "Jobber," with reference to the standardisation of lampholders for radiator lamps, I note he suggests that the B.E.A.M.A. should take the matter in hand. We, as the originators of the lamp radiators, very early discovered the very inefficient contact of the ordinary spring lampholders, and, in 1901, we patented an improved form of lampholder (illustrated herewith), using split pins which enter into sockets fitted in the stem of the lamp, thus ensuring a very much increased area of contact. We



have sold many thousands of these holders, which have proved absolutely satisfactory in every way, and we never get a failure.

In our opinion, the reason why these holders have not been universally adopted, is that the lamp requires a special cap to fit in the holder. The illustration we enclose will fully explain the principle, which, however, must be well known to large numbers of your readers, who, no doubt, use this lamp and holder.

We should be pleased to send a sample holder to any station engineer or to others who may wish to inspect same.

The Dowsing Radiant Heat Co., Ltd.,  
H. J. DOWSING, Managing Director.

London, W., February 18th, 1913.

### Heavy Service Lampholders and Adapters.

Having made exhaustive tests on the average lampholders and adapters now on the market, I have come to the conclusion that special holders should be made suitable for use where a temporary connection is needed for a small radiator, cooking utensil, or other form of apparatus taking more current than an ordinary lamp. Some firms are guaranteeing that the ordinary holder will do this, but tests made with them show that the springs of the contacts quickly deteriorate when a current of 2 amperes is passed through them. To be really useful they should carry from four to five amperes without unduly heating. If any manufacturer could meet this long-felt want, some thousands of holders could readily be sold in the city to which I belong.

Sales Superintendent.

### Cost of Running Small Generating Station.

Referring to Mr. Gray's query, the cost of running the small Diesel electricity works, where the supply has to be maintained continuously, and where the output does not exceed 315,750 units per annum, with a maximum load of 160 kw., works out at 709 of a penny per unit.

The information, however, given by your correspondent is too meagre to get a reliable figure, as the cost so much depends upon the load factor.

The figure given above is taken from the last return of the Chichester Electric Light and Power Co., who operate the small works for the supply of power and light to the City of Chichester, which works we designed and of which we are the retained consulting engineers.

Horace Boot & Partners,  
Consulting Engineers.

London, S.W., February 17th, 1913.

### ELECTROCHEMISTRY IN 1912.

In the use of the electric furnace for steel refining the United States Steel Corporation has taken a leading part, especially with respect to large-tonnage products, such as rails. The long list of breakages of rails, resulting in disastrous railway accidents, has become a very serious matter, and credit is due to the United States Steel Corporation for having undertaken to determine what can be done with the electric furnace to relieve the situation. From Mr. W. R. Walker's authoritative statement, made for the corporation in the paper before the American Iron and Steel Institute, the following sentences are significant:—"At the present time (May, 1912) there are approximately 5,600 tons of standard electric steel rails in service in the United States. These rails have been in the track about two years. During the past winter some of these rails have been subjected to very low temperature—in some cases as low as 52° F. below zero—and are being exposed to all the possible conditions of severe service. . . . Up to the present time we have not heard of any basic electric rails in use in this country being broken in service." It will be remembered that the steel for these rails is basic Bessemer converter metal transferred while in the molten state to the electric furnace for refining. Mr. Walker's statement augurs well for the future of the electric steel rail. But it is evident that before transportation companies will be willing to pay somewhat higher prices for electric steel rails for general use the experience of more years must be available. Although the commercial development will be necessarily slow, the outlook is bright.

The electric furnace for refining steel for high quality products (tool steels, &c.) is proceeding quietly and very satisfactorily. Several new furnaces have been erected. The electric furnace has been introduced into foundry practice for high quality castings. A special type of electric furnace for heating bars, billets and forgings is finding particular favour at present, as a result of the recent considerable increase in the cost of crude oil, which puts oil-firing very much on the defensive.

The use of the electric shaft furnace for iron ore reduction on a large scale (in competition with the blast furnace) is still restricted to the Scandinavian countries and California, where specially favourable conditions prevail. Under ordinary conditions the blast furnace has little to fear from its electric competitor. One result obtained with the electric iron ore reduction furnace is noteworthy. By reducing the amount of carbon and running the furnace at a low temperature, a metal is produced containing 2·2 per cent or less of carbon, a very small amount of manganese and silicon, and one low in sulphur and phosphorus. Being produced directly from iron ore in the electric furnace, it is called "pig steel," as it contains fewer impurities than pig-iron, and therefore requires less refining for making finished steel. This is

probably the most hopeful feature of the evolution of the electric iron ore reduction furnace.

Any progress that promises to cheapen aluminium is of particular interest to the electrical industries in view of the competition between aluminium and copper, especially for line construction. The electrolytic production of aluminium from alumina is now so far developed, that little saving may be hoped for in this step of the process. The trend of invention is, therefore, to cheapen the cost of the raw material—the alumina—and there is at present a large activity in this field. Besides several processes which are being kept carefully secret, two loom large in the limelight. The first of these is a new process of Mr. Alfred H. Cowles, for obtaining alumina, hydrochloric acid, caustic alkali, and white hydraulic cement from clay, salt and lime. The cheapness of the starting material, clay, and the production of the various by-products, are to result in a much reduced cost for alumina. A plant for developing the process on a commercial scale has been erected at Sewaren, N.J. The second, or Serpek process, which has been in use for a longer time on an experimental scale in a plant in France, produces aluminium nitride as an intermediate product, and finally yields pure alumina and ammonium sulphate. It, therefore, represents a combination of the production of alumina with the fixation of atmospheric nitrogen. The production of the by-product, the ammonium sulphate, reduces the cost of alumina. Both processes are interesting in another respect. Mr. Cowles hopes to make his process available for the extraction of potash, and thus to found an American potash industry which should make this country independent of Germany. In the process the ammonium sulphate by-product is also a fertiliser. Both processes, therefore, also afford an indication of the marvellous present activity in fertiliser chemistry.

Among the electrochemical processes for the production of fertilisers the two largest are utilised in the production of nitrates from atmospheric nitrogen by electric discharges through air, and in the production of calcium cyanamide. Both are commercially successful. Concerning the wonderful growth of the Norwegian nitrate industry, using the Birkeland-Eyde process, it is noteworthy that in less than 10 years this industry has grown to be one of the largest in Norway, utilising that country's enormous available water-powers, which can be developed at a very low cost, while the electrical energy could not be utilised in full for other purposes under local conditions.

As to the progress of calcium cyanamide, it is interesting to note that the Niagara Falls works are to be largely increased. Finally, it may be mentioned that the synthesis of ammonia from elementary nitrogen and hydrogen gases is now an accomplished fact, as a result of the commercial development of the Haber process by the Badische company. While it is not an electrochemical process itself, it is likely that the hydrogen gas needed as raw material will be made electrolytically.

Thus in the wonderful present growth of fertiliser chemistry—one of the greatest developments undertaken by science for the welfare of mankind—electrochemistry is taking properly a prominent part.—E. F. ROEBER, in the *Electrical World*.

### LEGAL.

JOSEPHSON v. METROPOLITAN ELECTRIC SUPPLY CO.

MR. JUSTICE JOYCE in the Chancery Division last week heard a motion by the defendants in this action, asking that it might be dismissed as disclosing no cause of action, that it was frivolous and vexatious, and an abuse of the process of the Court.

MR. WILBRAHAM, in support of the motion, said the plaintiffs Joseph Josephson and the Cosy Cinema, Ltd., claimed specific performance of an agreement to sell to them the defendants' lease of land in Amberley Road, Harrow Road, for £150. They relied upon letters passing between the parties between November, 1911, and June, 1912, but he (counsel) submitted that those letters disclosed no concluded agreement, and he further argued that the contract, if any, depended upon the plaintiffs securing the freehold, which they had not done.

The defendants were not represented, and his Lordship holding that there was no contract, dismissed the action with costs.

WESTERN ELECTRIC CO., LTD. v. GREAT EASTERN RAILWAY CO.

In the City of London Court on February 13th, before Judge Lumley Smith, K.C., plaintiffs sued defendants for £35 damages for breach of duty in regard to the carriage of 10 cases of telephone accessories from Antwerp to North Woolwich.

MR. BALLOCH, for the plaintiffs, said that the case was of much importance to all senders of goods by railway. The defendant company carried telephone accessories for the plaintiffs at 20s. per ton from Harwich to North Woolwich, and they became damaged by fresh water on the journey and were spoilt. The goods were carried under an owner's risk note; but the plaintiffs' case was that that exemption of the defendant company was unreasonable.

MR. BRUCE THOMAS, defendants' counsel, argued that the defendants were not liable for the damage which had occurred.

JUDGE LUMLEY SMITH, K.C., in a considered judgment, said the damage had occurred through neglect on the part of the defendants' servants, and not through wilful misconduct. The goods were

carried at a reduced rate at owner's risk under conditions exempting defendants from liability for damage arising from negligence (other than wilful misconduct) of their servants. The contention for the plaintiffs was that the contract was not just and reasonable within the Railway Canal Traffic Act, 1854, Sec. 7. *Prima facie*, a contract containing exemption from liability for negligence was not just and reasonable. The burden of proving that it was just and reasonable was on the defendants, and the fact that the plaintiffs had for a long time taken advantage of the contract was in favour of its being so, but the Courts had adopted the crucial test of whether the plaintiffs had an option to send their goods at a reasonable rate with liability of the company as common carriers. In his judgment, plaintiffs did not have an alternative option of sending the goods on the terms of the defendants having the ordinary liability of common carriers. The result was that, in his opinion, the defendants had not shown that the special contract which they relied on was just and reasonable. He thought the contract must be treated as for the whole journey, and not as divisible into separate contracts for land and sea carriage.

Judgment for the plaintiffs, with costs.

BRITISH ECONOMICAL LAMP CO., LTD., v. EMPIRE, MILE END, LTD., AND A. BERNSTEIN.

BEFORE a Divisional Court of the King's Bench Division, composed of Justices Lawrence and Lush, on February 14th, this case came before their Lordships on the appeal of the plaintiffs from the judgment of the Recorder in the Mayor's Court on December 19th.

MR. GEORGE WALLACE, K.C., who appeared for the appellant company, said that the appeal was against a decision of Sir Forrest Fulton, K.C., at the Mayor's Court, in a case tried with some despatch without a jury, and the question was raised in the appeal whether the movable bulb lamps used for electric light are part of the house. The Recorder had held that they were fixtures, and had given judgment against the plaintiff company. The action was brought by the British Economical Lamp Co. for the return of certain lamps that they had supplied to the Yiddish Theatre. The plaintiffs' business was that of letting out lamps to theatres and hotels upon agreement, a weekly rental being paid, and the plaintiffs supplied to the Yiddish Theatre Co. a number of electric bulb lamps. The landlord did not receive his rent—apparently (said counsel) nobody was paid—and he took possession of the theatre. The plaintiffs heard of this, and when they went round to the theatre to get the money due for the hire of the lamps or take them away, the landlord took the attitude that he was in possession, and that these goods were affixed to the freehold. When the case was before the Recorder, the plaintiffs called only one witness, who proved the supplying of 1,100 lamps. In cross-examination he said that there were about 800 holders for the lamps, so that there must have been 300 out of the 1,100 that were left lying loose on the premises, and were not affixed at all. The Recorder had held that the plaintiffs' lamps were fixtures, and if a thing was affixed to the freehold it became part of the house, and as long as they were part of the house the landlord taking possession took possession of everything that was part of the house. His (counsel's) contention was that these things were not part of the house. Counsel read the evidence given at the trial by an inspector of the plaintiff company to the effect that the lamps were let out on agreement at £3 per week, that rent became due for the first week, and that none had ever been paid. Mr. Wallace submitted that the decision that these lamps were fixtures and part of the house could not be supported, or there must be something in the nature of a permanent annexation to make a thing part of a house at all. These things would not be so permanently affixed as a carpet. Mr. Wallace, in reply to their Lordships, said there had been no claim to distrain. The freeholder had determined the tenancy, and in the pleadings the defence was that if the lamps claimed were on the premises, they were affixed to and became part of the premises, and were now the property of the defendants. Counsel proceeded to detail the agreement by which the lamps were let out, and MR. JUSTICE LUSH said there was no doubt that as between the plaintiff company and the theatre company the plaintiffs remained owners.

MR. WALLACE said the case was one of great importance to the plaintiffs, because if they were liable to hand the lamps over to the landlord taking possession, they would often be in the predicament in which they now found themselves.

MR. RANKIN, for the other side, argued that the decision of the Recorder, on the decided cases, was correct, and that they were fixtures, and after considerable argument the Court said judgment would be reserved.

AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYEES.—X.

(Continued from page 194.)

THE hearing of the case against the Brisbane Co. was continued, Mr. Frew continuing his address on their behalf. He submitted that no grievances had been submitted on behalf of the men's Union to constitute an inter-State dispute, and that consequently the Court had no jurisdiction. Holidays the company regarded as a luxury, not a necessity; but on this matter they had received no complaints. They did not think they should be called on to provide watches for the men. As to the wearing of the Union badge, the company could not agree to it. The company were not prepared to give the undertaking asked for by the Judge that in making future appointments they would not discriminate between Unionists and non-unionists. They had 680 members of another Union in their employ which were not in any way connected with the claimant Association, and the company did not feel it would be fair to this new Union to give the undertaking. The Judge pointed out that this decision would mean that in his award he would order preference to be given to Unionists, but the company would not alter their decision.

A day or two later, the Judge, Mr. Justice Higgins, handed to the representatives of the Brisbane and Adelaide Companies a draft of his proposed awards, and a day or two later heard objections to them both from the companies and the secretary of the men's Union. Two days afterwards, on December 21st, the Judge gave his final award.

The principal points in the Brisbane award are:—

Minimum wages to be paid to members of the men's Union—Motormen and conductors, first year 8s. 6d. per day, second year 9s., third year 9s. 6d.; signalmen 10s. (signalman includes any man who regulates tramway traffic at intersections); point boys 6s., lamp trimmers 8s. 6d., electrical mechanics (if electrical fitters) 11s., pitmen 9s. 6d., pitmen's assistants, 8s. 6d., car-washers or cleaners, 8s. 6d., overhead wiremen, first or leading, 10s. 6d., assistant 9s., horse car wagon drivers 8s., engine drivers 12s. 6d., boiler cleaners 8s. (with 6d. per hour extra when working inside boilers), greasers 9s., firemen on four fires 10s., on less than four fires 9s. 6d., trimmers or fuel men 8s. 6d., track gangers 9s. 6d., fettlers and trackmen (otherwise called maintenance men) 9s., track cleaners or sweepers 8s. 6d., horse dray drivers 8s., night watchmen 8s., lavatory men 8s., labourers not otherwise specified 8s.

A day to mean eight hours' work, overtime to be counted for first hour per day at time and a quarter, afterwards as time and a half for motor men and conductors. For other employes, week's time to be 48 hours, with time and a quarter for first two hours excess and time and a half afterwards. Between certain hours double time to be paid. For Sunday work time and a quarter to be paid, and on holidays time and a half. Holidays to be Christmas Day, Boxing Day, New Year's Day, Good Friday, Easter Monday, Eight Hours' Day, Anniversary Day and King's Birthday. All employes to have one day off per week without pay. After 12 months' service to have 14 consecutive days off with 12 days' pay, and to be given 7 days' previous notice of date of holiday. There are certain small exceptions to this rule.

The ordinary spread of hours not to exceed nine hours per day, except for 20 per cent. of the whole number, or such other proportion as may be allowed by the Board of Reference who may work in broken shifts with a spread of hours not exceeding 12 per day. Ten minutes to be allowed to motormen and conductors for signing on, and a similar period for signing off. No motorman or conductor to be on duty longer than five hours without meal relief, or to be liable to be called on to resume duty at a shorter interval than 10 hours, or to work more than six consecutive night shifts. When required to attend by roster, an employe is not to be paid for less than four hours, unless he has two hours' notice. Every motorman or conductor signing on for duty to have a full day's pay. Promotion to be governed by efficiency, and, in the event of equal efficiency, by seniority. Efficiency means special qualifications and aptitude for the discharge of the duties of the office to be filled, together with merit and good and diligent conduct. When employed on different duties, the employe to be paid the highest rate for any of his duties. Time spent in making written reports to be paid for. Time occupied at the request of the company in attending inquiries—unless for employe's own misconduct—to be paid for. The company to supply conductors with sufficient change.

In view of an appeal to the High Court on the question of the wearing of the Union badge, the award on this question was reserved. Officers of the men's Union are to be allowed to collect subscriptions and transact the business of the Union providing they do not interfere directly with the working of the tramway, or, if they are employes, fail in their own duties. A list of employes with order of seniority as to service shall be exhibited at each depot. All cars to be fitted with seats for motormen within six months, for use by the motormen as approved by the Board of Reference. All cars within the same period to be fitted with suitable side and end gutters to carry off water. The most important section of the award related to preference, and as it was the first time in which this principle had been embodied in an award it is advisable to quote it in full:—

"As between members of the claimant organisation and other persons offering or desiring service or employment at the same time, preference shall, in the manner hereinafter specified, be given to such members, other things being equal. Before making the appointment, the company shall satisfy itself that the proposed

**Platinum.**—As is pointed out in an article in the *Chicago Mining and Engineering World* for January 25th, most of the world's platinum still comes from the Ural Mountains, a small quantity being recovered in the United States from the gold places of northern California and western Oregon. This production, from a table furnished by the United States Geological Survey, was highest in 1906 with 1,439 oz., and now amounts to 800 oz., valued at £6,960. The estimated Russian output for the past year is 310,150 oz. Columbia produced 11,750 oz., and Australia and Canada contributed small quantities, not estimated.

appointee is a member of the Association, or that there is no member of the Association applying who is equally suitable for the appointment, apart from the fact of his membership."

The rest of the award states that complaints against employes shall be given them in writing, and that the accused shall be allowed to call witnesses on his behalf, and shall, if possible, be confronted with his accuser. If the charge is not sustained, the employe shall be paid for his time, and reasonable charges allowed for his witnesses. If the men's Union disagrees with the company's finding, the matter shall be referred by either party to the decision of the Board of Reference.

Provision was made for the constitution of the Board of Reference.

The new rates of wages were to be retrospective from October 1st, and the provisions as to spread of hours, from February 28th.

In making the award, the Judge referred to the length of the case, as it had occupied the Court for 93 days, or longer than any case he had had to deal with. This, in his opinion, was partly due to the difficulties of the case, and partly to defects in the Act.

He then gave a long and detailed account of the Brisbane dispute, which had done so much to impart acrimony into the whole question. He felt that the attitude of Mr. Badger, the manager, was unjustifiable and autocratic. In the Judge's opinion, the Arbitration Act encouraged the formation of employes' unions; in Mr. Badger's opinion they were very objectionable. He felt, therefore, that he must condemn the position taken up by Mr. Badger and his company, and as they would not agree to discontinue discriminating between non-unionists and Unionists, to the disadvantage of the claimant Association, he felt it necessary to award preference for the men's Union.

He had tried, in wording this clause, to so phrase it as not to curtail the efforts of the manager to get efficiency in his service. He regretted the necessity for taking this course; it was the first time he had done so, but the action of the company had rendered it necessary.

The company had raised the question of an Act recently passed by the Parliament of Queensland, which limited his powers to grant preference to members of the men's Unions. If such a point were seriously raised he should, as a member of the High Court which would have to decide it, preserve an open mind.

The position with regard to the other awards was gone into at the same time.

(To be continued.)

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"INQUIRER" writes:—"It is proposed to form a small private company to supply current for private lighting in a small town. The local (parish) council have no intention to apply for powers, and would offer no objection to overhead mains, the road authority being the County Council.

"What powers are necessary in order that the company may be in a legal position to supply current, and in order that their interests may be protected at any future time in the event of opposition by any other company or body, and how could these powers be obtained most easily and cheaply? Would a licence from the B. of T. be sufficient? In what way could the local gas company offer effective resistance (if any) to the powers being obtained?"

If the local authority of a district are not supplying electricity, it is competent for any person or persons, whether they are a company or not, to fulfil the rôle of supply authority. The Electric Lighting Act of 1909 made no difference in this respect, it being there provided by Sec. 23 that where in any area a local authority, company or person is authorised to supply electricity under Act of Parliament or under licence or provisional order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company or person to commence to supply or distribute electricity within the same area, unless such supply or distribution is authorised by Act of Parliament or by licence or provisional order granted in terms of the Electric Lighting Acts: provided that this section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy, from affording a supply to a railway company for purposes incidental to that company's undertaking, other than the conveyance of public traffic.

As to the second half of the query, a company may get to work either under licence or provisional order. The form of that provisional order will be found in the schedule to the Electric Lighting Clauses Act, 1899. But even if they do not work under provisional order, they cannot be prevented or interfered with by the local authority in the future, nor would the opposition of the gas company be successful.

**International Congress of "Cold."**—The third International Congress, organised by the Association Internationale du Froid, will meet in the United States from September 14th to 24th. The Congress will open at Washington on September 15th, and the actual sittings will take place at Chicago. Particulars can be obtained from the Association, 9, Avenue Carnot, Paris.

## BUSINESS NOTES.

**Trade Press Exhibit at Ghent.**—The trade and technical Press of this country is to play an important part in the British Section at the Ghent International Exhibition, which opens at the end of April, for a collective display is being organised by the Exhibitions Branch of the Board of Trade. A number of papers (including this journal) have already arranged to participate, and, under the scheme which has been adopted, it is expected that the display will attract much attention. The exhibit will take the form of a large reading room and library, where current numbers of the papers will be found on reading tables and bound volumes on the shelves which line the walls. A visitor will consequently be able, not only to see the latest copies of the papers which interest him, but also to refer to back volumes to see the range of subjects dealt with. The library has been specially designed by Mr. Frank Brangwyn, A.R.A., and the work is being carried out under his personal direction. It has been found possible to allot one of the best positions in the British Section to the library. On one side it opens direct on to the main avenue through the Exhibition grounds, and a large proportion of the visitors entering the British Pavilion must pass through it; on another side it communicates with the offices of the British Section. It also leads out of the gallery devoted to Arts and Crafts. This is the first occasion that such an exhibit has been made by British trade papers, and it is hoped that it will create great interest among Continental business men, who will thus have an opportunity of becoming familiar with not only our trade papers, but also their advertisements of British manufacturing firms. The Exhibition will remain open for at least six months, and during that time a great deal may be done to advance British trade interests. The Exhibitions Branch of the Board of Trade have arranged for an official of the British Chamber of Commerce in Belgium to be in charge of the library in order to answer all questions and furnish daily reports to the proprietors and editors of the papers taking part.

**Exhibition in Sweden.**—An international exhibition is to be held at Malmo in 1914, under the auspices of the Swedish Government. It is styled the "Baltic," and the participation of the States bordering on the Baltic have been specially invited, but other countries are not necessarily excluded. Machinery, especially electrical, will be strongly represented.—*Elektrotechnik und Maschinenbau.*

**Consular Notes.—Spain.**—The American Consul at Barcelona reports that there is a good and increasing demand in Spain for foreign electrical supplies such as electric motors, dynamos, &c. The use of electricity is greatly increasing in all parts of the Peninsula, not only in the principal centres of population, but also in the country where water power is chiefly used in the factories and for lighting purposes. In fact, there is a surprising number of small and relatively unimportant towns lighted by electricity. To meet this increasing demand for electrical supplies of all descriptions, Spain is obliged to purchase considerable quantities of these goods abroad, the total imports of electric apparatus in 1911 amounting to about £730,000, as against about £600,000 in 1910, and about the same in 1909. Only a small part of these imports came from the United States, and apparently very little effort has been made to introduce American electrical goods into the country. German manufacturers, on the other hand, are extensively represented in the important industrial centres, and it is as a result of this, that Germany succeeds in supplying about two-thirds of all the electrical machinery and apparatus imported. Relative cheapness also gives German products an advantage over those of other countries. In 1911 the total imports of electric motors, dynamos, regulators, and transformers, amounted to about £436,000, as against about £368,000 in 1910, and about £365,000 in 1909. No statistics are at present available showing the imports for 1911 by countries, but in 1910 Germany was the chief supplier of these goods, sending £136,000 worth of electrical machinery weighing from 880 lb. to 11,000 lb. and upward. France, England, and Switzerland were next, with £18,000; £18,000, and £28,000 respectively. The United States supplied £2,750 worth of this class of machinery. Germany also sent £103,000 worth of electrical machinery weighing 880 lb. and less, followed by France, Great Britain and Sweden with much smaller amounts. Imports from the United States in this line amounted to £2,000. There is an especially good demand for this class of machinery, which is evidenced by the fact that the imports nearly doubled in the past three years. The importation of electric accumulators and batteries is not important, amounting to only £65,000, which is almost entirely supplied by Germany, France and Great Britain, in the order named. On account of the increased home production, imports of electric cables and wires are gradually declining. Germany again holds the first place in this line, importing in 1910 £33,300 out of a total of £50,000. There are four factories for electric cables in the Province of Barcelona, and various others in different parts of the country. A steady increase is observed in the imports of telephone and telegraph apparatus and electric meters, which the Spanish tariff classifies under one heading. Imports amounted to £50,000 in 1909, £57,000 in 1910, and £68,000 in 1911. Germany is the chief supplier of these articles, furnishing in 1910 118,146 lb., valued at £33,000; but these imports consisted, for the largest part, of telegraph apparatus. Telephone apparatus is almost exclusively supplied by Sweden and France, imports from these countries amounting to £8,600 and £8,600 respectively. The

United States supplied 32,568 lb., valued at £900, but it is difficult to say just what articles are included therein. Electric meters are manufactured locally, there being two factories for this article in the city, the output of which is estimated at over 100 meters of various kinds daily. Imports of arc lamps are on the decline, the total imports amounting to £9,000 in 1911, as against £13,500 two years ago. Over two-thirds of the imports are of German manufacture. A surprising increase is noted in the imports of incandescent globes (mounted ready for use), which amounted to £81,000 in 1909, £95,600 in 1910, and £135,000 in 1911. There are now 10 factories for this article at Barcelona alone, but, notwithstanding their increased output and the constant erection of new factories, imports continue to rise. Again Germany is the principal supplier, furnishing in 1910 about £80,000 worth of incandescent globes. France and Austria-Hungary are also in the market, but with much smaller amounts. The actual wholesale price of globes manufactured in the country is 37s. 6d. per hundred, and imported globes sell at 70s. per hundred, payable at 90 days.

A new movement now on foot in the district of Catalonia to utilise water-power for the production of electricity has brought about a decrease in the price of electricity for both power and lighting purposes. Consequently many manufacturers at present using steam are considering the installation of electricity, and the demand for electrical machinery and supplies is expected to increase considerably in the near future. Barcelona and Bilbao are important receiving points for all kinds of electrical supplies, the latter port especially for electric cables.

**Paraguay.**—The American Consul at Asuncion reports that with the completion of the Asuncion electric light and power plant in 1913, there will arise a demand for motors and other electrical utilities, opening up a new field for manufacturers, provided they are ready to compete with the concessionaires of the plant who are connected with German sources of supply. As indicating the failure of American firms to grapple with conditions adequately the Consul states that soon after the concession was granted, he reported opportunities for certain electrical appliances for which an agency was needed in Asuncion. Replies were received from leading manufacturing concerns in the States, but led to no result, chiefly for the reason that definite estimates could not be made without much trouble from the price lists obtained. In one instance it took a fortnight to figure out an estimate for 15,000 electric lamps, fixtures, &c., on account of the variation in discounts. If there had been one discount for a whole list or a discount for a page, say, of classified articles, the American house would have stood on a more equal footing with its competitors. Some manufacturers made no offer to establish a direct agency, but offered to deal through their Buenos Ayres agents, apparently not realising that there are competitors dealing directly with this territory. Prices were often quoted f.o.b. at the factory, perhaps some interior point in the United States, leaving the prospective purchaser quite in the dark as to what he could offer the goods for here. Prices should at least be f.o.b. port of embarkation. Better still would be prices c.i.f. Monte Video or Buenos Ayres, but, best of all, c.i.f. Asuncion. Transportation companies and forwarding agents should make this possible.

**Guadeloupe.**—The American Consul at Guadeloupe reports that the concessions granted to Hubert Anclin, of Basse Terre, for the electric lighting of Point à Pitre, Basse Terre and Sainte Claude, put up for sale in the middle of 1912, have been taken over by the Société Anonyme d'Electricité de la Guadeloupe, composed of local capitalists. The stock of the company has been fully subscribed and one-half paid in. It is the intention to build only the Basse Terre plant at present. This plant will have a capacity of 18,000 O.P. of incandescent lights, of which 1,500 c.p. is to be furnished for lighting the Colonial Government buildings, and 2,000 c.p. for lighting the streets and municipal buildings; the balance is for private subscribers.

For the light furnished to the Government and municipality, a subsidy of approximately £1,200 per year is guaranteed under the terms of the concessions, and, under certain conditions, additional payments may be obtained. The amount which can be charged private subscribers is fixed at 50d. per c.p. per hour, but this is modified by a clause which permits the company to make private contracts; the use of meters for measuring the current furnished is optional. In private installations, it is provided that the current shall be brought free of charge to each building, but that the subscriber shall pay all costs within the building, all materials to be furnished by the company at the catalogue prices of French dealers in such commodities, plus 25 per cent. at the highest. Orders for the necessary equipment will be placed with the Thomson-Houston Co., Paris, and work was to begin in the early autumn. The high tariff on electrical supplies precludes orders being placed elsewhere than in France. The life of the concessions is 40 years, and at the end of that period the entire plant becomes the property of the Government and municipality.

**Osrams in Shanghai.**—Recent advices from the General Electric Co., of China, Ltd., shown that the Osram drawn-wire lamp is becoming very popular there. At the company's Shanghai branch, orders are frequently received for the lamps in lots of thousands. Indeed, during a fortnight in last November, orders aggregating 13,000 Osram lamps were secured from cotton mills in Shanghai alone. Furthermore, the Shanghai Tramways have ordered 1,000 Osrams.

**New Map.**—Mr. Edward Stanford has issued his usual map for the Parliamentary Session, 1913, showing the proposed railways, tramways and other schemes affecting London in connection with Bills where plans have been deposited with the L.C.C. The price is 2s.

**Strike.**—We are informed that the strike which is in progress at the works of MESSRS. EVERSHED & VIGNOLES, LTD., came about in consequence of a workman being discharged for neglecting his work. The men consider that he was harshly dealt with, and demand his reinstatement—a demand which the company, in view of all the circumstances, are not prepared to concede. We understand that the employés in the stores, packing department and winding and lacquering rooms are fully at work; further, that every member of the staff throughout the works is doing his utmost to help the company, and a considerable amount of work is thus being completed.

**The N. T. Journal.**—The liquidator of the National Telephone Co., Ltd., is disposing of the back numbers of our now defunct, but always excellent, contemporary, *The National Telephone Journal*. There were 70 monthly numbers, and only three are out of print, and any reader requiring a set can have same for a comparatively nominal charge by addressing, Mr. V. Baldwin, Room 37, Telephone House, E.C.

**Sweden.**—It is reported from Stockholm that a new subsidiary company has been formed by the A. B. Ljungström Steam-turbine for the purpose of erecting special workshops for the manufacture of the Ljungström turbine. Up to the present there has been no workshop suitable for building these engines commercially, and those turbines that have been completed have all been made for experimental purposes. The new company has a capital of £77,777, and it has already purchased suitable factory buildings in the small town of Finspong. The orders for turbines already booked are said to amount to a total capacity of 27,000 H.P., and there are in addition a number of engines that the company has been unable to deal with.

Our Swedish contemporary *Afjörsvärlden* has made an inquiry of the Nya Elektriska A.B., of Stockholm, with regard to the electrical industry in 1912 and the prospects for 1913. In reply, the company states that the demand for all kinds of electrical goods has been far more lively than in 1911, and the customers have increased in number. The number of electrical power stations projected or under construction, however, has been declining somewhat, a fact which is attributed to the uncertain conditions which will prevail until the policy of the Government in regard to the future has taken shape. The prospects for 1913 are very favourable, and the year will no doubt be one of increased activity, provided only that the Balkan war does not cause any greater disturbances. A large number of extensions are going to be made in the course of 1913, and the new plants to be erected are also numerous.

**Dissolutions and Liquidations.**—**RENARD ROAD AND RAIL TRANSPORT CORPORATION, LTD.**—A meeting is to be held at 82, Victoria Street, London, S.W., on March 18th, to hear an account of the winding up from the liquidator, Mr. H. A. Grimsdick.

**NATURAL GAS AND POWER CO., LTD.**—A meeting will be held on March 19th, at 11, Ironmonger Lane, London, E.C., to hear an account of the winding up from the liquidator, Mr. W. B. Peat.

**PREMIER BITUMEN AND ASPHALTE CO.,** Stratford, London.—Messrs. H. Levin and C. R. Berry have dissolved partnership. Mr. Berry will attend to debts and continue the business under the same style.

**J. STIFF & SONS,** High Street, Lambeth, London, S.E.—With reference to the purchase of the goodwill and connection of this business by Messrs. Doulton & Co., Ltd., last December, the partnership of S. J. Stiff, J. A. Stiff, and W. F. Stiff, as J. Stiff & Sons, was dissolved as from December 31st, and accounts against the firm should be sent to them without delay.

**KEVAN ELECTRIC CO., LTD.**—Liquidator (Mr. H. de V. Brougham) released February 11th, 1913.

**Book Notices.**—*The Universal Electrical Directory* (J. A. Berly's). 1913. London: H. Alabaster, Gatehouse & Co. Price 21s. ("A" edition, containing "British and Colonial" sections only, 12s.).—This very useful directory of electrical men and electrical trades, has now reached its thirty-second annual issue. It contains between 1,500 and 1,600 pages of closely packed directory matter, which everybody having relations with electrical men, either at home or abroad, ought to have within easy reach. In the first section it contains alphabetically arranged names and addresses, and where possible, the telegraph addresses and telephone numbers, of all electrical men and concerns in and around London. A similar provincial section comes next, a full British Classified Trades Section following. The usual handy British Geographical Section, Colonial and General Foreign Alphabetical and Classified Sections, Continental and U.S.A. Alphabetical and Classified Sections, then appear in the order stated. The Electricity Works Sections, both for Home and for the Colonies and many foreign countries, contain invaluable information respecting chief engineer, character of current, voltage, and so on, and in the alphabetical sections for both London and the provinces, financial information regarding companies is given. Produced, as the work is, in its present form as the result of very lengthy experience, and embodying alterations which changing years and the needs of users have proved to be necessary, we anticipate that it will be required in most business houses where communicating with electrical men is a daily necessity. Knowing only too well the importance of having reliable and full information respecting Colonial and foreign addresses, in these days of growing export electrical and engineering trade, the publishers and compilers have incurred heavy expense in their endeavours to ensure completeness and accuracy in this respect. To thousands of offices this information alone should be worth many times the cost of the book.

*Japanese Register of British Trades.* London: Far Eastern Advertising Agency, Ltd.—This volume has been printed and produced in Japan with native labour. It has been compiled consequent upon the need for such a publication by leading manufacturers in Japan who wanted to get into direct business relationship with manufacturers in this country. We hope that the book will be the means of increasing our trade connections with the enterprising business spirits in Japan. A large number of British names and addresses are given in classified trade sections. We understand that the work of revision and addition is being taken in hand for a 1914 edition.

"*Transactions of the Institution of Engineers and Shipbuilders in Scotland.*" Part IV, 1912-13. Glasgow: The Institution.

"*Transactions of the Illuminating Engineering Society.*" Vol. VII, No. 9. December, 1912. New York: The Society. Price 75 cents.

"*Proceedings of the American Institute of Electrical Engineers.*" Vol. XXXII, No. 2. February, 1913. New York: The Institute. Price \$1.

"*Proceedings of the Engineers' Club of Philadelphia.*" Vol. XXX, No. 1. January 1913. Philadelphia: The Club.

"*Bulletin Mensuel de la Societe Belge d'Electriciens.*" Vol. XXIX, No. 11. November, 1912. Brussels: E. Bruylant. Price 1 fr. 75 c.

"*Calculs Techniques et Economiques des Lignes de Transport et de Distribution d'Energie Electrique.*" By C. Le Roy. 1913. Paris: Hermann et Fils. Price 6 fr.

"Bells, Indicators, Telephones, Fire and Burglar Alarms, &c." By J. B. Redfern and J. Savin. Price 1s. 6d. net. "Iron and Steel." By O. T. Hudson and Guy D. Bengough. Price 6s. net. London: Constable & Co., Ltd.

"*Transactions of the University of Toronto Engineering Society.*" Vol. VII, No. 3. January, 1913. Toronto: The University.

"*Journal of the Western Society of Engineers.*" Vol. XVII, No. 10. December, 1912. Chicago: The Society. Price 50 cents.

"La Théorie du Rayonnement et les Quanta." By P. Langevin and M. de Broglie. Price 15 fr. "Sur les Effets Physiologiques des Courants Electriques." By Dr. G. Weiss. Price 5 fr. Paris: Gauthier-Villars.

"Essentials of Electricity." By W. H. Timbie. 1913. London: Chapman & Hall, Ltd. Price 5s. 6d. net.

Hearty congratulations to our contemporary the *Financial Times* on the celebration of its twenty-fifth birthday. Advantage was appropriately taken of the event for the publication of a bumper issue on February 13th, in which many interesting special articles and illustrations appeared, giving a mass of information of particular interest to all who are concerned with finance and commerce.

**Bankruptcy Proceedings.**—WILLIAM LONGDON and VERNON GEORGE COBB (trading as Longdon & Cobb), electrical engineers, 101A, Derby Road, Nottingham.—The public examination of the above-named debtors was held at the County Court House, St. Peter's Gate, Nottingham, last week, when the liabilities were put at £291, and the assets were estimated to realise £45, leaving a deficiency of £246. In answer to the Official Receiver, the debtor, Longdon, said he had been connected with the electrical engineering trade for over 30 years, and started trading on his own account about four years ago. The work had increased considerably, and in March, 1912, needing assistance, he took Cobb into partnership, the latter introducing a capital of £150. The business had not proved a success, and creditors began to press them as soon as the partnership was entered into. The case was adjourned so that the debtors might furnish a cash and goods account for a certain period prior to the date of the receiving order.

J. W. LEWISLEY, electrician, Nottingham.—Receiving order made February 14th on debtor's petition.

HARRY THORPE, electrician and engineer, 11, Bartholomew Villas, Kentish Town Road, London, late of High Holborn and Holloway.—Adjudication annulled on February 3rd, "it appearing to the satisfaction of the Court that all the debts herein have been paid in full." Date of adjudication, April 7th, 1905.

**Catalogues and Lists.**—MESSRS. WALTON & CO., Newton Street, Birmingham.—Advance copy of price list, with illustrations, of leather fillets, brass dowels, iron dowel plates, birchwood dowels, steel spring washers and leather washers for pattern shop and other purposes. This forms the first section of a price list which is intended to cover the requirements of the works manager.

THE ARMOURDUT MANUFACTURING CO., LTD., of Farrington Avenue, London, E.C., have issued a card with map showing how their premises may be quickly and conveniently reached from the principal suburbs.

MESSRS. COOKSON & CO., 25, New Oxford Street, London, W.C.—New lists of C. and C. ignition and car-lighting accumulators, traction accumulators, india-rubber corks and collars, and hydrometers for accumulators, also cheap engineer's watches.

THE DEROME STANDARD PULLEY BLOCK and CRANE MANUFACTURING CO., 78, Southwark Street, London, E.C.—32-page booklet (No. 78) containing revised prices and illustrations of their various cranes and pulley blocks.

A.E.G., Berlin.—Nos. 1 and 2 of "Mittlungen aus dem Kabelwerk Oberspreewitz," dealing with insulating materials, and armoured flexible cables for portable tools.

THE PARAGON WIRE MILLS, 10-12, Norman's Buildings, St. Luke's, London, E.C.—Price leaflets of silk and cotton-covered copper wires, bell flex, bell wires and braided wires.

THE SLOAN ELECTRICAL CO., LTD., 12, Golden Lane, London, E.C.—New catalogue of 40 pages, containing illustrations and clearly tabulated prices of various types, shapes and sizes of

metallic and carbon filament lamps, namely, Aurigas, Foster, Mazda Osram, Philips "U.K.," Tantalum, Wotan, Z, and Tubolite. Each section begins with a reprint in colour, and on a small scale, of the lamp-maker's poster. The company holds large stocks of all the lamps mentioned.

MESSRS. VEREYNS, LTD., 28, King Street, Covent Garden, London, W.C.—New list (eight pages) giving illustrated particulars and prices of the "Aston" automatic lighting sets, also several types of fans (Typhoon, Delhi, Rangon, and Ceylon).

MESSRS. JOU DAY & SONS, LTD., Ellerby Lane, Leeds.—Illustrated leaflet giving notes regarding the design and construction, &c., of their high-speed vertical engines.

**Trade Announcements.**—THE COUNTY ENGINEERING AND LIGHTING CO., LTD., of 10, Colonnade, New Street, Birmingham, announce that they have now given up contracting work and are taking up the business of engineers' agents. They have just been appointed sole agents to the Sun Electrical Co., for Birmingham and district.

For "Balduin" Engineering and Supply Co. under this heading last week read *Baldur*.

MR. R. H. JOHNSTON has resigned his position of London manager for the Rees Roturbo Co., Ltd., of Wolverhampton, and has entered into partnership with Mr. P. B. Down, also of the same company. The firm of Down & Johnston have their offices at Craven House, Kingsway, and are carrying on business as manufacturers' agents in plant, machinery, centrifugal pumps, and steam turbines. They desire to receive catalogues from makers of other specialities.

THE MIDLAND MANUFACTURING CO., LTD., of Rea Street South, Birmingham, will, in future, operate two telephone lines with a private branch exchange, Nos. 671 and 672 Midland.

## LIGHTING and POWER NOTES.

**Barwell.**—The P.C. has decided to submit to a meeting of parishioners a scheme of public lighting proposed by the Leicestershire and Warwickshire Electric Co., which offers to light the streets from August to April until 11.30 p.m. each day with 50-C.P. lamps at £2 10s. per lamp per season.

**Belfast.**—A special meeting of the Tramways and Electricity Committee has given further consideration to the question of the proposed extension of the electrical undertaking. Prolonged discussion took place on the reports of the city electrical engineer (Mr. Bloxam), and in the result the Committee passed a resolution expressing the opinion that an extension of the electrical undertaking was necessary. It instructed Mr. Bloxam to submit some further information at a special meeting to be held on 26th inst.

**Bingley (Yorkshire).**—The District Council has decided to enter into an agreement with the Keighley Corporation for the supply of electricity in bulk, and to apply for powers to borrow £5,500, the estimated cost of cables, sub-station and machinery; the agreement with Keighley is to be for ten years. In reply to a letter which had been received from the local Property Owners' Association, the chairman of the Council said much consideration had been given to the possibility or otherwise of Bingley generating its own supply by means of its own water power facilities, and an expert on the subject had given advice that such a scheme would not pay for several years even if there was sufficient water power, which there was not.

**Cardiff.**—In the electric lighting department, Mr. Arthur Ellis estimates for the year an expenditure of £52,200, as against an estimate of £45,714 for last year, and an income of £55,268 as against £50,750, thus allowing for an estimated surplus of £3,067, as against an estimated surplus of £5,035 last year, and an actual surplus of £2,458 in 1911-12.

**Carlisle.**—The Public Lighting Committee has decided to erect flame arc lamps in several parts of the borough, and has requested the Electricity Committee, along with the Gas Committee, to consider the question of reducing the charges for public lighting as and from the end of the present financial year.

**Chatham.**—An installation of electric lamps in the High Street, carried out by the Kent Electric Power Co., Ltd., was inaugurated on Monday, the current being switched on by the Mayor.

**Chesterfield.**—The T.C. has decided to supply current to the Chesterfield Tube Co., Ltd., at 75d. per kw.-hour for the first 100,000 kw.-hours per annum, this price to be reduced by '005d. per kw.-hour for each additional 10,000 kw.-hours, until the minimum price of '65d. is reached for a supply of 300,000 kw.-hours. The company is to pay a minimum of £500 each year.

In order to economically meet the large and increasing demand for current on the south side of the town, high-tension transforming machinery and transmission lines are to be provided, at an estimated cost of £3,040, to be met out of revenue.

**Christchurch (Hants).**—At the last meeting of the B. of G., an agreement was sealed with the Bourne-mouth and Poole Electricity Supply Co. to light the workhouse with electricity.

**Colwyn Bay.**—At a meeting of the Council last week, the manager of the electricity works reported that he had gone into the question of lighting the Cayley Promenade. As the work could not be done temporarily, it was decided that the matter should be postponed.

**Continental Notes.**—GERMANY.—A new 10,000-kw. steam turbine and alternator is to be added to the plant at the municipal central station at Chemnitz.

The Frankische Überlandwerke Gesellschaft is the name of a new company which has just been formed in Nuremberg, with a capital of £200,000 to establish a large central generating station for the supply of current for lighting and power purposes in the Mittelfranken Province. The Schuckert Co. and the Mittelfranken provincial authorities are both financially interested in the new undertaking.

It is reported from Cologne that the Rhenische-Westfälische Electricitätswerke Gesellschaft has decided on the establishment of a large new electricity generating station on the left bank of the Rhine near the Rodder Colliery. The plant, it is said, will comprise two 25,000-H.P. steam turbines.

FRANCE.—A company has just been formed at Orleans, with a capital of £18,000 and the title La Société l'Électrique de l'Orléanais, to establish a small central station for the supply of electrical energy for lighting and power purposes in the town and district of Orleans.

A hydroelectric scheme of some magnitude, concerning as it will the four departments, Bouches-du-Rhône, Var, Vancluse and Basses-Alpes, is now under the consideration of a special Commission nominated by the Minister of Agriculture. The scheme proposes to utilise the waters of the Fontaine de l'Évêque, the construction of two dams, and the building of a canal, 58 km. long, to Pourcieux, where water will be distributed by two branches to Var and the Bouches-du-Rhône. The Commission has already formulated a variety of modifications of the original scheme, and joint deliberations are now taking place previous to its final adoption by the Government. This scheme is one of a number submitted, at the invitation of the Minister of Agriculture, by various bodies for dealing comprehensively with the water resources of this part of France.

An understanding has been come to between the Usines de Creusot and the Forges d'Allevard with regard to the establishment at Pontcharra (Isère) of a hydroelectric station and steel works of a large capacity.—*La Lumière Électrique.*

SPAIN.—La Sociedad Energía Eléctrica de Cataluña has applied for a concession to establish an electric transmission line between Vilafranca del Panadé and Perafort, at a pressure of 80,000 volts, and for a similar line at 11,000 volts from Perafort to Tarragona and Reus, to transmit the current from the Casa Barba central station.

**Cromer.**—The referendum taken by the U.D.C. on the question of the transfer of the electric light undertaking to Messrs. Edmundsons, has resulted in 314 votes being cast in favour of the transfer, and 273 against, a majority in favour of 41. The replies received numbered 613, of which 26 were invalid, and 405 ratepayers declined to vote. A special meeting, which was called to consider the position on Monday, decided by eight votes to five to proceed with the agreement to transfer the undertaking.

**Douglas (Isle of Man).**—The Tynwald Court has held an inquiry into the application of the T.C. for a loan of £3,000 for an electric light installation at the Villa Marina. There was no opposition.

With reference to the proposed electric supply for the town, the Corporation has decided to obtain particulars of a scheme from experts, the cost not to exceed £12,000.

**Epsom.**—Subject to the following amendments, the Highways Committee resolved that consent be given to the prov. order which is being applied for by the Leatherhead and District Electricity Co.: (1) That the mains to be laid within two years should be extended at certain points in Cobham, Oxshott and Great and Little Bookham; (2) that the amount of the deposit (Electric Clauses Act, 1899) be £400; and (3) that the charges should be 6d. and 3d. instead of 8d. and 4d. The company agreed to the extensions, with the exception of Bookham, but refused to agree to a larger deposit than £200, and to a reduction in the charges. A further communication from the Committee to the company was made, but no other negotiations had taken place. Eventually the Council passed a resolution consenting to the order being granted.

**Eynsford.**—Sir Wm. Hart Dyke is having the electric light installed at Lullingstone Castle.

**Grange.**—The U.D.C. has decided to inform the Electric Lighting Co. that it will be prepared to give reasonable facilities for the erection and maintenance of electric lighting plant in Grange, and is negotiating for the purchase of a site which it would be prepared to lease for the erection of an electric lighting station.

**Hereford.**—Electricity is to be substituted for steam for pumping at the waterworks, and a loan of £1,600 is to be applied for by the T.C. for the necessary mains and plant.

**Huddersfield.**—The local Chamber of Trade has written to the Corporation Electricity Committee calling attention to the Chamber's previous resolution protesting against the profits of the Electricity Department going to the relief of the rates. It contends that the charge for lighting purposes should be reduced.

**Kearsley.**—The U.D.C. has asked the Lancashire Power Co. upon what terms it would be prepared to supply electricity for the lighting of Kearsley Hall Road and Slackey Brow, in substitution for the present oil lamps.

**King's Lynn.**—At a recent meeting of the T.C., the engineer submitted an alternative scheme for extensions to the electricity works, embodying the conversion of the gas engines into oil engines to be used as a standby; the extension of the building for additional boilers, and the provision of a boiler and economiser, and necessary pipes, &c., at an estimated cost of £2,000. The engineer's proposals were adopted, and tenders are to be obtained for carrying out the work.

**Leith.**—The Dock Commissioners have approved of the electrification of the pumping machinery at Alexandra Dry Dock, at a cost of £1,797.

**Leyburn.**—Two applications for permission to supply current by means of overhead lines at Leyburn have been made to the R.D.C.; one by the Leyburn Mutual Gas Co., and the other by a private company being formed by Mr. Peter D. Johnson. The Council on Friday last, decided to ask each of the applicants for plans showing where the proposed overhead lines are to be erected.

**London.**—WOOLWICH.—The Electricity Committee reports regarding negotiations with the Erith U.D.C., with a view to giving the latter a supply of energy in bulk, that it has decided to consult Mr. J. F. C. Snell in the matter and report further. The Committee has also decided to purchase oil switches in connection with the centralisation of the switchboards, which is to be carried out by direct labour, and the electrical engineer has been authorised to accept quotations for all other apparatus that may be necessary to complete the work. The L.C.C. has sanctioned the borrowing of £19,000 on account of the Council's application for £40,000 for the extension of the electricity undertaking at the Globe Lane Works, on the condition that the period of three years, proposed for the repayment of the outstanding debt of £9,228 on obsolete plant, should not commence to run until the extension scheme is completed. Further application is to be made to the L.C.C. for sanction to the borrowing of the following amounts in connection with the undertaking: General mains extensions, £1,500, repayable in 25 years; meters, £630, repayable in 10 years; services, £1,100, repayable in 12 years; and hire-purchase, £2,000, repayable in 10 years.

STEPNEY.—The Electricity Committee has decided to reduce the price of current to consumers whose total accounts for electricity supplied do not exceed £60 per half-year, from 8d. to 7d. per unit for the first 30 hours' use of the maximum demand during each of the six months ending March, and for the first 20 hours during each of the six months ending September, and 1d. per unit for all further consumption in each month. Representatives have been appointed to take part in the conference for the linking up of undertakings in East London in the manner adopted by Poplar and Stepney.

FULHAM.—An expenditure of £40 has been authorised for the purchase of a stock of electric irons, kettles, toasters, &c., to be left on trial with consumers.

**Manchester.**—The fog last Friday was responsible for a record output from the electricity stations. For the 24 hours ended Friday night the output was 563,092 units, compared with the highest previous record of 550,420 units on December 10th, 1912.

**Lowestoft.**—The T.C. has referred back for further consideration a recommendation by the Electric Lighting Committee, that to meet the increased cost of materials and coal, and the decreased consumption of current by metallic-filament lamps, the charge for current for lighting be increased from 4½d. to 6d. per unit, with 5 per cent. discount for payment of accounts within a month.

**Newport (I. of W.).**—The T.C. has accepted the tender of the Isle of Wight Electric Lighting Co., for public lighting for five years, at an annual cost of £390. The arc lamps are to be replaced with four-light lanterns.

**Oldham.**—The new mill to be erected by the Belgrave Mill Co., Ltd., is to be driven by electric power supplied by the Oldham Corporation.

**Paisley.**—The electrical engineer has reported that it is desirable that the sub-stations in connection with the works should be enlarged, and that additional transformers up to 200-kw. capacity be installed.

In connection with the electrical supply to the new works of the Seedhill Finishing Co., it is learned that the offer of the General Electric Co. for the necessary transformers and switchboards has been accepted.

**Radcliffe.**—A new weaving shed belonging to the Co-operative Wholesale Society of Manchester has just been started. There are 500 Northrop automatic looms and some 50 circular-box looms, each having its own motor attached.

The U.D.C. has applied to the B. of T. for an order to permit it to supply current to mills at Ainsworth, in the area of the Bury R.D.C.

**Salford.**—In a report in regard to the electricity undertaking, the supply of electricity in bulk, and the installation of rotary converter plant, the Electricity Committee informed the T.C. last week, that, having recommended the acceptance of the offer of the Lancashire Power Co. for supply in bulk, it would be

necessary to advertise for tenders for transformers and rotary converters at once. The cost of the machinery and erection would be as follows:—Three rotary converters and transformers, £8,000; high-tension switchgear, £2,000; cable connections and work in connection with installing, £2,000. The Committee recommended that sanction should be sought for borrowing powers. The report was adopted.

The terms under which the Electricity Committee has agreed to purchase energy from the Power Co., are for a one year's supply, £6 per kW. of maximum demand, plus 1d. per kW.-hour; for two or more years' supply, £3 per kW. of maximum demand for the first 1,000 kW., and £2 per kW. for additional demand up to 3,000 kW., plus 1d. per kW.-hour. The Corporation requires a minimum of 1,000 kW., an additional 1,000 kW. on 15 minutes' notice, and may want another 1,000 kW. on a month's notice. The company will have over 17,000 kW. of plant installed by the autumn, and it proposes to supply three-phase current at 10,000 volts, 50 periods, over duplicate 2,500-kw. cables to a meter house on the borough boundary, from which place the Salford authorities will deal with it. A lengthy Council discussion took place on the proposal on February 12th, at which Sir William Stevens expressed the opinion that the Manchester terms (which have not been disclosed) would, if understood, be found very similar to those of the company.

**Shipston-on-Stour.**—The B. of G. has entered into a fresh agreement with Messrs. Brown & Parsons, of Leamington, for electric light at the workhouse. The firm will supply 95 lamps with current for five years at an annual charge of £35, and undertakes to keep the lamps and fittings good for one year. It will lay the supply on free, and will be paid £58 for wiring work and fixing lamps.

**Silsden (near Keighley).**—Subject to the ratepayers' approval, the U.D.C. has decided to allow the Airedale Shed Co. to produce and sell electrical power to the tenants of Airedale Shed, a proposed new shed company, and any other firms willing to rent power from the company.

**South Africa.**—Our Cape Town correspondent sends some particulars of an extraordinary occurrence at the Durban power station, where recently an escaped monkey made its way on to the switchboard. The attendants engaged in a cautious but fruitless chase, and finally left the monkey to settle its own difficulties, which it did suddenly by touching some live switch terminals. The monkey was practically burned up, but fortunately the supply was not interfered with.

On January 25th a faulty and condemned H.T. switch was responsible for a 20 minutes' stoppage in the Johannesburg electricity supply to the city and suburbs. The tramways were unaffected.

A meeting of Wellington (Cape Province) ratepayers was held on January 24th for the purpose of discussing an electric lighting scheme. Mr. C. G. Trevett, electrical engineer, was also present, and gave an elaborate explanation of the proposed schemes, one using Diesel oil engines being estimated to cost £9,375, and the other with suction gas engines, £8,780. It was estimated that the annual working costs would be £2,410, and revenue £2,834, leaving a profit of £424. The latter scheme was approved by the meeting.

**Swindon.**—The T.C. has decided to have the pumping plant at Rodbourne Sewage Works worked by electricity.

**Swinton.**—The Council has agreed to the Salford Corporation supplying Messrs. Bayley & Craven's Printworks, Pendlebury, with electricity for power and lighting for a period of five years, subject to the supply being turned over to the Council at the end of the term if so desired.

The question of an extension of the use of electricity for street lighting and the improvement of the lighting of roads on the South Lancashire Tramways route by means of metallic-filament lamps on the tramway standards, which has been receiving the attention of the Highway and Lighting Committee of the Swinton and Pendlebury Council, has now been referred to sub-committee.

**Troon (Ayrshire).**—The T.C. has discussed a proposal to introduce a system of electric lighting for the burgh. In view of the increasing demands made upon the Corporation's gasworks, it is probable an electric lighting scheme will be adopted. Meanwhile, a Committee has charge of the matter.

**Tynemouth.**—The electrical engineer has been instructed to report as to what reduction in tariffs it will be possible to make, provided not more than £600 of revenue is sacrificed. A scheme by the electrical engineer for electrically lighting the sheds on the Fish Quay is under consideration.

**Walsall.**—The Corporation has retained the services of Mr. E. M. Lacey, consulting engineer, to report on the electricity undertaking at a fee of 200 guineas.

**Whitworth (near Rochdale).**—The U.D.C. has decided, on the recommendation of the Tramway Committee, to apply to the L.G.B. for formal sanction to the borrowing of £5,000 by the Council for electrical purposes.

**Woking.**—As the local Gas Co. has erected three high-pressure lamps, each of 1,500 c.p., and is maintaining these at its own cost, the Council has given permission to the Electric Supply Co. to put up three lamps for the purpose of comparison.

**Worsley.**—The Lancashire Electric Power Co. has intimated that it will this month undertake the work of extending the supply cables for the lighting of the district, and will therefore shortly be in a position to supply the current for the Brook Oak Park extension. Before this latter work can be proceeded with however, an inquiry will have to be held by the L.G.B.

**Wrexham.**—The R.D.C. has decided to have the new offices lighted by electricity.

## TRAMWAY and RAILWAY NOTES.

**Argentina.**—It is reported from Tucuman that work on the electric tramway from that city to Quebrada de Lules will be commenced in February.

It is expected that the first section of the electric tramways in the city of Salta will be opened to service this month.—*Review of the River Plate.*

**Australia.**—The tramway authorities have decided to introduce the railless electric traction system into Sydney. Two routes have been selected for trial purposes, and negotiations are proceeding with the agents of the Brush Co. in regard to the equipment, &c.

**Barnsley.**—A considerable scheme for linking up by railless trolley cars the mining townships of South Yorkshire, is in course of negotiation between the Barnsley Corporation, neighbouring District Councils and West Riding Tramway undertakings. The reason for the scheme seems to be the stubbornness of the railway companies in refusing to give satisfactory facilities for the district, and the places affected are Barnsley, Thurnscoe, Bolton-on-Dearne, Hoyland, Birdwell, Wombwell, Darfield, Cudworth, Grime-thorpe, Smithies, Carlton and Royston.

**Bingley.**—The District Council, on the recommendation of the Finance and General Purposes Committee, last Monday approved of terms of agreement, announced some weeks ago, with the Bradford Corporation for the leasing of proposed electric tramways between Nab Wood terminus of the Bradford routes and Bingley.

**Bolivia.**—A law has been passed authorising the Government to contract with the Electric Light and Power Co. of Cochabamba, for the following electric railway lines:—(1) The extension of the company's existing Vinto-Arani line to Totora; (2) the construction of a line from Cochabamba to Sacaba; and (3) the extension of the Cochabamba-Vinto line to Sipesipe.

**Bradford.**—Owing to the great variation in working hours, and the consequent difficulty in issuing passes, the Corporation Tramways Committee has recommended to the City Council that, in lieu of the present system of allowing school children and juvenile workers to travel, between certain specified hours, at half-fares, all young persons between the ages of five and sixteen years shall travel half-fares, and that children under five shall travel free as before.

**Brighton.**—The Watch Committee has declined to license 12 new petrol electric buses, belonging to a private firm, to ply in the borough.

**Bristol.**—At the meeting of the Council, a thoroughly representative Committee was appointed to consider the desirability of exercising an option to purchase the tramway undertaking within the city.

**Continental Notes.**—**HOLLAND.**—Plans are being prepared in respect of a projected electric tramway between Arnhem and Vepel, and also for a proposed line between Oosterbeek and Arnhem.

**RUSSIA.**—A preliminary concession has been granted in respect of a projected electric railway between Tiflis and Vladicancas.

**SWITZERLAND.**—An electric railway of some international importance is projected from Nyon to Morez by the way of Arzier, Saint Cergue and La Cure, towards the east of which the Grand Council of the Canton of Vaud has just voted the sum of £33,391. The line will be worked on the overhead trolley system, and will be 40 km. long, but by a junction with the French railway network at La Cure will have a development of 24,000 km., serving a large and populous area on both French and Swiss territory.—*La Lumière Electrique.*

**Dundee.**—Reporting on the proposed extension of the railless trolley system from Clepington Road to Lochee, Mr. P. Fisher, the tramway manager, said he did not think the installation would be self-supporting in the early stages, but it certainly would act as a feeder to existing services, and on the whole it would not be a serious burden to the tramway undertaking. Regarding a proposal to call upon the tramways department to contribute towards the maintenance of the road, Mr. Fisher pointed out that in every case where Parliamentary powers had been applied for to work this form of traction outside the boundaries of the authorities making the application, attempts had been made to get clauses introduced for the purpose of compelling the promoters to contribute towards the maintenance of the roads. Parliamentary Committees in every

case refused to look upon the running of railless cars of the passenger type as extraordinary traffic. This form of traction did less damage to a roadway than any form of mechanical traction where the prime mover was carried on the vehicle. Mr. Johnston, convener of the Tramways Committee, claimed at a meeting of the Committee that the railless cars had proved a convenience to the public. While the return per mile was not very high, the expenses were not great. Another member held that the experience of the past four months had shown that the trackless trolley car had come to stay. The extension was approved of, but it was decided to delay it until the question of road maintenance had been settled.

The tramway manager has been instructed to report upon the Craig Pier route, it being alleged that there is an annual loss on this branch of about £1,200.

**Cardiff.**—Notwithstanding the fact that the estimated expenses of the tramways department show an increase of £3,163 over last year's estimate, chiefly owing to the rise in wages, an increase of £7,175 is anticipated in next year's income, and an estimated surplus of £13,280, as against an estimated surplus of £9,268 in 1912-13, and an actual surplus of £11,218 in 1911-12.

**Dutch East Indies.**—The Samarang Joana Steam Tram Co. is making arrangements to improve its system of tramways in the town of Samarang by electrifying them. Particulars in regard to the contracts to be issued for carrying out the work have been submitted for the approval of the communal authorities.—*Board of Trade Journal.*

**Great Yarmouth.**—The T.C. has decided to double the tramway track in the Market Place, at Theatre Plain, and through Regent Road, at an estimated cost of £8,750.

**Halifax.**—The receipts in connection with the working of the Halifax tramways since April 1st last, the commencement of the municipal year, have shown an increase on those of the preceding year of £2,683, though the period has only been one of 317 days, as against 319 days. The figures, up to the latest report for year, are £91,639, as against £88,956.

**Ilford.**—It has been decided to abandon the idea of extending the tramway system, and of running railless trolley vehicles, in favour of using motor-buses. The question of removing the centre tramway columns in the High Road is under consideration.

**London.**—According to the *Evening Standard*, a Bill is to be introduced shortly for the construction of underground railways for the conveyance of mails and parcels in London. The original scheme was outlined in these columns at the time of the Departmental Committee's report on the matter. It contemplates 6½ miles of 7 ft. 6 in. diameter double track tube to be electrically operated and automatically controlled: the estimated cost is £530,000.

**Oldham.**—A proposal, by no means new, has been put forward that greater use might be made of the tramways for the carriage of goods during the night. If the suggestion could be carried out, the great industrial areas round Oldham, Rochdale and Manchester could be linked up, and goods could be conveyed to the docks of the Manchester Ship Canal. It is claimed that by this means business men would not meet with the frequent and long delays now suffered in the carriage of goods on the railways.

At a meeting of the Tramways Committee, the tramways manager, referring to the equipment of the long saloon bogie cars with four motors, said statistics showed that with four motors the car consumed 240 units per mile, and with the new equipment, the 40 H.P., it was only 146. Taking all things into consideration, he thought it would pay them to abandon all the four motor equipments and go to the single motor. They would save nearly half the current consumption for a start. To alter the cars to the single motor would cost about £245 per car. It was decided that in regard to six of the saloon cars the manager's suggestion should be carried out.

**Salford.**—The Corporation is appealing against the assessment of its tramways within the Barton Union, and litigation is pending on the subject. It is understood that the difficulty is upon the method of assessment.

**Southport.**—The Council has decided to take a referendum vote of the ratepayers on the question of Sunday running of the Corporation cars; the local company's cars already run on Sunday.

**Tynemouth.**—The local tramway company has again approached the T.C. to reopen the question of providing an extension to Preston; the Parliamentary Committee has expressed its willingness to consider the matter.

**Uruguay.**—It is reported from Monte Video that construction will shortly commence on the electric railway from Monte Video to Maldonado and Puente del Este. There will be a double line, and it is hoped to maintain a speed of about 100 km. an hour. The line will be built at a distance of 1 to 2 km. from the coast, and will go through a district susceptible of cultivation. It will pass near the Piripolis seaside establishment. The generating station is to be at Maldonado. The line will afterwards be prolonged to La Paloma and Rocha.—*Review of the River Plate.*

**Worsley.**—The South Lancashire Tramways Co. has deposited with the U.D.C. a plan of a length of tramway in Manchester Road connecting with the proposed new line through Little Hulton.

## TELEGRAPH and TELEPHONE NOTES.

**Australia.**—The Commonwealth Government has published the specifications for the power generating plant for the wireless station to be erected at Darwin, of 1,500 to 2,000 kw., to communicate with Singapore, and thus to connect Australia with the Imperial wireless chain.

The new cable of the Pacific Cable Board between Auckland and Sydney is now open for public business.

**Canada.**—The Province of Manitoba will spend £205,000 on extensions to the Government telephone lines this year.

**France.**—It is intended to erect a wireless station at Bouin, on the island of that name, lying off the Department of the Vendée.—*La Lumière Electrique.*

**Glasgow.**—The T.C.'s Special Committee on Telephones, having considered the question of junction fees between exchanges in the city telephone district and suburban telephone districts, has instructed the town clerk to write to the Postmaster-General and urge upon him the desirability of having these fees abolished and of having the city, as extended by the Glasgow Boundaries Act of 1912, embraced within one telephone district.

**Hull.**—The Corporation Telephone Committee, after negotiations with the Postmaster-General, has passed a resolution to the effect that, subject to terms being agreed upon, the Corporation is prepared to purchase from the Post Office the plant acquired by the latter from the National Telephone Co. in its area, and to apply for a new licence. It is understood that the Postmaster-General will not grant a new licence unless this is done. The price to be paid for the undertaking is that which the Government paid to the company, with allowance for depreciation.

**Imperial Wireless System.**—In reply to Major Archer Shee in the House of Commons, the Postmaster-General stated that the Scientific Committee had informed him that after consideration of the statements of representatives of firms who had been invited to give evidence as to the capabilities of their systems of long-distance wireless telegraphy, it had decided to treat the evidence as confidential.

The second interim report of the Select Committee on the Marconi contract was to the effect that the Committee had not had time to complete the inquiry, and recommended that a committee should be re-appointed next session. At the last sitting, on Wednesday last week, Mr. Oliver was again examined with regard to the sources of the rumours which he had heard, connecting members of the Government with dealings in Marconi shares. The witness said he could not recollect the names of any of the persons who gave him the information. He could not name any person who, to his knowledge, had benefited to a considerable extent by Marconi shares. Mr. L. J. Maxse, editor and proprietor of the *National Review*, was then called, and stated that when his attention was called to the matter in July, 1912, and he began to make inquiries, everything he heard went to show that there was something curious about it. The gambling in the shares of the company indicated leakage from somewhere, and the evasive replies of Ministers to questions in the House of Commons added to the mystery. Hundreds of thousands, perhaps millions, of pounds changed hands, to the immense advantage of those who were "in the know." The Postmaster-General could have stopped it if he had frankly stated the facts. There was nothing to explain the action of the Post Office in surrendering to Mr. Godfrey Isaacs. Ministers were primarily responsible for any suspicions that had been rife. Mr. Isaacs should not have taken part in the negotiations while his brother was Attorney-General. The rumours about particular Ministers (not the Postmaster-General) were persistent, and the public were uneasy about the matter. Several people, some of whom were Members of Parliament, had called the witness's attention to the subject. He was willing to state the purport of their communications, but he refused to divulge their names, as to do so would be a breach of confidence. The information he had received showed that there was strong ground for suspicion that Ministers had been gambling in Marconi shares: but he had no actual evidence.

The Committee, after long consideration and discussion, decided to report the witness to the House of Commons. This was done, but in view of the late stage of the session the Government decided to take no immediate action in the matter.

The Postmaster-General has again refused the Marconi Co.'s application for release from the contract.

**The Sounder in Submarine Telegraphy.**—It is announced in the annual report of the Commercial Cable Co. that Mr. John Gott, their chief engineer, has invented a device which enables the ordinary Morse signals to be sent over long submarine cables with the ordinary landline key and received on the Morse sounder, the invention thus constituting an immense advance on present conditions. The company has acquired the rights to manufacture the device, which is patented in all countries.

It is reported that the essence of Mr. Gott's system is the use of successive currents of alternate polarity in transmitting the signals, the four dots in the letter II, for example, being produced by two positive and two negative currents acting alternately; the discharge from the cable is used for effecting the reversal of the current after each signal, and the apparatus required is inexpensive.

Messages have already been transmitted from London to New York on the new system, and the use of automatic repeating relays rendered possible by the adoption of the new system has greatly increased the speed of transmission, whilst eliminating errors due to manual repetition.

**The Telephone on Board Ship.**—The three great liners of about 50,000 tons each, which have been ordered by the Hamburg-America line, are going to be fitted out with telephone exchanges of the most modern type, to which each cabin will be connected. The order for the installation has been given to Messrs. Siemens & Halske, of Berlin.

**Trans-Pacific Wireless.**—The *Electrical World* states that the Marconi Wireless Telegraph Co. has placed contracts with the J. G. White Engineering Corporation, of New York, for the erection of eight wireless stations, two pairs for Atlantic and two pairs for Pacific service. Receiving and sending stations, 30 miles apart, will be erected at Oahu, in the Sandwich Islands; Tamales Bay and Bolinas, California, near Belmar, N.J.; and in eastern Massachusetts. These stations will form part of a globe-girdling system, which will continue to the East by way of Japan, and thence ultimately to India. Twelve towers, 400-450 ft. high, will be spread out over a semi-circle covering a square mile at each station, and it is estimated that the range of each station will be from 4,000 to 6,000 miles.

**United States.**—The fast scout cruiser *Salem* has been ordered on a voyage across the Atlantic to test the transmitting capacity of the United States Government's new wireless telegraph station at Fort Myer, near Washington, D.C. Continuous tests are to be made throughout a radius up to 4,000 miles, although it is expected that even this range will be exceeded. Eventually it is hoped that this powerful new station will be able to communicate with any ship of the United States Navy, using intermediate vessels as relays for distances above 3,000 miles.—*Electrical World*.

The *Electrical World* states that the Telefunken station at Sayville, Long Island, N.Y., is in daily communication with ships on the Atlantic, and South American ports, having a range up to 5,800 km. The longest distances are covered with a 35-KW. plant, using a wave-length of 2,800 m.; for the shorter distances a 5-KW. plant with a wave-length of 600 m. is used.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—March 3rd. Service materials, for the U.D.C. electricity department. See "Official Notices" February 14th.

**Aberaman.**—March 10th. Electrical goods, for the directors of the Powell Duffryn Steam Coal Co., Ltd. Stores Manager, Aberaman, near Aberdare.

**Argentina.**—April 15th. Tenders will be received at the Dirección General de Minas, Geología e Hidrología, Buenos Ayres, for the supply of motors, cables, dynamos and kindred material required for the generation of motive power.—*Board of Trade Journal*.

**Australia.**—WESTERN AUSTRALIA.—February 27th. Buildings and boiler-house equipment, turbo-alternators and rotary converters, for a Government power station at Perth. See "Official Notices" January 24th.

SYDNEY.—March 17th. Motors for the City Corporation.

SOUTH AUSTRALIA.—March 5th. One section of a common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" January 31st.

COMMONWEALTH GOVERNMENT.—Darwin power station, about 2,000 kW. Equipment to comprise Diesel oil engines and accessories and overhead travelling crane, alternators and exciters, and switchboard.

NEW SOUTH WALES GOVERNMENT RAILWAYS.—March 5th. Twelve single-phase transformers, and one 12½-kw. generator. Specifications 388 and 389 (2s. 6d. each) from Electrical Engineer's Office, 61, Sydney.

**Barrow-in-Furness.**—March 3rd. Electrical stores for a year, for the T.C. Borough Electrical Engineer.

**Bedwas.**—March 5th. Electrical goods for a year, for the Bedwas Navigation Colliery Co., Ltd. (Form 4). The Secretary.

**Belfast.**—February 24th. Stores and materials for one or three years, for the City electricity department. See "Official Notices" January 31st.

**Birmingham.**—March 1st. Electrical stores for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. John D. Watson, engineer, Tyburn.

**Bolton.**—February 24th. Materials and stores, for the Corporation Tramways Department. See "Official Notices" February 7th.

**Bulgaria.**—SOFIA.—March 3rd. Tenders are invited for 100,000 insulators and 100,000 kg. galvanised iron wire. Particulars, Post and Telegraph Direction Sofia, Bulgaria.

**Colchester.**—March 10th. Sundry stores for the Corporation Electricity Department. Mr. W. Frisby electrical engineer, Osborne Street.

**Croydon.**—March 31st. Stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

February 21th.—Sinking artesian well and supply of pump, for the Corporation electricity works. See "Official Notices" Feb. 14th

**Dinas (near Porth).**—Refuse destructor and electrical generating works, Appletree, for the Rhonda U.D.C. Messrs. Robert Hammond & Son, 61, Victoria Street, S.W.

**Dukinfield.**—Electrical work required for the new Primitive Methodist School, Dukinfield. Messrs. J. H. Burton and J. A. Percival, architects, 150A, Stamford Street, Ashton-under-Lyne.

**Dundee.**—The Corporation Tramways Committee invites tenders for supply of stores for a year. Mr. Peter Fisher, general manager.

March 7th.—Two water-tube boilers, &c., mechanical stokers, economiser, steel bunkers and coal-handling plant, for the Corporation electricity department. See "Official Notices" to-day.

**Edinburgh.**—The Corporation invites offers for works and supplies, including upholding house telephone and electric bell installations at City Hospital, electrical material for interior wiring and jointing, and insulating material for electricity supply cables. Resident Electrical Engineer, Dewar Place.

**Edmonton.**—February 26th. Electric lamps for the B. of G. Mr. F. Shelton, clerk, The Grange, White Hart Lane, Tottenham.

**Erith.**—March 6th. Electrical work for three years, under U.D.C. assisted wiring scheme. See "Official Notices" to-day.

**G.C.R.**—March 4th. The Great Central Railway Co. are inviting tenders for stores during the year ending April 30th. 1914. (15) Electric light wires and cables; (16) electric light globes and shades; (17) electric light carbons; (18) casing, accessories and lamps; (60) telegraph materials. Samples may be seen, up to March 3rd, at the Conservative Club, Gorton Lane, Gorton, Manchester, and specifications and forms of tender can be obtained from Mr. W. Williams, Stores Superintendent, Gorton, Manchester. Applications, stating number of specification, should be accompanied by an addressed foolscap envelope, properly stamped.

**Germany.**—February 28th. The Finance Deputation of Hamburg is inviting tenders for the supply and erection of a 30-ton electric crane.

March 10th.—The lighting and water supply authorities of Bremen are inviting tenders for several heavy-oil engines and dynamos for the Hastedt central electric lighting station.

**Glasgow.**—February 26th. The T.C. invites offers for the various works required in connection with the erection of a dispensary at St. Rollox. Specifications, &c., from the Town Clerk, City Chambers.

**Heston and Isleworth.**—March 8th. Stores and materials for a year, for the U.D.C. electricity department. See "Official Notices" to-day.

**Hornsey.**—February 24th. Electricity meters, cables and cable stores, for the T.C. See "Official Notices" February 7th.

**Iford.**—March 1st. Council Education Committee. Tenders for the electric lighting installation at the South Park School extension, Water Lane, Iford. Mr. C. J. Dawson, architect, 11, Cranbrook Road, Iford.

February 25th.—Stores for a year, for the U.D.C. electricity department. See "Official Notices" February 7th.

**India.**—March 14th. Motors, transformer and motor-generator, for the B.B. and C.I. Railway. See "Official Notices" to-day.

March 4th.—Starting and controlling pillars, for the Bombay, Baroda and Central India Railway. See "Official Notices" to-day.

**King's Lynn.**—March 1st. Lancashire boiler, economiser and pipework, for the Corporation Electricity Department. See "Official Notices" to-day.

**Liverpool.**—February 24th. Two steam engines and dynamos (50 kw.), switchboard, motors, wiring for 1,500 lamps, motors, &c., in connection with the electric light and power installation at the Toxteth Union Workhouse and Infirmary, Smithdown Road. Mr. T. L. Miller, consulting engineer, 709, Tower Buildings, Liverpool.

**London.**—L.C.C.—February 25th. Electric wiring of the Camberwell and Cressy Road car-sheds. See "Official Notices" January 31st.

February 25th.—Three 1,500-kw. rotary converters, nine transformers for rotary converters, and two starting transformers. See "Official Notices" February 14th.

February 26th.—Electrical installation at Leipsic Road Elementary School, Camberwell, S.E. See "Official Notices" Feb. 14th.

March 4th.—Two 8,000-kw. turbo-generators, with condensing plant, &c. (extension of time). See "Official Notices" to-day.

March 5th.—Electrical installation at the Curtain Road Elementary School. See "Official Notices" to-day.

ST. PANCRAS.—March 4th. Arc lamp carbons, for the B.C. See "Official Notices" February 7th.

MARLBORNE.—February 26th. Stores and materials for a year, for the B.C. Electricity Department. See "Official Notices" February 7th.

SHOREDITCH.—February 24th. Two economisers (Green type), for the B.C. electricity department. See "Official Notices" February 14th.

STEPNEY.—March 17th. Boilers and boiler house accessories, turbo-alternators, condensers, accessories and switchgear, for the B.C. See "Official Notices" February 14th.

**Manchester.**—Corporation. Steel girder tramway rails. J. M. McElroy, manager.

**Neath.**—March 3rd. One 400-kw. high-speed engine, direct-coupled to a two-phase alternator, and accessories, for the R.D.C. See "Official Notices" February 14th.

**Newport (Mon.).**—March 4th. Electric light fittings for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

February 22nd.—Stores for a year, for the Corporation Electricity and Tramways Committee. See "Official Notices" Feb. 14th.

**Pontypridd.**—March 5th. Stores and materials for the U.D.C. electric light and tramways department. See "Official Notices" to-day.

**Swindon.**—March 8th. General stores and materials for a year, for the Corporation electricity and tramways departments. See "Official Notices" February 14th.

March 10th.—One 500-kw. mixed-pressure turbine and condensing plant, boiler feed pump and pipework, and one switchboard panel and cables, for the Corporation. See "Official Notices" February 14th.

**Swinton and Pendlebury.**—March 10th. One 25-kw. transformer and switchboard, main along Chatsworth Road, and annual supply of materials, for the U.D.C. Electricity Department. See "Official Notices" to-day.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

**Wallasey.**—March 15th. Fuel oil (400 tons) for a year, for the Corporation electricity department. Mr. J. A. Crowther, electrical engineer, Seaview Road, Liscard.

**Walthamstow.**—February 28th. Four double-deck tramcars complete with magnetic-brake equipments, for the U.D.C. See "Official Notices" February 7th.

**Warlingham.**—February 24th. Electric light sundries for the Mental Hospital, for Croydon T.C., for a year. Mr. F. C. Lloyd, Town Clerk, Town Hall, Croydon.

**Warrington.**—March 5th. Motors and transformers for a year, for the Corporation. See "Official Notices" Feb. 14th.

**Wigan.**—February 24th. High-tension three-core feeder cable, transformer and switchgear, for the Corporation. See "Official Notices" February 14th.

**Wimbledon.**—March 5th. Stores and materials, for a year, for the Corporation Electricity Department. See "Official Notices" February 14th.

**Wrexham.**—March 1st. Stores for a year, for the Borough Electrical Engineer's department. See "Official Notices" February 14th.

**York.**—March 10th. One 3,000-kw. turbo-alternator, with condensing plant, pipework and switchboard, water-tube boilers with chain-grate stokers, &c., storage battery and H.T. cables, for the Corporation. See "Official Notices" to-day.

## CLOSED.

**Aberdeen.**—The Corporation Electricity Committee has accepted the offers of the Orlikon Co. and Messrs. Bruce Peebles and Co., for additional generating plant. The cost of the new plant is £11,000.

**Atherton.**—The Electricity Committee of the U.D.C. has accepted the tenders of the W. Rose Hose Co., Ltd., and Messrs. F. Reddaway & Co., Ltd., for new fire hose.

**Austria.**—The adjudication on the tenders for glow lamps for the North, South, State and other Austrian railways for the current year has resulted again in favour of the latest pattern of the Westinghouse tungsten-wire lamp.

**Barnsley.**—For the Corporation electricity station Messrs. E. Bennis & Co. have received an order for two of their stokers and self-cleaning compressed-air furnaces.

**Bolton.**—The contract for an electric light installation at shop premises at 134, St. George's Road, is being carried out by the Charleson Accumulator Co., of Bolton.

The Corporation electricity department has ordered a "Bennis" ash elevator and bunker.

**Bewsbury.**—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for new boilers for the electric light works, at £1,782.

**Ealing.**—The B.C. has accepted the tender of Messrs. Ferranti, Ltd., at £1,978, for a new generator switchboard.

**France.**—There has just been placed with Messrs. E. Bennis & Co., Ltd., by the Mines de Douerges electric station, a contract for 16 "Bennis" high-duty coking stokers and self-cleaning compressed-air furnaces. This is a second repeat order, the machines having given every satisfaction in dealing with low-grade coal abroad.

**Glasgow.**—The Electricity Committee had divisions in connection with the placing of the contracts for the supply of boilers for Port Dundas and St. Andrew's Cross stations. In the former case it was proposed that the offer of Messrs. Howden & Co., Ltd., for four water-tube boilers, at £13,120, be accepted, while the amendment was that the offer by Messrs. Babcock & Wilcox, Ltd., amounting to £13,748, be agreed to. A second amendment proposed to give two boilers each to the competing firms. On a vote, it was decided by a clear majority to accept Messrs. Babcock and Wilcox's offer. So far as the St. Andrew's Cross offers were concerned, the proposal was the acceptance of Messrs. Babcock and Wilcox's offer to supply four small boilers, at £7,158, while the amendment was that Messrs. Babcock & Wilcox's offer and that of Messrs. Howden—the latter amounting *in toto* to £6,910—be accepted for two boilers each. The proposal was adopted.

At its last meeting, the T.C. remitted back to the Electricity Committee the proposals in connection with the placing of contracts for two turbo-generators and condensing plant, and a report by the engineer (Mr. W. W. Lackie) has been considered by the Committee. The original recommendation, as published in the REVIEW, was that an offer by Messrs. Willans & Robinson, Ltd., for one set of Curtis-Parsons turbo-alternators and condensing plant, amounting to £16,064, and an offer by the British Westinghouse Electric and Manufacturing Co., Ltd., for one set of Curtis-Rateau turbo-alternators and condensing plant, amounting to £16,721, be accepted. The engineer gave an exhaustive opinion, based on experience, in which he reviewed all the tenders submitted. It having been decided in committee to proceed with the selection of the offers, it was proposed that the offer made by (a) the British Westinghouse Electric and Manufacturing Co., Ltd., for one set of Curtis-Rateau turbo-alternators and condensing plant, amounting to £16,721, and (b) Messrs. Howden & Co. for one set of Rateau-Zoelly turbo-alternators and condensing plant, amounting to £17,793, be accepted. The amendment, that the former recommendation be reaffirmed, was carried by 15 votes to 6.

It is recommended by the T.C.'s Committee on Tramways that the following contracts be accepted:—

Steel plates for manholes.—William Baird & Son.  
Section pillar castings.—Walter Macfarlane & Co.  
P.B. flanged lampholders.—Edison & Swan United Electric Light Co., Ltd.  
Insulated stud bolts.—W. C. Yuille & Co.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government departments named:—

### ADMIRALTY: CONTRACT DEPARTMENT.

Incandescent lamps.—General Electric Co., Ltd.; Edison & Swan United Electric Light Co., Ltd.  
Switches and sockets, &c.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Edison & Swan United Electric Light Co., Ltd.; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Hawkers, Ltd.; McEach & Co., Ltd.; Player and Mitchell; Walsall Electrical Co., Ltd.; Westminster Engineering Co., Ltd.

### WAR OFFICE.

Rawinding generators.—British Westinghouse Electric and Manufacturing Co., Ltd.

### INDIA OFFICE: STORES DEPARTMENT.

Batteries.—Tudor Accumulator Co.  
Dynamoes.—J. Stone & Co.  
Engines.—Lancashire Dynamo and Motor Co.  
Insulators.—Bullers, Ltd.  
Lamps.—J. Stone & Co.  
Switchboards.—Eckstein, Heap & Co.  
Wireless telegraph apparatus.—Marconi's Wireless Telegraph Co.

### OFFICE OF WORKS.

Carbons for arc lamps.—General Electric Co., Ltd.

## GENERAL POST OFFICE.

Protective apparatus and telephonic apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.  
 Telephonic apparatus.—Western Electric Co., Ltd.  
 Telegraph cable.—British Insulated and Helsby Cables, Ltd.  
 Telephone cable.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; J. C. Fuller & Son, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; London Electric Wire Co. and Smiths, Ltd.; Peel-Connor Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.  
 Stoneware ducts.—Albion Clay Co., Ltd.; Doulton & Co., Ltd.  
 Telegraph ironwork.—Buller's, Ltd.; Gust, Keen & Nettlefolds, Ltd.; Walls, Ltd.; D. White, Ltd.  
 Bronze wire.—T. Bolton and Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (Incorporated in the London Electric Wire Co. and Smiths, Ltd.).  
 Flame-proof wire.—C. Macintosh & Co., Ltd.  
 Electrically lighting Birmingham Stores, Block "C."—Pinching & Walton.  
 Electric lift.—Waverley Station S.O., Edinburgh.—Waygood & Co., Ltd.  
 Telephone exchange equipment, Regent Exchange, W., and Dalston, N.E.—Western Electric Co., Ltd.  
 Telephone Exchange equipment, South Shields Post Office.—Peel-Connor Telephone Works, Ltd.

**Gravesend.**—The T.C. has accepted the tender of Messrs. Harrison, Tidswell & Co. for 1,000 tons of coal for the electric light works, at 16s. 6d. per ton.

**Hereford.**—The extension to the electric lighting installation in the County Surveyor's Department at the Shire Hall is being carried out on the Henley H.V.S. system using Holophane bowl fittings, by Messrs. Walker & Co.

**Heywood.**—The Electricity and Tramways Committee has contracted with the Tudor Accumulator Co. for repairs to the accumulators (£80 to £90).

**Hford.**—The U.D.C. has placed an order with Messrs. Watlington & Co. for bracket arms for the Tramways Department, at 8½d. per foot.

**Ipswich.**—The T.C. has accepted the tender of Messrs. Sulzer Bros. for a Diesel oil engine coupled to a high-lift centrifugal pump, at £2,370.

**Keighley.**—The Keighley and Bingley Joint Hospital Board has accepted the tender of Mr. H. Spencer for electrical work at the hospital.

**London.**—BERMONDSEY.—The Electricity Committee reports having had under consideration the necessity of improving the arc lamp lighting of the borough, and, with this purpose in view, had been testing all the best known makes of arc lamps, with the result that the following tenders have now been received:—

Crompton & Co., Ltd.—(a) 170 arcs erected complete, so that same are in every respect ready for working, £1,280 (slight reduction if existing line resistance is used); (b) five spare arcs, £29 10s.; (c) one year's supply of carbons, £16 18s. per 1,000 pairs; (d) price to be allowed for existing arc lamps, £137.  
 Engineering and Arc Lamp Carbons, Ltd.—(a) 1,362; (b) £37 15s.; (c) £9 9s. 6d.; (d) £87 10s.  
 Johnson & Phillips, Ltd.—(a) £1,615; (b) £17 10s.; (c) £4; (d) 15s. each.  
 General Electric Co., Ltd.—(a) £1,568; (b) £15; (c) £5 5s.; (d) 10s. each.  
 Oliver Arc Lamps, Ltd.—(a) £1,249; (b) £35; (c) £2 12s.; (d) £106 5s.  
 Jandus Arc Lamp and Electric Co., Ltd.—(a) £1,224; (b) £35 10s.; (c) £81 17s.; (d) £181.

The Committee has decided to accept the offer of Messrs. Johnson & Phillips, Ltd.

**HOLBORN.**—The B.C. has accepted the tender of Messrs. Barlow Bros. & Co., at £55, for wiring the public mortuary. Other tenders were received from Messrs. Rashleigh, Phipps & Co., at £64 15s.; Messrs. Willats & Son, at £62 10s.; and Messrs. Duncan Watson and Co., at £66 8s.

**WOOLWICH.**—The B.C. has accepted the quotation of Messrs. Ferranti, at £74, for oil switches.

**Paisley.**—We understand that Messrs. James Kilpatrick and Sons have secured the contract for the electrical work required in the proposed church at Walneuk.

**Salford.**—The Electricity Committee has accepted the tender of Messrs. Mather & Platt, Ltd., for filtration plant at the electricity works, Frederick Road, for £635.

**South America.**—Messrs. Gillespie & Beales, London, buying engineers for Messrs. Martin Bros., Valparaiso, have recently placed the following order with Messrs. Lindsay, Burnet and Co., Govan:—For ss. *Taltal*, two main boilers, complete with tanks and oil-burning apparatus on the Korting system, complete with all accessories; one donkey boiler, fitted for coal or, alternatively, oil burning.

**Wakefield.**—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for reinsulating an alternator at the generating plant, at £163.

**Yarmouth.**—The T.C. has accepted the tenders of Messrs. Bradbury, Son & Co., Ltd., for 500 tons of hard steam coal, and Messrs. Wm. Cory & Son for 650 tons of Digby and Pooloy Hall slack coal, for the Electricity Department.

## FORTHCOMING EVENTS.

**North-East Coast Institution of Engineers and Shipbuilders.**—Friday, February 21st. At 7.30 p.m. At the Lit. and Phil., Newcastle. Lecture on "Surface Combustion," by Prof. W. A. Bone.

**Royal Institution.**—Saturday, February 22nd.—At 8 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture III.)

Saturday, March 1st.—At 8 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture IV.)

**Institution of Electrical Engineers (Newcastle Students' Section).**—Monday, February 24th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "A Single Phase Traction System," by Mr. V. O. Haddock.

(Manchester Section).—Tuesday, February 25th. At 7.30 p.m. At the University, Manchester. Paper on "Some Recent Developments in the Manchester Street Lighting," by Messrs. S. L. Pearce and H. A. Ratcliff.

(London).—Thursday, February 27th. At 8 p.m. Fourth Kelvin Lecture on "The Ohm, the Ampere and the Volt—a Memory of Fifty Years, 1862-1912," by Dr. R. T. Glazebrook.

(Students' Section).—Wednesday, February 26th. At 7.45 p.m. At the Institution, Embankment, W.C. Adjourned discussion on paper on "Some Problems of Electricity Supply," by Mr. G. W. P. Page.

**Electro-Harmonic Society.**—Tuesday, February 25th. At 8 p.m. At the Holborn Restaurant. Ladies' night.

**Physical Society.**—Friday, February 28th. At 5 p.m. At Kine's College, Strand, W.C. Papers on "Interference by Röntgen Radiation," by Prof. C. G. Barkla and G. H. Martin; "Alternating Current Magnets," by Prof. E. Wilson; and "A Graphical Method of Optical Imagery," by Mr. W. R. Bower.

**Salford Technical and Engineering Association.**—Saturday, March 1st. At 7 p.m. At the Royal Technical College, Salford. Lecture on "Wireless Telegraphy," by Mr. J. McKeever.

THE ELECTRICAL ENGINEERS  
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAP.

The following orders have been issued for the current week:—

Monday, February 24th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, February 25th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, February 27th.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, March 1st.—(Left Half Battalion). "C" and "D" Companies. Week-end training at Dover. Dress:—Service dress, puttees and great coats. No arms will be taken. Parade at Victoria Station, S.E. and C. Railway, at 1 p.m.

Headquarters will be open from 10 a.m. till 12 noon for regimental business.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adj. For Officer commanding L.E.E.

## NOTES.

**Electric Drive in the Wood-working Yard.**—Referring to the article on this subject published in our issue of January 24th, we are informed that a clerical error was made in quoting the cutting speed of the horizontal reciprocating saw of Messrs. John Pickles & Sons' make. The saw was mentioned as being driven by a 15-H.P. motor, and it was stated that it was "capable of making one cut up to 48 in., cutting at the rate of 2 in. per minute." This should have been 2 ft. per minute.

**Parliamentary Notes.**—ADMIRALTY ELECTRICAL ENGINEER.—In Friday's Parliamentary Papers, Major Archer Shee asked the First Lord of the Admiralty whether the services of the chief electrical engineer had been lent to the Leeds Corporation; and if so, why this gentleman's services could be spared, in view of the Admiralty statement that it was not desirable that they should undertake the erection of wireless stations, as they could not spare their staff. Mr. Churchill replied that the circumstances referred to had not been previously brought to his notice. He was informed that the services of the superintending electrical engineer had not been lent to the Leeds Corporation, but that he had accepted an invitation unofficially to give an opinion on certain points connected with their electrical undertaking on which the advice of an impartial expert was desired. The acceptance by a servant of the Crown of employment such as this, which did not interfere with the performance of his official duties, was not actually prohibited by the regulations. The position of scientific experts in the service of the State presented special features, and he saw no reason to interfere with the arrangement made in this particular case. At the same time, he had given instructions that in future the consent of the head of the department must be obtained by an officer before undertaking any service of this character.

**ELECTRICITY IN MINES.**—On the motion for the adjournment of the House of Commons on Friday night, Sir A. Markham called attention to the Rufford Colliery disaster, which resulted in the death of 14 men. The disaster was caused by a hoppet, which broke through the headgear of the colliery, and a barrel containing some tons of water was precipitated down the shaft on to the men. Not a single man was struck by the hoppet but the deaths were caused by drowning. When the hoppet came down all the lights

in the shaft were put out, and the hon. member said that if electric lamps had been provided in the mine he felt sure that the majority, if not all, of the men would have been saved.

**STANDING ORDERS.**—The whole of the 112 private Bills deposited in the Private Bill Office for consideration by Parliamentary during the forthcoming session have now been before the Examiner and dealt with, with the exception of three, which have been postponed till March 4th. One of the postponed Bills is the London County Council Tramways and Trolley Vehicles Bill. Four Bills will not be proceeded with, one of which is that of the Halifax Corporation for powers to construct about 12 miles of new tramways, at a cost of about £200,000. In six cases, the promoters have failed to show proof of having complied with Standing Orders, and these Bills will accordingly have to go before the Standing Orders Committee, who will decide whether they shall be allowed to proceed. One of these is the Ely Valley Gas and Electricity Bill, where it was held that the notices did not sufficiently and accurately define the area proposed to be supplied with gas and electricity by Clauses 25 and 53. By Clause 58 it was proposed that the company should be under obligations similar to that provided for under Sub-Sec. 1 of Sec. 21 of the Schedule in the Electric Light Clauses Act of 1899, to lay down distributing mains in certain streets and roads mentioned in the second Schedule of the Bill, but as such streets and roads were not specified, it was held that the promoters had failed to comply with the standing orders. It was also held that the Leeds Corporation had failed to comply with the Standing Orders by not having the consent of the West Riding County Council, who are the road authorities, in respect of Tramway No. 6 in the Bill. This proposed tramway was one of 1 mile 5 furlongs to be constructed in the city and in the township of Templenewsam, in the rural district of Hunslet.

Amongst the Bills dealing with electrical matters which have successfully passed the Examiner, and will go for second reading, are the following: Bradford Corporation, Brighton Corporation, Central London Railway, Chesterfield Corporation Railless Traction, City and South London Railway, Cleveland and Durham County Electric Power, Crowborough District Gas and Electricity, Folkestone, Sandgate and Hythe Railless Traction, Hastings Tramways, Herne Bay Gas and Electricity, Huddersfield Corporation, London Electric Railway, Metropolitan District Railway, Metropolitan Electric Tramways, Metropolitan Railway, Mexborough and Swinton Tramways, Northern Counties Electric Supply, Rhondda Tramways, Western Valleys (Monmouthshire) Railless Electric Traction, and Westgate and Birchington Gas and Electricity.

**The Batti-Wallahs.**—We are informed that the informal meeting of the Batti-Wallah Society, on Wednesday, February 12th, was, as usual, exceedingly well attended. "It was strictly informal, the programme ranging from the telling of stories to a wrestling match." The members were asked to note that the date of the annual dinner, which was to have taken place on March 8th, is unavoidably altered to March 15th, owing to the proximity of the former date to the annual general meeting, which takes place on March 3rd.

**Educational Notes.**—On Saturday (15th inst.), the Clyde Model Engineering and Electrical Institute was opened in Govan, Glasgow; it has been established for the purpose of enabling apprentice engineers and other young mechanics to study their trades and develop ideas by experimenting with models. A well-equipped workshop has been provided, and already about 200 members have been enrolled.

The Education Committee of the London County Council has issued a report on eight years of technical education and continuation schools—mainly evening work.

**New British Westinghouse Club.**—On Saturday last the British Westinghouse new club premises in Moss Road, were formally opened. The Club is now open to all male employes of the British Westinghouse Electric and Manufacturing Co. The building has been constructed with a view mainly to convenience, and consists, on the ground floor, of a large hall capable of seating 300 persons, a dining room, and a spacious billiard room containing two tables. The remainder of this floor is occupied by the stewards' living rooms, &c. Upstairs are a number of committee and retiring rooms. The basement is mainly devoted to the rifle range, for which a sound-proof room has been constructed, giving a range of 25 yards and accommodation for four people to shoot at once. As regards the outdoor section, there will be five tennis courts, three grass and two hard, and a bowling green, and although these are not yet quite complete, it is expected that they will be in good working order by the commencement of the season. Mr. Peck, chairman of the Committee, opened proceedings by voicing the satisfaction of all present that the time had come when the difficulties of inception and organisation had been overcome, and the proud moment of inauguration had arrived. This had been made possible by the financial support of the directors and the members of the staff, but was mainly due to Mr. Lange, managing director, for his support throughout.

Mr. Longworth, the architect, presented a golden key to Mr. Lange, and Mr. Lange, in accepting, expressed his thanks. He said that it was his opinion that a turning-point in the history of the Club and the British Westinghouse Co. had been reached, and this had only been possible on account of the hearty co-operation of the staff. It was his pleasant duty to declare the Club open, and in doing so he outlined the history of the organisation. The forerunner of the present club had been primarily devoted to the engineering side of the firm and had been inaugurated as a means of transmitting to the younger employes, the apprentices in

particular, the knowledge possessed by the older engineers, and he wished to emphasise the fact that that object should always be kept in mind, and he appealed to the older members to foster the spirit of co-operation and watch over the well-being of the younger members. He wished to express his appreciation of the various interests now gathered under the one name, the British Westinghouse Club, such as the Social and Improvement Society, the Foreman's Association, and Apprentices' Section, who had so loyally subordinated their individual interests to the well-being of the Club as a whole. He referred to the great interest that Mr. Carlton, a previous managing director of the company, had in the Club and to the strongly educational lines on which he considered that it should be run, and that although the management of the company had modified this view somewhat, it was hoped that that primary object would always be kept in view. Mr. Lange also made special reference to the invaluable work of Mr. Tearle and his friends. In conclusion, he wished the club all possible success.

Mr. Tearle, chairman of the House Committee, regretted that the club was not in a more advanced state of completion, but said that it had been the feeling of the committee that in view of the large membership, it was advisable to open the premises at the earliest possible moment. It was some considerable time since Mr. Peck and Mr. Bissett conceived the idea and sketched out rough plans. The club was indebted to Mr. Derwent Simpson, solicitor to the company, for his help in suggesting methods of raising the necessary funds. On his recommendation, it was decided to issue



NEW BRITISH WESTINGHOUSE CLUB.

debentures to the extent of £3,000, of which £1,500 had been taken up by the company, who had also cancelled an existing debenture of £675, the interest on which was being paid by the club. The rest of the debentures have been taken up by members of the staff with the exception of about £150. He wished particularly to refer to the great kindness of Mr. Lange, not only in the gift of the three tennis courts, which would be a permanent record of such kindness, but for his advice and enthusiasm throughout.

Sir W. H. Bailey offered his congratulations, and mentioned that as a director of the Trafford Park estates, he was one of the first to discuss with Mr. George Westinghouse the question of purchasing a plot of land in Trafford Park for the company.

The remainder of the evening was devoted to the social side, and an enjoyable entertainment was given by the "Limits." An opportunity for the inspection of the premises was also afforded.

**Possibilities of a Tidal Electricity Works.**—Plans for utilising the tidal motion of the sea have often been suggested, without coming to anything. However, the first serious attempt to use it for the production of energy will shortly be made at Husum, on the Schleswig-Holstein coast of the North Sea, where, between the Isle of Nordstrand and the mainland, a reservoir of 4,000 acres is to be created by means of embankments. This reservoir will be subdivided by another embankment into an upper and a lower tank, communicating by sluices with the shallow inland sea on one hand and the turbine plant on the other.

The scheme is based on the assumption of a uniform tidal amplitude of 3 metres, the lowest ebb and highest flood each time reaching the same level, and their difference of level always being 3 metres. Under this assumption the working of the plant will be as follows:—When the water in the sea is higher than in the upper reservoir, this will be filled through the sluices; if, on the other hand, the water in the upper reservoir be at a higher level, this will flow off through the turbines, thus actuating the latter. This would commence some time after the beginning of low tide, and cease shortly after the beginning of high tide. An opposite process is to take place in the lower tank; when the water in the sea is higher than in the tank, it will flow in through the turbines, thus starting these some time after the beginning of high tide, and stopping them some time after the beginning of low tide. If the water in the sea be lower than in the tank, water will flow from the latter through the sluices into the sea.

The promoters of this scheme, on the hypothesis of a regular return of tidal amplitudes, presume that the operation of the turbines from one of the tanks may begin at the very moment the operation from the other tank ceases, thus ensuring a continuous service; they are reckoning on a level difference of 1½ to 2 metres between the sea and the tank actually in operation, the water in both tanks rising and falling about 1 metre during each tide.

The turbines are to yield 5,000 H.P., driving dynamos which will work without any accumulators, thus communicating their output directly to the supply system. The cost of construction is estimated at 5,000,000 marks, of which about 3,500,000 marks is allowed for the embankments and about 500,000 marks each for the turbines

and sluices, the buildings and the electrical part of the plant. The cost of the kw.-hour as produced in the tidal electricity works has been calculated in the first instance at 14d. but in the event of a large consumption it will be reduced considerably (down to 4d. and less). Even should the electrical enterprise fail, the promoters would in any case recover the value of the land reclaimed from the sea.

In an article recently published in a German daily paper (*Hamburger Korrespondent*), Mr. L. Benjamin severely criticises this scheme. He draws attention to the fact that the levels reached by the high and low tides are subject to considerable fluctuations, often unexpected and abrupt. When calculations are based on the actual tide curves, the hypothesis of an immediate transition between the working periods of the two tanks is seen to be inadmissible. In the most favourable case the dynamo would work during a period of about four hours, followed by a standstill of two hours, after which the next working period would begin. The working periods of four hours each would, according to the beginning of high tide, occur at changing times of day or night, so that the energy produced by the turbines, far from being always utilised immediately, would have to be stored, to be distributed to consumers at the right moment. No regular operation would thus be possible without the aid of expensive accumulators. Moreover, the district to be supplied would be by no means suitable for a rural power transmission plant, the enormous length of conductors and numerous transformer stations increasing the cost of electrical energy at the place of consumption far beyond the figure at which it could be produced by properly-designed steam electricity works.

The figures allowed for the cost of the reservoir are likewise criticised. As the ground at present lies at 1½ to 2 metres above normal low level, the formation of two tanks of so enormous a size would entail the excavation of at least 25,000,000 cb. metres of soil, which, if feasible at all, would greatly increase the estimated cost. The embankments, about 12 km. in length, would likewise entail an enormous expenditure on account of the muddy ground they would have to be built on.

In planning the machinery, the effective head has simply been taken as identical with the level difference between the sea and each tank. However, the water, in order to get from the remoter parts of the reservoir to the turbines, requires a sufficient head, while the water discharged from the turbines necessitates some additional head to avoid any back-pressure. When these heads are deducted from the level difference, the head actually available for the turbines is reduced considerably, beginning at most with 1 metre and falling to zero in the course of a working period. Now, while there are no turbines working under heads approximating zero, turbines suitable for a head of 1 metre are necessarily unsuitable for use with heads of less than ½ metre. In order to make up for this defect the number of turbines would have to be multiplied.

As, finally, the foundations of the turbine plant on the muddy soil of the sea coast would be extremely costly, the installation of the contemplated tidal electricity works would seem to entail a prohibitive expenditure, while its chances of success would be anything but satisfactory.

**Annual Socials, &c.—BLACKPOOL.**—Employés of the Blackpool Corporation Electricity and Tramways Department held a successful whist drive and dance on February 12th. The effort was in aid of an institute which the employés propose to organise for recreative purposes. Mr. C. I. Baker, the tramways traffic superintendent, was M.C. Alderman J. Brodie, J.P., chairman of the Tramways and Electricity Committee, assured the men that the Committee would do its best to assist them with their proposed institute. The Mayor rejoiced that the feeling of union amongst the tramway employés was so thorough. Mr. C. Furness, the general manager, said this was the first united whist drive the Electricity and Tramways Department had organised. When they considered that the two departments consisted of some 500 men, and most of them had families, he thought the time was opportune when they should have an institute of their own in which they could have social gatherings.

**LONDON.**—Some 60 members of the staff of Electrical Installations, Ltd., held their sixth annual dinner at "The Horns," Kennington, on the 15th inst., Mr. Stanley C. Russ being in the chair, who, after the usual toasts had been drunk, in a short speech alluded to the satisfactory growth of the business of the company. Advantage was taken of this opportunity to enroll a large number of new members for the E.I., Ltd., Athletic Club. After the dinner, various members of the staff entertained the company with a variety programme.

**MANCHESTER.**—On Friday last, February 14th, at the Midland Hotel, Manchester, 200 members of the staff of Ferranti, Ltd., held their annual dinner, which was followed by a musical entertainment, to which some of their number contributed.

**Institution and Lecture Notes.**—**INSTITUTION OF ELECTRICAL ENGINEERS.**—At a meeting of the Scottish Local Section in Edinburgh, last week, Mr. W. B. Hird, Glasgow, read a paper on the "Electric Arc," an electrically propelled vessel, which was built and put on the Clyde in 1911, for the purpose of demonstrating a particular method of electric propulsion.

**JUNIOR INSTITUTION OF ENGINEERS.**—The twenty-ninth annual dinner of the Institution was held on Saturday last at the Hotel Cecil, Sir A. Trevor Dawson, the President, occupying the chair.

After the loyal toasts, Rear-Admiral Arthur W. Waymouth (Director of Naval Equipment in the Admiralty) gave that of the "Profession of Engineering," which he claimed to be the most important in the world, because its purpose was the adaptation of

the forces of nature to the service of man. Since the old days of the hansom cab and the sailing ship, steam and the internal combustion engine had brought about wonders. The latter especially had made flight in air and submarine work possible, and would probably lead in the future as a motive power in engineering works. In naval construction, so extensive was the use of machinery in battleships to-day that every Naval officer was an engineer, and was proud to be one. In conclusion, the speaker recalled his close association with Sir Benjamin Baker on the Board of Ordnance, and paid a tribute to the value of the work accomplished by that great engineer. Capt. H. Riall Sankey, in reply, said that engineering was the only profession we could not do without. It was cosmopolitan and knew no bounds. He referred to the "Socialism of intellect" shown by Sir A. Trevor Dawson in his presidential address, in proposing that likely laids should be taken up and educated by the State.

The toast of the "Junior Institution of Engineers" was submitted by Major E. H. Hills (President of the Royal Astronomical Society) who, as a representative of one of the oldest scientific societies, extended the hand of fellowship to one of the youngest. To the astronomer, the work of the engineer in the mounting of telescopes, and in other ways, was vital and important. The differences between them were great, the work of one being speculative and that of the other practical. The engineer's sphere was "to do things," that of the astronomer "to know things," and those who would criticise the latter must remember that the useless things of one generation became the practical things of the next. The researches of Clerk Maxwell in one generation gave to the succeeding one wireless telegraphy, and enabled the wealthy merchant on the *Mauritania* to be kept daily in touch with—the price of lard. The desire to know things marked off the Western mind from the Oriental and the savage mind and placed it in the forefront of civilisation. As an instance of this desire for knowledge, the speaker referred to the life of Dr. Wilson, the naturalist to the Scott expedition, "whose loss had thrown a nation, and indeed the whole world, into mourning." One of the problems Dr. Wilson set himself to solve was that of the nesting and embryology of the emperor penguin, a bird which laid its eggs on ice in the middle of winter. Two years ago the doctor and two companions set out on a five days' journey, and on arrival at the desired locality, made a snow hut, but hardly was it finished before a fierce blizzard blew the roof away, together with their tent and other belongings. For 48 hours they lay in their sleeping bags without food. When the storm ceased, a consideration of the direction of the wind enabled them to recover their tent, and they were successful also in finding the eggs, for the possession of which they had risked so much. Curiosity was one of the highest characteristics of our race, and without it we were poor creatures of no value. We had still some chance of salvation if we did not commit the unpardonable sin of a blind worship of the useful.

Mr. S. Bylander (chairman of the Institution), in response, spoke of their hope of being able to secure a building of their own in the near future, and of the several advantages of membership. Their motto was "no standing still."

Later, Mr. W. A. Tooke (vice-chairman of the Institution) in giving the toast of "The President," referred to the services Sir A. Trevor Dawson had rendered them, and particularly to the value of the first Canet lecture, which he delivered four years ago, on "The Engineering of Ordnance."

An excellent musical programme was provided and was greatly enjoyed by all present.

**THE CONCRETE INSTITUTE.**—A paper was read by Mr. S. Bylander, entitled "Steel Frame Buildings in London," at the meeting on February 13th. The next meeting of the Institute will take place on February 27th, when Mr. J. A. Davenport will read a paper entitled "Economy in Reinforced Concrete Design."

**THE INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION).**—Mr. D. Betts (vice-chairman) has been transferred to the class of Associate Members, and his office is now filled by Mr. G. W. P. Page, who vacates the hon. secretaryship. The newly-elected hon. secretary is Mr. E. T. Driver, 24, Bradgate Road, Catford, S.E. The discussion on Mr. Page's paper has been adjourned to February 26th.

**MANCHESTER UNIVERSITY ENGINEERING SOCIETY.**—At a meeting of the Society on February 12th, Mr. S. L. Pearce, chief electrical engineer to the Manchester Corporation, gave a lecture on the Manchester electricity undertaking, illustrated with maps and lantern slides.

**INSTITUTION OF MECHANICAL ENGINEERS.**—The annual report of the Council was presented to the members at the meeting on Friday last week. It shows that the total membership at December 31st, 1912, was 6,160, an increase of 332. The total revenue for the year was £16,950 and the expenditure £13,344, leaving a surplus of £3,606, of which £710 was carried to capital account as entrance fees and life compositions. The net capital of the Institution amounts to £64,237. In an appendix to the report, full particulars are given of the scheme of examinations for Graduateship and Associate Membership as adopted by the Council. The next summer meeting will be held in Cambridge at the end of July.

**THE ASSOCIATION OF ENGINEERS-IN-CHARGE.**—A most enjoyable social evening and dance was held in connection with the above Association on Saturday, February 5th, when a company of upwards of 200 members and friends were present in the St. Bride's Institute, E.C. There was a good selection of dancers with five extras, including a flirtation and card dance, and Mr. Hardy's Bijou Orchestra, which was engaged for the occasion, provided an excellent musical programme. The special dances created much amusement, and at the same time added materially to the sociability of the evening. Messrs. H. E. Neal and W. T. Pickett (chairman and vice-chairman of the Association respectively) supported the efforts

of the committee by attending the function, and the arrangements made for the entertainment of those present left nothing to be desired. Messrs. W. H. Ball and M. C. White acted as M.C.'s for the evening, and they carried out their duties in a very effective manner.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS.**—Mr. A. B. Muirhead recently lectured at Musselburgh, on the subject of "The Handling of Electric Plant in Collieries," before the Eastern Branch of the Association.

An examination for competency in mining electrical engineering will be held on March 8th and 15th, at 10 centres in the United Kingdom. The subjects are A.C. and D.C. theory and practice, the special rules, distribution of electrical energy, electric lighting and signalling, &c. Full particulars can be obtained from the general secretary of the Association, C. St. C. Saunders, Bank Chambers, London Road, Derby, or any of the branch secretaries. Candidates must be on the register of the Association.

§ The Council announces that the following prizes are offered for papers for the present session:—An Association prize of Five Guineas for the best paper read at any branch; a prize of Two Guineas, given by Mr. Carlow, for the best paper by a member of the East of Scotland Branch; a prize of Four Guineas, given by Mr. Alex. Anderson and Mr. Matthew Brown, for the best paper by a working colliery electrician who is a member of the West of Scotland Branch; and a premium of Two Guineas, given by Lord Joicey, for the best paper by a member of the North of England Branch. Further particulars can be obtained from the General Secretary of the Association, Bank Chambers, Derby, or any of the branch secretaries.

**The Electro-Harmonic Society.**—The next concert (ladies' night) will be held at the Holborn Restaurant (King's Hall) on Tuesday, February 25th, at 8 o'clock p.m. The artists are as under:—Vocalists: Miss May Huxley (soprano), Miss Violet Oppenshaw (contralto), Mr. Hubert Eisdell (tenor), and Mr. Ivor Foster (baritone); violoncello, Mr. W. H. Squire; recitations, Miss Elsie Fogarty; entertainer at the piano, Miss Haidee Hamilton; entertainer, Mr. Thornley Dodge; solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

**Fatality.**—The death took place on Sunday at the Bolton Infirmary, of Albert Blakely (22), of Everett Street, Bolton, a tramcar conductor in the employ of the Corporation. On the previous day, whilst in charge of a car in Bradshawgate, Blakely, by some means, was struck by a passing tramcar, sustaining injuries which proved fatal.

**Coal Stacking and Firing.**—A paper by Mr. Kendrick was recently read before the Manchester District Institution of Gas Engineers. He endeavoured to explain the fires that had happened to stacks of coal during some months. At his works at Stretford they have had three serious fires in four years, and many cases of overheating. No. 1 store held 1,800 tons, and was an old retort house partly roofed, with and partly without louvres. No. 2 store holds 1,400 tons and has no louvre. No. 3 holds 800 tons, and has a two-span roof of corrugated iron. In the first two, coal is delivered by conveyors. In No. 3 it is hand-stacked, 14 ft. high. In the other stores it is piled in pyramids 24 and 20 ft. high, the top of the cones being 8 ft. across. No. 1 shed had given most trouble. The finest slack is usually sent direct to the retorts, but much fine stuff still gets into the store and fills the middle part of the piles, and to this dust and small coal the fire trouble is due.

As a result of what was observed, after each boat had been discharged, the fine dust was dug out and spread over the heap, and pipes were put in at intervals to enable the interior of the pile to be watched. Three years of immunity led to laxity, and the small stuff had not been fully dug out, and a fourth fire occurred. It was again the small coal which heated, but was not the immediate cause. Some old screened coal was buried under the new coal, and the store was filled, in about six weeks, to its utmost capacity. On emptying the shed, the rough coal under the slack was quite carbonised and fire was creeping under the slack. Apparently air had reached the new coal through the old tongue of open rough coal. The temperature in the tubes rose slowly to 90°, then quickly to 110°, with a quick jump to 300°, and it required a week to reach the fire, which had then spread considerably. As this coal was stored in the hot month of May, 1912, and was stacked quickly and was drier than usual, these causes appear to have been active in producing fires.

The colliery agents attribute the numerous fires of that year to the fact that after the strike, coal was much crushed at the face, and was very small, and it was not clean, being hurried away quickly for use, and more probably fresher coal than usual was stacked. Freshly-wrought coal is more prone to heat, especially if fine.

Coal as received is warmer than the atmosphere, as much as 2° to 12° in summer, and 4° to 20° in winter. Since a pit may have a temperature of 90°, coal must start from the pit fairly warm, and if stacked too soon, too high, or in too large mass, it is prone to heat. Also, coal mined first after the strike would be damper than usual, and dampness seems to engender fire.

Coals absorb from one to three times their volume of oxygen, and this produces heat, and if it can occur in a thick mass the heat accumulates. Stacking in cone shape from a conveyor causes the fines to accumulate at the apex, and these are apt to fire. This system of storage is thus to be regarded with suspicion. Coal owners suggest 11 to 15 ft. as the height of coal stacks, or a mean of 13 ft. Gas-

works practice is to stack 10 to 30 ft. Since coal under cover cools less slowly, it should be stored in less depths than when out of doors, whereas the reverse is the usual practice. The question of ventilation is a disputed one. Some men say ventilate freely and carry off the heat. Others say keep out all air and no heat can be generated. If this is so it would be quite safe to store in closed bunkers, exhausting the air at the top and admitting CO<sub>2</sub> at the base to fill the voids between the coal. In practice it appears that coal will be reached by air enough to make it become hot. Therefore, supply ample air to carry off the heat, for the oxidation will be less if the coal is cold. Yet in mines ample ventilation to remove gas has caused heating in the gob, and the checking of the air current has stopped the heating.

If a heap fires, very much water is needed to quench it, for water sets up air currents to fan the fires. At Stretford they treat affected coal with strong ammoniacal liquor and only put water on unaffected coal. The summing up is that coal from different seams should not be mixed, nor should coal of different classes.

Fine slacks should not be stacked at all, nor damp coal under cover. Large heaps are the more dangerous. Lumps, nuts and fines should be well mixed in stacking. Limit heights to 20 ft. in the open, and 16 ft. under cover. Avoid external sources of heat, leaking roofs, &c. Keep temperature records of coal as received and in stock, and if the heat rises to 90° or 100°, remove the top layers and watch carefully. Do not disturb a fired heap by pushing in bars. Do not apply water to a fire, but ammoniacal liquor. Remove and use heated coal promptly.

From remarks made during the discussion, it would seem that if coal is screened and stacked it does not become hot. This indicates the smalls as the cause of trouble. But it also indicates the need for good air circulation, for it is the fines that prevent this. It seems impracticable, as a rule, to gain safety by excluding all air, as that would undoubtedly prevent fire, for to produce fire there must be oxygen. The question is, can coal absorb oxygen, as oxygen which shall only begin to work when the coal is stacked? With present, day large stacks of coal, the subject becomes important.

**Mr. C. S. Northcote's Bankruptcy.**—Charles Spencer Northcote, 67, Stanthorpe Road, Streatham, London, electrical engineer.—The receiving order herein was made on creditors' petition, the act of bankruptcy being the failure of the debtor to comply with the requirements of a bankruptcy notice duly served upon him. The debtor appealed from the receiving order, and an order was made staying all proceedings thereunder pending the hearing of the appeal, which had now been dismissed. According to the statement of affairs, the liabilities are expected to rank at £1,709 12s. 10d. and the assets are estimated to produce £33 6s. 6d. The debtor became London manager to a firm of electrical engineers, and the firm having become a limited company in 1903, he was appointed a director. Three years later he left the company and sold his shares therein for about £4,000, opening an office at 2, Queen Anne's Gate, Westminster, on his own account. He traded there under the style of the Wholesale Electric Traders, and, at the same time, he was honorary secretary to an association, in which capacity he organised and managed the Manchester Electrical Exhibition of 1908. In 1909 he gave up his offices, and has since had no office and earned practically nothing, although he has tried to develop various electrical schemes, and he has lived on his capital. He purchased a frechold house at Forest Hill some 10 years ago for £3,000, and spent £1,000 on improvements. He had an overdraft at the bank, but gave them a fixed mortgage on the house for £1,500 about two years ago. He left this house in April, 1912, and it was unoccupied until last November, when the mortgages sold it by auction for less than the mortgage money. When he left this house he instructed the petitioning creditors to sell by auction the bulk of his furniture, and they did so; but being dissatisfied with the way in which the sale was conducted, he consulted a solicitor with a view to bringing proceedings against them. The petitioning creditors alleged that certain letters written by the solicitor so instructed were libellous, and they thereupon commenced proceedings against the debtor for libel, the action coming on for trial at the end of last June, when judgment was given by default, and the case referred to the Sheriff to assess the damages. Debtor instructed other solicitors, who appeared at the Sheriff's Court, but a verdict was given against him for £400, and costs. An appeal, which was entered by the debtor, was dismissed, and the petitioning creditors thereupon brought the present proceedings. No books of accounts had been kept by the debtor, who ascribed his failure to the verdict obtained against him by the petitioning creditors for damages for an alleged libel and the costs of the action.

At the first meeting of creditors, held last Tuesday at 132, York Road, Westminster Bridge Road, S.E., it was decided to leave the matter in the hands of the Official Receiver.

**Appointments Vacant.**—Charge engineer, for the Corporation Electricity Works, Crewe (£80). Chief draughtsman, for Provincial Cinematograph Theatres, Ltd. (£182). Electrical fitters, for H.M. Dockyard, Portsmouth (36s.). Fitter-driver for the Severalls Asylum, Colchester (35s.). See our advertisement pages in this issue.

**A South London Exhibition.**—This week, at Raleigh Hall, Effra Road (opposite Lambeth Town Hall), the South London Electric Supply Corporation, Ltd., is running an exhibition of electric heating and cooking. Demonstrations are given daily at 3.30 and 7.30 p.m. To-morrow (Saturday) night the Exhibition will close.

## SELF-STARTING SYNCHRONOUS MOTORS.

THE Lancashire Dynamo and Motor Co. has recently constructed a number of self-starting synchronous motors, some particulars of which we are enabled to publish herewith.

The "Lancashire" self-starting synchronous motor has been designed to overcome the great drawback of the synchronous machine, viz., that it requires skilled attention

The motor then comes into synchronism and runs as a synchronous motor, the field excitation being adjusted to suit the power factor which is required.

This type of motor is specially suitable for installing in a works and driving machines such as pumps or air compressors, on which the load is fairly constant. The excita-

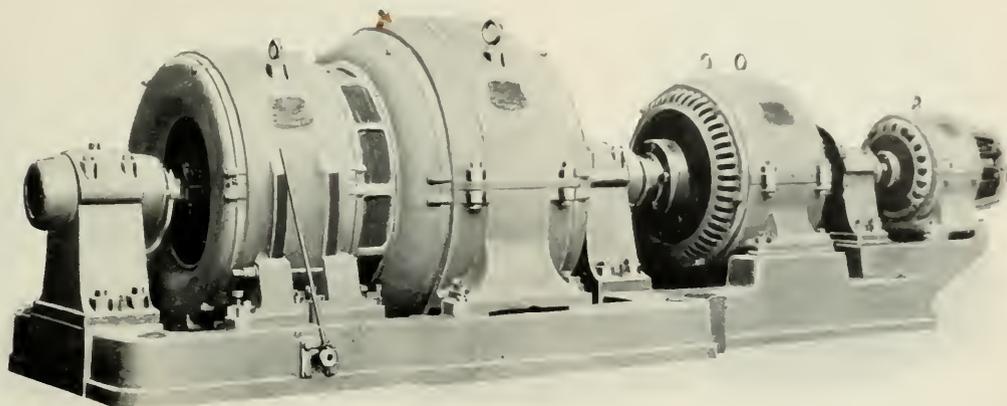


FIG. 1.—750-H.P. SELF-STARTING SYNCHRONOUS MOTOR DRIVING TRAMWAY GENERATOR, ALTERNATOR AND EXCITER.

and synchronising before it can be put on the circuit. The "Lancashire" type of machine starts up like a wound-rotor induction motor, and when it is up to speed, and the exciting current is switched on, it pulls itself into step automatically, thus enabling the motor to be used for all sorts of industrial purposes where a synchronous motor of the ordinary type would be inadmissible.

tion can be adjusted to raise the power factor of the works to something in the neighbourhood of  $\cdot 9$ , which is about the most economical value.

The motors are of the revolving field type with cylindrical rotors; the stator windings are former-wound, embedded in

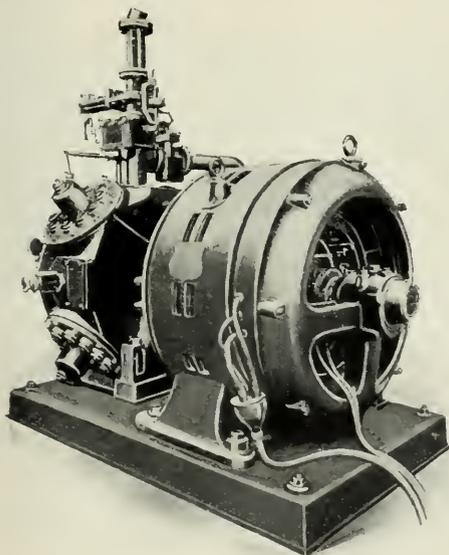


FIG. 2.—MOTOR-DRIVEN AIR COMPRESSOR FOR LONDON, ONT.

The current is switched on to the stator by the stator switch, and a resistance is put across the slip rings in parallel with the field winding. The motor then starts up, and as the resistance is cut out the speed rises until it gets close to synchronism. At this point, the rotor is put across a buffer resistance, and the switch being moved one step further puts the exciter across the slip rings, with all the resistance in series with the field.

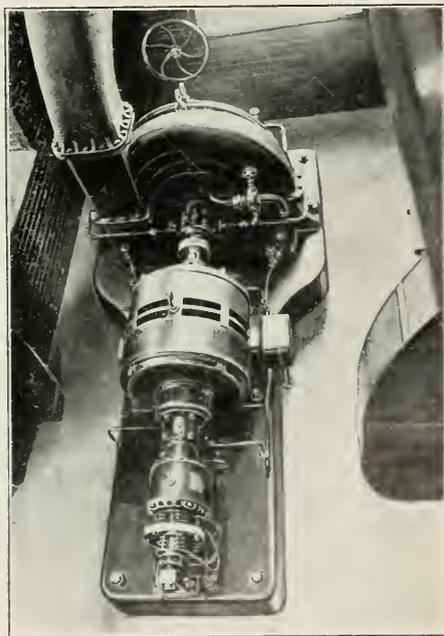


FIG. 3.—RATEAU TURBO-BLOWER WITH 250-H.P. SYNCHRONOUS MOTOR DRIVE.

partially-closed or open slots, and insulated in micanite troughs, which project some distance from the core and provide against breakdown at the point where the windings leave the slots. The end connections also are clamped to the end plates when necessary.

The rotor is constructed with numerous ventilating ducts, and a fan of full rotor diameter is provided on either side of it, which, in conjunction with the stator end shields, provides an excellent ventilating arrangement, the constructive features of which are shown in the views of the Erindale frequency changer mentioned later.

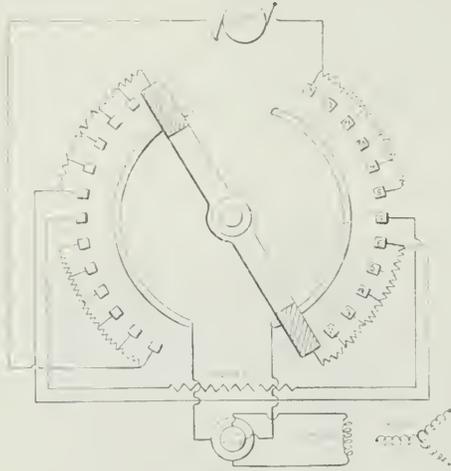


FIG. 4.—STARTER CONNECTIONS FOR SELF-STARTING SYNCHRONOUS MOTOR.

The rotor coils are wound with flat copper strip and afterwards taped. Standard ball bearings are fitted to the journals, and a double ball thrust bearing is provided to keep the rotor in position, the other bearings being free. These motors have been used for a variety of driving purposes, and some of these we illustrate: they have also been supplied to run idle and act as rotary condensers.

Our first view shows a 750-H.P. combination, one of two similar sets supplied to the city of Guelph, Canada, each consisting of a 750-H.P. self-starting synchronous motor direct-coupled to a D.C. traction generator and alternator with exciter; the latter machine is used to change the periodicity of supply from 25 to 62½ cycles, and the set runs at 750 R.P.M. from the 2,200-volt three-phase mains; the other views of similar motors in use are self-explanatory.

We further illustrate in figs. 6 to 9 a frequency changer recently supplied to the Erindale Power Co., Canada. The set consists of a synchronous motor direct coupled to an alternator, supported on two beam bed plates with three bridge type pedestal bearings, the starter motor and the exciter being carried by the end pedestals. The synchronous motor capacity is 1,150 K.V.A. at 12,500 volts, three-phase, 25 periods, and a speed of 300 R.P.M., and the alternator develops 1,000 K.V.A. at 13,200 volts, three-phase, 60 periods. The exciter is shunt wound, and generates 320 amperes at 125 volts. The starter motor is of the wound rotor type, running off 2,200 volts, and is controlled by a special oil immersed rotor starter in which the last five or six contacts are suitable for regulating the speed when synchronising. Fig. 6 gives a view of the above set taken on the Lancashire Dynamo Co.'s test bed.

From the rotor view of the 25-period machine, it will be seen that the field system is built up with salient poles, which are bolted to the periphery of the plate type cast-steel fly-wheel. The poles are built up of mild steel stampings, in order to reduce the eddy current losses to a minimum. The construction of the field system facilitates the removal of the poles when this is desired for inspection or repairs.

The field coils are wound with copper strip on edge; this arrangement prevents the layers rolling under centrifugal

force. Each coil is insulated and securely bolted between the spigots of two bronze clamping plates; afterwards it is placed on the pole and fixed against the pole tip by means of set screws. The pole tip prevents the coil flying out under the action of centrifugal force.

The machines are fitted with a system of forced ventilation to ensure cool running, fans being fixed on either side of the field system, as shown in our view of the rotor. The cold

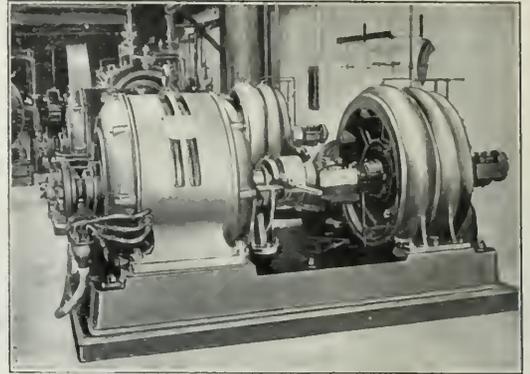


FIG. 5.—200-H.P. SELF-STARTING SYNCHRONOUS MOTORS DRIVING PUMPS.

air is drawn in and forced by the fans against the stator end-connections and along the field coils. The stator end-shields provide an effective guide to direct the air to the desired portions of the machine, and the hot air is expelled through holes in the stator case.

## ELECTRICAL APPARATUS AND STANDARDISATION.

By W. A. TOPPIN.

A CERTAIN amount of standardisation is necessary in every industry. There are two ways by means of which it may be

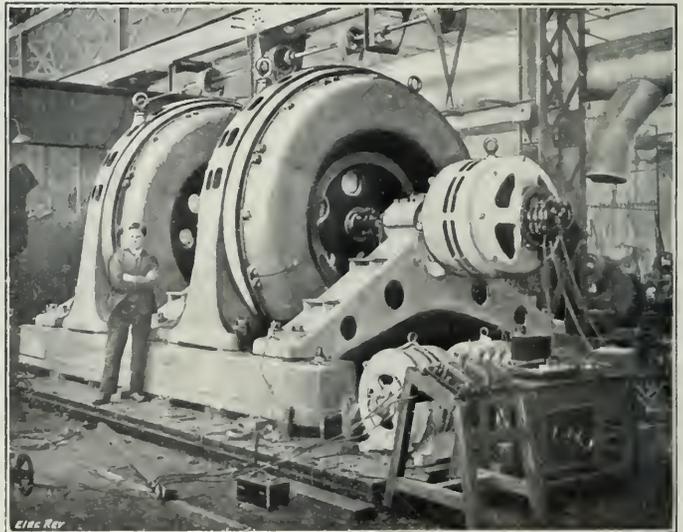


FIG. 6.—1,000-K.V.A. FREQUENCY CHANGER BY THE LANCASHIRE DYNAMO & MOTOR CO.

brought about. One is for the manufacturer to obtain the monopoly of manufacture of any particular article, as has been the case in the wood-screw industry; the other and much more satisfactory way, is for a committee of experts to issue rules that all the manufacturers agree to abide by. Fortunately for the growth of electric lighting, lamp caps have been standardised. Now that the public are beginning to find out that electricity can be used for so many purposes

besides lighting, wall plugs and a number of other things should be made of one standard pattern, so as to make electricity as cheap and as easy to use as possible.

I propose in this article to deal only with such electrical accessories as may be found in any house or office. If the Cable Manufacturers' Association could only arrange some means whereby anyone could at once say that a particular wire was association or non-association grade, it would save

A consumer A breaks a clip and goes to a contractor B for a new one, who finds he does not stock this particular pattern. A goes back, ties a piece of lemonade wire round the fuse terminals, and after one or two more fuse clips break tells B to fix a new fuseboard.

The distance apart and the width of the fuse clip contact should be settled for certain definite pressures.

An example of lack of uniformity between four five-ampere



FIG. 7.—STATOR, SHOWING END SHIELDS.

FREQUENCY CHANGER FOR THE ERINDALE POWER CO. (see page 306).

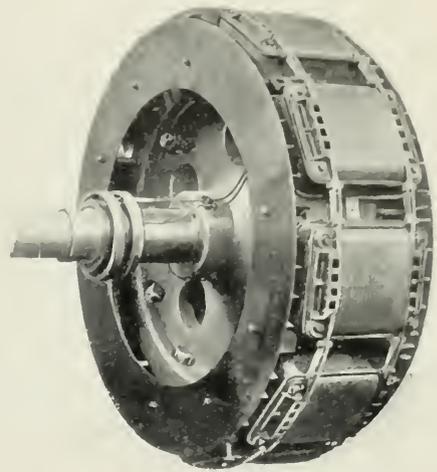


FIG. 8.—25-PERIOD ROTOR, SHOWING VENTILATING FANS.

the poorer contractors from taking such care of the labels from coils of association grade wire so as to make them last out a few coils of the other grade.

The screw thread for tubing should be standardised. At present contractors are put to considerable trouble through a tube from one maker not screwing into a T box bought somewhere else.

The number of types of main switches is legion, but this is not of such moment as the fuse question. Main and sub-fuses have to be frequently replaced, and it is essential that

250-volt porcelain clip fuses: the distances between fuse terminals were  $2\frac{1}{2}$  in.,  $2\frac{3}{8}$  in.,  $2\frac{3}{4}$  in., and  $2\frac{7}{8}$  in., and the thicknesses of the contact clip varied from  $\frac{1}{16}$  in. to  $\frac{3}{8}$  in.

A large firm are specialising in fuses of the screw-in Edison plug type. If these become popular other firms must be prevented, if possible, from making similar fuses having different screw threads. Switches do not give much cause for complaint, but wall plugs are most urgently in need of standardisation.

An example of the differences found between three five-amp. plugs by different makers: the distances between the centres of the contact pins were  $\frac{7}{16}$  in.,  $\frac{3}{4}$  in., and  $\frac{5}{8}$  in., and the diameters of the pins also varied. The use of wall plugs for irons, kettles, radiators and the like is increasing so rapidly that the lack of uniformity becomes very important.

Although the Edison type of screw lamp is not much used in this country except for battery work, the diameter and screw threads should be fixed. Attention was called to radiator lamps and their attachment by a prominent central station engineer a few weeks ago. He advocated a special

holder. Certainly the ordinary bayonet socket type suitable for a 50-c.p. Osram lamp is not suitable for carrying 1 ampere continuously. A screw-in connection similar to a "Zed" fuse seems very suitable, and should be standardised.

The connecting pins for electric kettles, irons, heaters, &c., all vary. An iron bought one year from a very prominent firm has a totally different sized connecting pin from

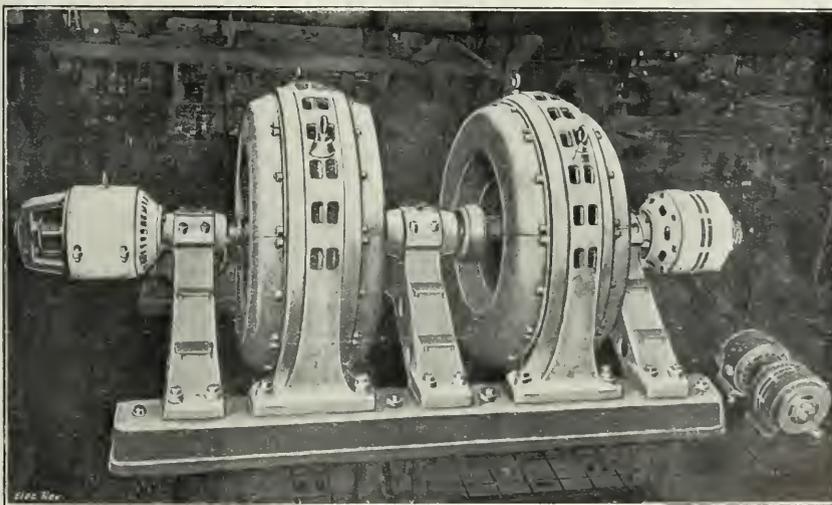


FIG. 9.—FREQUENCY CHANGER SUPPLIED TO THE ERINDALE POWER CO., CANADA (see page 306).

any non-electrical man should be able to do this, and make a good job of it with no risk to himself. For this reason I am a strong advocate of the spring clip type of fuse. The wire is visible, it can be replaced without fear of shock in the minimum of time. Now these clips vary: buy six fuseboards from six different makers and specify the same voltage and current in each case, and the chances are that not one of these clips will be interchangeable. What is the result?

an iron of the same size made two years later. A customer has therefore to state when ordering a new connector in what year his iron was made.

The time has undoubtedly now come when the electrical industry can standardise without anything but good resulting.

### THE NEW WORKS OF MESSRS. ECKSTEIN, HEAP & CO., LTD.

RECENTLY, through the courtesy of Messrs. Eckstein, Heap, we were enabled to inspect the new premises, known as the Lancashire Switchgear Works, in Caroline Street, Broughton, Manchester, into which they have moved, with a view to providing for a considerable extension of their business. It may be remembered that the concern was recently turned into a limited company, with Mr. Eckstein as managing director.

The new premises consist of three spacious floors, subdivided into various departments adapted for the firm's switch, fuse and instrument business.

The ground floor contains a machine shop fully equipped with capstan and other lathes, milling, grinding, drilling machines, &c., and adjacent to it an erecting shop for switchboards and mining switchgear, the latter being a recognised speciality with the firm.

A section of the ground floor is reserved for the packing department, and on each floor suitable stores are provided for the particular class of work carried on there.

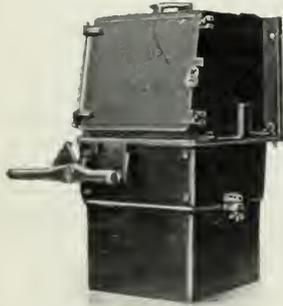
The test room equipment includes motor-generators and transformers for giving up to 10,000 volts pressure and several thousand amperes, but heavy material is tested in the shops by means of portable equipments on trolleys, which



THE DRAWING OFFICE, MESSRS. ECKSTEIN, HEAP'S NEW WORKS.

will give the necessary current and pressure range desired, and can be plugged into the local supply at convenient points.

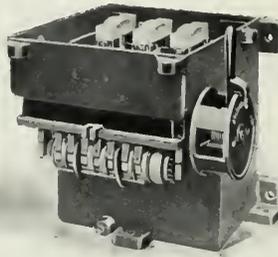
Amongst our views are some of typical productions turned



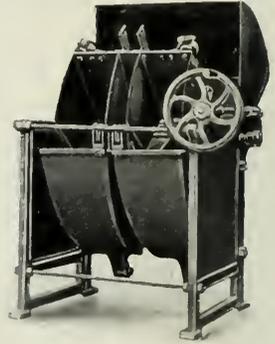
Auto-transformer Motor Starter.



Controller for Auto-starter.



Auto-transformer Starter with fuses.



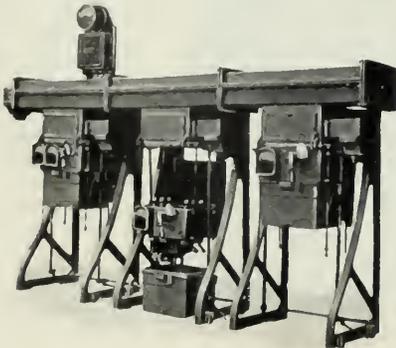
Liquid Starter.

#### SOME ECKSTEIN, HEAP SPECIALITIES.

The feature of the first floor is the extensive accommodation provided for the drawing office and estimating staffs, the counting house, board room and various private offices.

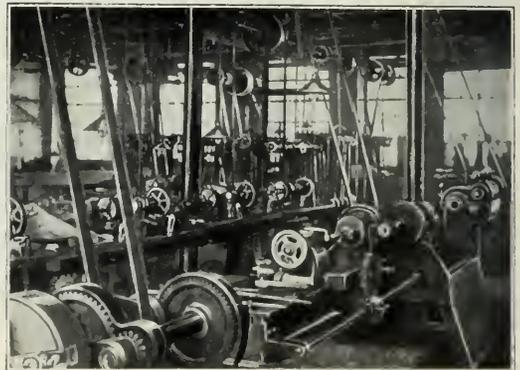
Elsewhere there are provided a shop for tool making and press work, an inspection room for small work, and depart-

ment by the firm, which it will be seen builds a very substantial type of switch for heavy service, such as in mines and factories, and pays particular attention to interchangeability of parts and ease of adjustment and renewal. In the case of mining switchgear, switches of 100 to 600 amperes



MINING SWITCHGEAR ARRANGED AS AN IRONCLAD SWITCHBOARD.

ments devoted to the construction of medium size switchgear, controllers, &c., coil winding and testing. The top floor is naturally reserved for the lighter class of work, such as knife switches, switch fuses, circuit breakers, fuses, &c., but it also contains pattern and instrument making shops, and an enamelling shop.



A CORNER OF THE MACHINE SHOP.

capacity are standard lines, while switches for use on switchboards ranging from 15 to 4,000 amperes capacity are also made. The firm always employs a toggle action in its switches, also standard contact units, which can be varied

in number as required, and nowadays the porcelain insulators in oil switches are readily replaceable, the older grouted-in insulator having been superseded.

During our visit many examples of mining switchgear for both low and high pressures were shown to us, and we illustrate an ironclad switchboard built up of mining units, and including bus-bar chambers, isolating links, trifurcating boxes, instruments, &c.

It may be noted that the overload and no-voltage trip coils are oil-immersed, as well as the current and potential transformers where these are necessary, thus providing perfect insulation; also that the switch parts and tank lowering gear are interlocked with the isolating links in order to ensure the operation of the oil switch prior to interference with the former gear.

We also illustrate two types of auto-starter; these are built for either star-delta or auto-transformer control, and can be fitted with automatic trips as required.

The firm does a large business in direct-current circuit-breakers, of the loose handle laminated brush type, fitted with carbon break and magnetic blow-out, for switchboard use, as well as in instruments for the same purpose.

In conclusion, it will be seen that the new company commences business under excellent conditions and well equipped to meet the exigencies of present day trade.

## COPPER.

THE sudden and heavy fall in price continues to be the subject of constant discussion. As is pointed out by the writer of an article in the *Times* (February 10th), the price at the beginning of last month for standard was £76½, while it is now little above £66, and touched this figure during the past week. The Balkan war is, of course, responsible for a general depression, but besides this the writer alludes to the stocks accumulating in the United States, and the fact that production has increased considerably. Production in that country is considerably ahead of the home consumption. In Europe, there is still a considerable margin between supplies and deliveries. Three-quarters of the European supply coming from United States, this must naturally be so. To the increased production and running ahead of consumption, the writer of the article attributes the reduction of the price by the American copper producers, from 17½ cents to 16½ cents per lb., which was the determining factor in the present fall.

In view of the fluctuations which affect the price of commodities when the greater part of the production is under one control, it is always good news to hear of fresh sources of production not yet tapped by the combines. A pamphlet is to hand containing reports of discoveries in the Russian Island of Nova Zembla, which, without claiming to be final so far as quantity is concerned, shows that considerable native outcrop copper is present in the district investigated. It claims to have proved the existence of two cupiferous veins of an average thickness of 15 to 2 metres each, and that these veins extend over a length of more than 2 kilometres; also that deposits of chalcopryite ore are present in the district (Miedny Peninsula). Concessions have been granted to a company in course of formation. Apparently, though in latitude 71°5' north the climate is naturally severe (average winter temperature - 15° to - 20° C.), yet there are settlements on the same island even further north which are inhabited the whole year round. The veins are under a kilometre from the coast.

So long as the United States continues to produce more than half the copper consumed in various parts of the world, it will naturally remain the dominant factor in any consideration affecting the copper market. The time when other parts of the globe will produce quantities allowing them to measure themselves with the United States in this respect does not, apparently, approach any nearer; on the contrary, the present policy of the United States producers appears rather to be one of holding back than of putting forth more effort to increase production. The usual annual summary of copper production figures appearing in the *Mining and Engineering World of Chicago* for January 25th, gives a useful and exhaustive summary of copper statistics for last year (1912). The present rate of consumption, we learn, may be largely increased by the use of copper in steel rails, on which experiments are being made. The presence of 1½ per cent. of copper appears to increase the useful life considerably. The use of copper for ornamental purposes is referred to, and even watch dials run into some hundreds of tons annually.

The increase in output of 1912 is the largest yet recorded, amounting to 230 million pounds (from estimates, final figures not being yet available).

In 1912 the United States produced 550,000 tons, against 490,000 in 1911. This is out of a world's production estimated at 977,000 tons. Against this production other figures show small, though many of them are quite healthy. Mexico is second with

68,000 tons, Japan shows third with 58,000, Australasia has 47,000, Canada 32,000, Russia 29,000, Germany 21,000 and Africa 20,000. The increases (over 1911), provided these figures are sufficiently near, are United States 15 per cent., Japan 5 per cent., Australia 7½ per cent., Canada 30 per cent., Germany 10 per cent. and Africa 15 per cent. Spain and Portugal alone show a decrease of 60 tons in an output of 50,000.

A table of the proportionate production of the United States to that of the globe is also given. This shows the percentage 162 in 1880, rising very steadily till 1895, when it was 60.8 per cent., then jumping to 55.0 for two years, afterwards declining, but attaining a maximum of 58.1 per cent. in 1906, and now being, according to the above figures, 56 per cent. As the figures assumed such large proportions the increase in the world's production fell off slightly, being 6 per cent. per annum for the latter half of the last century; in the present one it has been nearer 8 per cent. Variations have, of course, occurred, as in 1907, when the output was less than in the preceding year, but, taking the increase over the 12 years, the average will be found near this amount.

The leading territory in the United States for copper production is Arizona, which passed Montana in 1907. Its last year's output is estimated at 160,000 tons. Montana comes second with 138,000, Michigan third with 104,000, and Utah fourth with 65,000.

The Porphyry mines in Utah, Nevada, Miami, &c., are estimated to have produced 114,000 tons of the total. In Montana only one property—the North Butte—has deteriorated in producing ability and reserve of ore. In Lake Superior district, Calumet and Hecla mine shows a decrease of some 2,000 tons.

Coming to stocks, the beginning of the new year shows an increase of 7,000 tons over the end of the preceding one. Stocks were lowest in July, falling off since the commencement of the year, with heaviest drop in January. Production was highest in August and lowest in February—the difference between the two 12,000 tons, on an average of about 45,000. Domestic deliveries were highest in October and lowest in February.

Export deliveries were highest in January and lowest in April. Production increased 10 per cent. over 1911, domestic deliveries 15 foreign deliveries fell 1 per cent., and total deliveries gained 6 per cent.

The world's stocks as on December 31st were about 5,200 tons less than for the same date in the previous year.

On the financial side, 14 companies increased their dividends during the year, and four commenced paying dividends.

The lowest price for Lake Superior copper was in January 14½ cents. The highest was 17½, which appeared several times in June, August, September, November and December.

Electrolytic advanced pretty steadily throughout the year, being 14½ cents (low price) in January, and standing at 17½ (high price) from June onwards. Consumers, it appears, still refuse to carry heavy stocks of the metal, and thus refrain from stimulating the market with heavy orders. At the same time, the writer of the article considers that indications point to the first quarter of 1913 as a satisfactory one so far as dividends are concerned.

The influences on this market are at present so numerous that figures relating to it are of especial interest. In England the market is waiting for a clearer European outlook, and better conditions generally; in the United States the situation is affected by the Mexican war, by the question of production, and by the rumours concerning the health of one of the owners. The figures given by Messrs. Merton in their mid-monthly circular show an increase in the European visible supply for February 15th of 1,561 tons over the figures for January 31st. French stocks have increased 499 tons, and Dutch 1,430; Germany (Hamburg) is estimated to have increased 885 tons. English stocks, on the other hand, are 853 tons less.

Supplies from North America are heavy, though, of course, the half-monthly figures cannot be taken as being necessarily half the month's supply. Spain and Portugal's contribution is very small, Chile supplies are slightly low, Australian well maintained. The quantity afloat from Australia is large, 6,000 tons. The total deliveries are very fair at 22,993 tons, if the same rate be maintained. The average per month is 42,700 tons, and a 50,000-ton month is not often recorded, though last February exceeded that quantity.

**More New Terms.**—The proposal of a Standards Committee, composed of representatives of German and Austrian technical societies, to adopt the appellation "Neupferd" (new horse) for the unit of power (102 mkg/sec. = 1 kW.), has not met with general favour. In consequence, the Committee now puts forward alternatively "Grosspferd" (great horse), a term which of itself indicates that it is a unit of greater magnitude than the old (in the ratio of 102 to 75 mkg/sec.). What success awaits this new creation (says the *Zeit. für Ost. Ing. u. Arch.*) remains to be seen.

For our part, we shall simply go on calling it the kilowatt.

**The Electric Smelting of Copper Ore.**—It is stated that the Union Minière du Haut Katanga, which is the Belgian company engaged in the production of copper ore in the Katanga district of the Belgian Congo, and which placed a large quantity of raw copper on the Antwerp market for the first time in 1912, proposes to form a subsidiary company for the electro-metallurgical treatment of copper ore. The scheme contemplates the utilisation of waterfalls for this purpose.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—MR. H. T. BATES, who until recently occupied the position of resident engineer to the South Metropolitan Electric Tramways and Lighting Co., has been presented with a marble clock by his late colleagues. Mr. A. V. Mason, the general manager, in making the presentation, regretted Mr. Bates's resignation, and congratulated him on his appointment as resident manager to the Rothesay Tramway Co., wishing him every success in his new sphere.

The Torquay T.C. has increased the salary of MR. KEENAN, chief assistant engineer at the Electric Light Works, from £166 to £180 per annum.

The Barrow-in-Furness T.C. has increased the salary of the borough electrical engineer, MR. H. R. BURNETT, from £500 to £550 per annum.

The Dewsbury T.C. has increased the salary of MR. R. W. GRUBB, assistant electrical engineer, from £170 to £180 a year, rising by £10 per annum to a maximum of £200.

MR. J. MARTIN BLAIR, who was the Acton Council's electrical engineer from the inception of that authority's electricity undertaking until the transfer of the business to the Metropolitan Electric Supply Co., Ltd., has now severed his connection with the company, by whom he was engaged as local representative after leaving the Council's employment.

The St. Helen's T.C. has increased the salary of MR. J. W. WARR, outside superintendent at the electricity works, from £180 to £200 per annum.

BAILIE SMITH and MESSRS. P. G. STEWART and HANNAY, have been appointed, along with MR. W. W. LACKIE, chief engineer, by the Electricity Committee to represent Glasgow T.C. at the 18th annual conference of the Incorporated Municipal Electrical Association to be held in London in June.

The Bristol T.C. has increased the salary of MR. C. M. DAVIS, commercial engineer, to £200 per annum, and that of MR. A. J. NEWMAN, distribution superintendent, to £225 per annum.

The Electricity Committee of Bermondsey B.C. has decided to increase the salary of the electrical engineer (MR. W. E. J. HEENAN) by two annual increments of £50, to £625 per annum; also the salary of MR. L. A. LAWS (mains superintendent) from £185 to £200 per annum.

The salary of MR. J. H. BOWDEN, electrical engineer to the Peplur undertaking is, subject to the usual sanction, to be increased from £600 to £700 per annum, as from January 1st last. It is stated by the Council's responsible Committee that the salaries paid to the engineers of other electricity undertakings in London with similar outputs are considerably higher than that paid to Mr. Bowden, and under the circumstances they think that he is fully entitled to the increment.

On Friday evening last, at Bexley Heath, MR. CHAS. MITTELHAUSEN, late electrical engineer and tramway manager to the Bexley U.D.C., was presented with a pair of binoculars and a clock by the members of the various municipal departments. Councillor E. J. Reid presided, and the new electrical engineer, Mr. P. J. Stokes, was among those present. Councillor Reid, who had been for four years chairman of the Electricity Committee, said he had always found Mr. Mittelhausen the soul of courtesy and loyalty, and he congratulated him upon the results of his labours. Mr. Mittelhausen replied in suitable terms, and a few words from Mr. Stokes followed. The arrangements were made by Mr. S. Stone. On the following day, at a concert, the employés of the lighting and traction departments presented their late chief with a silver cigarette case.

**General.**—We have received a cutting from the *New York Herald*, reporting that last Saturday week at Halifax, N.S., Capt. Larnder, R. D. Legatte, watch officer, and James Himmelman, boatswain's mate, all of the cable steamship *Mackay-Bennett*, were honoured by the Dominion Government for a gallant rescue at sea. A handsome loving cup was presented to Capt. Larnder, a pair of binocular glasses to the watch officer, and a gold watch to the boatswain's mate. "It was just a year ago on the Georges Bank that between heavy snow equals and heavy weather the officer of the watch on the *Mackay-Bennett* thought he saw a vessel flying a signal of distress. A search was made, and at last the schooner *Caledonia*, heavily coated with ice, leaking, and her pumps choked, was observed. A boat in charge of Himmelman put off to the rescue, and the crew of six men were taken off the disabled vessel. The *Caledonia* was taken in tow, but when 60 miles from Halifax she capsized because of the tremendous weight of ice on her rigging and sides."

The *Times* states that in consequence of the absorption by the Underground Railways, Ltd., of the Central London Railway, MR. CECIL PARTRIDGE, general manager of the latter company since 1911, has accepted an offer of compensation, and will shortly retire.

Our readers will be interested to learn that MR. J. H. RIDER is leaving South Africa for a short holiday in the course of a month or two, and he will be in this country before Midsummer.

MR. R. H. CRIDGE, formerly of Messrs. Siemens Bros. Dynamo Works, Ltd., has been appointed by the Electrical Apparatus Co., Ltd., as their London representative for motor control and switchgear.

MR. CHARLES J. CLOSE has been appointed to represent the Marconi International Marine Communication Co., Ltd., in the North-Eastern Counties. Offices have been acquired at Milburn House, Newcastle-on-Tyne. The registered telegraphic address of the North County branch is "Expanse, Newcastle," and the telephone number is "Central 1125."

MR. H. R. KEMPE, who, as our readers are aware, recently retired from the position of principal staff engineer and electrician to the Post Office, was on Monday last presented with a silver tea and coffee service by Mr. W. Slings, engineer-in-chief, on behalf of his colleagues and friends at St. Martin's-le-Grand.

MR. C. D. CROMPTON has recently severed his connection with the Post Office Telephones, Manchester, and has taken up a position on the staff of Messrs. L. E. Wilson & Co., 20, Cross Street, Manchester. Before leaving he was presented by his late colleagues with a fountain pen.

MR. O. L. REMINGTON, manager of Messrs. W. McLean & Co., electrical merchants, of Melbourne, has arrived in London, and his address is at the Hotel Cecil. He is open to confer with firms and others who have special lines of manufacture for introduction to the Australian market.

**Obituary.**—MR. GEORGE MATTHEY, F.R.S.—We regret to record the death of Mr. George Matthey, which occurred on 14th inst. at Eastbourne. The deceased gentleman was 87 years of age, and he had been practically all his life a member of the well-known firm of Johnson, Matthey & Co., Ltd., of Hatton Garden, London. He joined it at the early age of 19, and a few years later became a partner. He relinquished his active association with the business some seven years ago. The *Times*, in alluding to Mr. Matthey's career, mentions his early interest in the development of platinum for commercial purposes, including chemical apparatus and electric lamps. "The iridio-platinum of which the standard metre was made was manufactured by his firm under his direct superintendence." He was decorated with the Legion of Honour, and in 1879 was made an F.R.S.

## NEW COMPANIES REGISTERED.

**Teleca Co., Ltd. (127,163).**—This company was registered on February 18th, with a capital of £2,000, in 1,750 participating ordinary shares of £1 each, and 5,000 deferred ordinary shares of 1s. each, to carry on the business of engineers, contractors, &c., and to acquire certain patents for an invention relating to a telephone cord attachment. The subscribers (with 100 participating ordinary shares each) are:—E. V. Cheese, 1, Albemarle Street, W., merchant; P. C. Anderson, 9, Goutfield Gardens, S.W., accountant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, 100 shares; remuneration, £50 each per annum, after 5 per cent. is paid on the participating ordinary shares. Registered by E. Anderson, 329, High Holborn, W.C.

**London Commercial Electrical Stores, Ltd. (127,131).**—This company was registered on February 12th, with a capital of £1,000 in £1 shares, to take over the business carried on at 65-7, Knightbridge Street, E.C., as the "London Commercial Electrical Stores," to carry on the business of electricians, manufacturers of and dealers in all kinds of electrical apparatus and sundries, &c., and to adopt an agreement with F. Taussig. The subscribers (with one share each) are:—H. H. Kemp, 35, Alexandra Park Road, Muswell Hill, N., clerk; F. Taussig, 65-7, Knightbridge Street, E.C., electrical engineer. Private company. The number of directors is not to be less than two or more than three; the first are F. Taussig (governing director), and P. J. White; remuneration of governing director £350 per annum. Registered office, 65-7, Knightbridge Street, E.C.

**Electricity Meters Patent Development Syndicate, Ltd. (127,175).**—This company was registered on February 14th, with a capital of £800 in £1 shares, to acquire British and Canadian patents granted to A. M. Billington and W. H. Johnson relating to electricity meters, and to adopt an agreement with the Johnson-Billington Electricity Meters, Ltd. The subscribers (with one share each) are:—H. B. Spiller, 28, Hastings Road, Ealing, W., stockjobber; H. Harrison, 11, Victoria Street, S.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. B. Spiller, H. Harrison and C. W. B. Brisdon; solicitor, J. T. Goddard, 5-6, Clement's Inn, W.C. Registered office, 155, Salisbury House, London Wall, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Varley Magnet Co., Ltd.**—Particulars of £2,500 debentures, created January 21st, 1913, filed pursuant to Sec. 93 (b) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,400. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Bryant Trading Syndicate, Ltd.**—Mortgage debenture, dated January 23rd, 1913, to secure £5,000, charged on company's undertaking and property, present and future. Holder: J. T. Bentley, Dovercourt, Essex. This debenture ranks subject to debentures already issued by the company to Messrs. Jagard & Golding, but in priority to the debenture issued to C. B. James for £21,000.

**C. H. Hare & Co., Ltd.**—Present capital £16,000 in £1 shares (8,000 pref.); original capital, £12,000 in £1 shares (4,000 pref.); increased to present amount February 26th, 1912. Return dated December 30th, 1912; 5,200 pref. and 8,000 ord. shares taken up; £1 per share called up on 5,200 pref. and 502 ord.; £5,702 paid; £7,493 considered as paid on remainder. Mortgages and charges: £3,500.

**X. L. Electric Co., Ltd.**—Debenture dated January 15th, 1913, to secure £400, charged on the general assets. Holder: Capt. C. Wiener Ewell.

**Electricity Supply Co. for Spain, Ltd.**—Particulars of £250,000 debentures, created November 8th, 1898, and having the benefit of a trust deed of same date, filed pursuant to Sec. 98 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £6,000. Property charged: The company's undertaking and property, including uncalled capital. Trustees: A. B. Monks, 123, Cannon Street, E.C., and C. Hill, 88, Lendalhall Street, E.C.

**Alfred A. Secrett, Ltd.**—Debentures dated December 31st, 1912, to secure £105, charged on the company's undertaking and property, present and future. Holder: F. W. Laveis, 75, Waddon Road, Croydon.

**Blackpool, St. Anne's and Lytham Tramways Co., Ltd.**—Particulars of £20,000 debentures, created by resolutions of January 13th and March 13th, 1905, and December 23rd, 1912, filed pursuant to Sec. 98 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Sykes & Sugden, Ltd.**—Mortgage dated January 22nd, 1913, to secure £720, charged on leasehold land in Spring Place, Huddersfield, with the Spring Place Works thereon, and machinery, shafting, &c., therein, also leasehold land in George Street, Huddersfield, with dwelling house, &c., thereon. Holders: Huddersfield Equitable Permanent Benefit Building Society, Huddersfield.

**Filaments, Ltd.**—A memorandum of satisfaction in full of debentures, dated February 11th and January 1st, 1910, securing £220, has been filed.

**G. H. Turner & Co., Ltd.**—Issue on January 28th, 1913, of £100 debentures, part of a series of which particulars have already been filed.

**Strode Co., Ltd.**—Particulars of £15,000 debentures, created January 20th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £12,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**I.T.C., Ltd.**—A memorandum of satisfaction to the extent of £1,500 of debentures, dated July 26th, 1910, securing £3,000, has been filed.

**New System Private Telephone Co., Ltd.**—A memorandum of satisfaction to the extent of £1,000 on January 8th, 1913, of debentures dated January 7th, 1908, securing £3,000, has been filed.

**United Electric Car Co., Ltd.** (formerly Electric Railway and Tramway Carriage Works, Ltd.)—A memorandum of satisfaction to the extent of £20,000, on January 1st, 1913, of mortgage dated November 28th, 1901, securing £50,000, has been filed.

**Magneta Time Co., Ltd.**—Debenture dated February 3rd, 1913, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: M. D. Fox, 103, Phinbeach Gardens, S.W.

**Amazon Telegraph Co., Ltd.** (44,532).—Capital, £250,000, in £10 shares. Return dated December 2nd, 1912. All shares taken up. £250,000 paid. Mortgages and charges: £285,800.

**Douglas Southern Electric Tramways, Ltd.** (45,701).—Capital, £50,000 in 30,000 pref. and 20,000 ord. shares of £1 each. Return dated December 17th, 1912, filed January 8th, 1913. 25,573 pref. and 15,472 ord. shares taken up. £1 per share called up on 12,566 pref. and 8,804 ord. £18,370 paid. £3,075 considered as paid on 13,407 pref. and 9,668 ord. Mortgages and charges: Nil.

**Costa Rica Electric Light and Traction Co., Ltd.** (56,447).—Capital, £130,000 in £1 shares. Return dated January 3rd, 1913. All shares taken up. £7 paid. £129,993 considered as paid. Mortgages and charges: £267,700.

**Foster Engineering Co., Ltd.**—Issue on February 7th, 1913, of £2,000 debentures, part of a series of which particulars have already been filed.

**Accumulator Industries, Ltd.** (67,180).—Capital, £40,000 in £1 shares. Return dated January 14th, 1913; 37,006 shares taken up; £1 per share called up on 26,506; £26,484 paid, leaving £2 in arrears; 10,500 shares considered as fully paid. Mortgages and charges: Nil.

**Electromobile Co., Ltd.**—Issue on January 30th, 1913, of £309 15s. debentures, part of a series of which particulars have already been filed.

**James Keith & Blackman, Co., Ltd.**—Issue on February 12th, 1913, of £1,000 debentures, part of a series of which particulars have already been filed.

**Foreign and Colonial Lighting Co., Ltd.**—Charge on company's undertaking, property and rights of all kinds, dated February 12th, 1913, to secure £210. Holder: A. B. Reikett, Kenmore, Highlands, St. Leonards-on-Sea.

**Pontelec Welding Patents, Ltd.** (107,935).—Capital, £30,000 in £1 shares (20,000 ord. and 10,000 pref.), return dated January 2nd, 1913; 20,000 ord. and 5,000 pref. shares taken up; £5,000 paid on the pref., £20,000 considered as paid on the ord. Mortgages and charges, £1,800.

**British Electric Transformer Co., Ltd.**—Satisfactory results. Available balance, £24,714; reserve, £9,000; preference dividend, £2,597; 10 per cent. dividend on ordinary shares, £7,895; directors' extra remuneration, £1,108; carry forward, £4,117. Meeting, February 28th.

**W. T. Henley's Telegraph Works Co., Ltd.**—Profit, £92,069, less fees, debenture interest, depreciation, &c., £23,986 = £68,083 + £36,862 brought forward and £4,011 Bahamas Florida securities. Total, £108,987. Put to depreciation of securities, £1,219; to reserve, £15,000; bonus distributing Bahamas Florida fund, £4,000. Preference dividend, £9,000; dividend on ordinary shares (15 per cent.), £30,000; carry forward, £45,017. Meeting, February 28th.

**Para Electric Railways and Lighting Co., Ltd.**—Revenue, less expenses, £133,038. After providing for interest and sinking fund, preference dividend, depreciation (£15,000), contingencies (£15,000), 5 per cent. is paid on ordinary shares, and £9,870 carried forward. Operating expenses decreased; difficulties overcome. Meeting, February 28th.

**Telegraph Construction and Maintenance Co., Ltd.**—Net profit £109,619 + £106,658 brought forward = £216,277. Interim dividend, 5 per cent., £22,410; further dividend, 10 per cent. and bonus of 12s. per share, require £67,230; reserve fund, £20,000; carry forward, £106,637. General business of the year satisfactory. Meeting February 27th.

**London Electric Supply Corporation, Ltd.**—Profit £68,670, compared with £61,412. Available after debenture interest and sinking fund £40,983. Preference dividend, £26,952; 2½ per cent. on ordinary, £8,325; contingencies, £1,000; carry forward, £4,706. New reserve fund opened in form of sinking fund account, to receive £12,000 annually for redeeming debenture stock in 1931. Supply for traction 75 per cent. increase, and for industrial purposes 26 per cent.; units sold advanced from 20½ to 28½ millions; total costs reduced by 20 per cent. To meet L. B. & S. C. demand new capital (£250,000) will have to be raised. Meeting, February 27th.

**Mackay Companies.**—The report states (says the *Financier*), that the profit and loss account for the past year shows the following results: Receipts.—Income from investment in other companies, \$4,136,009. Disbursements.—Dividends paid on the Mackay Companies' preferred shares, \$2,000,000; dividends paid on the common shares, \$2,069,020; operating expenses, \$31,323; leaving to be carried forward \$35,665. The most notable event of the year in connection with the Mackay Companies is an invention by Mr. John Gott, who has been the chief engineer of the Commercial Cable Co. since its organisation in 1884. He has invented a device by which the Morse dot-and-dash signals can be used on long submarine cables—that is to say, messages can be sent by the ordinary landline Morse key and read on a Morse sounder. The far-reaching effect of this invention on all kinds of telegraph transmission, both by land and sea, cannot at this time be definitely stated, but the Commercial Cable Co. believes that, by this invention, it will be possible to transmit, through automatic repeaters, telegraph signals around the world. The Commercial Cable Co. has acquired the rights to this invention, and has taken out patents all over the world.

**African Trans-Continental Telegraph Co., Ltd.**—The liquidator (Mr. P. J. Baird), presiding at a meeting held at 2, London Wall Buildings, E.C., on 13th inst., referred to the impracticability of realising an undertaking of this nature by sale in the ordinary way. There were matters difficult to overcome consequent upon terms arranged for the extensions into Portuguese, German, and other territory. They hoped that present negotiations with the Imperial and the German Governments might result in the adjustment of these difficulties and the continuation of the service. They were now waiting for the reply of H.M. Government to proposals submitted last October, and meanwhile the service was being continued under a guarantee by the British South Africa Co. against loss on working. The meeting is reported in the *Times* of February 14th, from which we gather that "under no conceivable circumstances" will there be any return to the shareholders "who must . . . write off their shares as valueless."

**Continental.**—SWITZERLAND.—La Société Franco-Suisse pour l'Industrie Electrique, of Geneva, is declaring a dividend of 5 per cent. for the last financial year, as compared with only 4½ per cent. in the preceding 12 months.

HUNGARY.—The Felten und Guillaume Ungarische Kabelfabrik Gesellschaft, of Budapest, reports a profit of £29,647 for the last financial year, as compared with only £27,454 in the preceding 12 months. The dividend is being increased from 16½ to 17½ per cent.

**Gateshead and District Tramways Co.**—The directors have resolved to recommend (subject to audit) that a dividend at the rate of 7 per cent. per annum be paid on the ordinary shares for the half-year ended December 31st, 1912, making with the interim dividend at the rate of 5 per cent. per annum for the half-year ended June 30th, 1912, paid on September 20th last, a total of 6 per cent. for the year 1912, and that in addition a bonus of 1 per cent. be paid on the ordinary shares. The annual meeting is called for March 13th.

**Stock Exchange Notice.**—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of £33,000 5 per cent. 50-year mortgage bonds of £100 each

## CITY NOTES.

### Late City News.

JUST as we are going to press there has arrived a batch of company reports, from which we extract the following. The full reports will be referred to further next week:—

**Bruce Peebles & Co., Ltd.**—Results less satisfactorily than 1911. Adverse balance, £4,594. Trading seriously affected by strikes and consequent disorganisation. Prospects now better, owing to improving prices and demand. Meeting, Edinburgh, February 28th.

### German Electrical Companies.

**The Deutsche Glühlampen Fabrik of Plauen**, which was formed in 1910, with a share capital of £100,000, has just decided to reduce the capital to £50,000. At the same time, preference shares of from £12,500 to £25,000 are to be issued to provide working capital.

**The Berlin Elektromobil A.G.** has terminated the financial year 1911-12 with a deficit of £149,000, which is practically the same as in the preceding year, the share capital being £150,000. When the Halensee depôt has been sold, and certain actions for damages have been settled, the liquidation can be closed. The depôt is booked at £37,000, whilst mortgages of the same amount are in operation.

**The Helios, Elektrizitäts A.G., of Cologne**, the liquidation of which is occupying several years, disposed of Roumanian investments at Braila and Bucharest in 1911-12, as well as the holding in the Altona-Blankenese Railway. Further payments were made to creditors, and the debenture-holders have now received 75 per cent. in cash, and the banks 80 per cent. An interest is still held in two supply works and one tramway. The deficit remains at £419,000, as in 1910-11.

**The Moore Licht, A.G., of Berlin**, which was formed in 1910, and has already been subject to one scheme of financial reconstruction, has now convened an extraordinary meeting to consider a further reorganisation in view of the fresh loss of £13,000 incurred in 1911-12. It is now suggested that the preference and ordinary share capital of £70,000 should be reduced to £9,500, and that a further issue of preference shares of £3,000, having a prior right over existing preference capital, should be made. The patents for the Moore light for France and Belgium are to be sold.

**The A.E.G.-Lahmeyer Werke, of Frankfurt-on-Main**, which took over the dynamo works of the Felten & Guilleaume Co. two years ago, report gross profits of £35,500 for 1911-12. After meeting general expenses and placing £2,340 to depreciation, as against £2,380 in 1910-11, the net profits are returned at £31,900, as compared with £28,800 in the six months forming the previous and first financial year. A dividend of 6 per cent. has been declared on the share capital of £500,000, this being the same rate as in 1910-11 for six months.

The liquidation of **E. H. Geist, Elektrizitäts A.G., of Cologne**, reporting on the year 1911-12, states that manufacturing operations were continued until January 1st, 1912, when the works were taken over by the Colonia Electricity Co., which then completed the unfilled orders on the books. The accounts show gross profits of £9,600 in 1911-12, as compared with £7,200 in the previous year, the former sum being absorbed by general expenses and depreciation. The debit balance remains at £24,000 on a total share and loan capital of £55,000. It is stated that the Colonia Co., which was granted an option for five years on the works, plant and site, has not exercised the right as yet.

**The Bergmann Elektrizitäts Unternehmungen A.G.**, which was formed to financially promote railway construction and central stations on behalf of the parent company (Bergmann Electricity Works Co.), has closed the year 1911-12 with a fresh loss, which amounts to £17,000, as compared with a loss of £15,000 in 1910-11. The directors' report states that further progress was made in the business of the railway department, but activity in the central station department was suspended, and the work restricted to the completion of the undertakings in hand. The limitation in this direction is in accordance with the programme decided upon some time ago.

**Mather & Platt, Ltd.**—The directors' report, as abstracted in the *Times*, states that the net profits for 1912, after charging depreciation and directors' remuneration and expenses, amounted to £144,749. The directors have transferred to the works removal account £30,000, leaving £114,749, plus the balance brought forward, making a total of £147,506. The directors recommend a dividend of 10 per cent. per annum, free of tax, on the ordinary shares (less the interim dividend), together with a bonus of 2 per cent. free of tax, and propose to transfer to reserve account £20,000, and to carry forward £35,506. The large extensions at the company's Park Works referred to in last year's report have been carried out. The directors do not anticipate that any further allocation from profits will be necessary in respect of works removal.

**Underfeed Stoker Co., Ltd.**—The directors (according to the *Financier*) have declared a dividend at the rate of 2½ per cent. per annum.

**City of London Electric Lighting Co., Ltd.**—The directors have decided, subject to completion of audit, to place £50,000 to reserve, and to recommend dividends of 12s. per share (at the full rate of 6 per cent. per annum) on the preference shares, and 16s. per share (at the rate of 8 per cent. per annum) on the ordinary shares. On account of these dividends, 6s. per preference share, and 6s. per ordinary share, was paid in September, 1912, and the balance remains to be paid. After payment of the dividends and other appropriation, there will remain about £24,000 to be carried forward. In addition, the directors have also decided to recommend a bonus of 2s. per ordinary share (less income-tax) out of the amount standing to the credit of the dividend equalisation fund.

**Metropolitan Railway Co.**—At an extraordinary general meeting, held on 12th inst., the proposal to acquire the G.N. and City Railway Co.'s undertaking was approved by an overwhelming majority.

### St. James's and Pall Mall Electric Light Co., Ltd.

Mr. M. R. PRYOR (chairman) presided on Tuesday at the offices, Carnaby Street, S.W., over the annual meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 270), the CHAIRMAN referred with regret to the absence of Mr. Leaf, the chairman, who had an attack of influenza. He also asked the shareholders to join with the board in sympathetic regret at the death of Sir J. H. Morris, who was the senior member of the board. They would, doubtless, know that Mr. F. J. Walker became the manager and secretary of the company at a time of very great anxiety, and it was due, in the first place, to his efforts, that the present situation of the business—second to none, he ventured to say, for soundness and success amongst the electric companies of London—was due. The board had considered that Mr. Walker's exceptional services deserved exceptional recognition, and they had, therefore, invited him to take the vacant seat on the board, but with the title of managing director. They had appointed him to the post for a period of five years, during which he would not be subject to the condition of retirement imposed on the other directors. He trusted that was entirely in accordance with the shareholders' wishes, and he need hardly say he looked on it as a very important benefit to the company to secure the services of Mr. Walker in the dual capacity. On reading through the accounts, they must have been struck with the similarity they showed to those of the previous year. The sale of electric current, although still showing the effects of the metallic-filament lamp, and by no means so elastic as they could have hoped it would have been, showed some improvement. Connections had increased by no less than 634 kw., and the units sold had gone up a little more than 300,000. The gross revenue from the sale of current had increased by £2,300. There had been an almost similar increase in the cost of generation, viz., £2,100, and the ultimate result arising from various differences too small to call attention to, although they were kept well in view by the board, was that the balance available for dividend was £54 less than last year. In view of a fact, to which he would refer later, this result was, in their opinion, very satisfactory, and it was a good deal better than they had dared venture to hope for a year ago. He would like to draw attention to the fact that this did not involve any difference in the sums put aside for depreciation and contingencies. Last year the chairman told them they had in view the replacement of some old and obsolete units at Carnaby Street station by new transforming generators and accumulators. They had steadily pursued the policy of keeping the station up to date, and the first stage in the improvement would be carried out in the summer. The appearance of quietude which the figures seemed to show was really illusory. The outstanding feature of the year was the great coal strike, which they were anticipating when they last met, and the storm burst a fortnight later. Their assurance that they had made sufficient provision for any period of time over which the strike could reasonably be expected to last was justified by events, and the store they had accumulated at Grove Road carried them through without the necessity of stinting the supplies in any way, a result of which they ventured to feel somewhat proud. But although the most obvious difficulty was thus averted at the cost of continuous vigilance and anxiety on the part of Mr. Walker and Mr. Dobson, yet the strike left a legacy in the shape of the increased cost of coal, and this he feared they must consider permanent, although part of the increase was due not to the strike, but to the great industrial activity which was characteristic of the past year, and so far showed no sign of decrease. It might interest them to know that the cost of Midland bituminous coal which, at the time of the strike was, on a four years' average 11s. 4d. a ton, rose after the strike to 14s. 9d. per ton, which was a 30 per cent. increase. In view of this great rise, it reflected the highest credit on their engineer, that the total cost of generation had not increased beyond the additional revenue. This had been done by increased efficiency at Grove Road station, on which they relied for the whole steady load, using their Carnaby Street station only to help on the peak. The new 3,000-kw. turbo-generator, of which the chairman spoke last year, had proved of inestimable value, and they had to take into serious consideration on the board of the Central Co. the need of adding more plant of a like character before long. That was not the immediate problem for them there, but he mentioned it as a fresh argument for their policy of converting Carnaby Street from a generating to a transforming station. In the absence of the chairman, he hesitated to analyse the accounts, but they were exceedingly simple and did not contain any points on which he could advantageously dwell.

Mr. B. FITCH seconded the motion, and the report was adopted. On the motion for the re-election of the retiring directors, proposed by the CHAIRMAN, Mr. W. H. Ash and Mr. Patchell congratulated the board on having elected Mr. Walker to his new position. Mr. BOURN proposed a vote of thanks to the chairman and board, and also to Mr. Dobson and the engineering staff. The motion was carried, and the CHAIRMAN, in reply, heartily reciprocated the words of Mr. Bourn as to the loyalty and hard work of Mr. Dobson and his staff.

Mr. WALKER, in acknowledging what had been said regarding himself, remarked that he fully appreciated the high compliment which had been paid him, and would devote the same care and attention, coupled with the same enthusiasm, to the affairs of the company as in the past.

**Bournemouth and Poole Electricity Supply Co., Ltd.**—The directors have declared a final dividend on the ordinary shares at the rate of 7 per cent. per annum for the half-year ended December, making 6 per cent. for the year, less income-tax

### Rand Mines Power Supply Co.

THE *South African Mining Journal* contains a report of the fourth annual meeting of this company, held in Johannesburg last month. Mr. F. D. P. Chaplin presided, and said that the report and accounts showed the rapid progress which the company had made since entering the revenue-earning stage, and indicated that there was every prospect of a considerable growth in the company's business in the immediate future. Notwithstanding the fact that they were still partly in the construction stage, they were able to earn a profit of close upon a quarter of a million during the financial year ended August 31st last. This satisfactory result would have been even better but for the unfortunate breakdowns, which involved not only the payment of penalties, but also a considerable loss of revenue, as well as increased expenditure in bringing the plant again into commission. The company's experience in regard to breakdowns appeared to be one which was inseparable from the entry of large generating units into commercial service, especially when, as in this case, the commencement of operations was accelerated on account of urgent and increasing demands for power before sufficient reserve plant was available. However carefully the machine was designed and constructed, reliability could only be secured through experience gained in actual operation. There could be no question, however, that the policy adopted enabled the company to derive the greatest possible advantage in the shape of revenue from the full output of the plant, and at the same time furthered the interests of the consumers by the provision of the available supply of power at the earliest possible date. Adequate arrangements had been made for the extension of the company's generating stations and transmission and distribution systems. Everything possible was being done to provide a sufficient supply of power to meet notified future demands, and, provided that the manufacture of plant and the progress of the extension works were not hampered by delays due to strikes in Europe, and other causes, which had been their unfortunate experience in the past, there was every reason to believe that the company would soon be provided with the full complement of plant and equipment, inclusive of reserve plant necessary to meet all requirements. After the company had commenced operations, experience soon indicated that there were several defects in the agreement between the company and the Rand Mines, Ltd., which would have to be remedied, and certain alterations would have to be made before the contract could be regarded as a workable instrument and satisfactory to the parties concerned. The decision to draw up a new agreement and form of contract was no light undertaking, and not only entailed very difficult negotiations between the representatives of the board, acting with the Victoria Falls and Transvaal Power Co., Ltd., and the representatives of the Rand Mines, Ltd., but also involved an immense amount of labour and care in the preparation of such important documents. This new contract, although not yet finally agreed, was now in the hands of the representatives of this company and the Rand Mines, Ltd., in London, and they expected very shortly to hear that the document has been completed. As the result of the very close relations which had been found to exist between this company and the Victoria Falls and Transvaal Power Co., Ltd., it had been thought advisable to arrange the accounts upon a basis which was not originally contemplated. As a part of this arrangement, it was found advisable that one firm of auditors should audit the accounts of both companies, and it had consequently been arranged, in order to bring this about, that a change should be made in the auditors of this company.

The report and accounts were adopted.

### Electrical and Industrial Investment Co., Ltd.

The first ordinary general meeting of this company was held on Monday at Electrical Federation Offices, Kingsway, W.C., Mr. C. Shirreff Hilton, the deputy chairman, presiding in the absence, abroad, of the chairman, Mr. E. Garcke.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 269), said he believed the shareholders would consider the balance-sheet thoroughly sound and satisfactory. During the seven months with which the accounts dealt, they had made a profit, after meeting all administration expenses, of £11,325. That profit was derived from interest and dividends on investments and from fees and commission on financial services. After paying interest on the debentures and the dividend on the preference shares, there remained a balance of £4,943. Out of that it was proposed to write off the whole of the preliminary expenses, amounting to £1,629, and to carry forward the balance of £3,314. There would have been no difficulty in recommending the declaration of a dividend on the ordinary shares, but the large holders of those shares agreed with the directors in the view that the better course was to strengthen the position of the company by building up a large carry-forward in the early history of the company's career. The shareholders could well afford to go without a dividend on the ordinary shares on this occasion, because they received a very handsome return on the liquidation of the City of Birmingham Tramways Co.; and they were receiving a dividend on the preference shares which they held, which was a substantial return on the cash capital they had invested. Of course they were not losing the undivided profits—they were still there, and they would serve to improve the value of the ordinary shares. The company was formed last May, to take over the investments of the City of Birmingham Tramways, Ltd., and the capital was subscribed for the main part by shareholders and debenture-holders of that company. The securities which they took over amounted to over £604,659, but the issued

capital of the company amounted to £381,808, so that securities to the extent of about £222,000 had to be realised. That surplus of securities was represented by investments which had been made by the trustees for the debenture-holders of the City of Birmingham Tramways, Ltd., and were made in trustee securities. The nominal value of those securities was £211,400, and they had cost the trustees £219,591. As the yield on those securities was only 3½ per cent., there was no advantage in raising capital for the purpose of holding them, and they were, therefore, realised. Unfortunately, gilt-edged securities during the last few years had suffered serious depreciation, and the losses suffered on the realisation of those securities by the company amounted to £22,468, or about 10½ per cent. of the capital amount. It was well, however, that they were sold, for those high-class securities had undergone a still further depreciation, and the losses would undoubtedly have been greater had they been retained. The loss had been charged against the reserve, which had been created to meet depreciation. A part of that reserve was provided by the old company, but a further addition to that fund had been made, and would continue to be made, by adding to it any profit which the company had made, or would make, by the realisation of investments. On the other hand, any loss that might be made on the realisation of investments would be borne by that reserve. By dealing with profits and losses in that way they hoped to establish the company in a strong position. Their policy was to keep the capital account distinct from the revenue account, and to hold all investments at their actual cost—they did not propose to write them either up or down. The present investments amounted to £485,866, and they were spread over 179 investments. Of those the larger proportion were quoted securities, and taking them at the middle price at December 31st, and taking the other securities at cost, the aggregate value was more than the net figure at which they stood in the balance-sheet. The major part of the investments—£261,000—were in the form of debentures and debenture stocks; £126,000 were in preference shares, and only £86,000 in ordinary shares. The board had special facilities which enabled them to gauge the value of electrical investments, and as most of the investments were made by the City of Birmingham Tramways, Ltd., whose powers of investment were limited to tramways and kindred securities, a large number were in electric power and traction undertakings, electric lighting, tramways and railways. It was desirable that they should raise a little further capital by the issue of ½ per cent. debentures so as to reduce the average cost of their capital, and as opportunity offered, the directors proposed to issue further debenture stock.

Mr. J. A. CHRISTIE seconded the motion, and the report was adopted.

### Kensington and Knightsbridge Electric Lighting Co., Ltd.

THE directors' report to the end of 1912 shows that the renewal and reserve fund account now stands at £115,361, being an increase of £8,746. After providing for the amount placed to that account, and paying the dividends on the 6 per cent. first preference shares to June 30th, 1912, on the 5 per cent. second preference shares to September 30th, 1912, and an interim dividend at the rate of 8 per cent. per annum on the ordinary shares for the first half of the year, the balance standing to the credit of the net revenue account for the year 1912 is £9,159. Out of this £1,500 has been appropriated to the payment of the first preference dividend to the end of the year, and £625 has to be set aside to meet the portion of the dividend on the second preference shares accrued to the same date. It is proposed to pay out of the balance of £7,034 a further dividend on the ordinary shares at the rate of 10 per cent. per annum, for the past half-year, making, with the interim dividend paid on August 16th, 9 per cent. for the year. This will leave a balance of £1,784 to be carried forward.

The meeting is called for February 27th, at 148, Brompton Road, S.W.

**Crossley Brothers, Ltd.**—The directors report that for the year ended December, 1912, the amount to the credit of revenue account is £56,322, out of which a dividend has been paid on the preference shares, at the rate of 5 per cent. per annum, for the first half of the year, amounting to £10,085. It is proposed to pay a further dividend for the second half of the year at the rate of 5 per cent. per annum on the preference shares amounting to £10,085, and to carry forward £36,153. The decrease in profits is due to the serious reduction in the normal output caused by the prolonged strikes at the Openshaw works during the months of January, February, and September. The meeting is called for February 25th, at Manchester.

**Chelsea Electricity Supply Co., Ltd.**—The directors recommend a dividend for the half-year to December 31st, 1912, at the rate of 6 per cent. per annum on the ordinary share capital, making 5 per cent. for the year 1912, after paying debenture interest and placing £13,626 to depreciation fund, £704 to debenture premium redemption fund, writing off £1,089 from the cost of extinction of founders' shares, £1,000 from cost of purchase of Cadogan Electric Light Co., and £1,352 off cost of investments; carrying forward £2,832, subject to audit. The dividend is the same as for 1911, and will be payable on and after March 15th.

## Westminster Electric Supply Corporation, Ltd.

THE directors' report for 1912 shows that the total power of the lamps, motors and apparatus connected to the company's mains had increased from 35,337 kw. to 37,710 kw. The length of roadway in which continuous-current mains have been laid now exceeds 93 miles, making about 377 miles of ways, into which upwards of 280 miles of copper (strip and cable) have been drawn. In addition six miles of trunk mains (35 miles of ways) are laid in the company's area to connect the stations with the Central Electric Supply Co.'s station at St. John's Wood. An interim dividend at the rate of 9 per cent. per annum on the ordinary shares, and the dividend on the  $\frac{1}{2}$  per cent. preference shares, for the half-year ending June 30th, 1912, have been distributed. After allowing for depreciation, sinking fund and other charges, the net balance is £17,840, from which must be deducted the second half-year's dividend on the preference shares, which absorbed £11,653, leaving £36,188. Out of this the board recommend the payment of a dividend at the rate of 11 per cent. per annum, less income-tax, for the past half-year, making 10 per cent. for the year, carrying forward £7,703.

The meeting is called for February 26th.

Units sold	18,638,125
Used on works for lighting, meter testing, &c.	496,376
Total	19,134,501
kw. on circuit	37,710

## Liverpool Overhead Railway Co.

THE forty-ninth half-yearly general meeting was held on February 11th, at Liverpool, Mr. Harvey C. Woodward presiding over a good attendance.

THE CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, p. 233) regretted that ill-health had compelled Sir William Forwood to resign the chairmanship of the company, and the directors had appointed him (Mr. Woodward) to fill the vacancy. Sir William had been chairman of the company from its inception, and had always taken the keenest interest in its successful working. His colleagues on the board missed his presence greatly, but hoped that he might yet be able to take some part in their deliberations. With the kind assistance of his co-directors and the faithful co-operation of the manager and staff, he hoped to see their little railway steadily improve its position. The directors were gratified at being able to place before the shareholders more encouraging accounts. There had been a considerable boom in the trade of the port, in which that railway had fortunately participated, and which was reflected in their increased earnings. They had carried during the half-year 559,040 more passengers, which yielded an increased revenue of £3,245, at an increased expenditure of £1,181. He could assure the shareholders that they had not neglected the up-keep of the undertaking, but had steadfastly adhered to their policy of maintaining its efficiency. The railway had now been opened 20 years, and it was to-day structurally in as good a condition as ever. The coal strike imposed upon them the necessity of carrying reserve stocks of coal; they obtained a suitable position near their generating station, where they had stocked a good supply. Their traffics were keeping up well, and they had already made three records this year in the number of the cheap workmen's return tickets. It was anticipated that his Majesty the King would open the new Gladstone Dock at Seaford in July. When that dock was in operation many of the big liners would, no doubt, be transferred to it from Canada Dock, and that, together with the new repair yard of Messrs. Harland & Wolff, adjacent to the railway, should increase their receipts still further in future. The traffic during the past half-year was the best they had had since December, 1900 (an exceptional year, owing to transports for the South African war), and, taking into consideration the serious competition which they had encountered since that date, the result was satisfactory. But he did not wish to make the picture too rosy. They were still exposed to keen competition. The cost of fuel and all materials had steadily increased, and concessions to their staff were a heavy item in increasing their expenses; while the Government, following on the Workmen's Compensation Act, had added a new burden in the shape of sickness and unemployment insurance. In the face of these obstacles to good dividends, their earnings per passenger tended rather to diminish, and last year averaged only 1'67d. per passenger, against 1'93d. in 1904. These fractions did not convey much to a general audience, but on the workmen's cheap tickets the reduction in fares practically amounted to carrying fully 1,000,000 more passengers in 1912 than in 1904 for about the same return in actual money, and they could only rely upon increased traffic for further improvement in their receipts. With regard to the debenture issue, the advance in the Bank of England rate to 5 per cent., and the European war, rather tended to hinder its success, but they succeeded in placing nearly three fourths of it on the terms of the prospectus. They had still a few thousands to dispose of, and if any of the shareholders or their friends would like a good home investment in a railway earning over three times the interest on its debenture, with the additional guarantee of the Mersey Dock Board, a kind of security that they could sleep over comfortably, they would be pleased to allot their requirements. The directors would hold one meeting a year, which would be in February, but that did not debar them from paying an interim dividend in July or August, when they considered that their traffics justified that being done.

MR. J. E. ANDERSON seconded the adoption of the report, and the motion was carried unanimously.

## South Metropolitan Electric Light and Power Co., Ltd.

THE report of the directors for 1912 states that the revenue account shows a credit balance of £33,933, which, with £3,067 brought forward, makes a total of £37,001. After deducting £12,423 for interest on debenture stock paid and accrued, and for other interest, and £6,504 for interim dividends paid on the preference shares, there remains a balance of £18,073; out of this there is to be paid a final dividend upon the 7 per cent. cumulative first preference shares, requiring £5,004; a final dividend upon the 6 per cent. cumulative second preference shares, absorbing £1,500; there is placed to credit of depreciation account £4,000, to credit of preliminary expenses £2,000, to credit of showroom account £100, and the balance (£5,470) is to be carried forward.

The following figures show the progress of the business:—

Year.	Lamps (35-watt). Connected at end of year.		In-crease.	Consumers.	Gross revenue.	Expenditure.	Net revenue.
	1909	1912					
1909	191,302	19,674	3,916	£11,847	£16,465	£25,882	
1910	205,046	16,744	4,305	44,157	17,578	27,609	
1911	230,191	22,145	4,697	51,614	20,541	31,072	
1912	258,872	28,681	5,263	66,604	22,670	33,933	

The new consumers and lamps connected show a greater increase than in any previous year, and the company's showroom continues to be of material assistance to the development of its undertaking. During the year the plant at the power house has been increased by the addition of one 1,500-kw. turbine, which will be put into service shortly. Further connections have been made in the area of the West Kent Electric Co., Ltd. A further £20,000  $\frac{1}{2}$  per cent. first mortgage debenture stock has been issued during the year.

The meeting is called for February 26th at Winchester House, E.C.

## City of Buenos Ayres Tramways Co. (1904), Ltd.

THE meeting of this company was held on Thursday last week, at Winchester House, E.C. Mr. J. HEATON, in proposing the adoption of the report, said that it was in precisely the same form as they had adopted ever since their fusion with the Anglo-Argentine Co., and the result which they showed was even more satisfactory than in any previous year. The annuity of £70,660 from the Anglo-Argentine was a fixed one, and had been duly received, and the shareholders had received the three quarterly dividends up to September 30th last. Ever since the fusion, it had been a great satisfaction to him as chairman of the company, and as a director of the Anglo-Argentine Co., to refer to the increased revenue of the latter undertaking. For the year 1912 that company would again show an increased revenue, and their annuity of £70,660 would be the first charge upon a sum, roundly speaking, of a million sterling. Their amortisation funds had been fully maintained, but for the past year they had been able to increase the amount placed to the general amortisation fund to £4,500, as against £3,650 for 1911. He explained last year that such would be the case, because they had been able to make new leases of their farm property at figures considerably in excess of the former rents.

MR. E. H. WOODS seconded the motion, and the report was adopted.

## Cambridge Electric Supply Co., Ltd.

THE directors' report for 1912 shows that during the year 1912 there have been connected 198 additional consumers, having the equivalent of 6,286 (30-watt) lamps, making a total to date of 82,580. The number of units supplied during the year has been 810,703, an increase of 110,116 units. £3,279 has been transferred from the depreciation account for the purpose of writing off plant which has become obsolete. The accounts show a total profit for the year of £10,172, which, added to £904 brought forward from 1911, makes £11,076. After deducting debenture and other interest £1,927, placing £3,500 to depreciation fund account, there remains a balance of £5,649. An interim dividend of 2 per cent., absorbing £1,696, has already been paid, and the directors recommend the payment of a further dividend of  $\frac{3}{4}$  per cent., making  $\frac{5}{4}$  per cent. for the year. This will absorb £2,968, leaving to carry forward £984. The directors have decided to issue the 577 shares shown in the accounts as the balance of the authorised and unissued capital. They will be in the first instance offered to the existing shareholders and an application form was enclosed with the report. The premiums will be added to the depreciation fund account or reserve as the directors may determine and the capital paid up to reduction of the bank loan. Dr. P. W. Latham has found it necessary to resign his seat on the board owing to his leaving Cambridge. He had served the company as a director for 18 years. Mr. S. R. Ginn has been appointed to the vacancy. The meeting is called for February 25th.

Metropolitan Electric Tramways, Ltd.—An extraordinary general meeting is called for February 24th, to confirm the resolution passed on 7th inst., approving of the new Bill now being applied for.

Newcastle-upon-Tyne Electric Supply Co.—Dividend on ordinary shares for the year, 5 per cent., including 2 per cent. interim paid in July.

## Tyneside Tramways and Tramroads Co.

THE directors report that for the half-year ending December 31st, 1912, the surplus of receipts over expenses is £4,486, plus £724 brought forward, making £5,210, and after deducting interest on debentures, loans, &c., amounting to £1,006, there remains an available balance of £4,204. A dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax) absorbs £661; a dividend on the ordinary shares at the rate of 2½ per cent. per annum (less income-tax) (the same rate as for the corresponding half-year of 1911), requires £1,674; there is to be placed to the credit of reserve for renewals, depreciation and other contingencies, increasing it to £13,245, £1,400; writing down consols to £75 per cent. absorbs £102, leaving to be carried forward £427. The dividend paid on the ordinary shares for the whole year is an increase of ½ per cent. as compared with the year 1911. The traffic receipts show a decrease of £51 as compared with the corresponding half-year of 1911, but for the whole year there is an increase of £819. The whole of the track, overhead line, and rolling stock, has been kept in thorough repair out of revenue.

	1910.	1911.	1912.
Car-miles (Tyneside Tramway Co.'s cars)	697,218	705,120	717,567
Passengers carried (Tyneside Tramway Co.'s lines)	4,475,721	5,306,341	5,619,301
Total traffic receipts	£23,087	£26,070	£26,488
Gross profit	6,678	8,875	9,456

The half-yearly meeting was held at Newcastle-on-Tyne on 11th inst., Dr. J. THEO. MERZ, who presided, said that the traffic receipts for the past year were £26,888, which was an increase on the previous year of £792. That increase was realised in the first half of the year, for there had been a decrease during the second half, owing to the very poor holiday traffic. That latter item was £174 less than in the previous year. Workmen's traffic showed an increase of £200, it was most satisfactory, however, to see that on the whole the increase was on the ordinary traffic. There was an increase in the mileage run mostly on workmen's traffic, which yielded only a small revenue, and also on some experimental services in districts where the local authorities had asked for increased facilities. Those experiments did not pay, and they had lost money by increasing the number of cars. The cost per mile had gone up from 5'6d. to 5'9d. owing to repairs to lines and cars. The repairs to lines would be very heavy, but that expense would be met out of the reserve fund, upon which they had not yet drawn. He referred to the dividends recommended in the report, and said that 2½ per cent. was the largest they had paid. As to the current year, it had opened well, the receipts being slightly more than in the corresponding period of last year.

Mr. G. E. HENDERSON seconded the adoption of the report, which was agreed to.

## City and South London Railway Co.

THE fifty-seventh ordinary general meeting of the shareholders of the above company was held on the 11th inst. at the offices, 71, Finsbury Pavement, E.C., the Right Hon. C. B. Stuart Wortley, K.C., M.P., in the chair.

THE CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 232), said their minds were all occupied with the one dominating and unprecedented fact that the passenger receipts for the half-year were less by £6,522, and the balance to net revenue was down by £6,812. This was an even greater fall than he anticipated in November 26th, 1912. It represented the equivalent of a diminution in dividend on the ordinary stock for the half-year at the rate of more than 7 per cent. It was an effect of the same cause as that which he had in mind when, a year ago, he pointed to the then recent amalgamation between omnibus and railway companies as an example of an arrangement which they ought not to reject should it be offered to them. Its apprehended realisation as the year went on, was what made them enter into the negotiations which he described on November 26th, and approve the terms that on that day they advised the ordinary stockholders to accept from the Underground Railways Co. It had led to their recommending that day a dividend on ordinary stock at the rate of less by 1 per cent. than that which they were able to recommend a year ago. All these facts were part and parcel of a newly emerged state of affairs, which began to affect their traffics in February, 1912, and had since developed into a serious menace to their prosperity as a passenger-carrying industry—he referred to the systematic and determined increased provision of motor-omnibus travelling facilities. He knew of only two ways in which they could contend with an adverse influence such as this. They could level up the attractiveness of their own service, so as to outbid their competitor, or they could come to terms with their competitor in such a way as to make him a partner instead of an enemy. The board claimed that the arrangement that they had made with the Underground Co. combined the advantages of both these policies, and that the application to Parliament, which they recommended them to make, was a necessary part of the necessary policy of improving the attractiveness of the service. The service had fallen behind in the race for public favour because, if judged by modern standards, the trains did not go fast enough and the carriages were not roomy enough. Had the railway been built in 1900, instead of during a series of years ending with 1890, the tunnels would have been made of

11 ft. 6 in. diameter, instead of 10 ft. 6 in. And in respect of speed, as well as of other factors, higher standards could and would have been attained. The chairman entered in some detail into the circumstances that had led up to the present proposals. Not long before the apprehended fall in their traffics became a realised fact, a big combination embracing the District Railway, the three West End tubes, and the London General Omnibus Co., had just been brought about on the principle of replacing cut-throat competition by co-operation and mutual assistance in the service of the public. An offer came their way, which they thought it good enough to give their provisional acceptance; and the result had been that it was accepted by no less than 99 per cent. in value of their ordinary stockholders, and that to a corresponding extent the Underground Electric Railways Co. of London, Ltd., were at this moment owners of the City and South London Railway. That great organisation was now to that great extent interested in seeing to it that their prosperity should not stagnate, that their receipts should no longer fall away, that their line and plant should be modernised and improved, and that they should be linked up physically with, and made comparable in respect of the attractiveness of the service they would offer, with the more modern tube railways that now ran between Hammersmith, Highgate and Finsbury Park in the north, right away to Hammersmith in the west, and Elephant and Castle in the south. They would perhaps desire him to describe and justify the proposals they made in the Bill, which they would shortly ask them to approve, rather than that he should make a second speech when the proceedings of the ordinary meeting were over. They proposed to ask Parliament to sanction their enlarging their tunnels wherever necessary from their present small diameter to that of 11 ft. 6 in., which was approximately the diameter of all the four tube railways built since their own. They proposed also to seek power to equip their system with all the useful rolling stock; that was with motors of the desired speed, and carriages of the desired height and width, to bring their service into line as regarded speed and quality with the best and most comfortable of those other systems. That they asked for power to do with capital moneys. Wonderful as it seemed, their consulting engineers told them that this operation of reconstructing the tunnels could be carried out by very short lengths at a time without important interruptions to traffic. Still, they thought it desirable to ask Parliament to protect their preference stockholders by a provision that any loss of dividend to them, arising from whatever cause, during the reconstruction process, might be made good to them out of the capital moneys to be raised under the Bill. The authorised but unissued capital that they had power to raise was £1,150,000 of stock or shares, and £413,363 in debenture stock or other form of loan. The £1,150,000 of stocks or shares might be as to £600,000 in ordinary stock, and as to £550,000 in preference stock. As things now stood under their existing powers, the borrowing powers could not be exercised to any amount above a mere £30,030, except as and when corresponding amounts of share capital had been issued and had produced in money not less than 50 per cent. of their face value. At the present market price of the ordinary stock it would be impracticable to raise money by that means. Consequently in the opinion of the board, the only course to be adopted was to raise the necessary funds by the issue of the £550,000 available preference stock, which would rank *pari passu* with the existing issued preference capital under the Act of 1905, amounting to £200,000. The issue of this preference stock would not prejudice the holders of the preference stock issued under the Acts prior to 1903. Parliament would be asked to allow them unrestricted power to raise the whole of this £413,363 of loan capital without reference to the price or amount of share capital issued. That undoubtedly meant that a sum of £413,363 debenture stock was to be sought to be issued in front of the preference stocks, which, but for the special power sought, could not have been so issued. It would be disrespectful and therefore impolitic for him to enter fully then, and by anticipation, upon the facts and arguments whereby they hoped to commend to Parliament their financial as well as their other proposals. What he might do, and ought to do, was to satisfy their preference stockholders that it was to their interest that these proposals to Parliament should be made. He submitted to them, with all respect, that for that purpose little could be needed in the way of argument. Were they going to remain in all respects as they were a year ago, or two years ago? They might object to taking the risks of adding to prior charges. But they could not remain as they were then, and they did not stand where they stood then. They were neither getting the same traffic nor making the same money. Could anyone doubt that it was better to rehabilitate and improve in good time the earning power of the system so as to make it such as the experience of other systems had shown to be remunerative even against surface competition? And though for this purpose they had to put in front of them an added interest charge of some £16,500 a year, let them look at the weekly traffics, not only as regarded their amounts, but as regarded also their movement and tendency, and judge whether to stay as they were, unimproved, and with shrinking margins, was not a prospect more menacing than that presented by the policy they offered, namely, that of two alternative risks they should take the one which instead of inertia and stagnation gave them that adaptation to their surroundings which was the surest condition of either renewed or continued vitality. Add to this that if the Underground Co., as the owners of the ordinary stock, were interested in improving the dividend on the ordinary stock, they were *a fortiori* the friends and protectors of the preference stockholders.

Mr. C. S. GRENFELL seconded the motion, which, after a short discussion, was adopted.

Subsequently, at a special meeting, the Bills to which the chairman referred in his speech, were approved.

### Notting Hill Electric Lighting Co., Ltd.

THE directors report that during the year ended December, 1912, the expenditure on capital account was increased by £2,201 to £249,608, and it now exceeds the receipts by £40,265. The cost of the joint station at Wood Lane to date has amounted to £224,340, and joint debenture stock amounting to £227,500 has been issued. This stock is subject to cumulative sinking funds, which now amount to £52,607 invested in trustee securities. The following table shows the progress of the company:—

	Equiv. of 8 c.p. lamps.	Profit.
1909 .. .. .	180,909	£20,839
1910 .. .. .	189,885	22,002
1911 .. .. .	193,156	23,557
1912 .. .. .	211,838	24,436

The number of consumers is now 3,771, and, with the exception of 31, they are supplied at 200 volts. The gross revenue for the year was £44,780, an increase of £1,721. From the available net profit of £25,056, there have to be deducted the following:—Depreciation, renewal and reserve fund, £3,000; debenture and other interest, £2,424; Kensington and Notting Hill joint debenture stock—interest, £2,439; sinking funds, £1,473; to be distributed to staff under co-partnership scheme, £286; leaving a balance available for dividend of £15,433. Both classes of 6 per cent. preference shares have already received their full dividend, which absorbs £8,136, and leaves a balance of £7,297 available for dividend on the ordinary shares. The directors, therefore, recommend the payment of a dividend of 5s. per share, less tax on the ordinary shares, absorbing £6,368. The balance carried forward is £929, compared with £619 in 1911. The scheme of co-partnership with the company's staff, foreshadowed by the chairman at the last general meeting, was brought into operation during the year. Under this scheme, as shown above, £286 will be distributed to the staff, being an addition of 8 per cent. to their wages.

Units generated and purchased .. .. .	8,341,191
Units sold—Public lamps .. .. .	103,958
Private consumers by meter .. .. .	2,978,456
Total sold .. .. .	3,082,414
Units used on works .. .. .	26,922
Total accounted for .. .. .	2,509,336
Expended in distribution transformers and accumulators .. .. .	831,855
Public lamps .. .. .	53
Total maximum supply demanded .. .. .	1,691 kw.

### Newcastle and District Electric Lighting Co., Ltd.

THE directors' report for the year ending December 31st, 1912, states that the number of units sold was 14,789,149 as against 13,599,294 sold in 1911, being an increase of 8.75 per cent. The result of the year's working was—Gross profit of £27,933, plus £9,898 brought forward, making £37,831, less interest on 4½ per cent. first debenture stock, 6 per cent. second mortgage debentures, temporary loans, &c., £14,965; directors', trustees', and auditors' fees, income-tax, leasehold redemption fund, &c., £1,471; leaving £21,395, less interim dividend paid August 16th, 1912, £4,199; leaving an available balance of £17,195. Out of this there is to be paid a dividend at the rate of 3 per cent. per annum (less income-tax) for the half-year ended December 31st last (making, with the interim dividend paid in August, 3 per cent. for the year). £4,200; £1,900 is to be transferred to second mortgage debenture redemption fund; writing off second debenture issue expenses absorbs £400, transfer to reserve fund £2,000, and £8,695 is to be carried forward. The profits for the year have been affected by the National Coal Miners' strike and other labour troubles, but notwithstanding this the gross receipts have increased. Contracts for the supply of coal over the whole of the present year were made before the great rise in the price took place, and the directors do not anticipate that the total expenditure per unit under this head will be greater than for 1912. Work is proceeding in connection with the Newburn Tramways, and they will be open for traffic in May. The company under an agreement made with the Corporation of Newcastle-upon-Tyne will supply all the electrical energy required for working the cars for a period of ten years. At the end of that time negotiations may be entered into for renewing the contract. In the early part of last year £150,000 6 per cent. second mortgage debentures were offered to the public, and practically the whole of this amount was taken up; £2,000 of these debentures have been redeemed. The whole of the property owned by the company, including plant, machinery, mains, &c., has been maintained in a high state of efficiency out of revenue during the year. Reference is made to the death of Mr. James Patterson, who had been secretary of the company since its inception. The meeting is to be held to-day (Friday).

## STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange markets have been steeped in gloom and depression. At the root of the troubles lies the tightness of money—due in no small degree to the prosperity of the country, so that we are presented with the anomaly of excellent trade playing havoc with securities of all kinds in the stock markets. Amongst

the issues with which we deal, the most noticeable are those in the Mexican group, substantial falls having taken place in nearly everything connected with that country. The shares and bonds of the utility undertakings in Mexico have been affected even more than the rest.

The slump lowered Mexican Light and Power descriptions very materially, the Company's first mortgage bonds shed no less than 5 points, while the seconds dropped about as much to 8½. The Common stock is 3 down on the week, and the Preferred 4½. The great fear, of course, is lest the revolutionaries—or the Federals, for that matter—may blow up the Company's stations, either by design or accident. The street fighting is also responsible for a fall of 4 points in Mexico Tramway Common shares, this Company's bonds of both classes being down about 3 points each. These movements, of course, follow upon earlier falls, and the decline since the beginning of the year is now assuming serious proportions.

Going back a couple of months, it may be recalled that Mexico Trams stood at 110, against the present price of 106½. Mexican Light and Power Common were 84½, and now are 79, the first Mortgage bonds being 96 against the current quotation of 90½. The flatness has spread to Monterey Fives, which are down 3; while Pachuca bonds are dull at 91½—the latter guaranteed, of course, by the Mexican Light and Power Company. The various trust and financial undertakings which in normal times can be depended upon to support the market by taking bonds such as those of the Mexican utility companies are holding their hand in view of the state of the country; and individual holders, more or less alarmed by the outlook, have been persistent sellers during the past two or three weeks. No doubt the sanest view to take is that the revolution is bound to come to an end before long, and that as the utility companies have excellent businesses, their re-establishment will naturally follow, so that the position of the first mortgage bondholders should be tolerably secure. But it is not surprising that the proprietors of the junior stocks should feel uncomfortable, and it is to be devoutly hoped that the turmoil will be appeased as rapidly as permanently.

Other Latin-Canadian shares and bonds have suffered in sympathy with the Mexican slump. Sheswinigan Water, and Montreal Light, Heat and Power, for instance, are as much as 6 and 7 points down respectively. Kaministiquia bonds are ½ lower. Rio Trams First Mortgage and Sao Paulo Trams First Debenture have given way 1 and ½ respectively. British Columbia Railway issues are weaker. Brazil Traction Ordinary lost 1½ on top of their fall last week.

Notwithstanding this welter of weakness, a few exceptions stand out which redeem the list from being entirely one way. For instance, Winnipeg 4½ per cent. Debenture is ½ higher; Perth Debenture improved to the same extent; West Kootenay Sixes are 1 up. The improvements, however, certainly require a good deal of searching for, the market, as a whole, being very unstable.

English Electricity Supply shares are upheld by the declarations of their dividends, and the City of London announcement, with its bonus on the Ordinary shares, caused the price to gain another 10s., bringing it up to 18½. Kensington are better at 8 middle, and there has been some inquiry for certain of the Preference shares, in the course of which Metropolitan Preference and St. James' Preference both gained fractions. The market, as a whole, is steady, without much interest being displayed by the public; and not even the fogs of last week caused so much as a ripple of bullishness amongst the price list.

Home Rails have been flat; from North-Westerns to East London's the dismal tale was repeated day by day, the foreign outlook and the tightness of money combining to make these stocks a target for bear attacks at the same time that the tired bulls were closing their commitments. The Undergrounds have suffered with the rest. The Central London trio, *ex* dividend, show comparatively small falls, but City and South London Preferences, also *ex* their 2½ per cent. dividends, were marked down 5, showing a drop of 2½ on balance. Metropolitan's have fallen sharply, but Great Northern and City Preferred Ordinary braced up to 2½ on the ratification of the agreement by the Metropolitan to take over the line. Districts went back below 40, and there has been a sharp drop in Underground Electric Railways Ordinary shares, while the company's 1s. shares also gave way. These falls were associated with the issue of the report, which, as we were remarking last week, was considered rather disappointing. It seems to show that the payment of dividends on the Ordinary and the "A" shares is still some way off; and holders who have been looking for news as to a probable distribution in the near future are inclined to wonder whether this will be made as soon as they had expected.

The Telegraph market is amongst the few to resist the flat tendency noticeable elsewhere. Rises have taken place in Anglo-American Ordinary, Commercial Cable Debenture, Eastern Telegraph Ordinary, Eastern Extension Debenture, Globe Ordinary, Great Northern's, and Western Telegraph Debenture—a highly satisfactory list, having regard to the weakness in the rest of the markets. Amongst the few declines which have taken place, there is one of ¾ in West India and Panama, which, of course, are held by a speculative division; while Direct Spanish Preference eased off to 6½. The Telegraph market is steady, without special feature. As the books of the National Telephone close finally on the 25th inst., dealings are now transacted either for cash or for settlement when the ultimate award is made; and, obviously, there is not much temptation to gamble in the stock in these circumstances.

The Manufacturing group has been distinguished by a rise of three-eighths in British Insulated and Helsby Cable shares, which carried the price to 8½ middle. The greater part of this improvement, however, was subsequently lost. Telegraph Constructions are 1 better, and the rest of the shares in this group are quietly firm.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 18th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Feb. 18th.	Rise + or Fall	Present Yield p.c.	
Bournemouth & Poole, Ord.	10	1811. 5 1/2	1912. 51	94-104	..	6 4 9	Kensington & Knightsbridge, Ord	5	9 8 1/2	7 1/2-8 1/2	+ 1/2	5 9 1
Do. 4 1/2 % Pref.	10	4 1/2	4 1/2	84-94	xd	6 17 1	Do. 4 % Deb.	Stock	4 4	90-99	..	4 6 0
Do. Second 8 % Pref.	10	6 5	6 5	94-104	xd	6 17 1	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 1/2	76-80	..	5 12 6
Do. 4 1/2 % Deb. Stock	Stock	4 1/2	4 1/2	94-98	..	4 11 10	London Electric, Ord.	8	2 1/2	1 1/2-2	..	3 15 0
Brompton & Kensington, Ord.	5	10 10	10 10	84-94	..	6 6 8	Do. 8 % Pref.	5	6 5	6 5-6 1/2	..	6 11 7
Do. 7 % Cum. Pref.	5	7 7	7 7	84-94	..	8 17 9	Do. 4 % First Mort. Deb.	Stock	4 4	84-92	..	4 7 0
Central Electric Supply, 4 %	100	4 4	4 4	95-98	..	4 1 8	Metropolitan	5	4 4	3 1/2-4	+ 1/2	5 0 0
Charing Cross, West End & City	5	5 5	5 5	48-54	..	4 17 7	Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2-4 1/2	..	4 17 0
Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2	48-48 1/2	xd	4 14 0	Do. 8 1/2 % Mort. Deb.	Stock	4 1/2	87-100	..	4 10 0
Do. "City Undertaking" 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2	36-42	..	5 2 10	Midland Electric Corporation 4 1/2 % First Mort. Deb.	100	4 1/2	84-88	..	4 1 5
Do. Do. 4 % Deb.	100	4 4	4 4	82-94	..	4 5 1	Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5 5	4 1/2-4 1/2	..	5 2 7
Chelsea, Ord.	5	5 4	5 4	96-99	..	4 15 9	North Metropolitan Power Supply, 5 % Mortgage (Red.)	100	5 5	99 1/2-102 1/2	..	4 17 7
Do. 4 1/2 % Deb.	Stock	4 1/2	4 1/2	96-99	..	4 10 11	Notting Hill, 8 % Non-Cum. Pref.	10	8 6	9 1/2-10 1/2	..	5 11 7
City of London, Ord.	10	8 6	8 6	17 1/2-19	+ 1/2	4 4 3	Oxford	5	7 1/2	6 1/2-6 1/2	..	5 9 8
Do. 6 % Cum. Pref.	10	6 6	6 6	12 1/2-13 1/2	..	4 9 0	St. James' and Pall Mall, Ord.	5	10 10	9 1/2-9 1/2	..	5 8 11
Do. 5 % Deb.	Stock	5 5	5 5	116-120	..	4 8 4	Do. 7 % Pref.	5	7 7	7 1/2-7 1/2	+ 1/2	4 13 4
Do. 4 1/2 % Second Deb.	100	4 1/2	4 1/2	100-102	..	4 8 9	Do. 8 1/2 % Deb.	100	8 1/2	8 1/2-8 1/2	..	4 9 6
County of London, Ord.	10	6 6	6 6	11 1/2-12	..	4 19 9	Smithfield Markets, Ord.	5	2 2	2 1/2-2 1/2	xd	..
Do. 6 % Pref.	10	6 6	6 6	11 1/2-12 1/2	..	4 11 1	South London, Ord.	4	5 5	2 1/2-2 1/2	..	5 8 1
Do. 4 1/2 % Deb.	Stock	4 1/2	4 1/2	104-105	..	4 4 11	Do. 5 % First Mort. Deb.	100	5 5	97-100	..	5 0 0
Do. 4 1/2 % Second Deb.	Stock	4 1/2	4 1/2	98-101	..	4 8 8	South Metropolitan, 7 % Pref.	1	7 7	7 1/2-7 1/2	..	5 12 0
Edmundson's, Ord.	43	Nil	Nil	42-48	..	Nil	Do. 4 1/2 % First Deb. Stock	100	4 1/2	96-99	..	4 11 3
Do. 6 % Cum. Pref.	5	Nil	Nil	42-48	..	..	Urban, Ord.	23	Nil	..	..	..
Do. 6 1/2 % Non-Cum. Pref.	5	..	..	12-13	..	5 6 11	Do. 5 % Cum. Pref.	5	6 2	2 1/2-2 1/2	..	..
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	4 1/2	82-85	..	5 17 1	Do. 4 1/2 % First Mort. Deb.	100	4 1/2	84-87 1/2	- 1/2	5 2 10
Folkestone	5	6 6	6 6	42-54	..	4 17 7	Westminster, Ord.	5	10 10	9 1/2-9 1/2	..	5 8 1
Do. 5 % Cum. Pref.	5	6 6	6 6	42-54	..	4 17 10	Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2-4 1/2	..	4 5 9
Do. 4 1/2 % First Deb.	100	4 1/2	4 1/2	90-92	..	4 12 6						
Hove	5	9 8 1/2	9 8 1/2	7 1/2-8	..	..						

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 8 % Pref.	5	6 6	6 6	54-58	..	5 6 8	Monterey Ry. Light & Power, 5 % 1st Mort. Deb.	100	5 5	81-85	-3	5 17 8
Calcutta, Ord.	5	8 1/2	7 1/2	62-74	..	5 19 4	Montreal, Lt., H. and Power	\$100	8 9 1	233-283	-7	3 15 8
Do. 5 % Pref.	5	6 5	6 5	42 1/2-57 1/2	..	4 16 5	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$500	5 5 1/2	10-20	..	..
Calgary Power, 1st Mort. Bds.	100	5 5	5 5	92-94	..	5 6 5	River Plate, Ord.	Stock	10 10	217-227	..	4 8 0
Canadian Gen. El. Com.	\$100	7 7	7 7	116-120	..	5 16 8	Do. 8 % Non-Cum. Pref.	Do.	6 6	104-103	-2	5 10 1
Do. 7 % Pref.	\$100	7 7	7 7	120-124	..	5 13 0	Do. 5 % Deb. Stock	Do.	6 6	100-102	..	4 18 0
Cordoba Lt., Power and T., Ord.	1	3 5	3 5	43-45	..	5 6 10	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	4 1/2	100-102	..	4 8 8
Do. 5 % Deb.	100	5 5	5 5	96-99	..	5 1 0	Shawinigan Water, Capital	\$100	5 5	133-142	-6	3 10 5
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6 6	6 6	93-95	..	6 6 4	Do. 5 % Non-Cum. Pref. Bonds	\$500	5 5	106-108	..	4 12 7
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5 5	5 5	90-93	..	5 7 6	Do. 4 1/2 % Per. Deb.	Stock	4 1/2	100 1/2-102 1/2	..	4 7 10
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5 5	5 5	95 1/2-97 1/2	..	5 2 7	Toronto Power, 4 1/2 % Deb.	Do.	4 1/2	98 1/2-100 1/2	..	4 9 7
Kalgoorlie Elec. P. and L., Ord.	10 1/2	Nil	Nil	7 1/2-8 1/2	..	Nil	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5 5	91-94	..	5 6 5
Do. 6 % Pref.	1	6 6	6 6	7 1/2-8 1/2	..	9 15 2	Victoria Falls Power, Pref.	1	11 1/2	17 1/2	..	..
Kaminitiquia Power, 6 % G. Bs.	\$600	5 5	5 5	101 1/2-108 1/2	- 1/2	4 16 7	West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6 6	106-108	+ 1	5 11 1
Madrin, Ord.	5	Nil	Nil	13-14	..	..						
Melbourne, 5 % 1st Mort. Deb.	100	6 6	6 6	101-104	..	4 16 2						
Mexican El. Lt., 5 % 1st M. Bds.	100	5 5	5 5	79-83	- 1/2	6 0 6						
Mexican Lt. & Power, Common	\$100	4 4 1/2	4 4 1/2	77-81	-3	4 18 9						
Do. 7 % Cum. Pref.	\$100	7 7	7 7	100-105	- 1/2	6 13 4						
Do. 5 % 1st Mort. Gold Bds.	..	5 5	5 5	89-92	-5	5 8 8						

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4 4 1/2	4 1/2	7-7 1/2	..	6 0 0	Monte Video Telephone, Ord.	1	6 6	6 1/2	1 1/2-1 1/2	..	5 13 0
Do. 5 % Deb. Red.	Stock	5 5	5 5	97 1/2-99 1/2	..	5 0 6	Do. 5 % Pref.	1	5 5	5 5	3-4	..	5 14 8
American Telep. & Tel., Cap.	\$100	8 8	8 1/2	135-137	+ 1/2	5 16 10	National Telephone Def.	Stock	8 8	90-95	..	4 10 8	
Do. Collat. Trust	\$1000	4 4	4 4	91-93	..	4 6 0	New York Telep., 4 1/2 % Gen. Bds.	100	4 1/2	94 1/2-99 1/2	..	4 11 5	
Anglo-American Telegraph	Stock	3 3	3 3	60-68	+ 1/2	4 8 8	Oriental Telep. and Elec.	1	5 5	1 1/2-1 1/2	..	4 18 6	
Do. 6 % Pref.	Do.	6 6	6 6	110 1/2-113 1/2	..	5 7 7	Do. 6 % Cum. Pref.	1	6 6	6 6	1 1/2-1 1/2	..	4 8 11
Do. Def.	Do.	80/	80/	24 1/2-24 1/2	..	6 1 8	Do. 4 % Red. Deb.	Stock	4 4	88-90	..	4 8 11	
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5 5	5 5	102-104	..	4 16 2	Pacific and European Tel., 4 % Guar. Debts.	Do.	4 4	97 1/2-99 1/2	..	4 0 5	
Chili Telephone	5	7 7	7 7	75-77	+ 1/2	5 1 7	Renter's	10	10 10	11 1/2-11 1/2	..	8 10 2	
Commercial Cable, Etig., 4 % Deb.	Stock	4 4	4 4	79-81	+ 1/2	4 13 9	Submarine Cable Trust	Cert.	6 6	127-130	..	4 13 4	
Cuba Telephone	10	6 6	6 6	14-17	..	6 9 9	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	Stock	4 1/2	96-98	- 1	4 11 10	
Do. 10 % Pref.	10	10 10	10 10	16-17	..	5 17 8	United River Plate Telephone	5	8 8	7 1/2-7 1/2	+ 1/2	5 3 8	
Direct Spanish Telegraph, Ord.	5	4 4 1/2	4 4 1/2	84-93	..	5 6 8	Do. 6 % Cum. Pref.	5	5 5	5 1/2-5 1/2	..	4 8 11	
Do. 10 % Cum. Pref.	5	10 10	10 10	64-65	- 1/2	7 8 2	West Coast of America	2 1/2	2 1/2	1 1/2-1 1/2	..	4 0 0	
Direct United States Cable	10	5 4	5 4	65-70	..	6 15 7	Do. 4 % Debts., 1 to 1,600 guar. by Bras. Sub. Tel.	100	4 4	95-98	..	4 1 8	
Direct W. India Cable, 4 1/2 % Reg. Deb.	100	4 1/2	4 1/2	99-101	..	4 9 0	West India and Panama Telep.	10	2 1/2	1 1/2-1 1/2	..	..	
Eastern Telegraph, Ord. Stock	Stock	7 7 1/2	7 7 1/2	183-186	+ 1	5 3 0	Do. 6 % Cum. 1st Pref.	10	6 6	10-10 1/2	..	5 14 3	
Do. 8 1/2 % Pref. Stock	Do.	8 1/2	8 1/2	78-80	..	4 7 6	Do. 6 % Cum. 2nd Pref.	10	6 6	9 1/2-10	..	6 0 0	
Do. 4 % Mort. Deb.	Do.	4 4	4 4	96-98	..	4 1 8	Do. 6 % Debts.	100	5 5	101-103	..	4 17 1	
Eastern Extension	10	7 7 1/2	7 7 1/2	13-13 1/2	..	5 8 8	Western Telegraph, Ltd.	10	7 7 1/2	15 1/2-18 1/2	..	5 2 9	
Do. 4 % Deb.	Stock	4 4	4 4	95 1/2-97 1/2	+ 1/2	4 2 1	Do. 4 % Deb.	Stock	4 4	96-97	+ 1	4 2 6	
East and S. Africa Tel., 4 % Mt. Dh. Mauritius Sub.	95	4 4	4 4	98-101	..	3 19 8	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	97 1/2-100 1/2	..	4 10 0	
Globe Telegraph and Trust	10	6 6	6 6	10 1/2-11	+ 1/2	5 9 1							
Do. 6 % Pref.	10	4 4	4 4	123-127	..	4 18 2							
Great Northern Telegraph	10	18 18	18 18	29-31	+ 3	5 14 3							
Indo-European Telegraph	95	18 18	18 18	57-59	..	5 10 2							
Mackay Companies Common	\$100	5 5	5 5	85-89	..	5 12 4							
Do. 4 % Cum. Pref.	\$100	4 4	4 4	68-72	..	5 11 1							
Marconi's Wireless Telegraph	1	20 20	20 20	42-44	- 1/2	4 8 11							
Do. 7 % Cum. Parlo. Pref.	1	17 17	17 17	93-94	..	4 5 0							

\* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ Bs. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railway and tramway companies in the home market. Columns include Name, Stock or Share, Dividends for, Closing Quotations Feb. 18th., Rise + or Fall, Present Yield p.o., Name, Stock or Share, Dividends for, Closing Quotations Feb. 18th., Rise + or Fall, Present Yield p.o.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railway and tramway companies in colonial and foreign markets. Columns include Name, Stock or Share, Dividends for, Closing Quotations Feb. 18th., Rise + or Fall, Present Yield p.o., Name, Stock or Share, Dividends for, Closing Quotations Feb. 18th., Rise + or Fall, Present Yield p.o.

MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations Feb. 18th., Rise + or Fall, Present Yield p.o., Name, Stock or Share, Dividends for, Closing Quotations Feb. 18th., Rise + or Fall, Present Yield p.o.

\* Unless otherwise stated, all shares are fully paid, † Interim dividend.

## GERMAN EXPORTS OF ELECTRICAL GOODS IN 1912.

The following figures showing the exports of electrical goods from Germany in 1912, are taken from the recently issued official trade statistics; figures for 1911 are added for purposes of comparison, and notes of any increases or decreases are given. The total exports of all kinds of electrical goods in 1912 were 114,546,700 kilogs. valued at 233,496,000 marks, as against 107,630,500 kilogs. valued at 208,017,000 marks in 1911:

	1911. Kilogs.	1912. Kilogs.	Inc. or dec. Kilogs.
<i>Dynamos, electric motors, transformers, &amp;c., up to 25 kg. weight.—</i>			
To Austria ... ..	88,000	116,000	+ 28,000
" Russia ... ..	56,000	84,000	+ 28,000
" France ... ..	34,000	50,000	+ 16,000
" Great Britain ... ..	39,000	48,000	+ 9,000
" Other countries ... ..	222,000	277,000	+ 55,000
Total ... ..	439,000	575,000	+ 136,000
<i>Ditto, from 25 kg. to 100 kg.—</i>			
To Austria ... ..	499,000	672,000	+ 173,000
" Russia ... ..	223,000	268,000	+ 45,000
" Great Britain ... ..	104,000	212,000	+ 108,000
" Belgium ... ..	126,000	193,000	+ 67,000
" France ... ..	157,000	189,000	+ 32,000
" Italy ... ..	249,000	193,000	- 56,000
" Holland ... ..	111,000	197,000	+ 86,000
" Other countries ... ..	792,000	927,000	+ 135,000
Total ... ..	2,261,000	2,851,000	+ 590,000
<i>Ditto, from 100 to 500 kg.—</i>			
To Austria ... ..	768,000	895,000	+ 127,000
" Russia ... ..	502,000	622,000	+ 120,000
" Belgium ... ..	497,000	577,000	+ 80,000
" Great Britain ... ..	345,000	503,000	+ 158,000
" Brazil ... ..	291,000	491,000	+ 200,000
" Spain ... ..	275,000	433,000	+ 158,000
" Italy ... ..	539,000	454,000	- 85,000
" Argentina ... ..	279,000	330,000	+ 51,000
" Other countries ... ..	2,315,000	2,536,000	+ 221,000
Total ... ..	5,811,000	6,841,000	+ 1,030,000
<i>Ditto, over 500 kg.—</i>			
To Japan ... ..	3,613,000	2,960,000	- 653,000
" Italy ... ..	2,349,000	2,650,000	+ 201,000
" Argentina ... ..	1,631,000	2,689,000	+ 958,000
" Belgium ... ..	1,341,000	1,892,000	+ 551,000
" Russia ... ..	1,248,000	1,421,000	+ 173,000
" Spain ... ..	1,128,000	1,686,000	+ 558,000
" British S. Africa ... ..	2,479,000	1,328,000	- 1,151,000
" Brazil ... ..	857,000	1,078,000	+ 221,000
" Other countries ... ..	9,554,000	8,559,000	- 995,000
Total ... ..	24,200,000	24,063,000	- 137,000
<i>Cables.—</i>			
To Belgium ... ..	3,427,000	4,382,000	+ 955,000
" Holland ... ..	4,446,000	5,721,000	+ 1,275,000
" Sweden ... ..	4,475,000	3,033,000	- 1,442,000
" Japan ... ..	4,714,000	4,489,000	- 225,000
" Argentina ... ..	4,095,000	3,514,000	- 581,000
" Norway ... ..	1,839,000	1,570,000	+ 231,000
" Great Britain ... ..	1,133,000	1,220,000	+ 87,000
" Other countries ... ..	18,704,000	14,041,000	- 4,663,000
Total ... ..	42,333,000	37,970,000	- 4,363,000
<i>Electric arc lamps.—</i>			
To Russia ... ..	90,000	91,000	+ 1,000
" Austria ... ..	64,000	66,000	+ 2,000
" Great Britain ... ..	71,000	71,000	—
" Argentina ... ..	68,000	68,000	—
" Other countries ... ..	352,000	263,000	- 89,000
Total ... ..	645,000	557,000	- 88,000
<i>Metal-filament lamps.—</i>			
To Russia ... ..	Details	370,000	—
" Great Britain ... ..	Details	260,000	—
" Spain ... ..	not	136,000	—
" Italy ... ..	not	162,000	—
" Austria ... ..	available.	190,000	—
" France ... ..	not	113,000	—
" Other countries ... ..	not	850,000	—
Total ... ..	not	2,071,000	—
<i>Galvanic batteries.—</i>			
To Great Britain ... ..	214,000	293,000	+ 79,000
" Holland ... ..	84,000	116,000	+ 32,000
" Sweden ... ..	89,000	166,000	+ 77,000
" Switzerland ... ..	75,000	99,000	+ 24,000
" Other countries ... ..	471,000	516,000	+ 45,000
Total ... ..	933,000	1,190,000	+ 257,000

	1911. Kilogs.	1912. Kilogs.	Inc. or dec. Kilogs.
<i>Electric apparatus for lighting power, &amp;c.—</i>			
To Russia ... ..	1,332,000	1,790,000	+ 458,000
" Austria ... ..	1,021,000	1,627,000	+ 606,000
" Italy ... ..	951,000	1,263,000	+ 312,000
" Belgium ... ..	839,000	1,195,000	+ 356,000
" Argentina ... ..	1,189,000	1,361,000	+ 172,000
" Brazil ... ..	303,000	611,000	+ 308,000
" Japan ... ..	845,000	627,000	- 218,000
" Great Britain ... ..	589,000	815,000	+ 226,000
" Other countries ... ..	4,591,000	6,128,000	+ 1,537,000
Total ... ..	11,666,000	15,317,000	+ 3,651,000

	1911. Kilogs.	1912. Kilogs.	Inc. or dec. Kilogs.
<i>Electric meters, &amp;c.—</i>			
To Austria ... ..	324,000	406,000	+ 78,000
" Russia ... ..	301,000	397,000	+ 96,000
" Italy ... ..	221,000	361,000	+ 140,000
" Argentina ... ..	139,000	163,000	+ 24,000
" Japan ... ..	65,000	101,000	+ 36,000
" Spain ... ..	55,000	147,000	+ 92,000
" Belgium ... ..	83,000	118,000	+ 35,000
" Denmark ... ..	76,000	103,000	+ 27,000
" Other countries ... ..	684,000	761,000	+ 77,000
Total ... ..	1,952,000	2,557,000	+ 605,000

	1911. Kilogs.	1912. Kilogs.	Inc. or dec. Kilogs.
<i>Insulating tubes.—</i>			
To Belgium ... ..	Details	306,000	—
" Switzerland ... ..	not	866,000	—
" Russia ... ..	not	354,000	—
" Sweden ... ..	available	286,000	—
" Austria ... ..	available	274,000	—
" Other countries ... ..	not	1,079,000	—
Total ... ..	not	3,165,000	—

	1911. Kilogs.	1912. Kilogs.	Inc. or dec. Kilogs.
<i>Electric signalling apparatus, &amp;c.—</i>			
To Russia ... ..	Details	140,000	—
" Great Britain ... ..	not	122,000	—
" Belgium ... ..	not	94,000	—
" Denmark ... ..	available	63,000	—
" Holland ... ..	available	59,000	—
" Other countries ... ..	not	408,000	—
Total ... ..	not	866,000	—

	1911. Kilogs.	1912. Kilogs.	Inc. or dec. Kilogs.
<i>Telephones and telephone apparatus.—</i>			
To Russia ... ..	Details	134,000	—
" Great Britain ... ..	not	89,000	—
" Italy ... ..	not	85,000	—
" Austria ... ..	available	53,000	—
" France ... ..	available	41,000	—
" Other countries ... ..	not	403,000	—
Total ... ..	not	805,000	—

	1911. Kilogs.	1912. Kilogs.	Inc. or dec. Kilogs.
<i>Finished armatures and commutators.—</i>			
To Austria ... ..	434,000	597,000	+ 163,000
" Italy ... ..	621,000	511,000	- 110,000
" Belgium ... ..	371,000	429,000	+ 58,000
" France ... ..	287,000	202,000	- 85,000
" Great Britain ... ..	300,400	430,600	+ 130,000
" Russia ... ..	289,000	270,000	- 19,000
" Japan ... ..	626,000	246,000	- 380,000
" Argentina ... ..	341,000	191,000	- 150,000
" British S. Africa ... ..	222,000	130,000	- 92,000
" Other countries ... ..	1,573,000	1,030,000	- 543,000
Total ... ..	5,064,000	4,036,000	- 1,028,000

	1911. Kilogs.	1912. Kilogs.	Inc. or dec. Kilogs.
<i>Accumulators.—</i>			
To Denmark ... ..	1,245,000	1,101,000	- 144,000
" Sweden ... ..	1,137,000	1,953,000	+ 816,000
" Holland ... ..	373,000	444,000	+ 71,000
" Norway ... ..	101,000	290,000	+ 189,000
" Japan ... ..	898,000	293,000	- 605,000
" Argentina ... ..	902,000	3,081,000	+ 2,179,000
" Chile ... ..	101,000	699,000	+ 598,000
" Other countries ... ..	1,619,000	1,209,000	- 410,000
Total ... ..	6,376,000	9,070,000	+ 2,694,000

Kilogram = 2.204 lb.

**The Electrical Production of Ferro-Silicon and Potash.**—It is reported from Gothenburg that a Swedish engineer (Axel Lindblad), who is known through his work in connection with the electric smelting of iron, is experimenting with a trial plant in which felspar, which contains up to 18 per cent. of potash, is electrically smelted with coal and iron. The main product resulting is ferro-silicon, whilst easily soluble potash salts are in the slag. A quantity of 100 tons of fertilising potash is said to have been made already with the experimental plant, and it is now proposed to erect a large installation. It is stated that the economic question of manufacturing will depend upon whether it will be possible to find a market for the large tonnage of ferro-silicon which must be produced, without depressing the price of this alloy.

## THE USE OF ELECTRICITY AND ELECTRICAL ACCIDENTS IN MINES.

(Continued from page 253.)

A FOURTH accident, which occurred at Auchengeich Colliery, and caused the death of a miner, was also due to a fault in the earthing system. The current, which was three-phase at 440 volts, was used for coal-cutting purposes. The main and trailing cables were armoured and the earthing was intended to be effected by means of the armouring connected to an earth plate at the surface, but it transpired afterwards that owing to a mistake on the part of a workman, and a lack of supervision on the part of the officials, no efficient earthing system existed. A fault developed at a joint in one of the cables, and, in consequence, the armouring became alive. Deceased, who was pushing a loaded tub, came in contact with it and was killed.

On investigating the accident, it was difficult at first to discover why the earthing system did not carry away the leakage, and thus prevent an accident. It was, however, afterwards found that a workman when cutting a drain had come across a wire or cable, and as it crossed the path of the drain he cut it with his shovel. This cable was the earth wire for the whole system at the colliery; after it was cut the safeguard of earthing ceased to exist, and this accident was the result.

We have mentioned on other occasions the tendency to practical joking with electricity amongst the employes at collieries, but one would scarcely think it possible for anyone to go to such a length as the victim of the following accident, who, as the Inspector says, "paid the penalty of his folly with his life." The accident took place at Polton Colliery, and caused the death of an engineer's labourer on the surface while he was attempting to make a connection between the cables of a lighting circuit and a lathe in the fitting shop, in order that the man working it should, on the following day, receive a shock. It appears that deceased went into a loft about 10½ ft. above the lathe at the close of the day's work, where he was unseen, and he was not missed. Inquiries were made about him the next morning, and his body was found by the engineer lying on the floor face downwards, with his head close to the edge of the loft overlooking the workshop, but partly hidden by some belt pulleys. The engineer touched him and received an electric shock, and therefore had the current cut off. The deceased's right arm and the left side of his face were severely burned; his right arm had made contact with a live zinc plate and his face with an iron bracket connected to a girder and thus to earth. He was quite cold, and had apparently been killed outright on the previous night. His intention clearly appears to have been to make a connection between a live lighting wire and a bracket carrying the belt pulleys, so that the man who worked the lathe and oiled the machinery would get a shock when at work next day. It is almost inconceivable that a workman should be so foolish, and no doubt had this man not been killed, the intended victim of the practical joke might have been seriously if not fatally injured. As we have said, this is not a solitary instance of this sort of thing, and the Inspector further goes on to say: "Recently it has come to my knowledge that a man employed at a coal-cutting machine underground had been giving men shocks by switching the current on at the gate box, and then placing the trailing cable in contact with the frame of the machine, and thus causing men working near it to receive a shock. Fortunately, no one was hurt. The special rules do not provide for the punishment of offences of this kind, and it was not possible to do anything except dismiss the man in question from his employment at the colliery."

The following are briefly details of the non-fatal accidents which occurred in this district:—

1. A brusher was sent out from the face to bring in a trailing cable from a gate-end box to a coal-cutter, and instead of taking it in and returning to switch on the current, he, in order to save himself the trouble of the double journey, switched it on at the gate-end box, and was carrying the live cable in. The terminals came in contact with the pavement, and the resulting flash burned his hand. He was lucky to

escape with such slight injuries, as he might have been fatally injured. It is difficult to understand why men will be so foolhardy. The only reasonable explanation is that they do not realise the serious risk they run by such recklessness. "Such work as bringing in trailing cables should only be done by the *machinemen themselves*, as they have, or should have some knowledge of the danger of electricity, and would not, I trust, be guilty of such conduct."

2. A coal-cutter driver received a severe shock from a coal cutter driven by D.C. at 500 volts, with concentric cable and earthed outer. The circuit breaker on the surface was thrown out by an overload on the coal-cutter, and when the machine stopped, he leaned forward to switch off and received the shock. An examination of the machine afterwards showed that the *negative connection was 2½ turns slack and loose*. This was tightened up, and there was no trouble afterwards. The cause of the shock was, no doubt, this bad negative connection. Mr. Masterton, one of the junior inspectors, in investigating the accident, found that the negative connection between the gate-end box and cable was *unsatisfactory*.

3. A pumper was putting in a switch which required to be put in smartly, but he put it in slowly, with the result that an arc was formed, which burned the back of his hand. The current was A.C. at 500 volts. *He had no duty in the switch room and should not have touched the switch.*

4. A coal-cutter chageman was burned on the back of his neck, owing to the machine becoming charged, and an earth connection not having been made by the injured man. The gate-end box was earthed to a water pipe, and the coal-cutter to the box by an additional wire in the trailing cable attached to the box by a lug and screws, and he failed to attach this wire. The leads ran along the bottom to the opposite side of the coal-cutter, and as they were liable to be damaged, the manager had them put into an iron pipe, and this necessitated a large hole being made into the controller box. This hole *had not been bushed*, and the vibration of the machine caused the edge of it to cut through the insulation of the leads, resulting in a short. It is fortunate that the neglect to bush the hole properly did not result in fatal injuries. The defect was at once remedied, and *it will be a lesson to everyone concerned not to overlook such a necessary precaution in future.*

5. A coal-cutter machineman received a shock owing to a small spring of a switch breaking and allowing the live tongue of the switch to come in contact with the casing of the machine and make it "live." The machine was not earthed, and the current was at once switched off. The injured man was unconscious, and it was not until artificial respiration had been kept up for three-quarters of an hour that he regained consciousness. The current was A.C. at 400 volts; at the time of the accident preparations were being made to earth the frames of the machines to the surface, and the neutral point of the system has also been earthed. It is a miracle that this man was not killed, and but for the praiseworthy manner in which the men at hand kept up artificial respiration he would have died. The accident shows the necessity of efficiently earthing the frames of all apparatus, and, further, of maintaining artificial respiration for a long period in cases of supposed death from electric shock.

6. An assistant electrician on looking at an underground motor noticed that the brushes were sparking slightly, and, in order to remedy this, he turned the rocking gear, but pushed it too far, and the flash thus caused burned the back of his hand.

"A non-fatal accident injuring a motor attendant also occurred on the surface. The motor driving the screening plant had been changed over from a direct-current one at 500 volts to a three-phase at 3,000 volts, a week before the accident occurred. The D.C. switchboard was allowed to remain, and it was intended to change it at the week end. The fuses were withdrawn and the switch was opened, but two live terminals on the board, 4 ft. from the floor and 2½ in. apart, were unprotected.

"The injured man was the only one who had access to the motor room, which he kept locked. He stated that he was sitting on a box in front of the board having a meal, at the end of which, as he was getting up, his sleeve caught an enamelled 'danger plate,' which projected sideways from

the board, and a flash resulted which burned the back of his hand. His story does not appear to be a very likely one, and I fear he had been placing something across the terminals, and that when facing the board a short flame burned his hand; he, however, adhered to his statement. In any case he should not have been sitting so close to a switchboard as to touch the danger plate, and I do not for a moment think he would do so with a 3,000-volt current. *Terminals should not be left exposed* in this way, and I am surprised that it should have been allowed."

An underground fire caused by the failure of the electrical plant took place at East Parkhead Colliery. The supply of electricity at this colliery is on the concentric system at 500 volts, and the installation was an old one, predating the Electricity Special Rules. The origin of the fire was traced to fusing in a four-way junction and fuse box, which was nailed to two props on the side of a haulage road about a quarter of a mile from the shaft bottom. An examination of the junction box after the occurrence showed it was a very probable cause of fire. There were clear signs of frequent arcing both on the side of the box, and inside the cover, and it is likely that an arc caused by the blowing of a fuse was formed to the side of the box, and that this was maintained until the insulation of the cable, and then the supporting timber, caught fire.

One of the cables was damaged by a fall of stone on the in-bye side of the junction box, and also on the in-bye side of a fuse, which was inserted in the cable nearer the gate-end box, just before the fire was noticed. It is probable that this fall caused the fuse in the junction box to blow. The fuse on the in-bye side of the junction box should have protected the latter, and that it failed to do so points to its having been the heavier fuse of the two. When Mr. Nelson made his inspection and investigation it was estimated to be 2/18 and, if so, was about 300 per cent. in excess of the working current, whereas the special rules require that it should not be more than 200 per cent. The fire in all probability would have been prevented if the fuse had not been too heavy for its circuit. This is a matter of importance, as arcing may continue for some time before causing the means provided to open the circuit to operate, as apparently happened in this case, if the means provided are slower in action than is required.

(To be continued.)

## APPLICATIONS FOR SITUATIONS.

By "WHISTLEFIELD."

ROBERT BURNS, the Scottish poet, wrote—

"O wad some Power the giffie gie us  
To see oursel's as others see us"

but if he had had to read through the numerous applications which are received in reply to jobs advertised in the ELECTRICAL REVIEW, he would probably have implored "Some Power" to give the applicants the ability to read their applications through the eyes of the wretched engineer or manager who is endeavouring to separate the good from the bad, and form a list for the purposes of an interview.

It is sometimes declared that if a man have plenty of assurance and cheek, he can get a job more easily than one who is lacking in these qualities, but does it occur to the man who knows that he is capable and has good qualifications that he may throw away all these advantages and have to yield place to another who is not so qualified, because he has relied too much on his conscious superiority, and has forgotten that the employer who is reading the applications does not know all that the applicant knows, and is forming his opinion from what is actually written, so that the man who can state his real or supposed qualifications in a convincing manner, emphasising the special qualifications which are required for the job, will stand far more chance of getting an interview than one who is careless in the arrangement and wording of his application?

The chief point which should be borne in mind by anyone

who writes an application is the fact that, for every job advertised there are not only a large number of applicants, but the standard of qualifications of the applicants is invariably high, and there are always several who are quite capable of filling the post with credit; therefore it is not only necessary to show that one is capable of filling the post because of training and past experience, but the very manner in which the application is drawn up should show that, besides technical knowledge and practical experience, the candidate has common sense and is capable of appreciating what is important and what is trivial, of realising that managers are busy men who want facts and data clearly and tersely expressed.

It is little things like these which turn the scale for or against a man in a great many cases, since all employers appreciate men who have their wits about them and who think for themselves.

It is want of thought which allows a man to send in his application written on half a dozen sheets of paper, none of which are numbered, and which have not been fastened together, and very often the fault is aggravated by the fact that the testimonials are on a different kind of paper from the application, so that when they have got mixed it is not an easy matter to collect all the sheets relating to the one application, and find in what order they should be arranged.

An even worse habit, and one that is very prevalent, is to use ordinary notepaper written on every side, so that it is not only necessary to pin the sheets together when they are received, but they must be unpinned every time they are looked at. The worst cases of this kind are applications which are written on notepaper commencing on page 1, then going to page 4, then to page 2 and page 3, the same thing being repeated through three or four sheets without a single number to denote how the pages and sheets follow one another. It stands to reason that a man who is so careless and thoughtless with regard to his own concerns will not be considered a suitable person to put in any responsible position by an engineer or manager, especially when other men equally good but not so careless are available.

Another form of thoughtlessness is exhibited in the long rambling application which leaves one confused at the end, without any clear idea of what the applicant has done. An application of this kind running into a number of sheets of closely and often badly-written foolscap receives scant attention when it is one of a large pile that have to be waded through.

A moment's thought would show that when selecting a man for a post it is necessary to know his age, his present position, and the positions which he held previously. These facts could quite easily be tabulated on one page, so that at a glance it could be seen if a man was in the running or not; then on subsequent pages the information could be amplified under different headings.

The usual method of writing a continuous letter detailing the whole history of the candidate from the time he went to school to the time he made his application, leaves the reader annoyed at having to read so much to find the essential facts, and this is prejudicial to the candidate's chances.

If such information as classes attended or certificates gained seem to be essential, let them be tabulated under the heading of classes attended or certificates gained; then, if the information is not required by the man who is selecting the candidates, he can pass over that section and lose neither time nor patience. The same method could with advantage be adopted when dealing with all the data and particulars submitted, and the result will be an application in which all information required can be quickly and easily found, and which will leave a favourable impression of the applicant's method of work.

While it is not desirable that an application should be too long, it is possible to make it too brief. The following which was received in reply to an advertisement of an important post in a power station is typical of many that are sent:—

"Dear Sir, I beg to make application for the post of \_\_\_\_\_ advertised in the ELECTRICAL REVIEW of \_\_\_\_\_. I have had good experience in power station work, having held a similar post for four years; if there is any other information that you desire, or if you wish to see my testimonials, I shall be glad to call on hearing from you, yours \_\_\_\_\_."

This information might have been sufficient if the applicant had stated in what power station he had worked during those four years, or had given some indication of the plant in use; as it was, no information was given, there were plenty of other good men, and this application was thrown aside. The following extract from another application is a gem in the art of compression:—

"I have had over ten years' experience in the electrical business with contractors, manufacturers, consulting engineers and supply authorities. During this period I have been engaged on, and have been in charge of, the erection, running and repairs of motors, generators, boosters, rotary converters, switchgear, control gear, high and low-tension cable laid solid, drawn-in and armoured, the lay out of static and rotary sub-stations with gear; I am familiar with the economical running of plant and with all tests applicable to fault localisation, and have had a good works as well as theoretical training, and am accustomed to the control of men."

Unfortunately this applicant mentioned later that his age was 24, so he was promptly classed "with the goats."

Another application was one that was a model of all that an application should be; it tabulated in a clear and concise manner all the information that one desires on the front page, and on the following pages was a brief well-drawn-up letter stating the applicant's experience. The surprising thing was that another application drawn up in exactly the same manner came for the same job from a man in another part of the country; the data given were, of course, different, but the style and method of arrangement were identical. It left one wondering by how much the candidate's natural desire to present his qualifications in a favourable light had been improved on by a professional hand, and how big a pinch of salt was necessary before accepting the statements submitted.

Some candidates have all their testimonials printed, as well as tabulated statements of their training and experience; then the application takes the form of a covering letter drawing attention to the special points in their testimonials, &c., which have a direct bearing on the job advertised. This seems to be quite a good method, but some carry it to an extreme, and one comes across printed applications with blank spaces left for filling in the particulars suitable for the occasion, as—"Dear Sir,—Having noticed in this week's — that you are advertising for —, I herewith make application for same." The impression which such an application leaves is that a number of these forms must be filled in and sent off each week to justify printing a form which ceases to be up to date within a few months.

The use of the firm's official paper and envelopes shows a lack of sense, for, naturally, the manager or chief to whom one applies will think that, if paper and envelopes are taken, other of the firm's property might be taken also if occasion offered, and the candidate is prejudiced in his eyes.

No one can lay down the law as to how an application should be drawn up. It must vary with individuals and circumstances, but perhaps these few lines may make intending applicants think a moment before writing, and so prevent them from making those blunders which are due principally to want of thought, but for which a heavy price in disappointment may have to be paid.

## PROCEEDINGS OF INSTITUTIONS.

### Starting and Speed Control of Induction Motors.

By F. C. ALDOUS.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Manchester, January 14th, 1913.)

IN the following paper two and three-phase motors only are considered, which may be taken as having the same characteristics for starting and speed control. Single-phase motors are started on light load, and, being only to a limited extent suitable for speed regulation, are not dealt with in this paper.

The type of motor which is most suitable for any particular service is determined by the conditions of the load, which may be classed as follows:—

1. Constant speed, where after being started the motor has to run at one speed only.

2. Variable speed, where the motor may operate at more than one speed.

For constant speed, many engineers are strongly prejudiced in favour of the slip-ring induction motor, as opposed to the squirrel-cage motor. The latter has many advantages not possessed by the slip-ring motor, and can be used in many cases where the slip-ring motor would be impossible.

It can be used in practically all cases where it normally runs at a constant speed, and up to a size such that the starting current shall not cause undue disturbance to the voltage of supply.

As a rough rule it may be said that when running off the mains of a supply company, the horse-power of a squirrel-cage motor which has to start on heavy load should not exceed 5 per cent. of the K.V.A. of the total minimum generating plant, or 10 per cent. if it starts on light load. On a large power system lower figures than the above would have to be taken. On a self-contained system, such as a group of collieries with their own generating plant, these figures may be easily doubled, since the permissible voltage drop will be greater. A mill which is group driven by squirrel-cage motors can be started up with the generator; power is supplied to the motors at a very low frequency, so that the starting conditions are very good and the whole mill is run up together. In a case like this the motors are provided with starters, so that if it is necessary to shut down a group it can be started again without shutting down the whole mill. The horse-power of any individual motor may in this case be as high as 20 per cent. of the K.V.A. of the turbo-generator.

For variable-speed work the slip-ring motor is generally preferred to the squirrel-cage motor, but where the motor operates at low speeds only for short periods, or where the use of slip-rings is objectionable, squirrel-cage motors may be used with advantage, especially in small sizes.

If good speed regulation is required at several speeds, as for machine-tool driving, or if full-load torque is required for long periods at reduced speeds, a multi-speed motor, which is generally of the squirrel-cage type, is preferable. For two-speed motors with a ratio of speeds 2:1 this can be done by using a winding which is connected for one number of poles for the low speed, and for half that number for the high speed. For other ratios, or for more than two speeds, it is necessary to use two windings, which might, for instance, be connected for 6, 8, 12, or 16 poles, giving a very useful range for variable-speed work. Where suitable speeds cannot be obtained by the use of multi-speed motors, this can often be done by means of "cascade" control, or the cascade motor of Mr. L. J. Hunt can be used.

If the torque required at low speeds is very much reduced, as in the case of fan-driving, a normal slip-ring motor with rheostatic control generally gives the best results. The input to the motor is reduced about in proportion to the square of the speed. The simplicity of the slip-ring motor with rheostatic control and its low first cost render it preferable to the different complicated systems which are now put forward, showing a high efficiency at all speeds.

Squirrel-cage motors of small size can be started by switching full voltage on to their terminals. In this case about six times full-load current is taken momentarily, which current is independent of the load to be started, though its effect on the supply voltage is, of course, more noticeable when starting a heavy load than when starting a light load. The torque developed may be about twice normal torque. Above a certain size, say, 5 to 10 H.P., the starting current is usually considered excessive, and an auto-starter or star-delta starter, or in the case of two-phase motors a series-parallel starter, is used.

If different voltages are thrown on to the terminals of a motor, the current varies directly as the voltage, whereas the torque varies as the square of the voltage; so that a motor which with full voltage on its terminals gives twice normal torque, and takes six times normal current, will, when 50 per cent. of full voltage is thrown on its terminals, give half normal torque and take three times normal current. If this is done by means of an auto-starter with a 2:1 ratio, then when the current in the motor is three times normal, the current in the line is  $\frac{1}{2}$  times normal, since the K.V.A. on the primary and secondary of the auto-starter are equal. In the same way it is found that with a tapping giving 70 per cent. of full voltage, three times normal current is drawn from the line, and full-load starting torque is developed.

With the star-delta starter the motor is designed to run connected in delta. Leads are brought out from both ends of each phase, and by means of a double-throw switch the motor is started in star connection, and when up to speed is switched over to delta connection. By this means rather less than 60 per cent. of full voltage is thrown on to each phase at starting, corresponding to an auto-starter with a 60 per cent. tapping. The series-parallel starter used with two-phase motors in which the windings are connected in series for starting, and in two parallel circuits for running, is seen in the same way to have the same effect as a 60 per cent. tapping. The total energy absorbed during starting is not reduced by using a reduced voltage at starting. When a squirrel-cage motor starts against a load consisting entirely of inertia, the total energy absorbed and the heating of the motor during starting are independent of the starting voltage. If the load consists partly of a friction load, the energy absorbed and the heating of the motor are reduced if the starting voltage be increased.

A high starting voltage is preferable where there is no objection to the consequently heavy starting current.

Sufficient starting torque can usually be obtained by taking a normal slip of 4 or 5 per cent., though on motors of large size this value of slip can generally be somewhat reduced. High-speed motors especially, for pump driving, requiring a comparatively

small starting torque, are generally designed with a normal slip of not more than 24 to 34 per cent., giving an increase of efficiency at normal load and a reduced starting torque.

When specially heavy starting torque is required, as for crane motors and motors for operating sluice valves or small compressors, squirrel-cage motors are built with rotors of much higher resistance, giving a slip of 8 to 10 per cent. at normal load. The rotors are specially built to withstand the heat developed in them without deterioration, and the motors are generally started by switching full voltage on to their terminals, or, in the case of crane motors, are controlled by varying the terminal voltage by means of an auto-transformer provided with different voltage tappings.

In fig. 1 are shown the speed-torque curve, A, and current-torque curve of a motor of 10-H.P., three-phase, 50-cycle, 400 volts, 950 R.P.M., having a normal current of 135 amperes per phase and a normal torque of 553 lb. at 1 ft. radius. This curve shows that the torque at starting is just twice normal, increasing to a maximum of 3.2 times normal at 670 R.P.M. and coming down to normal torque at 950 R.P.M. Curves B and C are drawn for motors having the same stator winding, and rotors of respectively two and three times the resistance of the first motor. The other curve shows the stator current, which is the same for the different motors at the same torque. Fig. 2 shows the rate at which the above motors speed up and the current curves during starting. Curves A and A<sub>1</sub>, fig. 2, refer to the above motor A, fig. 1, when starting on full voltage against a friction torque equal to full-load torque, the load having a fly-wheel effect of 100 lb. at 1 ft. radius. Curves B, C, B<sub>1</sub> and C<sub>1</sub>, fig. 2, give respectively the speed and current for motors B and C when started under the same conditions. Curves D and E refer to the first two motors A and B, still starting against the same load; but, in this case, the motor is started with an auto-starter giving 75 per cent. of full voltage on the motor.

It will be seen from these curves that a motor with a good overload capacity and with a normal slip of 5 per cent. will give a good starting torque without taking an excessive current. By carefully comparing these curves with those drawn for a rotor of high resistance, it is seen that with 10 per cent. normal slip a higher

if the design and workmanship were very carefully carried out, and the only thoroughly satisfactory design is one in which all the contacts are brazed or welded.

DISCUSSION.

PROF. MILES WALKER said that with regard to variable-speed control, he was partial to the use of auxiliary machines generating a back E.M.F. Of course large machines were referred to, and in all probability the use of a booster in the rotor circuit would be extensively employed in the future. The booster arrangement was very simple, the rotor of the induction motor being connected in series with the armature windings of a small D.C. generator excited from a special small exciter. The whole arrangement could easily be controlled by automatic switchgear, and one of the simplest methods of varying the speed was to rock the brushes on the D.C. generator. This arrangement seemed to have a wide future for rolling mills.

MR. FAYE-HANSEN said that with slip-ring motors of modern design, especially for low periodicity, the rush of current if switched on to the full voltage might be as large as, or larger than, the current taken by the squirrel-cage motor starting from an auto-transformer. This kick, however, only lasted for a very small part of a second, and if required could be greatly reduced by using a switch having an auxiliary contact which at the first step put a resistance in series with the motor. The speed control of squirrel-cage motors had the disadvantage that the maximum torque was reduced as the square of the voltage applied, so that if a large torque was required at low speeds, the motor might get unstable. It shared also with the slip-ring motor the disadvantage that if run at low speeds, the speed changed very much with an alteration in load. This and the low efficiency of these motors at low speeds justified in many cases the use of pole-changing motors or cascade control of some kind, notwithstanding the increased cost and complication. Regarding the control of pole-changing squirrel-cage motors, it must be remembered that as a rule it would not be allowable to switch the motor directly over from one speed to the other, as the rush of current might then be nearly as great as if the

motor were started from rest at full voltage. In going over from one speed to another, therefore, the tappings on the auto starter would, as a rule, have to be used. In some cases multiple-point starters were called for, but this was very seldom justified, as nearly always the rush of current to start up the motor was very much greater than the rush of current in switching over from the starting tap to full voltage. An important drawback to the use of multiple-point starters was that fairly heavy currents would have to be broken, while in a two-point starter, as a rule, only comparatively small currents were switched out. The current density in the motor at the moment of switching in was, approximately, 26,000 amperes per sq. in. The author was rather too severe in condemning riveted, screwed and soldered joints in all squirrel-cage motors, though he was justified in doing so in all cases

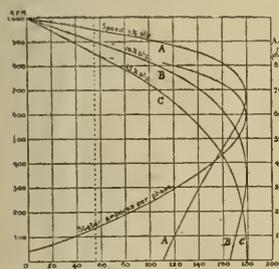


FIG. 1.—SPEED-TORQUE AND CURRENT-TORQUE CURVES.

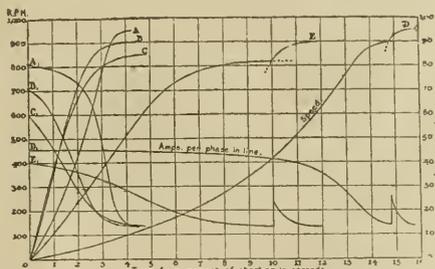


FIG. 2.—SPEED AND CURRENT CURVES DURING STARTING.

torque and a considerably lower current are obtained at starting, and of course a lower efficiency at normal load, but that there is not much advantage in increasing the slip above 10 per cent. In these curves the rotor resistance is assumed to be unaffected by temperature.

The heating of the motor is dependent upon the starting voltage. In order to give an idea of what this heating may amount to, an example is given of the starting of a squirrel-cage motor which drives by a belt a heavy mining fan. These fans, owing to their great inertia, are well known to impose very severe starting conditions upon squirrel-cage motors. The fan delivers 100,000 cu. ft. of air per minute against 4½ in. W.G. Its runner has a weight of 1 ton and a radius of gyration of 3 ft., and its speed is 415 R.P.M.

The motor is of 100 H.P., three-phase, 50-cycle, 500 volts, 720 R.P.M., and starts on a 70 per cent. voltage tapping. It has a starting torque with the rotor cold of 1.75 x normal with full voltage, and a normal slip of 4 per cent.

The rotor is heated up during starting far more than the stator. It cools off very rapidly, and after about 1 minute almost attains its normal temperature.

When the motor is first started, the rotor heats up so rapidly that though the current is diminishing the rate of heating increases, owing to the fact that the resistance of the rotor is increasing. After 30 seconds, when the motor is nearly up to speed, the rotor still has a temperature rise of 95° C., corresponding to an increase in slip of nearly 40 per cent. above its slip when cold. On switching over to full voltage the motor comes up to a speed of 712 R.P.M., and gradually creeps up to its normal speed of 720 R.P.M. as the rotor cools off.

The rotor has a maximum temperature rise of 126° C., meaning an actual temperature of perhaps 150° C. This is not excessive, since a rotor of good design and construction can stand temperatures far in excess of this without deterioration. When running at normal load the rotor has a temperature rise of less than 20° C., and the heating which occurs during starting is entirely local, since there is not sufficient time for heat to be transmitted to the stator.

Though the temperature of 150° C. is not sufficient to melt solder, it would certainly be undesirable to use solder on a rotor which operates under such severe conditions. Any screwed or riveted contacts would be liable to deteriorate under such conditions, even

where such heavy starting conditions occurred. There had also been made some short-circuited rotors without any joints at all, the winding being punched out of sheets, pulled into shape, and then placed in the slots. A winding having independent short-circuited turns had the advantage that the tendency to creeping speeds due to higher harmonics in the field form was reduced.

MR. W. CRAMP said the example of constant-speed drive in a mill, as quoted by the author, might be applied with advantage to many cases where a large number of line shafts or machines had to be started together, but he thought it much better to excite the alternator separately at starting. The statement that the rotor of a squirrel-cage induction motor would run synchronously with the magnetic field of the motor at no load was quite erroneous. Whilst discussing the question of speed variation the speaker referred to a type of squirrel-cage rotor having two windings, one at the surface of the rotor as usual, and the other embedded in the rotor close to the shaft. The effect of this arrangement was that when starting, the frequency being high, only the outer winding would be affected, but as the frequency diminished the inner winding would come into play, thereby reducing the rotor resistance. Some years ago, a repulsion-induction motor had been built by him along these lines with very satisfactory results. In this case, the repulsion motor winding was in slots around the rotor periphery, and this winding carried most of the current at starting. Below this winding was a squirrel-cage rotor winding, which as the motor approached synchronism, carried more and more current. The result was a machine having an excellent starting torque, a small commutator with short-circuited brushes, excellent commutation and a general characteristic load-speed curve like a compound-wound direct-current motor. It was made originally for single-phase circuits and for fan driving. It could be thrown straight on to the line without a starter as all necessary regulation could be obtained by rocking the brushes.

MR. B. THOMAS said the examples of constant-speed driving and method of starting up were very interesting, but it was doubtful whether the system could be adopted in cases of friction load. Some friction loads were very great, a case in point being that of a motor-driven air-compressor. When single-cylinder machines had

to be dealt with, a starting device operated in conjunction with the compressor valves had been found necessary.

MR. J. FRITH said that partial insulation of the rotor winding on squirrel-cage machines was no good at all. The windings should either be thoroughly well insulated or connected to the core at every point. Rotors of solid cast-steel had been used with great success in crane work. They started well, and owing to their high power factor, the current was comparatively small.

PROF. MARCHANT said that, in the case of one motor in his laboratory, there was quite a strong seventh harmonic in the flux wave, which caused the motor to run fairly steadily under certain conditions at one-seventh synchronous speed. It was sometimes quite difficult to get it to run through this speed when starting. This phenomenon was found mostly in motors with a small number of slots per pole per phase, and seemed to be particularly marked in motors which were fitted with pole-changing devices. From this point of view, the wound rotor had an advantage over the squirrel-cage rotor.

The AUTHOR, in reply, said that six times normal was the usual figure for the starting current of squirrel-cage motors. Some motors, particularly high-speed machines, took more than this, but if the starting current was reduced much below the figure quoted, trouble would probably arise. He wished to emphasise the desirability of aiming at a good starting torque. The scheme explained by Prof. Walker was particularly interesting, as some system of that kind was essential for variable speed control. It was a difficult matter to decide what system to install in rolling mills, as variable speed control was essential in addition to a heavy torque. Regarding Mr. Faye-Hansen's remarks, what he (the author) referred to expressly was the current which flowed for a second or so after switching. The determination of the short-circuit current was far more difficult than that of the no-load current. In the case of the short-circuit current, it was necessary to determine the size, number and shape of slots together with details of the end connections, and altogether it was a complicated business, and if there was any doubt about calculating the value, a good margin should be allowed. Concerning the heating of the rotor winding, he maintained that in certain types of windings there was no time for the heat to be transferred to the core. In many cases it had been found that the heating of the part of the winding inside the core was greater than that at the ends of the core. The figures given in the paper formed a rough idea of what to expect, and it was necessary to calculate the heating of the windings as independent of the core. Experience had shown that it was best to eliminate joints where possible, especially in small machines. The rotor of a squirrel-cage motor did not exactly run synchronously with the magnetic field, but the difference was so small as to be immeasurable. The energy absorbed by a squirrel-cage motor exceeded that absorbed by a slipping motor at starting. Regarding the question of saturation, all calculations had been made assuming the current proportional to the voltage, and this seemed a very true estimate. Squirrel-cage motors were admirably suited to operating small air-compressors.

In order to produce an ink line on the paper without introducing friction, the siphon must not touch the paper even momentarily, and arrangements have been made to jerk the ink in fine drops on to the paper. To accomplish this the whole of the siphon suspension is vibrated rapidly up and down between the springs V and K

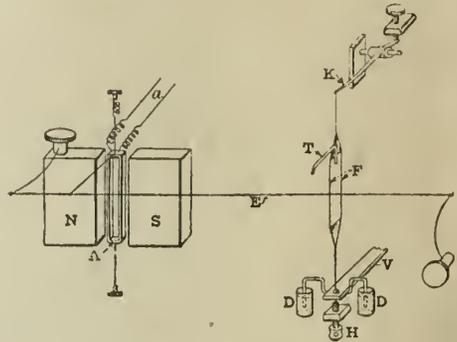


FIG. 1.

by means of the spring V, which is attached to a vibrator. To impart a jerk to the siphon, a stop, H, is fixed directly under the axis of suspension, and two little dash-pots, D, D, on either side prevent the spring bouncing on the stop.

When the instrument is adjusted to have a natural frequency of 10.5 per second, with a 300-ohm 300-turn coil, a current of 50 microamperes gives a full-sized signal corresponding to a deflection of

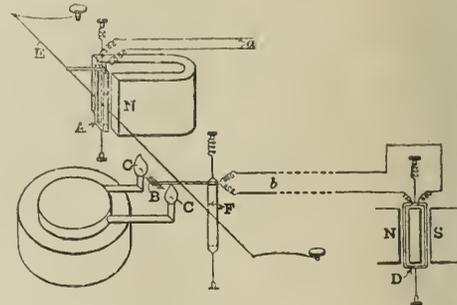


FIG. 2.

0.1 in. on the paper. Under these conditions the back E.M.F. of the coil is only about one-quarter to one-fifth of that of the ordinary recorder coil.

Trials with this instrument have shown an increase of speed of 30 per cent. on the longest Atlantic cables.

In the thermo-electric magnifying relay, fig. 2, the power in the relay circuit is generated by means of five thermo junctions at different temperatures. The heat is supplied by two little flames, C, C, and a

**Some Methods of Magnifying Feeble Signalling Currents.**

By S. G. BROWN.

(Abstract of discourse delivered at the Eighth Annual Exhibition of Apparatus, held by the PHYSICAL SOCIETY, on December 17th, 1912.)

TELEGRAPHY over long submarine cables is continually on the increase, and it is a fairly accurate statement that the number of messages sent doubles itself every 10 years. It is therefore important that, besides the increase in the number of the cables laid down each year, means should be devised to increase the carrying power.

The instruments which I have invented and am about to describe were designed primarily for cable work, but they are easily applicable to recording many other kinds of signalling impulses.

Lord Kelvin invented the siphon recorder about 45 years ago: he designed it so carefully that no improvement in its sensitiveness has been brought about until now.

The ordinary siphon tube is about 2½ in. long and from 8 to 12 mils in diameter. The moving coil consists of 500 turns of 2-mil wire at a mean radius of ½ in. The coil and siphon are mounted on separate axes and are connected by silk fibres so that the angular movement of the siphon is about two to three times that of the coil. By reducing the length of the siphon to ½ in. and substituting a narrower coil it is possible greatly to increase the sensitiveness of the recorder.

In order to make the inertia effects of the moving system a minimum, it is advisable to make them equal for the coil and the siphon. Even a narrow coil of 300 turns has about 100 times more inertia than the siphon, so that it is necessary to move the siphon through √100 times the angle moved by the coil. By reducing the number of turns on the coil and increasing the field it is possible to reduce the natural period for a given sensitiveness and back E.M.F., but in practice it is inadvisable to reduce the turns on the coil below 50 or 100. Means of magnifying the motion of the coil and transmitting it to the siphon have to be used. In this instrument (fig. 1) it is accomplished by means of a fine fibre, E, which is kept in tension by flat springs at each end. The fibre is attached to an arm carried by the moving coil A, and to a vertical fibre, F, on the siphon suspension.

The siphon is carried on an aluminium carrier to which a single central fibre is attached at the top and two parallel fibres, F, 0.2 in. apart below. One leg of the siphon lies on the axis of the suspension and dips into a small opening in a pipe extending from the ink-pot.

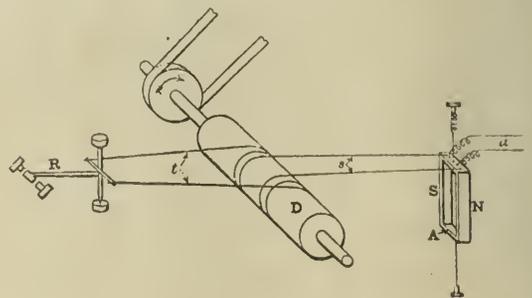


FIG. 3.

very light thermopile, n, is suspended so as to swing in and out of the flames, and is coupled to a moving coil through which the received currents pass. The thermopiles consist of alternate junctions of platinum and platinum + 20 per cent. iridium, wires being used of 1 mil. diameter. The wires are melted on to a fine glass tube about 10 mils diameter. For moving the thermopile in the flames similar arrangements to those just described for the siphon recorder are employed.

An alternative arrangement which gives greater sensitiveness and enables heavier thermopiles to be used is to fix the thermopiles

and vary the flames by means of a valve or shutter actuated by the coil movements.

As the thermopile current depends on the difference of temperature between the junctions, a certain time is required to heat the wires. It is found that for cable work, where the frequency seldom exceeds 10 per second, the lag is inappreciable, but for considerably faster movements it becomes important. In duplex working, when the sending current has to be balanced so as not to affect the receiver, quick "jarry" movements are very difficult to eliminate, but the lag in the thermo instrument reduces these movements very considerably and is a valuable property.

When a thermopile with seven junctions on each side was deflected 0.075" the current sent through a resistance of 42 ohms (equal to its own resistance) was 0.81 milliampere. With the natural period of the coil equal to 8.7 per second and a 480-ohm 480-turn coil, a current of 0.03 milliampere through the coil gave a current of 0.81 milliampere from the pile through an external resistance of 42 ohms. For slowly changing currents this corresponds to a magnification of power of about 27 times, and, of course, this can be greatly increased by reducing the period of the coil. For quickly changing movements the power magnification is not so great, owing to the back E.M.F. of the coil. Trials of this instrument on an Atlantic cable have shown an increase in speed of about 40 per cent.

The instrument just described is a magnifying relay—that is to say, it multiplies the impulses received in exact proportion to their strength. This form of relay is quite distinct from an ordinary make-and-break relay, which delivers a constant current for any impulse over a certain strength. For very many purposes it is essential that received impulses should be magnified without altering their shape, and this can only be done by an instrument with a constant magnifying power.

This property I will now illustrate in an entirely mechanical relay in which movements operated by very small forces are largely increased in strength without affecting their motion. The relay consists in principle of a rotating spindle around which are wound one or more turns of a flexible cord. The spindle is revolved in such a direction as to pull away from the magnified forces and towards the small forces that control the movement. Suppose a heavy weight has to be raised by a force of one-tenth of the amount, it will obviously be necessary to supply 90 per cent. additional energy, and this is supplied by the motor driving the spindle. The magnification of force and energy depends on the number of turns which the cord makes round the spindle and follows a compound interest law.

Fig. 3 shows an application of the principle to cable work, in which the small forces operating the coil A are intensified sufficiently to work the coarse relay arm R. The spindle rotates away from the relay arm R and towards the coil, and produces a much greater tension in the fibres *t* than in *s*. When the coil swings on its axis the tension is increased in one of the fibres and diminished in the other and a similar change in a magnified degree takes place in the fibres *t*.

By using means of this sort it is possible to work an ordinary siphon direct writer (which normally requires some 3 milliamperes) by a current of 10 microamperes.

### American Electrical Installations.

At a meeting of the YORKSHIRE SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS on Wednesday, the 12th inst., Mr. T. Harding Churton delivered a lecture on "Some American Electric Plants."

MR. CHURTON dealt first with the generating stations deriving their water power from Niagara. Tracing the history of the Niagara Falls Power Co., he stated that the three present stations of the company had a total capacity of 160,000 H.P. The two stations on the American side had in operation 21 generators, each capable of delivering continuously 5,000 E.H.P., whilst the station on the Canadian side had five generators of 10,000 E.H.P. The three stations were interconnected so that either power house could act as a reserve for the other two. The turbines in the American power house No. 1 were Fourneyron inverted twin turbines designed by Faesch & Piccard, of Geneva, those in power house No. 2 were Francis single turbines, equipped with draught tubes, and designed by Escher, Wyss & Co., of Zurich; and the turbines in the Canadian plant were Francis double inward discharge turbines, with draught tubes, designed by the same firm. All the generators ran at a speed of 250 R.P.M. Speaking of the Electrical Development Co., of Ontario, and the Ontario Power Co., he described their machinery in detail, and mentioned that from the transformers at one of the sub-stations of the latter company, the voltage was stepped up to 60,000 volts, at which voltage energy was transmitted as far as Syracuse, New York State, 160 miles away. The line consisted of aluminium conductors 1½ in. in diameter, carried on steel towers, 55 ft. high to the top wire, with an average span of 500 ft., the insulators being of porcelain and weighing 35 lb. each. In the immediate vicinity of the station the current was sent out untransformed at 12,000 volts, and delivered to the transformer station of the Hydro-Electric Power Commission of the Province of Ontario for transmission and distribution at 110,000 volts. The system of transmission lines of this Commission was 300 miles in length, and included municipalities within a distance of about 150 miles from Niagara, embracing the City of Toronto. The current was at 25 cycles, and he noticed that in large rooms where there were many lamps the flicker due to the low frequency was quite perceptible, particularly from lamps not directly in the line of vision. Mr. Churton went

on to describe two hydro-electric plants in British Columbia—one, that of the British Columbia Electric Railway Co., Ltd., and the other, that of the Western Canada Power Co.—the water for which was derived from Lake Hontzen and Lake Stave respectively. In the case of the British Columbia Electric Railway Co., he said that the company also supplied light and power, and a notable increase in the consumption at private residences had been observed, which was due to the adoption of electrical cooking and heating appliances. Here, also, the use of electricity for illuminated signs for advertising purposes had been developed to a most wonderful extent. Among the special features at the Vancouver sub-station of this company might be mentioned the installation of three six-phase 60-cycle rotary converters, which were among the largest of their kind in the world. Speaking in regard to two steam-driven plants which he had visited—the Delray plant of the Detroit Edison Co. and the Fisk Street plant of the Commonwealth Edison Co., Chicago—he said the features that struck him particularly were the large size of generating units adopted, the compactness of the plants, the great extent of the labour saving devices and the excellent organisation and appointments everywhere observed. At the Delray station the coal consumption was equal to about 2.23 lb. per kw.-hour delivered, the thermal value of the coal being 14,000 units, and the cost delivered about 10s. a ton. The Fisk Street station plant already contained 10 14,000-kw. sets, but the demand was so great that an extension was now in progress which, when completed, would embrace four additional sets of 25,000 kw. each; the first of these sets was being built at Messrs. C. A. Parsons's works at Heaton-on-Tyne. This generator would be capable of giving continuously 25,000 kw., but its most economical load would be 20,000 kw.; it would generate three-phase current at 25 cycles, 4,500 volts, at a speed of 750 R.P.M. The lecture was very fully illustrated by means of lantern slides.

In the course of a discussion which followed, many questions were asked, and MR. CHURTON, in reply, said he thought the reason for using 25 cycles was that it afforded greater facilities for long-distance transmission than higher-frequency current did. As to charges for power, the price in Toronto was 2½d. per unit for the first 50 units used in a month, ½d. for the second 50 units, and ¼d. for the third 50 units. At Vancouver for power there was a charge of 4s. per H.P. on the rated load per month, plus ¼d. per unit used, up to 100 H.P., over that ¼d. per unit up to 200 H.P., and over 200 H.P. ½d. per unit. At Toronto, for lighting the charge was 4d. per unit for the first 25 units, and a reduction of 1½d. per unit for all over that. At Vancouver the charge for lighting was 5d. for the first 50 units and a sliding scale down to 1½d. per unit for all over 1,500 units per month. In regard to a question as to liability to accidents, he thought that the construction was so very strong that the liability there was rather less than it was here, and, of course, the high voltage made no practical difference to the risk of shock. In regard to generating costs, he took it that the prices at which the energy was sold were a fair indication, but it should be remembered that the generating costs of water-power plants were made up in a totally different way from those of steam plants. The cost of running a water-plant station must be fabulously less, because the labour bill was next to nothing. In a power house with 50,000 or 60,000 H.P. there would be one man walking about the place with practically nothing to do. In regard to wayleaves, the lines that went from Niagara to Toronto were over private ground all the way, and to a large extent that would apply to the others; where public roads were crossed there were additional protections and safeguards.

### CONTROL OF METERS AND LAMPS FROM THE CENTRAL STATION.

ON Friday last we took part, on the invitation of Messrs. Handcock and Dykes, in a visit to Staines to witness a demonstration of a new system of controlling apparatus connected with a network of distributing mains, without the use of pilot wires and without affecting any other consuming apparatus on the mains in any way. The new system is the joint invention of Mr. W. Daddell, President I.E.E., and Messrs. Handcock & Dykes, and was described in a recent communication to the *Journal* of the Institution of Electrical Engineers, from which we abstract the following particulars:—

The underlying principle is to control relays, which may be inserted anywhere on the general system of mains, by means of a superposed current impressed on the main current flowing in the system. If the main current be continuous, then the control current may be alternating, of any desired frequency. If the main current be alternating, then the impressed current must be of a different frequency, the relay in either case being so designed that, while it instantly responds to the impressed current, it is unaffected by any alteration of the main current or pressure.

As long as the feeder bus-bar voltage is kept constant the amount of power supplied to consumers is practically unaffected by the ripple. The output of the main generators is simply reduced by an amount equivalent to the power produced by the "ripple generator."

In direct-current systems the solution is simple. The relay is connected as a shunt across the mains and in parallel with the lamps and with the meter to be controlled. If a condenser be placed in series with the relay, it is obvious that as long as there is only a continuous voltage on the mains, no current passes through

the relay. As soon, however, as an alternating voltage is impressed on the mains a current passes through the relay and causes it to actuate the particular mechanism required.

When the main supply is alternating the problem is not so simple, inasmuch as the condenser will allow a current to pass through the relay from the main 200-volt 50 cycle supply as well as from the small superposed ripple. The relay must in this case be made "selective," so that it will operate only when a current of the selected frequency is impressed on the line. Such a selective relay is also to be preferred for a direct-current supply as it enables several relays adjusted for different frequencies to be employed, any one of which can be brought into action as required.

In order to achieve this result, the inventors take advantage of the principle of resonance, and so choose the self-induction of the relay  $L$ , and the capacity of the condenser  $K$ , that at the frequency  $F$ , at which the relay is intended to operate, they are in resonance, whilst at the normal frequency they are not. That is to say, neglecting resistance, the following relation is established:— $L \times K \times (2\pi F)^2 = 1$ .

When this relation holds, the potential differences between the terminals of the relay and of the condenser are much greater than the applied potential difference, and, consequently, the current passing through both the relay and the condenser is much greater

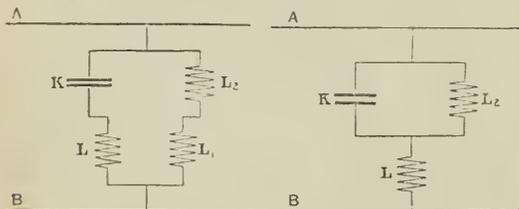


FIG. 1.

FIG. 2.

than that due to the applied voltage. The two potential differences are out of phase with each other, and their vector sum is equal to the applied voltage. In practice they find the potential difference between the terminals of the relay coil at the resonance frequency to be some 10 times the applied potential difference.

It is found best to adopt, on alternating circuits, frequencies comprised between the third and fifth harmonics of the supply.

A satisfactory value for the R.M.S. value of the superposed voltage is 5 per cent. of the supply voltage, whether direct or alternating. That is to say, on a 100-volt circuit, direct or alternating, the R.M.S. voltage of the ripple is to be 5. The simple resonance circuit described above works perfectly in the case of a D.C. supply, and has many advantages over the non-resonant relay; but in the case of an A.C. supply, unless the resonance is made unduly sharp, or there be a large difference between the frequencies, the condenser  $K$  and relay  $L$  will let through sufficient current at the supply frequency to attract the armature of the relay.

To get over this difficulty the inventors add a compensating circuit to the relay, as illustrated in fig. 1, where  $L$  is the relay coil, the armature and core being omitted for the sake of clearness. On top of this coil is wound a second coil,  $L_1$ , which may have, roughly, the same number of turns, and this coil is connected in series with a choking coil,  $L_2$ , having a high self-induction. The current through the choking coil  $L_2$  and compensating windings  $L_1$  is made to lag about  $90^\circ$ . If these two currents be adjusted to approximate equality, their action on the core of the relay can be made very small. A compensated resonance relay of this sort will work with certainty at 5 volts at 200 frequency and will take no notice of 100 volts at 50 frequency. This relay would only operate when it should not if the voltage of supply were allowed to rise from 100 to somewhat over 200 volts, so there is no fear of failure from this cause.

Failure takes place when the superposed voltage is reduced to about 3.5 volts. If the superposed voltage be maintained at its normal value of 5 volts a variation of some 5 per cent. can be made either way in the frequency before the relay fails to act.

The relays are adjusted for use on a 100-volt 50-frequency supply. The capacity of the condenser  $K$  is 2 mfd., and the self-induction of the relay winding  $L$ , 0.3 henry. The compensating winding  $L_1$  is wound closely on top of  $L$ , and has approximately the same number of turns. The choke coil  $L_2$  is adjusted until the force acting on the armature produced by the 50-frequency current is a minimum. Under these conditions there flow through  $K$  and  $L$ , and also through  $L_2$  and  $L_1$ , two currents, each approximately 0.06 ampere, and having a phase difference of somewhat less than  $180^\circ$ . The current taken from the mains is the vector sum of these two currents and only amounts to 0.02 ampere. The true power taken at 50 frequency and 100 volts is 0.7 watt. At 200 frequency and 5 volts, the currents through the two circuits are no longer equal, that through  $K$  and  $L$  being 0.15 ampere and that through  $L_2$  and  $L_1$  0.01 ampere. The current through the relay winding is nearly in phase with the applied potential difference between the mains, whilst the current through the compensating winding  $L_1$  lags about  $90^\circ$ . Hence, the ampere-turns on the two windings of the relay arc nowhere nearly equal, and consequently there is a force acting on the armature. The actual power taken at 200 frequency and 5 volts is about 0.7 watt.

These figures are given as an example. It is of course quite easy to modify them by slight alterations in the windings of the coil. The windings on the relay coil are arranged so that the current would flow round the core in the same direction if a continuous current could be passed through the two circuits as connected up, that is to say, if the condenser were short-circuited. This means that the two windings can be converted into one, and the arrangement illustrated in fig. 2 can be used, which is electrically identical with that in fig. 1.

In order to superpose the ripple on the supply, whether D.C. or A.C., the simplest way is to put a small high-frequency alternator in series with the main generators. Where high voltages are employed, and also in the case of direct-current supply, the secondary of a transformer can be placed in series with the main generators and the primary be connected to the high-frequency alternator. Several relays adjusted for different frequencies can be connected to the same supply and be brought into action by varying the speed of the high-frequency alternator.

By inserting relays in the bases of the lamp-posts, street lighting can be switched on or off from the station, either as a whole or in sections as may be desired. Arc lamps or high-power lamps can be switched off at any desired time and smaller lamps substituted for them. Transformers in sub-stations can be cut in and out exactly as required. Effective control can be maintained over the main switch on the premises of consumers who are taking current at special rates during restricted hours. In return for a small payment shopkeepers can have lights burning for window display or for advertising purposes till any agreed hour, when they can be switched off from the station by means of a relay fixed on the premises. In many residential districts public clocks are either absent or so unreliable that a ready means of setting the domestic clocks would be very desirable, and there are a number of people who would be very willing to pay a small sum per annum to have installed on their premises a relay which would be actuated from the station, and would give an audible signal daily at, say, 8 a.m. Greenwich mean time.

The compensated resonance relay should be of considerable assistance in electric track signalling on railways.

The increasing use of electricity for various domestic purposes other than lighting has increased the need for some simple system of charging. Every one can understand selling current at one price when the station is busy, i.e., at peak load, and at a much lower price at slack times, when otherwise some of the plant would be more or less idle. It does not matter in the least to the station for what purpose the current is used. In some A.C. stations in residential districts the two-rate system has been introduced as an alternative to a flat rate, and by far the greater number of consumers have elected to take the two-rate system despite the increased meter rental entailed by the necessity of having two separate meters and a clock switch. In such districts where the plant is always running, one can obviously afford to sell current at a low rate off the hours of peak load.

It will be seen that the "two-rate system" presents many advantages, but the necessity for constantly altering the setting of the clocks and winding and keeping them in order is a serious drawback. Where two-rate meters are already installed, a simple relay, as described above (to which the name of "Handyell" has been given, pronounced "handle"), can take the place of the clock switch, thus effecting a considerable saving in first cost and in cost of upkeep. It has, moreover, the advantage that the time of operation can, if desired, be adjusted each day to suit the variation in the time of peak load.

This dispenses with the clock, but the inventors propose to go further and make the ordinary meter serve the purpose of a two-rate meter. At Staines, on the system of the Egham and Staines Electricity Co., Ltd., to which Messrs. Hancock & Dykes are the consulting engineers, electrical energy is sold at 7d. per unit; it was found that there was a lively demand for a supply off the peak at 2d. per unit, with two-rate meters, and the engineers, observing that if a consumer's meter were stopped for five minutes and allowed to run for two minutes, the result would be the same as that given by a two-rate meter, decided to adopt this method of charging. A small alternator is installed at the generating station, with a synchronous motor to drive it, and an automatic arrangement of cams and switches is used to break the field circuit of the alternator for two minutes out of every seven. During the other five minutes the alternator, which has a frequency of 200 cycles and voltage of 140 volts, and is connected in series with the 2,000-volt mains, supplies the "ripple" superposed upon the 50-cycle supply; each meter to be controlled is provided with a resonance relay, which breaks the shunt of the meter while the ripple is flowing, with the aid of a small mercury switch of the type widely used in sign flashers, and therefore of proved reliability. It should be mentioned that the supply is given through house transformers at 100 volts, so that the actual voltage of the ripple on the secondary circuit is about 5 volts, allowing 2 volts for drop in the mains.

During the peak, the high-frequency alternator is shut down and short-circuited, so that the meters work full time. The system has been in successful operation for some months, and no difficulty has been met with in explaining it to consumers.

The continuous consumption of power is 0.7 watt per relay at 50 cycles: when the ripple is in operation, a further 0.7 watt is consumed, at 200 cycles, making 1.4 watts per meter, but during this period (5 out of 7 min.) the shunt loss of the meter, say, 1.5 watts, is cut off. During the remaining two minutes, the shunt loss and the relay loss are added, so that, on the whole, there is a slight net loss due to the use of the relays.

In such a case as the above, the high-frequency alternator must

be capable of carrying the whole of the supply current continuously, and of generating the pressure necessary for the ripple, but the power required to drive it is only a fraction of its K.V.A. rating thus derived. At Staines, the mains are single-phase concentric with the outer earthed, and the high-frequency generator is connected in series with the earthed conductor; but it is important to observe that the "Handyell" system is entirely independent of "earth," and is, obviously, equally applicable to a wholly insulated system. It will undoubtedly prove a valuable aid to the central-station engineer.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### New Pattern "Stannos" House Zed-Fuse Box.

Messrs. Siemens Bros. & Co., Ltd., are placing a new house fuse box on the market which is exceptionally compact, neat in appearance, and, we understand, low in price. Fig. 1 shows an open fuse box (half size) wired with "Stannos" wire on the concentric system. The continuity of the "Stannos" sheathing is



FIG. 1.—STANNOS HOUSE ZED-FUSE BOX.

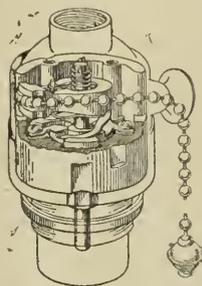
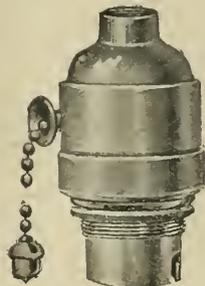


FIG. 2.—B.T.H. PULL-CHAIN SWITCH HOLDER.



maintained by means of "Twiston" connectors terminating at the left-hand corner, efficient contact being ensured by means of the screw, as shown. The box is also eminently suitable for use with ordinary braided wires. It has a capacity up to 15 amperes. Further particulars can be obtained from the makers.

### B.T.H. Pull-Chain Switch Holder.

We referred briefly in our last issue to the ingenious pull-chain switch holder recently placed on the market by the BRITISH THOMSON-HOUSTON CO., LTD. We are now enabled to give a more detailed description, with illustrations (fig. 2). The stiff, jerky action of the ordinary key-switch holder has always been recognised as a serious demerit, because of the risk of lamp breakage. The new B.T.H. Pull-chain Switch-Holder has a horizontal rotary action, controlled by a beaded chain hanging from the top of the holder. This action is so "sweet" and easy that the lamp can be switched on and off without the slightest vibration. Twelve inches of chain are supplied with each holder, so that if it is attached to ceiling fittings, the switching can easily be done from the ground. The contractor who fits a B.T.H. Pull-chain Holder to a table standard, and keeps it standing on his counter, is sure to make sales to many people who pull the chain out of curiosity, and then want to buy the whole equipment.

### The "Fors" Car Lighting Dynamo.

The latest dynamo designed for electric lighting purposes on motor-cars, is that which has just been put on the market by Messrs. RICHARD PAPE, LTD., Belvedere Works, Belvedere, Kent. The machine, which is electrically self-governing, is designed for use with the well-known "Fors" 12-volt storage battery. The dynamo, inclusive of the auto-switch, measures less than 10 in. long  $\times$  8 in. wide and 6½ in. high, and weighs 20 lb. complete as illustrated (fig. 3). The normal speed is 2,000 r.p.m. and the maximum output is 150 watts. The makers claim the following, among other advantages, for it:—Accessibility of the brushes and commutator, dust-proof joints, absolutely constant voltage by a special design of field magnets, and absence of mechanical complexity.

The brush casing can be readily detached by removing a locking

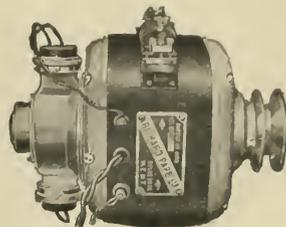


FIG. 3.—"FORS" CAR LIGHTING DYNAMO.

stud, and the position of the brushes may be varied to obtain the best result. The magnetic switch is bracketed to the carcass so that the whole is self-contained. The voltage regulation is effected by means of supplementary pole shoes, in conjunction with the field magnet, their purpose being to divert part of the flux of the main magnets. When the voltage of the dynamo is sufficient, the automatic switch closes the circuit between the dynamo and the battery, and when the speed is too low it disconnects the battery from the dynamo. A 12-volt battery of 40 amp.-hours capacity is intended to be used with this installation, but preferably a 75 amp.-hour battery is employed when the vehicle is required for constant use at night with fairly long periods of intermittent use of the engine. A neat switchboard forms part of the installation.

### New Westinghouse Oil-Break Switch.

THE BRITISH WESTINGHOUSE CO. has recently brought out a small oil-break switch suitable for switchboard mounting on A.C. three-phase, 50-period circuits up to 125 amperes and 650 volts. It is constructed on the well-known metal and mica principle and has one or two unique features. The switch is simple in design and sound in construction, as will be recognised from fig. 4, which shows the switch with tank removed. It will be seen that the

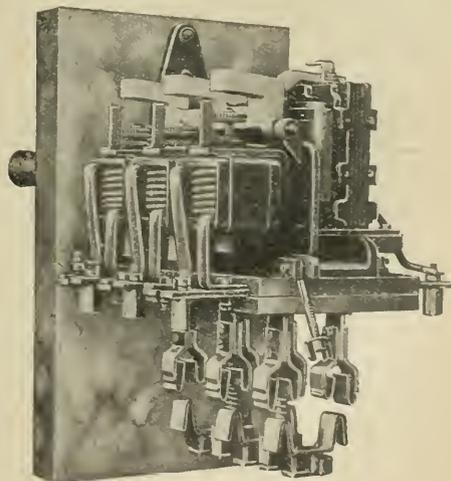


FIG. 4.—SMALL WESTINGHOUSE OIL SWITCH.

connections to the stationary contacts pass out through the side of the slate or other insulating material, this arrangement making it most convenient for connecting up.

Above the slate slab, on the left-hand side, the overload coils are shown, and these operate the tripping bar in the ordinary way. On the right-hand side of the switch, the no-volt release coil is fitted.

The switch is fitted with a loose handle arrangement, and it is impossible to close it when there is no voltage on the circuit.

The three moving contacts are mounted on a steel bar, insulated with moulded mica. The rods which connect this bar to the operating mechanism are of steel, and pass through guides secured to the base of the switch, thereby ensuring that the moving contacts have a parallel motion. It will be noticed that spiral springs are fitted, thus giving a quick break action to the switch.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 2,718. "Electric furnaces." F. C. WARDALL and J. MARCHANT. February 8rd.
- 2,732. "Electrical switchgear." A. L. TACKLEY and CHLORIDE ELECTRICAL STORAGE CO., LTD. February 8rd.
- 2,740. "Electric heating devices." P. OOOD. February 8rd.
- 2,749. "Telephone transmission circuit." H. C. FOERTON. (Convention date, July 18th, 1912, United States.) February 8rd. (Complets.)
- 2,752. "Electromagnetic stress meter for telephone exchanges, and for other purposes." SIEMENS BROS. & CO., LTD., and E. A. PETTIBORY. February 8rd. (Complets.)
- 2,757. "Electrical switches." W. MCGEOCH & Co., LTD., and W. T. REYNOLDS. February 8rd.
- 2,758. "Electrical switches." W. MCGEOCH & Co., LTD., and W. MCGEOCH, JUN. February 8rd.
- 2,764. "Lampholder used for imitation candles and other electric light purposes." E. PHILLIPS. February 8rd.
- 2,772. "Cut-out for motor and other electric circuits." A. E. CULLEY. February 8rd.
- 2,778. "Electromagnetic switching mechanism for heavy current switches with automatic release." BEROMANN ELEKTRICITÄTS WERKE ART.-GES. (Convention date, February 1st, 1912, Germany.) February 8rd.
- 2,781. "Electric circuit closing bolts or latches for doors." P. R. J. WILLIS. (G. A. Spring, United States.) February 8rd.
- 2,808. "Ignition devices for internal-combustion engines." B. HOFFS. February 8rd.
- 2,830. "Electric footwarmer to be used in connection with an electric battery or dynamo fitted to a motor-car." T. W. JOYCE and E. G. HALPFENNY. February 4th.
- 2,831. "Electric sparking plug, suitable for internal-combustion engines, the said plug having an attachment to indicate any form of misfiring, and also detachable firing points at extreme base." T. W. JOYCE, H. E. HIRSH and E. G. HALPFENNY. February 4th.
- 2,836. "Enclosures for arc lamps." H. AYRTON. February 4th.
- 2,868. "Electric heating and cooking apparatus." F. A. WILKINSON. February 4th.
- 2,898. "Electric storage batteries." G. O. DAVIES. February 4th.
- 2,901. "Electric incandescent lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 4th.
- 2,908. "Construction of portable secondary batteries." E. J. CLARK and HART ACCUMULATOR CO., February 4th. (Complets.)
- 2,917. "Transmitting apparatus for use in wireless telegraphy and telephony." G. MARCONI. February 4th.
- 2,918. "Transmitting apparatus for use in wireless telegraphy and telephony." G. MARCONI. February 4th.
- 2,919. "Transmitting apparatus for use with wireless telegraphy and telephony." G. MARCONI. February 4th.
- 2,928. "Telephone transmitters." E. GRISSENER. (Divided application on 7,482/1912, March 27th.) February 4th. (Complets.)
- 2,929. "Telephone repeater circuits." E. GRISSENER. (Divided application on 7,482/1912, March 27th.) February 4th. (Complets.)
- 2,930. "Telephone repeater systems." E. GRISSENER. (Divided application on 7,482, 1912, March 27th.) February 4th. (Complets.)
- 2,981. "Telephone lines." E. GRISSENER. (Divided application, No. 7,482, 1912, March 27th.) February 4th. (Complets.)
- 2,946. "Fittings designed for employing direct and indirect lighting in combination." H. P. MACLAREN. February 5th.
- 2,951. "Electric imitation candle." R. GROVES. February 5th.
- 2,958. "Replaceable electric fuses." A. WILLIAMS. February 5th.
- 2,971. "Dynamo-electric machinery, particularly that used for starting internal combustion engines (more especially motor-cars and the like)." G. J. SCOTT. February 5th.
- 2,978. "Methods of compensation for selenium cells, and in the applications of selenium cells to telegraphy." H. W. MALCOLM. February 5th.
- 2,992. "Process for the manufacture of filaments, strips, films, sheets, and the like from cellulose solutions." VEREINIGTE GLANZSTOFF FABRIKEN ART.-GES. (Convention date, April 13th, 1912, Germany.) February 5th. (Complets.)
- 3,006. "Contact make-and-break devices for use with electric flashing signs and the like." C. DE FREETES. (Convention date, February 23rd, 1912, France.) February 5th. (Complets.)
- 3,012. "Wireless telephony." W. T. DITCHAM and ORINDELL MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD. February 5th.
- 3,046. "Magnetic separators." BOWES, SCOTT & WESTERN, LTD. February 5th.
- 3,055. "Electro-automatic stop motion apparatus for knitting, weaving, and like machines." A. RUNGE. February 5th.
- 3,057. "Means for effecting ignition in internal combustion engines." G. E. HEYL and T. T. BAKER. February 5th.
- 3,108. "Wireless telegraph, telephone or submarine signalling system." RADIO-SIGNAL CO., LTD., W. H. SHEPARD and A. E. MCKENZIE. February 5th.
- 3,110. "Electric measuring instruments." E. I. EVERETT and K. EDOCMERE. February 5th.
- 3,111. "Fuses for use in electric circuits." SPAGNOLETTI, LTD., and V. E. JOYCE. February 5th.
- 3,112. "Process for manufacturing ductile tungsten wires or filaments." FIRM of J. KREMEZSEK. (Convention date, March 18th, 1912, Austria.) February 5th. (Complets.)
- 3,122. "Circuit arrangements for telephone exchanges." SIEMENS & HALSKE ART.-GES. (Convention date, February 6th, 1912, Germany.) February 5th. (Complets.)
- 3,148. "Electric heating and drying apparatus." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 5th.
- 3,162. "Method of making sheets, rods, wires, filaments and the like of tungsten and molybdenum or alloys thereof." WESTINGHOUSE METALLURGEN GESELLSCHAFT G.M.B.H. (Convention date, February 9th, 1912, Austria.) February 5th. (Complets.)

- 3,224. "Ventilation of dynamo-electric machinery." SIEMENS BROS. DYNAMO WORKS, LTD., E. G. KIEFFER and W. PARESE. February 7th.
- 3,227. "Polyphase alternating-current motors and generators." CROMPTON AND CO., LTD., and H. BUDGE. February 7th.
- 3,233. "Electric switches." SPAGNOLETTI, LTD., and V. E. JOYCE. February 7th.
- 3,246. "Wireless telegraphy and telephony." SIGNAL G.E.M.B.H. (Convention date, February 12th, 1912, Germany.) February 7th. (Complets.)
- 3,249. "Electric control of alternating-current motors." OTIS ELEVATOR CO., LTD. (Otis Elevator Co., Incorporated, United States.) February 7th.
- 3,250. "Electric motors particularly adapted for hoisting purposes." OTIS ELEVATOR CO., LTD. (Otis Elevator Co., Incorporated, United States.) February 7th.
- 3,271. "Manufacture of a material suitable for electrical insulation and other purposes." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 7th.
- 3,309. "Insulator for supporting the current rails of electric railways and tramways." A. WATKINS. February 8th.
- 3,326. "Electrical printing telegraphs." B. SOLDATENCOW. (Addition to 14,659/1910.) February 8th. (Complets.)
- 3,339. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) February 8th. (Complets.)
- 3,344. "Circuit arrangements for junction lines at automatic and semi-automatic telephone exchanges." SIEMENS & HALSKE ART. GES. (Convention date, February 10th, 1912, Germany.) February 8th. (Complets.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

- ELECTRIC HEATER FOR FLUIDS. J. Mann. 26,435. November 27th. (June 27th, 1912.)
- SHADE SUPPORTS FOR ELECTRIC LAMPS. J. N. Mollett. 28,462. December 18th.
- BRUSH GEAR FOR DYNAMO-ELECTRIC MACHINES. H. Leitner. 28,517. December 21st. (June 19th, 1910.)
- ELECTRIC SWITCHES. P. Drussid. 28,942. December 22nd.

### 1912.

- TRANSMITTING SWITCH APPARATUS FOR THE CONTROL OF ELECTRIC MOTORS. Vickers, Ltd., and H. J. Creffield. 1,240. January 16th.
- ELECTRIC SUPPLY SYSTEMS HAVING VARIABLE-SPEED GENERATORS. British Thomson-Houston Co. and E. Garton. 1,681. January 20th.
- CONTROL OF ALTERNATING-CURRENT ELECTRIC MOTORS. E. Rosenberg. 1,979. January 24th.
- METHODS OF, AND MACHINES FOR, ELECTRIC WELDING. British Thomson-Houston Co. (Allgemeine Elektrizitäts Ges.) 2,843. January 29th.
- ROTATING INTERREPTERS FOR MAGNETO-IONIZATION APPARATUS. H. Diehl. 2,472. January 30th. (February 8d, 1911.)
- RENEWABLE ELECTRIC INCANDESCENT LAMPS. E. M. Bailey and W. Plews. 3,806. February 16th.
- MINI EXPLODERS. Sterling Telephone and Electric Co. (Schaffler & Co.) 5,217. March 1st. (Addition to No. 12,145 of 1911.)
- ELECTRIC BLOCK-SIGNALING SYSTEMS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 5,559. March 6th.
- ELECTRICAL SWITCHES. B. L. Fricc. 5,562. March 6th.
- ELECTRICALLY-OPERATED VALVE-CONTROLLING DEVICES. G. Keith and J. Keith. 6,617. March 18th.
- GALVANOMETERS. T. Clark and J. May. 9,094. April 17th. (Cognate application, No. 23,680 of 1912.)
- APPARATUS FOR CONVERTING TELEGRAPHIC CODE FIGURES INTO TELEGRAPHIC WORDS, AND VICE VERSA. M. W. Rebdar and A. W. C. Voigtberger. 9,195. April 18th.
- INCANDESCENT ELECTRIC LAMPS. W. J. Lusted. 9,983. April 26th.
- WIRELESS TELEGRAPHY APPARATUS. W. S. Peake. 10,501. May 3rd.
- MACHINES FOR FORMING FILAMENTS FOR ELECTRIC LAMPS. British Thomson-Houston Co. (General Electric Co.) 11,252. May 11th.
- SIGNAL INSTALLATIONS FOR SUPERVISING THE RELATIVE POSITIONS OF TURNTABLES OR OTHER ROTATING STATIONS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 14,638. June 22nd.
- ELECTRO-DEPOSITION OF METALS AND LIKE ELECTROLYTIC PROCESSES, AND APPARATUS OR APPLIANCES TO BE USED IN CONNECTION THEREWITH. A. Round and R. Fisher. 15,492. July 3rd.
- ELECTRIC BOILERS. J. Bally. 16,042. July 9th. (July 11th, 1911.)
- SHADE HOLDERS FOR INCANDESCENT LAMPS. H. H. Palmer. 18,177. August 7th. (March 19th, 1912.)
- ELECTRIC FURNACES. J. M. Bocuze. 21,290. September 18th. (October 14th 1911.)
- ELECTRIC SWITCHES. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. 21,913. September 26th.
- AUTOMATIC CONTROLLING DEVICE FOR ELECTRIC CUT-OUTS. J. H. De Thierly. 22,251. September 30th. (September 30th, 1911.)
- ELECTRO-OSMOTIC EXTRACTION OF WATER FROM ANIMAL, VEGETABLE OR MINERAL SUBSTANCES. Ges. für Electric Osmose m.B.H. 23,545. October 15th. (July 17th, 1912.)
- ELECTRODES FOR USE IN PRODUCING ENDOthermic REACTIONS. H. Pauling. 24,031. October 21st. (October 24th, 1911.)
- ELECTRIC SWITCH ON-AND FUSE BOARDS. E. J. Selby and W. Prested. 1,646. January 20th.
- ELECTROLYTIC APPARATUS. J. T. Niblett. 1,671. January 20th.
- ELECTRIC SWITCHES. British Thomson-Houston Co., Ltd., and E. Garton. 1,680. January 20th.
- ELECTRIC TABLE SYSTEMS FOR WORKING SINGLE LINES OF RAILWAY. A. T. Blackall and C. M. Jacobs. 1,832. January 23rd.
- APPARATUS FOR THE CONTROL OF ELECTRIC CIRCUITS. H. Leitner. 1,965. January 24th.
- DYNAMO-ELECTRIC MACHINERY. H. C. Biddleley. 1,969. January 25th.
- ELECTRIC INCANDESCENT LAMPS. Deutsche Gasglühlicht Akt.-Ges. (Auer Ges.) 2,284. January 29th. (November 4th, 1911.)
- ELECTRIC LIGHTING SYSTEMS FOR MOTOR-CARS AND THE LIKE. British Thomson-Houston Co. and E. Garton. 2,874. February 8rd.
- DRIVING OF VEHICLES BY MEANS OF INTERNAL-COMBUSTION ENGINES COMBINED FOR RECHARGING FURNACES WITH DYNAMOS, ACCUMULATOR BATTERIES AND MOTORS. H. Pieper. 3,271. February 9th. (February 20th, 1911.)
- ELECTRIC FUSED SWITCHES AND SWITCHBOARDS. H. H. Berry and W. J. Markham. 3,388. February 9th.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

FEBRUARY 28, 1913.

No. 1,840.

## ELECTRICAL REVIEW.

## ELECTRICAL PROGRESS IN SHANGHAI.

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VERY encouraging reports have reached us regarding the rapid rate at which electrical advance is taking place in Shanghai. The municipal electricity supply department is giving a very strong lead, and, with the display of spirited enterprise in the provision of facilities, there is a growing disposition on the part of the public to avail themselves of electrical supply for lighting, heating and power purposes.

The new Riverside power station is now nearing completion, and in about three weeks' time it will start running. This station is designed to accommodate a plant of 14,000 kw. capacity, and the first instalment, which was put in last year, amounts to 4,000 kw. Already the engineer has laid before his Council the necessity for putting in further extensions, and it has been decided to call for tenders in the course of a few months for two 5,000-kw. turbo-alternators and condensers, together with the necessary boiler plant.

It is interesting to learn that the Department is taking a very live interest in electric vehicles. Its present equipment consists of a fleet of five petrol motor-cars and a 2-ton motor-lorry, but owing to the enormous increase of business and the large area to be covered—10 miles from end to end—it is considered more efficient, in order that the staff may get about more rapidly, to increase the number of cars by four or five more, while there is also to be added a 5-ton motor-lorry, with a crane attached, for handling heavy goods. The prevailing conviction there seems to be that it is the business of an electricity undertaking to use "everything electrical" as much as possible, so it is more than likely that the new cars will be electric and that the replacement of the existing petrol cars with electric will follow. Certainly the latter should possess greater electrical advertising value than would petrol ones, and the adoption of electric cars by the public, as well as an extension of everyday electrical applications, should also ensue. It is not surprising that the remarkable development of the electric vehicle in the United States should have turned attention in that direction. We have again and again had to deplore in these columns how backward we in this country are in this respect, though we admit that there are other causes responsible beside apathy. It is practically certain that if we are behindhand with the use of a class of requirement, we are in danger of being behindhand also in its manufacture, and somebody else may profit because he has advanced more progressively than we. We do well if we weigh up the electric vehicle question with this additional possibility in our minds.

In Shanghai, which is perfectly flat and has good roads, an effort to push the electric vehicle is thought certain to be followed by a great success, provided that the battery and electric equipment are looked after by competent people, and

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**THE UNIVERSAL ELECTRICAL DIRECTORY**  
(J. A. Berly's).

# 1913 EDITION

Ready.

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we should say that the good example of the Electricity Department would count for much with the public. One result of so excellent a move would doubtless be that before long there would be several hundreds of electromobiles in Shanghai, all of which would naturally take their current for charging purposes from the municipal supply department, and, may be, they would be "after the pattern" of those used by that Department. Supply can be given to charge batteries for such a purpose at 7d. per unit or even less, and as the price of petrol is going up all the time this should form an added electrical inducement. The number of the "Point Fives" in this country is, as our readers know, small at present, but it is not the fault of the municipal electrical engineer of Shanghai that he is not already among their number. As a matter of fact, the Electricity Committee has twice passed a suggestion emanating from him that a flat rate of 1·7 candareens per unit, which is equivalent to ½d., should be introduced for all energy used for heating and cooking. It was the Council that did not see its way to let Shanghai have the credit of adding to the membership of the enterprising Point Fives Club, for it was not prepared to confirm its Committee's recommendation at the first time of asking, while at the second it compromised by authorising a reduction to 7d. Perhaps the club will recognise the qualifications of Mr. Aldridge, and duly fête him during his stay here in the coming summer.

It may be more or less of a revelation to our readers to learn what admirable advance is taking place in the adoption of electric radiators by Chinese consumers on the Shanghai circuits. During the past winter these westernised gentlemen have given us an illustration of what we may be able to do among others of their colour as we try to develop our radiator business in this Far-Eastern world. The total connections of heaters and cookers in Shanghai now aggregate over 500 kw.

But it is not only in lighting and heating that there is gratifying electrical enlightenment in this international municipal community. Our electrical firms who do not already know it, should take note that the cotton industry there is at the present moment booming. One small mill of 10,000 spindles has already been electrified, and there is in contemplation the electrification of an additional 30,000 spindles in the same mill. At another mill the electricity department has a contract for a supply of 500 kw., and at yet another for about 450 kw., both of which consumers will go on to the mains within a few months; while, still further, there is a 50,000-spindle new mill in prospect. Knowing what we do of events in the textile industry at home and in some other countries, we are justified in anticipating that the electrification of several of the older Shanghai mills, and the adoption of electricity by a new one, will ultimately result in bringing into line numerous other factories of the same class which have been running for a great number of years. While all this is most gratifying and encouraging from the purely electrical point of view, it has a distinctly unfortunate side, at the moment, from the purely *British* standpoint, for we gather that German firms, displaying that enterprise which we have so often felt it our duty to refer to in relation to their Chinese electrical business, are securing the bulk of this work. We have again and again discussed reasons for their successful competition with us in this market, and while it is not our

present intention again to go over that ground in detail, we should be shirking our responsibility did we not mention it here, seeing that it is one of the great factors that must not be lost sight of in our rejoicing at the unhindered progress of electricity.

Observers who are well qualified by long experience and close association with the market and its conditions, have no difficulty in explaining our relative backwardness. They say now, as they have said in our pages on previous occasions, that our Continental friends succeed readily because they co-operate willingly with prospective customers. They get out special motors suitable for cotton spinning, such as those for variable speed on ring frames, and also small loom motors. These they put in experimentally free of cost, and the low rate charged by the electricity department assists them in their effort to secure a satisfied power-user. It will be to our enduring shame and regret if the great bulk of the Shanghai mill motor equipment work falls into the capacious lap of the Fatherland. But there it is. Such is feared to be a correct impression of the prospect. Our manufacturers cannot say that they do not know. What are they going to do to meet the situation? Can they—will they—do nothing? Obviously it is the work of the Electricity Committee to sell electricity, and to encourage anybody who will assist it to that end, and an international municipal council can hardly be expected to be swayed either by British or German influences where merit and enterprise (which cover, we suppose, both price and quality considerations) must be the deciding factors.

One—indeed *the*—outstanding feature of the position seems to be that upon which so much stress has been laid here—our need for organisation and combination. If our information be correct, and we believe that it is largely so, while most of the big English firms are represented in Shanghai and other cities by merchant houses—who, it is said, do very little for the people whom they represent—the large German manufacturers have their own representatives on the spot (sometimes Germans, sometimes Englishmen—as has happened in some of our Colonial markets) who are most highly trained engineers and men well qualified to discuss matters in technical and commercial detail, and are armed with that full measure of authority which enables them to settle matters direct without referring things home to the Fatherland.

In opposition to this trump card in competition, what do we produce?—English engineers who are so versatile that their duties embrace quoting for anything from a steel bridge to a power station, and who cannot therefore be expected to possess that detailed experience in all the branches of engineering in which they are called upon to do business. Consequently, instead of being able to enter into a contract right on the spot without waste of time, they have to refer the matter to—"the dear Homeland"! That there are difficulties in the position we fully recognise, difficulties that are not lessened by the fact that there are a number of conflicting interests and competitors, while with our Teutonic rivals the competition is practically limited to three or four big combinations. But to sit and sigh and let the work pass by is not generally like the British race. Let us, at least, continue to attend to this setting up of more suitable and efficient British representation abroad—especially in China—that so many authoritative voices have urged upon us in the last four or five years. A little has been done, but in the words of Cecil Rhodes, "So much remains to do!"

#### Advertising Electricity.

WE report this week a paper on this subject, read before the I.E.E. by Mr. H. C. Palmer, in which a definite scheme of organised publicity is put forward, having for its aim the education of the public to a better appreciation of the advantages to be derived from the use of electricity for domestic purposes. This is a matter which has occupied a prominent position in the proceedings of the Institution during the past year or two, and which, as the outcome of the recent reforms, will doubtless command more and more attention

in the future. That there is an urgent need for action in this direction can hardly be questioned; that need has existed for some years, and has grown continuously more insistent. The aggressive and enterprising policy of our rivals, embodied in the British Commercial Gas Association, has greatly increased the urgency of the question, and has at the same time shown what can be done even in this country by organised and co-operative effort.

There is nothing new in the idea; as long ago as 1906 we published a series of articles by an expert, Mr. R. B. Matthews, with the express purpose of arousing our central-station managers to a due appreciation of the possibilities before them, and the best means of realising those possibilities. Other articles of a similar nature have appeared in our pages from time to time during the past decade, but the result has been far from satisfactory. We believe that this is not wholly the fault of the engineer-managers, many of whom are strongly in favour of an active policy of advertisement: the difficulty is due rather to the control of the great majority of our electricity supply undertakings by inexperienced committees, often composed largely of small tradesmen and professional men who have no conception of the meaning of organised publicity, and whose hands are tied by the restrictions imposed by the Local Government Board's auditors. It must be said, however, that at the present stage of development of the business, which is gradually being evolved from the condition of an engineering problem to that of a commercial undertaking, the first element of the compound engineer-manager is in many cases the controlling one, and the tendency in such cases is to regard the supply of electricity rather in the light of a profession than in its true aspect, that of a trade. We wish here to emphasise the latter view to the utmost, and to point out that, to an important trade such as this, well-organised publicity and bold advertisement are an absolute necessity. True it is that the merits of electricity are such that, as a correspondent recently pointed out, the trade is bound to make progress, even without the aid of such a scheme; but this in our opinion is a feeble excuse for inertia, and an unseemly one to emanate from a purveyor of *electrical energy*, of all things. Moreover, the enemy have already embarked upon a campaign of activity which puts to shame the advocates of a policy of *laissez-faire* in electricity supply, and which, if the latter do not wake up, may work much mischief.

One of the difficulties to be contended with is the argument that *all* will benefit by such a scheme, including those who do not contribute to its support. This is true enough, but as a serious objection it is not worth a moment's consideration. Putting aside the ethics of the question, and disregarding the jaundiced complexion of those who cannot bear to do good to their neighbour without making him pay, it stands to reason that if all are benefited, those who object will also benefit—why, then, do they object? As for the difficulties imposed by the auditors, which prevent direct contribution to the funds of a publicity association—that is one of the obstacles which ought to be removed, and which could be removed if the Institution of Electrical Engineers and the Incorporated Municipal Electrical Association took the matter in hand.

We have said nothing regarding the merits of the particular scheme put forward by Mr. Palmer; but, as it runs on lines similar to those which we have so long advocated, it will suffice for us to express our approval of it in the main. The great thing, however, is to get the subject forward, and to keep it prominently in the forefront as the question of the day, so that the Industrial Committee of the Institution and the other bodies directly concerned may have the necessary support of public opinion, and may be kept up to the mark and alive to the real need for vigorous and sustained action. For that purpose we shall welcome all such papers as aids to the realisation of an effective scheme of publicity.

Artificers in the Royal Navy. The criticisms which we offered two weeks ago, regarding a pamphlet and a letter sent to us from the Royal Naval Artificer-Engineers' and Engine-Room Artificers' Benevolent Fund, have elicited a number of replies, which will be found in

our "Correspondence" columns. It scarcely need be explained that the article did not raise any objection to legitimate claims being brought to public notice through the Press upon fair and proper grounds, but it did denounce "the attempt to force them upon the public, through the Press, upon the questionable grounds" stated in the pamphlet and the letter. A correspondent asks us why we demur to those statements of claims, and the answer is that we find them in important details to be unsupported by the facts. To illustrate this, it suffices to examine the declaration that "we are rapidly drifting towards the serious position of a steam Navy minus engineer officers," and the further inexactitude that "it is notoriously difficult to get candidates to enter for the engineer branch at all." Another correspondent, presumably also a member of the Benevolent Fund, asks us to believe "that, from 1910 to 1915, not a single engineer officer will have been added to the Royal Navy."

Are we rapidly drifting towards the serious position of a steam Navy minus engineers? The current *Navy List* supplies a sufficient answer to that question. We find that in 1911 no fewer than 48 ratings were promoted to the rank of warrant officers as engineers. In 1912, there were 79 similar promotions, and in January of the present year 15 more were added, or a total of 142 since 1910. These are warrant engineer officers promoted from the rating of chief E.R.A. and E.R.A., and also from the rating of mechanic to fill vacancies as they arise on the established list. It has to be remembered that these warrant officers have received a considerable amount of marine training, and they are admirably suited for the duties which they are called upon to perform. The *Navy List* contains a very substantial number of engineer captains, engineer commanders and engineer lieutenants, and the new-scheme officers will next year begin their specialist courses in engineering. In all these circumstances, therefore, we feel obliged to reject the assertion that "we are rapidly drifting towards the serious position of a steam Navy minus engineers."

It is difficult to infer anything of value from the statement of a correspondent to the effect that the present and the past naval cadets loathe and detest the dirt and grease inseparable from the engine room of a ship, and that they dislike marine engineering. Presumably not even a member of the Benevolent Fund has a craving for dirt or a hankering after grease. If the statement is intended to convey that the cadets and midshipmen are adverse to engine room duties, it is not in accordance with the opinions expressed by officers serving afloat, nor is there any valid reason why a cadet trained at Dartmouth and in cruisers should be less attracted to those duties than a cadet trained at Keyham. Again, it is difficult to find argument in the suggestion that "the prospects of internal combustion engines and the probable absence of stokers in the near future call for concentration on the subject of marine engineering." for the question of indecision on the part of cadets in the selection of a branch for specialisation has not yet arisen. A young officer who has passed through the new scheme of education and training may be expected to know at least as much about internal-combustion engines as a member of the Benevolent Fund who may have entered the service as a copper-smith, and he will probably be as well informed concerning them as the average officer of the mercantile service. In other words, the members of the Benevolent Fund would be well advised if they stated their claims upon their own merits, without attempting to prejudice a scheme of training naval officers which has not yet developed sufficiently far to enable them to judge of its results. They plead for sympathy and fairness; they will not secure these virtues by prejudice, and they will but injure what may be a good cause by overstating their case. The artificer of to-day is better trained and better educated than his predecessors, and he must expect, therefore, to have placed upon his shoulders a greater burden of responsibility, in proportion to the increase of power and complexity of ships and armaments. This principle extends to all ranks and ratings, and it is not to be expected that the commissioned ranks of the engineer branch can be indefinitely increased in numbers while there are capable petty officers and warrant officers well able to lend a hand in supervisory duties.

## THE USE OF ELECTRICITY AND ELECTRICAL ACCIDENTS IN MINES.

(Continued from page 321.)

In the Newcastle district there were two fatal accidents, one caused by a countersunk screw working up and coming into contact with a metal covering, and the other by a broken ammeter carrying current to the casing. "Neither of these accidents would," says the inspector, "have occurred had the apparatus been properly earthed." In one case the earth wire had been accidentally removed, but in the other case the installation being new no earth wire had been attached.

In the Durham district there were two fatal accidents underground, resulting in the death of two persons and injury to a third, and one on the surface.

Of the underground accidents the first occurred at Sherburn Hill Colliery, where direct current at a pressure of 550 volts is used for working a coal-cutter, the current being conveyed in two ordinary insulated cables, which were carried to the switchbox, and then to the coal-cutter. Height had been made in the cross-gate way to within two yards of No. 9 gateway, and at this point where the cables were carried past the gate-end the height was only about 3 ft. As soon as height was made, the usual practice was to carry the cables across the gate-ends in wood boxes, so as to be well clear of the tubs. At the time of the accident this had not been done, although the wooden box was lying ready. It is probable that when a putter named Ashworth (the injured person) came out of No. 9 gateway with a full tub, a large coal on the tub caught one of the cables and dragged it slack, and that shortly afterwards as Ashworth was pulling his empty tub by the in-bye end into the gateway, it came in contact with the slack cable and jammed it against a projecting portion of the gateway, resulting in an abrasion of the insulation, and the core of the cable came in contact with the iron tub he was engaged with. He was knocked down and found with one foot lying across one of the rails. At the same moment another putter named Laverick, who was sitting on one of the tramrails in the cross gateway about 10 yards distant, also received a shock, and was severely burnt about the head and bare parts of his body, and in spite of continued efforts to restore him, was found to be dead. Ashworth recovered after about 40 minutes' treatment. A pony was standing attached to the full tub which Ashworth had brought out, but it took no harm, as the tub was not in contact with the tramrails, all four wheels being off the way. The tubs were of iron, and evidently Laverick received a shock, the current passing through the tub Ashworth was pulling, and then through the tramrails. The cables were suspended by leather slings secured to props, or by wooden supports. The obvious remedy to prevent such an occurrence is to provide more height at gate ends where cables are carried across, and the latter should be laid in boxes, where they cannot come in contact with tubs or ponies. Special Rule (of the code of rules recently superseded) 28 appeared only to apply to the protection of cables on main haulage roads, but the principle is the same, as an insulated cable in such a cramped position is more likely to suffer damage than on a roomy engine plain.

The second accident occurred at Lumley Third Pit, in connection with a coal conveyor. The conveyor in question was a Blackett conveyor, driven by a  $6\frac{1}{2}$ -H.P. motor of the squirrel-cage type. The current supplied was three-phase, the pressure at the terminals of the supply transformer being 400 volts. On the day of the accident a deputy received a slight shock about three-quarters of an hour after the motor had been started. It was accordingly stopped, and a message sent to the surface for an electrician, who found on examination that at the point where the trailing cable was connected to the motor a loose strand of wire from one of the leads at the terminal block had worked through the insulating tape, and was making contact with the frame of the motor. This was rectified, and the motor restarted. Four hours afterwards the deputy, as he was going along the mothagate, heard a humming noise on approaching the motor, and at once shut off the current at the gate-end box. He then found the conveyor attendant lying

unconscious and face downwards between the tramrails at the delivery end of the conveyor. He at once gave an alarm, and artificial respiration was tried for  $1\frac{1}{2}$  hours until a doctor arrived and pronounced life extinct. Provision was made to earth the conveyor to bank, and subsequent tests showed that the earth provided was fairly good. The earth wires also were found on inspection after the accident to be efficiently attached. The accident is thus most difficult to account for, and one possible explanation appears to be that the conditions when the accident occurred, and afterwards when the tests were made, were not the same. A loosely attached earth-wire would explain the occurrence; or it might be that the earth connection, though good, was not good enough, and the motor frame was therefore enabled to assume a potential sufficiently high above the surrounding ground (which was wet) to cause the accident.

The surface accident took place on the screens at Trimdon Grange Colliery, and caused the death of a screeman. The current was three-phase at 220 volts, and was used for lighting purposes. At the time of the accident, the deceased was in the act of using his handkerchief to clean the thick protecting globe, which surrounded an incandescent light bulb. The wires to the lamp were carried in an iron tube, at the end of which was an iron lamp shade. As the deceased was cleaning the globe he suddenly fell backwards, and on being asked what was the matter, he said he had "touched that globe," evidently associating in his own mind the action of touching the globe with the state of his sudden collapse. He immediately became unconscious, and efforts to restore him by artificial respiration were persevered with for  $1\frac{1}{2}$  hours without success. A post-mortem examination showed that the cause of death was a diseased mitral valve, but there was no direct evidence to prove that the deceased had received an electric shock. An exhaustive investigation of the accident did not afford any satisfactory result, as no actual leakage could be afterwards discovered, though the insulation of the whole circuit was low. No mechanical damage of the wires could be found, which would have accounted for the iron pipes which contained them becoming live. The pipes were supposed to be earthed by an earth wire connecting them to some cast-iron piping of a coal-washer, but it was evident the connection to earth was not a good one. The accident happened after some heavy rains, and the conditions existing at that time were more favourable to leakage than they were when the tests were made by Mr. Nelson, H.M. Electrical Inspector. It is probable that death was due partly to the fact that the deceased had a diseased heart, and was therefore unable to withstand a shock which might not have proved fatal to a person with a normal heart, and also to the fact that the damp conditions existing at the time were favourable to a temporary breakdown of the insulation.

Three ponies were killed by electric shock by two accidents. On the first occasion two ponies were electrocuted, the initial cause being the breakage of one of the armature-end connections in the motor of a Morgan-Gardner coal-cutter, thus rendering the framework of the machine alive. The current was 500 volts continuous, and the trailing cable contained the earth wire. Unfortunately the person in charge of the machine had neglected to tighten up the screw of the earth wire by which it was connected to the metal frame of the reel. The reel had been left standing across the tramrails, and a pony coupled to an iron tub received a shock and moved towards the reel, and is supposed to have got on to one of the cables and pulled the connection plug out of the reel. Another pony on reaching the gateway also received a shock through the rails, tub and gears, and was also killed. An earth wire was afterwards continued from the earth wire of the out-bye armoured cable and taken into the switchbox and joined on to the short earth wire from the reel to an iron rod. This additional earth wire afterwards was the means of conveying a fatal electric shock to another pony within a fortnight owing to the parting of the out-bye armoured cable. The coal-cutter motors were subsequently altered and overhauled, and the installation, which was by no means of recent date, put into a more reliable condition.

There were no fatal accidents in the Yorkshire district, but (says the late Mr. Pickering) it is too early to decide whether this is happy chance or whether the potential dangers

of electricity are better realised. Several underground fires originated by arcing of electric cables. Of the latter, one is described, and it might have had serious consequences, as 411 men had to be brought to the surface, 140 of them through smoke. It is thought that the cause of the fire was "arcing at the point where the three-core cable was separated for connection to the switch and fuses. The cable was paper covered, lead coated and armoured with steel tape. As the Inspector says, "Paper is a hygroscopic material, and the lead sheath of cables insulated with paper is designed to keep out moisture. When the cable is split, a proper "dividing" box should be provided to effectively seal the ends. A wrapping of tape was used instead of a box, and it is probable that this was not moisture proof, and that, therefore, the paper became damp and lost its insulating properties."

(To be continued.)

KENT COAL.

By G. LLOYD JONES, A.M.I.E.E., M.I.M.E., Principal of West Ham Testing Laboratory.

A FEW days ago, by the courtesy of Mr. Arthur Burr, managing director of the Kent Coal Concessions Co., the writer was enabled to take samples from the Beresford 4 ft. 8 in. seam, at Snowdon Colliery.

The Beresford is the first workable seam uncovered, and to many central station engineers—those especially in neighbouring districts—it must be of the greatest interest to have put before them data upon which they may judge as to the value of the coal from this new field for steam raising purposes, which is already being put on the market in considerable quantity.

The proximate analyses given relate to run-o'-mine samples taken from the actual working faces. The one was taken from above, and the other from below the 6-in. shale band, which splits the seam midway in the horizontal plane:—

	Above shale band.	Below shale band.
Volatile matter ... ..	27.98	28.26
Coke ... ..	70.34	69.76
Ash ... ..	7.20	6.11
Fixed carbon ... ..	63.14	63.65
Moisture (hygroscopic)... ..	1.68	1.98
Sulphur (separately determined)	1.32	1.29
Calorific value (as dried)	13,990 B.T.U.	14,180 B.T.U.
Net effective calorific value (as fired) ... ..	13,316 B.T.U.	13,454 B.T.U.
Evaporative power (as fired) ...	13,79 lb. of water from and at 212° F.	13,92 lb. of water from and at 212° F.

The results obtained show the coal to be of exceptionally high thermal value, and since the hygroscopic moisture is comparatively low, having regard to the other general characteristics of the coal, it will be noted that its net effective evaporative power, which takes into account the negative value of the moisture existing as such, and that produced by the combustion of the hydrogen in the volatile matters, is but little less than the evaporative power of the dry coal. On the other hand, the coal was extremely tender and would suffer severely through breakage in transit. Its structure is columnar, the columns being of short length, determined by the lines of natural stratification. When broken transversely to the axes of the columns a crystalline fracture was shown with a suggestion of tarriness. The coal taken from above the shale band disclosed heavy lime salt impregnations due to percolation of water carrying these salts through the interstices. Below the shale band the interstitial impurities were markedly less due no doubt to the protection afforded by the hard shale. The volatile matters were readily liberated, and burned with a long, bright, sturdy, somewhat smoky flame, giving sooty deposits. The coal is of a very agglomerative nature, and produces a silver grey, hard, compact, close-grained coke of excellent quality. The ash is of dark purple brown colour and considerable density.

The utility of this coal for general central station purposes must be severely discounted by its friability. The percentage of "fines" must necessarily be very great, even were the coal screened at pit, as it crumbles under the slightest pressure between the fingers, and riddling through the grate bars would be inevitable in spite of its caking properties. For coking stokers it appears almost ideal, and the great density of the ash means that frequent cleaning out would be unnecessary, as the bulk would be proportionately small. If hand-fired, smoke production must result, and frequent levelling of fires would be required to prevent the formation of blow-holes, which would accentuate the trouble.

Although touching upon a rival industry, it may be of interest to mention that the gas analysis shows the coal to be exceptionally rich, giving a yield of 11,500 cu. ft. per ton of 15.1 c.p. by No. 2 Metropolitan burner, or equivalent sperm value 595.4 lb.

The friability of the coal is not detrimental to its value for gas making.

It will be understood that this article merely relates to the Beresford seam, and it may very possibly be that the seams at greater depth, which aggregate no less than 130 ft. in thickness to the 3,000-ft. level, may prove to be harder and less susceptible to damage in transhipment. Several of the shafts being sunk by other companies subsidiary to the parent company, the Kent Coal Concessions Co., are already in the coal measures, and the day is now near at hand when the present staple Kentish industry—hops—will be overwhelmed by coal from the new Black Country, with sunny Margate transformed into the Blackpool of the South.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Artificers in the Royal Navy.

In the current issue of your journal there appears a leading article dealing with the claims put forward by the chief and artificer engineers and engine room artificers for better pay, accelerated promotion, and a minimum pension of £100 per annum for chief artificer engineers. Your method of discussing these claims is, to say the least of it, unsympathetic, if not unfair, and seeing that the ELECTRICAL REVIEW is an engineering magazine, your remarks call for a rejoinder from someone that has an intimate knowledge of the subject, and such knowledge the writer of this letter claims to possess.

You state at the outset of your article that the subject which you discuss has nothing to do with "the old trouble concerning engineer officers." Well, it has, and it hasn't. In so far as the old trouble was the offspring of class prejudice and arrant snobbery, the grievances of the engine room artificer class are of the same order, but to pursue that aspect of the question would encroach too much upon your space.

You state that the "plea put forward by certain (italics are by the writer) discontented, &c." Why, may I ask, do you set out to weaken the plea by making it appear that a mere handful, and these a "discontented" handful, are pushing their claims for further recognition, when further on your article claims to speak for the "great body of artificer engineers"? There is only one organised body of chief and artificer engineers and engine-room artificers, and it is this organisation which issued the plea which you have fallen foul of. It must be assumed that these responsible men know where the shoe pinches, and so suggest a remedy so that conditions of service for them may be readjusted and modified. You admit that the several points enumerated in the plea are "legitimate" ones, but demur to them being forced upon the public through the Press. Why? may I ask again. A few weeks ago, columns upon columns of special articles appeared in the Press advocating higher pay

for lower deck ratings, and it is to the everlasting credit of the Press that it took such an altruistic attitude on behalf of an overworked and underpaid body of men as those included under the general term of lower deck ratings.

After admitting that the grievances put forward in the plea which you criticised are, as abstract propositions, "legitimate" ones, you proceed to state that the pamphlet "must entirely alienate the grumblers from the sympathy of those who have more than a superficial knowledge of service matters." Here again you emphasise what I must describe as prejudice against the large body of men whose views and aspirations are voiced in the plea with which you dealt so caustically.

There are grumblers and grumblers, and there is an offensive way in which the adjective can be used, which makes its use so dangerous. Its use in a professional organ, and on such a subject, is to be regretted.

But no more serious points in your indictment. You describe the statement:—"We are rapidly drifting towards the serious position of a steam Navy minus engineer officers" as a "loose and inaccurate statement," but you fail to show wherein is its inaccuracy. A more generous-minded critic might have passed what is condensed into the broad generalisation about a steam Navy minus engineer officers. It may be crudely worded, but in essence it is true. The last Keyham-trained engineer officers joined the Navy as sub-lieutenants in 1910 (there were 10 of them); and, according to your own showing, it will be 1915 before any of the common entry officers are sufficiently specialised in engineering to be drafted into the service for engineering duties. What of the five years' hiatus? Where are the engineer officers to supply wastage and the normal expansion of the Navy? Further, will there be a sufficient number of these "specialised" (I hope you like the word, though it doesn't sound engineering) officers to go round—*i.e.*, to relieve chief and artificer engineers who are now doing the duties formerly carried out by Keyham-trained engineer officers? Yes, *actually* doing those duties.

So much for your charge of looseness and inaccuracy. You further state that it is misleading to link up the artificers with the commissioned ranks. In fact, you say that it is "unfortunate." May I again put the query mark after the word why? The Admiralty has no hesitation in linking them up. At the present moment there are 23 engineer lieutenants who at one time were artificers, and 636 chief and artificer engineers who served in the same humble but responsible capacity. There is little differentiation amongst ranks and classes when duty is being performed, and it is only sticklers for gradation that refuse a place in the sun for the engine-room artificers. However, your article finishes on a sound note by stating that you think that the lower commissioned ranks will be replenished from amongst the most deserving of the warrant officers. In conclusion, it appears to the writer of this letter a great pity that the engine-room artificers should have received a blow in what, it was hoped, was the house of a friend. Society, and other flippant and irresponsible organs can criticise as they like, but when an engineering magazine takes to that general art in an ungenial manner, it causes sorrow and disappointment amongst those who expected different treatment.

W. Stoddart,

*Ex-Chief E.R.A.*

Southsea, February 18th, 1913.

I have read your criticisms on "Artificers in the Royal Navy," and I should be glad if you would allow me to reply.

You state that if the artificers forward their application for increase of pay, promotion, &c., to the proper authority, it will receive attention. Well, Sir, since 1882, the artificers have been asking for this *same* rise in pay and prospects, without success, and therefore in justice to the great body of artificers, is it not time an appeal was made to the general public?

With regard to the shortage of engineer officers, it cannot be denied that from 1910 to 1915 not a single engineer officer will have been added to the Royal Navy, and at the same time a very large number of engineer com-

manders will have retired (this year 28 are due to retire). This, in conjunction with the large and powerful ships being newly commissioned, proves beyond any dispute the serious shortage of engineer officers.

As to the lack of volunteers for specialising in engineering, anyone with the slightest acquaintance with the present or past naval cadet knows how much they loathe and detest the dirt and grease inseparable from the engine room of a ship, and if you heard the remarks that are made by them regarding marine engineering, I venture to think you would feel doubtful as to the success of the scheme.

I must confess it is a surprise to me to read an article in a technical paper upholding a system which can only produce a jack-of-all-trades; surely there is sufficient to study and master in the profession of engineering without introducing such subjects as navigation, gunnery, &c. The complication of modern warships, the prospects of internal combustion engines and the probable absence of stokers in the near future call for concentration on the subject of practical marine engineering, and if the young cadet is only undecided as to what he shall specialise in, it will not tend to produce the best or most efficient engineers.

Might I point out that the whole of the mercantile engineers are exactly the same class and type of men as the artificer engineers and engine-room artificers of the Royal Navy? It is only since this scheme has come along that commissions in the Royal Naval Reserve have been refused to valuable officers of the mercantile marine, and it is curious that, although some 300 were considered to have sufficient professional knowledge to receive commissions, now it is impossible for any mercantile engineer to receive a commission, while, on the other hand, upper-deck officers of the merchant service are being made lieutenants on the active list.

The fact remains that the engineering profession is looked down upon by large numbers of officers in the Royal Navy.

As an engineer in the Reserve, holding an extra first-class engineer's certificate, with some experience in the Navy, I say that, in the artificer engineers and engine-room artificers, the country has sufficient practical engineers to take complete charge of the engine rooms of the whole of the ships in the Navy, and I feel confident that, should the time arrive for them to prove their worth as engineers, they will acquit themselves with credit to their cause and their country.

R.N.R., M.I.Mar.E., A.M.I.M.E., &c.

Your leader on "Artificers in the Royal Navy," in the issue of February 14th, calls for some comment from those you unfairly designated "certain discontented ones, and misguided few."

I say unfairly, because the implication is that the contents of that "remarkable" pamphlet, so adversely criticised by you, were not approved by the great body of those ranks and ratings enumerated therein. It may, however, interest your readers to know that the Benevolent Fund members number not less than two-thirds of the total of artificer engineers and E.R.A.'s in H.M. Navy—a number which is considered fairly representative of the corps, and sufficient at least to warrant the formulation of demands for their special benefit, yet of great importance also to the general efficiency of naval service.

Moreover, the "abstract propositions that are all legitimate" have been duly made to the proper authorities, and received careful consideration. But more than that is necessary to ensure success, and the Navy, being "in effect a secret service," only leaves one other method available for pushing demands and interesting public opinion, *viz.*, the Press, which, generally speaking, is favourable.

The impracticability of sending out an accompanying explanatory volume of detail will be recognised, and it is sufficient here to say that the facts stated are unimpeachable. A reference to the official current Navy list will at once show that there are no officers—except artificer engineers—available to even fill up the ranks of engineers retiring every month; and all that is asked is that consideration may be given to the claims of those who are already performing the duties of, and are borne in lieu of, engineer lieutenants in many ships.

Artificer engineers and E.R.A.'s will be quite content if, as you suggest, the way is left open for "those who can climb to the higher ranks," and are quite prepared to fulfil any conditions to that end, outside of the monetary qualification imposed on cadets.

Trusting you will give publicity to this addition to "the scanty information available" hitherto, and thanking you in anticipation.

C. J. W.

Devonport.

[This correspondence is referred to in our leader pages.—Eds. E.R.]

**Fixing Contacts in Springs.**

In your issue of February 14th, 1913, I noticed under the above heading a device by Mr. S. E. Srawley, of Liverpool, which, indeed, is a great improvement on the old method of cutting the wire into bits and inserting them by means of a pair of tweezers.

Your contributor could, of course, not have been aware that a similar tool of my design, also for a small handpress, has been working in a London factory this last six years very successfully—producing 2,500 to 3,000 springs per day, of any kind.

This tool includes piercing the hole, feeding in and cutting the wire, forming a single point, double point, single flat and double flat contact, as required, and finally throwing out the spring automatically into a box by the side of the press, each spring being picked up once only.

A second and much improved tool for the same purpose is now also at work in another London factory.

Should any firm be interested in the above, I shall be pleased to furnish further particulars.

M. W. F. Petmeky.

London, N.W., February 20th, 1913.

**Testing the Continuity of Earth Conductors.**

With reference to my letter of the 3rd inst., in reply to "Continuity," kindly grant me further publicity in reply to Mr. J. P. C. Kivlen.

In my reply to "Continuity," I simply dealt with a method of testing an earthing system for continuity to the earth connection.

As regards the class of cable and the arrangement of the earthing systems, before dealing with this matter, it would be necessary to consider the circumstances of each individual case. I presumed the regulations in regard to the conductivity and continuity of the earth conductors were fully understood, and there should be no difficulty in complying with the rules. Provided this is done, all that remains is to maintain the efficiency of the system by careful inspection and tests from time to time.

Now, with regard to the method of testing. Mr. Kivlen seems to look upon the "bridge" test with awe, and I do not quite follow him when he refers to the expense of a few thousand gallons of water and a few tons of coal; but I assure him that the tests are easily made, and even the cost of a single life may be avoided.

Referring to Rule 14, sub-Sec. (c) (i), Mr. Kivlen states that this does not call for a "bridge" test, or any definite measurement at all; he further states that a continuity test can be taken by joining one of the copper conductors to the armouring at the far end of the cable, and testing by "Megger" or galvanometer from the same conductor to the armouring at the near end. I say that to rely upon a test of this description is simply asking for trouble, and I would much prefer to risk inspection only.

The "Megger" or galvo. would, no doubt, show perfect continuity, but 5 or 10 per cent. of his load current on the earth conductors would probably show some serious defects in the continuity of his earthing system. This is an important point, and, I believe, has been the cause of several fatal accidents.

With regard to an expensive insulation testing ohmmeter and generator, no damage need be feared, but the instrument is practically useless for such a test.

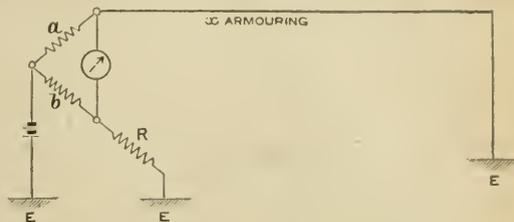
A more reliable test can be taken on similar lines,

which is practically a conductivity test, by applying current to the cable and armouring with voltmeter and ammeter in circuit. Then the fall of potential across the ends of the conductors will give the resistance by Ohm's law, viz.—

$$r = \frac{\text{drop in volts}}{\text{current}}$$

This is a simple method, and should appeal to the "Small Colliery Electrician" referred to by Mr. Kivlen.

Mr. Kivlen states that my method does not test the continuity of the earth conductor. I take it he means the whole length of conductor. This can easily be done when the arrangement of the system is known, and may be applied in his case as follows:—



Thus the total res.  $r$  of the line and earth is  $x = a/b$ .

If the cable be used as a second line the res. of the earth conductor can be determined separately from that of earth, as well as the res. of earth.

Let  $r$  = res. of first line,  $r_1$  = res. of second line,  $r_{11}$  = res. of earth.

Connect the far end of  $r$  and  $r_1$  together to get the total resistance  $R$ ; connect  $r$  and  $r_{11}$  and measure res.  $R_1$ .

Connect  $r_1$  and  $r_1$ , and get the total res.  $R_{11}$ .

$$\text{Then if } T = \frac{R + R_1 + R_{11}}{2}$$

$$r = T - R_{11}$$

$$r_1 = T - R_1$$

$$r_{11} = T - R$$

I note that Mr. Kivlen agrees that it is necessary to test the earth itself, although he states that the rule does not call for it. The rules, however, refer to the Board of Trade Regulation, which requires two earth-plates to be laid and maintained, so as to secure electric contact with the general mass of earth, and so that, if possible, an E.M.F. not exceeding 4 volts shall suffice to produce a current of at least 2 amperes from one earth connection to the other, through the earth—a test to be made once every month.

It was pleasant to find Mr. Kivlen finally coming over to my side by means of a "rapid" bridge test. But why "rapid"? A continuity test may be taken on the earth conductors at any time without disorganising the system, provided, of course, there is no serious leakage disturbance.

I am glad to have had the opportunity for discussing the subject with Mr. Kivlen, and hope to see further correspondence on the subject.

B. T. Davies.

Swansea, February 17th, 1913.

In further reference to the subject of mines regulations and the continuity of earthing conductors, the point I wished to emphasise, but which, perhaps, I did not quite make clear, appears to have been lost sight of by most of those taking part in this interesting correspondence—that is, the 50 per cent. conductivity at all joints, as required by Rule 8 (b). My object in writing was to open a controversy on this subject with a view to an exchange of opinions on this important matter.

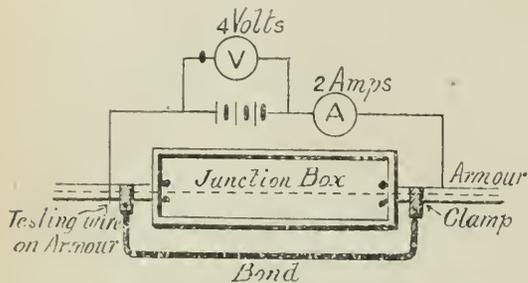
I take it for granted that a modern colliery installation is provided with armoured cables that comply with the recommendation of the Engineering Standards Committee, so that the question of continuity and conductivity of the actual armouring is assured.

I cannot agree with Mr. Kivlen where he says: "This does not call for a 'bridge' test or any definite measurement at all." Rule 8 (b) clearly states that some definite measure-

ment is required to prove that there exists the required 50 per cent. conductivity. The question arises, is the connection between the armour or clamp at each side of a junction box sufficient to ensure a 50 per cent. conductivity? I am confident, provided a clean and tight connection is made, that it does, but what is required is a ready method of testing to prove this beyond doubt.

The galvanometer or "megger" test does not necessarily prove continuity if the armour is in a damp place, and conveys no idea of the conductivity of the earthing system.

To ensure the best possible earth at the surface of the mine, I have sunk two earth plates at a distance of 25 ft. apart in wet clay, surrounded by small coke, but I cannot get above a 25 per cent. conductivity between the two plates, although I agree that a good earth at the surface is most desirable. I think it quite as important to provide



additional earth plates or connections to pump suction in the mine, although I can only get a 25 per cent. conductivity between my two surface plates, I can get 100 per cent. between my earthing system and absolute earth taken off the surface water supply pipe.

I should like to suggest a method of testing the continuity and conductivity of joints in the earthing system that does not require any interference with the line conductor and does not interrupt the supply, namely, the one referred to in the memorandum on Rule 8. This method may be open to criticism, but I think as it meets the requirements of the Light Railway orders and merits mention in the memorandum of testing earth plates, it might be usefully applied for periodically testing the conductivity through junction boxes, &c.

I should like to see the merits or demerits of earthing the mid-voltage point of a medium-pressure direct-current system discussed through the medium of your columns.

Norton, February 24th, 1913.

#### Continuity.

Mr. H. Field's communication is, perhaps, just a little inconsistent. If he follows the correspondence closely he will find that I replied to a question that had a direct bearing on cable armouring, and on nothing else, Rule 12 (c). I later proceeded to interpret Rule 14 (c) (i), and, in this instance, I did not deal with cable armouring as the predominating factor, as your correspondent states. I dwell on the importance of testing the "earth," the one "earth" that the Home Office recognises—the proper discharging device at the surface. Both taken conjointly give the best means of complying with the rule.

He has a cable to the bottom, and goes in-by hanging on pumps, haulages, &c., showing no distributing system to speak of. The conditions, of course, might allow of nothing else. Under certain conditions it is bad practice, and does not allow of proper discriminating devices being installed. Now, Rule 14 (c) (i) tells him to examine the apparatus, &c., and surely, if he has proper bonding devices, he can do this with the sense of sight and feeling, and discover a fault if one exists. If he has 50 natural earths in the pit it does not prevent him from testing the continuity of his armourings from one or all of his machines right to the surface. Then let him, if he will, disconnect his main earth cable, the one running to the earth plates at the surface, and test the value of his plates with the surrounding soil by the method I have shown. The Home Office give his earth conductors

an absolutely definable resistance, and he should know this value. This applies, no matter what the conditions, in three-phase work. It is theoretical, of course, but with joints, &c., if it is not more than 100 per cent. higher, he will do very well.

I could test 50 natural earths in the pit by a little discrimination, either by the method put forward by Mr. Davies or myself. The point is, how can you stop the plant to do this or any of the tests? If he now tells me whether his neutral point is earthed or clear, I will point out to him a means of defining the earth that tripped his switch.

Uddington West,  
February 22nd, 1913.

John P. C. Kivlen.

#### The Use of Electricity in Mines.

The article dealing with "The Use of Electricity and Electrical Accidents in Mines" in your last two issues was both instructive and interesting, and I note the recommendations put forward. It would further interest me, and I believe a great many other readers, if the writer of the article would give a general outline as to how he would carry out the following scheme:—

Incoming supply from supply company at 11,000 volts carried down shaft 300 fathoms to sub-station at bottom, with four coal-cutters which operate at the same time at 200 volts in a 22-in. seam, 1½ miles from the bottom. Power not being used elsewhere in the mine.

Tollcross, February 26th, 1913.

J. S. Walker.

#### "Life Understood."

I have always had a warm corner in my heart for the ELECTRICAL REVIEW, and those connected with it, dating from the time when, as a young man, I used to read it through regularly every week, including such advertisements as were new to me. I am, therefore, writing a letter dealing with the review that recently appeared in your paper on a book called "Life Understood," of which I am guilty of being the author, hoping that the letter may be of the use to your readers that many letters and articles in the ELECTRICAL REVIEW were to me in the days gone by.

The main point made by the reviewer was that the point of the book was elusive. I am not quite sure what he took as the main point of the book, for different readers might choose different points according to that in which they were interested, as the book claims to have cleared up all occult phenomena and put them on a scientific basis. I think we may, however, take the main point to be "What is Life?" I point out clearly in "Life Understood" that every man appears to be a material being liable to sin, suffering and sickness, but that he is really a perfect being in a perfect world governed by a perfect God, and that he is being humbugged and fooled and hypnotised to believe that the material being is him, whereas the real spiritual man is the only real man, and he has life eternal, the matter having no life but being merely illusory phenomena, like a series of cinematographic pictures.

In the Bible we are told in many places that we are Sons of God, and yet Jesus said, "Ye are of your father the devil." I point out that, mathematically speaking, Heaven is a world of four dimensions, and that we see only three dimensions of it, and therefore see it all wrongly. The love, the life, the wisdom, the joy, the knowledge, in fact, everything good that you see about a man is heavenly, part of the real spiritual four-dimensional man; whereas the sin, sickness, troubles and sorrows are of our "father the devil," and are merely a series of cinematographic pictures that flash by in front of the real man and hide him from us. It is for this reason that the psychometric and prophetic results are obtained, as it is possible for the human being to get in mental touch with these cinematographic pictures, and see what is about to happen or what has happened. When you know how to think rightly you can destroy the evil in these cinematographic pictures, and it will not be manifested.

The above facts are capable of proof, and no one need

take what I say, as they can prove for themselves the facts set forth in "Life Understood."

Another objection is that I deal with "things metaphysical." This is true, because I point out that metaphysics, science and religion must all agree when their mistakes are corrected.

We have until recently believed that matter is an indestructible thing. If this be so, matter, and therefore sin, sickness and trouble must exist for ever. Now, I point out in "Life Understood" how matter, being electricity, can be caused to appear and disappear scientifically in two different ways, and I show the two ways in which this can be done, one by altering the electrical tension, which can be done hypnotically, the other by the action of God, the principle of good which short circuits the lines of force of which the ether is composed. These lines of force are identical with what are called "thoughts"; thought being a high-tension electrical current, and matter, from a metaphysical point of view, a manifestation of thought.

The reviewer says:—"The author has certainly written a book that is unique. He deals with a vast array of subjects, but not always with the pen of a specialist. For instance, hypnotism, according to his idea, is everything that is bad and useless. He does not seem to be aware of the wonderful mental cures that are being effected every day by means of this truly extraordinary science."

I dealt with a "vast array of subjects," as they all confirm the statements put forth and show that when a man really knows what the facts of life are, such results as are obtained by sorcery, spiritualism, hypnotism, faith healing, thought reading, clairvoyance, and last, not least, how Jesus did his miracles, become easy to understand.

With regard to hypnotism, which is merely the power of one human mind over another, if the reviewer had been able to give more time, he would have found not only that in "Life Understood" do I deal fully with hypnotism, mentioning that there are "five different forms of hypnotism, all of them wrong," but that I show the reason why, to use his words, it is "bad and useless," and further show the proper method of mental working whereby evil and matter can be always destroyed, and not only the person helped that a man was endeavouring to help, but the one mentally working, instead of being harmed, as in the case of hypnotism, is improved mentally, physically and morally. I can deal best with this one point by saying that the man who is probably the leading medical authority in the world on the human mind, asked me not long ago whether I would help one of the three leading hypnotic doctors, who by his work had got himself into a very bad state of health, and he thanked me sincerely when I promised that I would do this.

In "Life Understood" I point out that hypnotism and its results have been known for centuries, and that the results obtained by witches and sorcerers in olden days were merely hypnotic. To-day these results are said to be due to hypnotism and mental suggestion. I deal fully with psychotherapy, and also give a list of results obtained through hypnotism, and the names of some 30 of the leaders from Kelmont up to the present time.

With regard to spiritualism, I do not think that "the treatment is somewhat general," as I give not only the scientific reasons for the results obtained, but show in detail the different classes of results that can be obtained by so-called spiritualism, and also point out that it has nothing to do with departed spirits in any shape or way, but is merely due to the action of the sub-conscious mind of the medium.

It is quite true that in the book there are "weird terms," but the reason for this is that it is always difficult to explain metaphysical matters clearly, until one knows the way in which an author employs his words, and special terms, which in every case have been explained, have had to be used—not coined—in order to prevent confusion.

F. L. Rawson.

P.S.—Since writing the above, I see an article in the *Daily News* in which it deals with some recent statements by Dr. Stenson Hooker in a lecture by him on hypnotism. I have often discussed mental effects with Dr. Hooker, who has come to me for advice at various times, and it will be seen that he clearly draws attention to the dangers and abuse of hypnotism.

If it is capable of abuse, and everyone must admit this, it is fundamentally wrong. Working mentally in the proper way, no harm can possibly accrue to the healer or patient, and good must always be done.

## THE SOUNDER IN SUBMARINE TELEGRAPHY.

By EDWARD RAYMOND BARKER.

UNDER the above heading, the *ELECTRICAL REVIEW*, in its issue of February 21st, drew the attention of its readers to a matter which—through the medium of practically the whole British daily Press of February 17th—had already riveted the notice of an important section of the public. Reference is here made to the news cabled over from New York Press agencies, relating to the success attending the adoption, by the Commercial Cable Co., of our countryman Mr. John Gott's new principle of telegraph-working: a principle enabling the ordinary Morse, with its attendant automatic-translation facilities, to be worked on long submarine cables.

Before offering further comment, the writer seizes the opportunity to convey to Mr. John Gott whole-hearted congratulation on the success of his invention: one based on a principle which—whatever various means may henceforward be devised or may have been devised by other experimenters—will, throughout future history, remain, and ever will be recognised as wholly and entirely his.

Any one of Mr. John Gott's large circle of friends will rejoice in the realisation of his ideas, and in the overcoming of difficulties ever present in the practical carrying-out of instrumental details.

The concept of utilising the cable discharge, after each dot or dash of a Morse signal, to cause a switch-over to a reverse battery polarity, is simple as well as ingenious, and it is a combination of these two attributes which marks the true genius. The consequent close succession of signals, whether dots or dashes, of alternate + and - polarity, not only tends, during the progress of a letter or of a word, to keep a cable in an electrically neutral condition, but discourages distortion.

Now that, through the Press, the nature of the Gott principle has been disclosed, various experimenters out of sheer personal technical interest will bring out other devices for the carrying-out of the Gott principle. The writer had two of his own, one of which was suggested to him by mechanism devised by a friend for a "wireless" steered submarine torpedo. One of these is a purely mechanical "step-over"—to and fro—action. The other is electromagnetic. But whatever may be the device by which the current is automatically reversed on the coming to rest of the Morse key after the transmission of any one dot or dash, the principle—and it is that which matters—is covered by the patents taken out, so the Press informs us, in all countries.

The writer would not have ventured to discuss technical details, had not matter sufficient to warrant discussion already appeared in the technical Press.

So far the writer has dealt with this subject solely in its bearings on the distinguished inventor. One may rest assured that Mr. John Gott is in no way responsible for the wording of the messages emanating from New York Press agencies. The same applies to the gentlemen who, under their eminent President, control in New York the business of the Commercial Cable Co. From these gentlemen, all and individually, the writer has received kindnesses and acts of hospitality that he will never forget. At the same time he has been in New York quite often enough to know how easily exaggerations get afloat.

In this mention of exaggerations, the writer is prompted by the fact that one great point in the Press notices has been the alleged discovery of effective cable Morse, that is to say, of a device enabling a common Morse inker or sounder to be used on a long submarine cable at a good commercial speed. The question instantly arises: "Is cable-Morse quite

unknown?" The writer here refers to cases where the Morse has supplanted the Kelvin recorder.

A highly respected contemporary, the *Electrician* (February 21st) in a leading note, and an interesting descriptive article, gives much the same information as that to be found in the *ELECTRICAL REVIEW* (February 21st), and, elsewhere, indulges in a joke about the advent of cable Morse. On page 166 of the esteemed contemporary's current supplement, emphatic denial is given to a rumour that a magnate (named) in the "wireless" (financial) world, on reading of Mr. John Gott's system, remarked . . . Well, on second thoughts, the writer prefers not to repeat the words. These may be read in the columns of the contemporary. They evince keen regret on the part of the speaker that the business likely to accrue from the new system had not come his way.

To return, however, to the question as to the progress already made in cable Morse—a method of working, according to practically all the Press notices, now for the first time rendered feasible. Is it just, then, that we should ignore the work of the late M. Pierre Picard, of the French Government Telegraph Service? Mr. John Gott would be the first man to give an emphatic negative to this question.

According to the *Comptes Rendus de l'Académie des Sciences*, of Paris, on December 21st, 1903, a Commission nominated by the Académie unanimously voted the "Prix Hughes" to M. Pierre Picard for telegraphic improvements, resulting not only in a greatly increased signalling speed on the cables, but in rendering feasible, on the French Government Marseilles-Algiers cables, the use of rapid Morse, and of the Hughes and the Baudot printing systems. Hitherto siphon recorders had been used. On the Oran-Tangiers cable, too, Picard-Morse had been adopted with—when press of traffic required it—Wheatstone auto-transmission.

The writer begs leave to quote from the *ELECTRICAL REVIEW* of September 11th, 1903, certain statements of fact as to M. Pierre Picard's work—work still in full swing between Paris and Algiers, with auto-relay at Marseilles.

Direct communication between Paris and Algiers by means of the Baudot apparatus. The total length of the line was 1,800 km., of which 900 km. were cable. . . . M. Picard has devised a most ingenious method of employing the periods of rest between the emitted currents to produce the signals. The 'tail' of the current, hitherto considered the enemy of the submarine telegraphist, has now been made his best friend. Instead of the length of the current forming the dots and dashes, the signals are made by the length of time between the currents. The currents are all of equal length and strength. In the picturesque language of a French engineer: 'On parle, pour ainsi dire, avec des silences.' Each signal is composed of two currents of equal duration, one positive and one negative. Between these two currents, the positive and the negative, a period more or less long distinguishes the dash from the dot. The system can also be applied to printing telegraphs with equal success. . . . The transmissions from Paris to Algiers direct were effected by means of translating relays at Marseilles. Paris can employ a four-armed set to Algiers; the arms unemployed at Paris are used at Marseilles. The Central Office at Paris can on occasion give up two arms to the Elysée Office, and the Central Office at Algiers can on its side give up two arms to the palace of the Governor-General, thus establishing direct communication between the offices of the President of the Republic and the Governor-General."

Much more detailed information regarding the Pierre Picard principle of cable working may be obtained from the valuable illustrated articles written by M. le Dr. A. Tobler (Professeur à l'École Polytechnique de Zurich), and published in *Le Journal Télégraphique* de Berne, for December 25th, 1903, and January 25th, 1904.

From this source we learn that, in 1898, when still the Kelvin recorder was worked on the three Marseilles-Algiers cables, increase of traffic appeared to necessitate an additional cable. However, the adoption of the Baudot, made possible on the cables by Picard's method of transmitting incipient impulses of alternate polarity without earthing the cable at the sending end, obviated the necessity for a fourth cable. In fact, since the adoption of the Picard-Baudot, the three cables have largely sufficed for all purposes, and the public receives its telegrams in print, direct from the Paris-Algiers apparatus.

Again, very clear notes on the Picard principle are given in *Le Journal Télégraphique* of December 25th, 1906, by M. A. Carletti. He shows that Picard sought to arrive at absolute sign-alternation, combined with equality in the strength and duration of actual electrical charges, and this without any reference to the duration of an actual signal—that is to say, to the duration of the interval between the first impulse of a given sign and the following impulse of opposite sign. What differentiates Picard's principle from all others employed, or tried up to his time, has been his absolute abandonment of any idea of bringing back the electrical condition of the cable to a neutral condition after the application of each charge. Picard has brought about that each transmitted impulse finds the cable in a symmetrically neutral electrical condition. In other words, a + charge finds the cable influenced by a - charge of known value; a - charge finds in the cable a + charge equal to the preceding - charge, and so on.

On cables of "great length," M. A. Carletti remarks, Picard insulates the line after each momentary charge impulse and, according to the nature of the cable, he substitutes, in certain cases, an earthing period of given time value, followed by a "freeing."

The writer has attempted, in figs. 1 and 2, to summarise matters.

Fig. 1 compares the Picard and the Gott transmission principles, and shows the word "Picard" in conventional

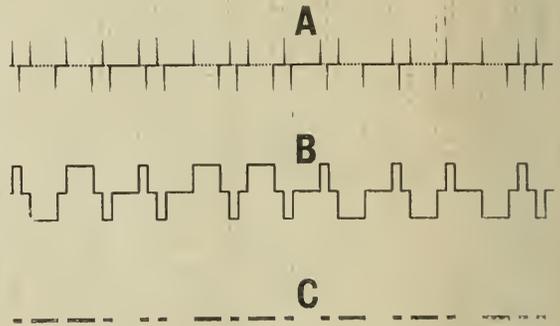


FIG. 1. PICARD (A) AND GOTT (B) COMPARED.

graphs illustrative of the two principles, and in corresponding Morse.

Fig. 2 shows what may be termed the master device of Pierre Picard, applicable to hand Morse or to Wheatstone auto, to the Hughes or to the Baudot.

In fig. 2 a simple cable Morse circuit is shown. Continuous lines = main circuit; interrupted lines = local circuits;  $R_1$  and  $R_2$  are two polarised relays;  $L_B$  and  $L_B$  are local batteries.

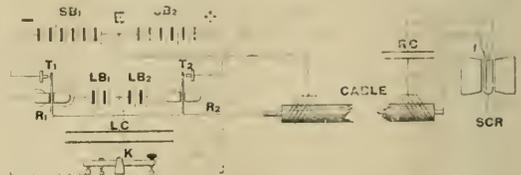


FIG. 2.—PIERRE PICARD'S CABLE MORSE.

Owing to the presence of the local condenser LC, any depression of key K causes a momentary "kick" of relay tongue  $T_1$  up against its stop contact on the + pole of the sending battery  $SB_1$ .

Again, each time K comes to rest after each dot or dash, the relay tongue  $T_1$  makes a momentary contact against its stop contact on the - pole of  $SB_1$ .

During the interval between the two relay tongue kicks caused respectively by the depression and the raising of K, the sending end of the cable remains insulated on the electrically connected tongues  $T_1$  and  $T_2$  at rest.

A graphic presentment of the working of the momentary + and - impulses is shown by "A" in fig. 1, which does not pretend to represent the real electrical conditions in the cable.

At the receiving end of the line is s c o n, a suspended-coil relay specially designed by M. Pierre Picard. The coil has no self-retractive force, but is absolutely free to respond, in its movements, only to cable impulses.



FIG. 1.—SIMPLEX GIRDER BOX.

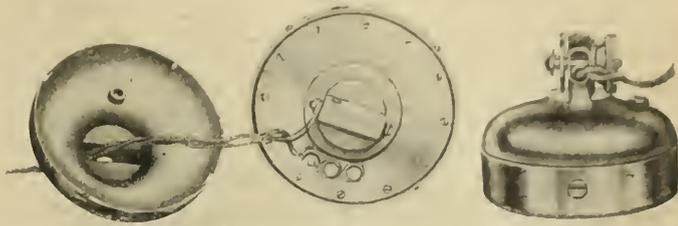


FIG. 2.—GOTTSCHALK TRANSMITTER WITH BACK CASING REMOVED, AND COMPLETE.

Between the relay and "earth" is the receiving condenser R C.

It will be seen that in Picard's system, + and - momentary impulses cancel out, whether in a signal, a letter, a word, or 1,000 words.

The Gott system of transmission, illustrated in B (fig. 1), if subjected to similar analytical treatment, gives interesting results, showing a certain + percentage of overcharge in some cases, and - percentage in others, but balancing out very evenly on the whole.

Results are here given of electrical analyses applied to the following sentences transmitted on the Gott principle. In each case a start has been made with the + current. The dot has been taken as unit.

"The Commercial Cable Co., of New York, United States of America."

(+) units = 151, (-) units = 126, overcharge = 19.8 (+) per cent.

"The Telegraph Construction & Maintenance Co., of Greenwich."

(+) = 131; (-) = 133. Overcharge = 0.75 per cent. (+).

"Siemens Bros. Dynamo Works, Ltd., Stafford and London, England."

(+) = 129; (-) = 113. 10.9 per cent. (-).

"The India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd."

(+) = 133; (-) = 121. 9.9 per cent. (+).

The simple alphabet without accented letters, &c.

(+) = 87; (-) = 71. 22.5 per cent. (+).

Figures 1 to 0 inclusive:—

(+) = 45; (-) = 55. 22.2 per cent. (-).

Taking the sums of the foregoing:—

(+) = 679; (-) = 649. Overcharge = 4.6 per cent. (+).

The question remains: To what extent is the Picard principle—so successful in the Mediterranean—applicable over average Atlantic and Pacific cables? Here, at any rate, lies an untrammelled line of legitimate investigation open to all.

It has been shown how Pierre Picard was honoured by the Académie des Sciences of his country. May the writer be allowed to express the hope that equivalent or greater distinctions will be conferred in London and in New York, on John Gott, the British inventor of the London—New York cable Morse.

**Inquest.**—The funeral took place last Friday at Acton cemetery of Mr. Charles Ellis, an electrical engineer, employed by the Great Western Railway Co. Deceased was 50 years of age, and a member of the London Railway A.A., to which he had rendered assistance by the erection of a special telephonic service for the facilitation of the meetings at the Stadium and, at Castlebar Park, Ealing. The deceased died suddenly, and at the inquest the medical evidence showed that he was in the early condition of pneumonia, and there was dilatation of the heart, which produced syncope. A verdict of death from natural causes was returned.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Conduit Girder Box.

In a supplementary sheet (T 3), MESSRS. SIMPLEX CONDUIT LTD., of Charing Cross Road, W.C., give particulars of two new conduit accessories—their patent girder clip and girder box. The

latter, which we illustrate, is a neat arrangement for carrying conduits around girders in factories, &c. Where it is required to drop a light from the girder, the box can be provided with a porcelain connection piece and a cord grip at a small extra charge. It is stated that the box itself is practically equivalent in cost to the two inspection bends which in the ordinary case would be used. The box has a cast base, which projects over the sides of the cover, preventing any moisture draining off the girder from penetrating inside the box. A rubber or leather washer should be used between the underside of the base and the lock nut.

### The Gottschalk Telephone Transmitter.

Practically all the commercial types of telephone transmitter have employed the same type of diaphragm as was found in the very first instruments designed. The Gottschalk transmitter, however, is the result of over five years' careful investigation of the



FIG. 3.—GOTTSCHALK TRANSMITTER, AND DIAPHRAGM.

properties of vibrating diaphragms. Instead of employing a loose diaphragm made of some dead metal, such as aluminium, which is commonly used for the purpose, phosphor-bronze is employed, which is rolled to produce an initial tension. The diaphragm is then formed, without drawing the temper, into a pan-shaped disk, the projecting edge of which is securely clamped, leaving the central portion free to vibrate like a drum-head.

A resistance cell of the ordinary type is connected to the centre of the diaphragm by means of a spider-shaped member having a number of feet, which are soldered to the inner surface of the diaphragm (fig. 3). These feet being equi-distant from the centre, pick up the sound vibrations at the point of maximum amplitude, and it will be noted that this method of connection is entirely different from the ordinary method, wherein the cell is connected to the diaphragm at the centre. The cell with the diaphragm is placed in a back casing, the various parts being illustrated in the accompanying figures. A connection is made between the front electrode of the cell and an insulated terminal carried on the casing, in such a manner that the circuit is confined to the electrodes and granular carbon, so that no part of the casing or diaphragm is in circuit.

Certain other details of construction result in an instrument which is absolutely watertight, as it may be immersed in water for hours, or even days, without any damage whatever. The casing being of brass and the diaphragm of phosphor-bronze, there is no corrosion such as commonly occurs in transmitters where aluminium diaphragms are employed.

As the sensibility of the instrument is considerably increased by the improved diaphragm construction, it is possible to dispense with the usual mouthpiece. Telephone companies figure, especially in the case of desk sets, that the annual maintenance cost for mouthpiece replacement is as high as 2s. per telephone. The Gottschalk instrument eliminates this charge, as the mouthpiece consists of a flat perforated metal guard, which is practically indestructible (fig. 3).

The mouthpiece can be thoroughly cleansed, and as it is flat, it will be often wiped, which is not the case with the usual funnel-shaped mouthpiece. With the Gottschalk instrument the user unconsciously gets close to the flat guard as there is nothing to repel him, and better average transmission results.

The shell of the instrument is provided with a large drain hole, so that water and moisture can drain off the diaphragm. The latter has no holes or seams whereby moisture can penetrate to the interior.

From tests made in several University laboratories and by Mr. H. R. Van Deventer, this instrument, in its commercial form, was found to average from 3 to 7 miles better in terms of standard cable than transmitters of ordinary construction.

#### Ferro-zincing or Ironising.

In a new process for protecting iron and steel surfaces from corrosion, of which we have received particulars from MR. SHERARD COWPER-COLES, an alloy of zinc is electrolytically deposited on the surface of the iron or steel to be protected, which is more durable than coating with zinc alone. The great drawback to zinc is that it is so readily attacked by weak alkalis or acids. The resisting power to corrosion of zinc-iron alloy has already been established in connection with the process of "Sherardising," which consists of forming an alloy of zinc and iron on the surface by bringing iron or steel in contact with zinc dust or powder at a temperature considerably below the melting point of metallic zinc. The new process of ferro-zincing or ironising has the advantage that articles of almost any size can be coated, and it is cheaper and more efficient than hot galvanising; as the process is a cold one, there is no distortion.

## BUSINESS NOTES.

**Book Notices.**—*Deutscher Kalender für Elektrotechniker* (Uppenborn's). Edited by G. Dettmar. Thirtieth year. Munich: R. Oldenbourg. Price 5 M.—This handbook, one of the very oldest-established, is issued in two parts, one neatly bound in leather for the pocket, the other in paper covers. The former contains tables, units, elementary principles, measurements, and treatises on electrical machinery D.C. and A.C., batteries, generation and distribution, lighting and power, regulations, &c., with a diary at the end. The second part covers electric traction, telephony and telegraphy, electrochemistry, physics and mathematics. The two together constitute what is practically an encyclopaedia of information on electrical and allied subjects in compact form, and must be highly prized by their users.

"The Design of Alternating-Current Machinery." By James R. Barr and R. D. Archibald. Price 12s. 6d. net. "The Bandit Printing Telegraph System." By H. W. Pendry. Price 2s. 6d. net. "A First Book of Electricity and Magnetism." By W. Perren Maycock. Fourth Edition. Price 2s. 6d. net. London: Whittaker and Co.

"Journal of the Franklin Institute." Vol. CLXXV, No. 2. February, 1913. Philadelphia: The Institute. Price 50 c.

"The Physical Review." Vol. 1, No. 1. January, 1913. Lancaster, Pa.: The American Physical Society. Price 60 c.

"Atti della Associazione Elettrotecnica Italiana." February 15th, 1913. Milan: Stucchi, Ceretti & Co. Price L. 150.

"Einfluss der Scheinenspur auf die Eisenbahn und Kleinbahn-Wagen." By James Sutherland Warner. London: The Warner International and Overseas Engineering Co., Ltd. Price 1 M.

**Dissolutions and Liquidations.**—THE GILBERT ARC LAMP CO., LTD.—This company is winding up voluntarily, with Mr. W. A. Henderson, 3, Fenchurch Street, E.C., as liquidator. A meeting of creditors is called for to-day. We are asked to state that this liquidation is merely for the purpose of completing the transfer of the assets to Engineering and Arc Lamps, Ltd., of Sphere Engineering Works, St. Albans, Herts.

CRATHORNE & GREEN MANUFACTURING CO., electrical engineers, Wagner Street, Old Kent Road, S.E.—Messrs. J. L. Crathorne and F. J. Green have dissolved partnership. Mr. Green attends to debts, &c., and will continue the business.

HARTLEPOOL ELECTRIC TRAMWAYS CO., LTD.—A meeting will be held on March 28th at Electrical Federation Building, Kingsway, W.C. to hear an account of the winding up from the liquidators, Messrs. H. W. Davis & H. A. Staggs.

LIGHT RAILWAYS SYNDICATE, LTD.—A meeting is called for April 2nd at the offices of the New General Traction Co., Ltd., 8, Crosby Square, E.C., to hear an account of the winding up.

**Osram Lamp Patents.**—On Friday, February 7th, 1913, in the High Court of Justice, Chancery Division, Mr. Justice Swinfen Eady granted an interim injunction to the Osram Lamp Works, Ltd., restraining the Oro Light and General Supply Co., Ltd. ("Oro" lamps) their servants, agents and workmen from selling lamps infringing Osram Patents Nos. 23,899 of 1904 and 18,622 of 1906. We are informed that the lamps in question were made by the Wolfram Co., Augsburg, Bavaria.

**Catalogues and Lists.**—MESSRS. LAING, WHARTON, LTD., 7, Great Newport Street, London, W.C.—English and French editions of Messrs. Vedovelli, Priestley & Co.'s catalogue of high and low-tension switchgear, for which the firm are sole agents in the United Kingdom.—The English edition consists of 44 pages, and contains excellent illustrations, descriptive particulars, and tabulated prices of various switches, fuses, relays, switch fuses, lightning arresters, limiters, resistances, &c. The French edition

(of 72 pages) deals with the same and many additional lines, and contains half-tone illustrations of overhead high-tension lines, electric railway overhead construction work, electric luminous fountains, &c.

MR. GEORGE ELLISON, Victoria Works, Warstone Lane, Birmingham.—Illustrated sheet, No. 500/1, containing a full description of their new drum type controllers for cranes, hoists, &c. They are now manufacturing controllers, both for D.C. and A.C. circuits, and several new features are embodied in the present design, one being the very large space allowed for connecting up.

MESSRS. AITON & Co., Derby.—Catalogue of between 30 and 40 pages, containing a great deal of information useful to engineers, relating to flanged pipes and accessories. Tabular prices and diagrams are given of cast-iron pipes, wrought-steel pipes, expansion bends and steam separators, table and hanger brackets, automatic exhaust relief valves, and high-pressure steam traps. Tables are included of the flow of steam and water in pipes, also a standard specification. It is claimed that by the use of this catalogue an engineer can decide the sizes of pipes which will be required for certain duties, and can work out their cost, including the usual accessories.

MESSRS. ALDOUS & CAMPBELL, LTD., Lower Bland Street, London, S.E.—Blotter card, showing one of their switch control electric passenger lifts.

MESSRS. MITCHELLS, ASHWORTH, STANSFIELD & Co., LTD., 23 and 24, Old Bailey, London, E.C.—24-page illustrated catalogue concerning "Mascolite," a material for reducing and correcting shocks and vibration and for deadening sound. Mascolite "P" (single thickness), is a special mixture of fibres which is used for permanent-way chair pads, and is used by tramway companies for lining the car underframes, &c.; "B U" (built up) is of the same material but with prepared cork between each layer, and it is used as packing for permanent-way chairs, engine foundations, &c.; a third-class is the "I.R." (with rubber insertions). The purposes of the material in connection with electrical machinery are well illustrated, and many testimonials are given.

MESSRS. PETERS, LTD., 63, Queen Victoria Street, London, E.C.—Two finely prepared catalogues; one describes and gives a specification and tests of the firm's patent semi-Diesel crude oil engines, with a table of sizes and prices; the other deals equally well with their stationary and portable oil engines, combined engines and pumps, and electric lighting plants. Shipping weights and dimensions, prices, and a long list of users, are given. Both publications are beautifully illustrated.

**Bankruptcy Proceedings.**—SAMUEL BROOKES (trading as Netherton Tube Fittings Co.), Chapel Street, Netherton, and Star Tube Works, Primrose Hill, Netherton.—Receiving order made February 19th on debtor's petition. First meeting, March 6th; public examination, March 18th; both at Dudley.

C. O. McMILLAN, electrician and cycle dealer, 15, High Street, Portmadoc.—Trustee (Mr. L. H. Jones, Chester) released November 4th, 1912.

CHARLES SPENCER NORTHCOTE, electrical engineer, 67, Stanthorpe Road, Streatham, London. The following are creditors:—

Benton, C., London	£200	Eaton, T., Wimbledon	£20
Bourne & Hollingsworth, Ltd.,	24	"Bankers" (London City and	
Chalk & Cox, London	40	Midland Bank), London	600
"Bankers" (Capital and		Osborn & Osborn, London	50
Counties), London	110	Robinson, Peter, London	31
Debenham & Storr, London	548		

CLIFTON ROBINSON, Keith House, Porchester Gate, W.—Before Mr. Registrar Linklater, on Tuesday, an application on behalf of bankrupt for the variation of an order of 1911 suspending his discharge for four years, was heard. It appeared that debtor had been unable to obtain an appointment since he applied for his discharge, and he had been supported by his mother, Lady Robinson. The trustees of certain family funds had now considered the position, and had decided to provide £2,500 for the creditors if the Court would vary the order and grant the discharge straightaway. This would enable an additional dividend of 3s. 6d. in the £ to be paid to creditors. A claim by the father's executors for £18,000 would be released. It was stated that creditors for £12,000 approved of the application, though two small creditors thought the offer should be increased to 7s. 6d. The Registrar granted the application, and made the order of discharge, subject to judgment of £2,500.

J. W. LEWISLEY, electrician, Nottingham.—First meeting, March 6th; public examination, March 14th; both at Nottingham.

**Ebonite Manufactures.**—At the factory of the NEW ECCLES RUBBER WORKS, LTD., at Eccles, a new shop, with special plant, has been devoted to the production of ebonite pipes, &c., required for the conveyance and storage of acid and other corrosive liquids. Lead and other materials previously used have been largely superseded, as ebonite is found to withstand successfully the action of even the strongest acids, and pipes made of this material are capable of standing enormous pressure. We are informed that in a test for a required strength of 30 lb. per sq. in., it was found that a pressure of nearly 80 lb. was resisted. At the works mentioned, pipes of all sizes are turned out, the more usual being from 2 in. to 6 in. bore. Stop cocks, bib cocks, valves, pumps, and all accessories are also made of ebonite. The company manufactures ebonite-covered rollers for textile purposes.

**Clyde Tape.**—We have received from MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., a piece of cable insulated with vulcanised bitumen, on which a joint has been made and insulated with "Clyde" tape. We recently drew attention to the fact that this tape, when warmed with a blow lamp after the joint had been lapped with it, became one with the insulation on

the cable, and the specimen joint before us fully bears this out, for on slitting it open it is difficult to tell where the tape ends, and the original coating of bitumen begins. Such a joint should be found perfectly waterproof and of high insulation resistance.

**Trade Announcements.**—MR. JOHN HARGROVE, late of Messrs. H. Simon, Ltd., of Manchester, has taken over the management of the London office of the Rees Rotarbo Manufacturing Co., Ltd., manufacturers of rotary pumps and condensers. THE BRITISH CENTRAL ELECTRICAL CO. announce that, owing to increased business, they are moving to larger premises, and from March 1st their new address will be 6 and 8, Rosebery Avenue, E.C. (near Holborn Town Hall). Telephone number: "Holborn, 5848" (two lines); telegraphic address: "Briticent, Holborn, London."

## LIGHTING and POWER NOTES.

**Argentina.**—It is expected that the electric light station at Merlo (Buenos Ayres), will be completed and ready for service in about three months' time. Public lighting will consist of 50 arc lamps.

It is reported that the Cia. Orlando Americana, which has the contract for the public lighting of Campana, intends to suspend the service as the Municipality is owing it \$5,000, and it sees no prospect in getting the money.—*Review of the River Plate.*

**Atherton.**—The U.D.C. has adopted the recommendations of Mr. Miller for improving the system of electricity supply in the district, and instructed him to prepare the necessary plans and estimates for carrying out the scheme and report further. Inquiries are to be made for a suitable site for the proposed new sub-station.

**Australia.**—The Sydney (N.S.W.) City Council supply to Merrickville, recently inaugurated, will include shortly, in addition to street and private lighting, a supply of about 3,000 H.P. for power purposes, to the Sydney Steel Co. and others.

With reference to the proposed North Sydney Municipal Council supply from a private concern, efforts are being made to induce the Lord Mayor of Sydney to use his influence with the North Sydney authorities to take a bulk supply on new terms from the Sydney Council, and thus maintain the municipal service.

**Barnes (Surrey).**—The U.D.C. has decided to supply current to the hospital on a flat rate of 2½d. per kw.-hour, or 3½d. per kw.-hour, subject to the usual discounts, for 2,000 kw.-hours during the winter quarters, and 750 kw.-hours during the summer quarters, and 1½d. per kw.-hour beyond.

**Bath.**—The Electric Lighting Committee of the T.C. has decided to apply to the L.G.B. for an additional loan of £5,000 for mains and services for three years.

**Bedford.**—The T.C. has decided to proceed with the lighting by electricity of the streets in the Queen's Park district, at a cost of £1,151.

**Chester.**—Mr. S. E. Britton, the city electrical engineer, has effected a much-needed improvement in the lighting of Foregate Street, and incidentally conferred a boon on users of the thoroughfare. The old system of lighting was by arc lamps in series, which necessitated a number of standards down the centre of this important street. These poles have now been removed, and the lamps are suspended on the "Barrow" system, while the overhead tramway wires are supported from the premises or from standards erected inconspicuously near to the buildings.

**Colne.**—A firm of manufacturers erecting a new shed is in negotiation with the local Electricity Committee regarding the driving of looms by electricity. Provided satisfactory arrangements can be made, a trial will be given to a motor on each loom. This will open out a new development where hitherto this kind of loom-driving has been unknown.

**Continental Notes.**—FRANCE.—Representatives of 40 communes in the region between Ay and Epernay, in the Marne Department, have formed themselves into an intercommunal conference, with a view to the installation of an electric light and power service. A committee, consisting of nine mayors, has been nominated to draft the plans of the proposed installation.—*La Lumière Electrique.*

BELGIUM.—La Société de l'Electricité de l'Escaut has secured a 10 year's concession for the supply of the electrical energy required in connection with the new docks in the north district of Antwerp.

**Darwen.**—The Mayor started the new steam turbine at the electricity works on February 19th. The turbine has been installed at a cost of nearly £6,000. The Mayor congratulated the Electricity Committee upon the progress of the electricity department. At present there were half a dozen industries in the town relying upon electricity, and whereas they consumed 130,000 units a few years ago, they now consumed one million units. Councillor Thornley said there was a small loss on the electricity undertaking in 1911, but in 1912 the working showed a profit of more than £400.

**Dover.**—The electrical engineer has been instructed to report upon the desirability and cost of providing automatic time switches for the public incandescent lamps.

**Ealing.**—The chairman of the B.C. Electricity Committee has made inquiries into the proposals of the Fixed Price Light Co. relative to the B.C. entering into a contract with it for the fitting, wiring and lighting of small houses, under the scheme, now in force at Wimbledon and other places in or near London; and, in company with Alderman Green and the borough electrical engineer, he has visited Wimbledon and inspected a number of the houses there to which current is supplied under the company's scheme. Before coming to any decision on the subject, the Electricity Committee has requested the engineer to procure certain additional information and submit it at the next meeting.

**Edinburgh.**—The Corporation Electricity Committee has agreed to recommend that the minimum charge for light should be 10s. per annum, and for power £1. It was also agreed that, should the minimum in either case for lighting or power not be used, to allow of a combined charge of 30s. per annum for lighting and power.

**Finchley.**—Application is to be made to the Local Government Board for sanction to a loan of £15,000, made up as follows:—Mains, £7,500; consumers' connections, £6,000; and meters, £1,500.

**Fleetwood.**—The chairman of the Electricity Committee and the electrical engineer have been deputed to inspect plant made by the three firms which have tendered for machinery, boilers, &c., required in connection with the extensions to the electricity works.

**Galashiels.**—It is stated the majority of the T.C. favour the idea of a municipal electricity scheme. A suggested site for the power station is on the town's property at the refuse destructor, and a siding from the railway could be conveniently laid. The probable capital cost of the scheme has been put at £30,000. The power is wanted chiefly for the mills. A deputation from the T.C. visited Glasgow to consult experts and obtain information to report to the Council. The question may be submitted to the decision of the ratepayers by plebiscite.

**Ham.**—The Highways Committee of the District Council reports the receipt of an application from the Twickenham and Teddington Electric Supply Co., asking for permission to place overhead wires across Ham Fields. It was agreed that the required consent be given on the company entering into an agreement to alter the position of the overhead lines, or place them underground if and when required by the Council.

**Harrogate.**—The T.C. has applied to the L.G.B. for a loan of £6,250 for the provision of additional plant for the electricity works.

The Council has decided to loan, free of charge, to consumers for a month's trial, electric irons for domestic use.

**Hornsey.**—At the February meeting of the B.C., it was decided to invite tenders for a new cooling tower. It was reported that delay in erecting the barometric condensing installation had resulted in the contracting company paying £65 as liquidated damages. A recommendation that application should be made to the L.G.B. for sanction to the borrowing of a further sum of £3,000 for house services was referred back.

The North Metropolitan Electric Power Distribution Co. wrote referring to the Bill promoted by the Tottenham and Edmonton Gas Light and Coke Co., Ltd., and suggesting that the Council should oppose the Bill, and that evidence from representatives of the Council might be forthcoming in the first instance at the ensuing Board of Trade inquiry, in favour of the company which was applying for a Wood Green electric lighting prov. order. It was decided not to adopt the suggestion. A petition is to be presented against the Bill promoted by the Metropolitan Electric Tramways, Ltd., authorising them to provide and work trolley vehicles on certain routes in Wood Green, Tottenham, and Walthamstow, with a view to linking up districts served by existing tramways. It is considered that local authorities should be consulted when power for construction is sought.

**Huddersfield.**—The financial statement relating to the electricity undertaking for the year ending December 31st last showed that the income had been £45,078, compared with £39,592 for the previous year, the chief items being single-phase lighting, £24,962; single-phase power, £4,614; and three-phase power, £11,123. The expenditure amounted to £28,511, against £23,978 for 1911, leaving a surplus balance of £16,566. Interest on loans absorbed £6,960, redemption of debt £5,352, and the amount repaid to the Public Works Loans Board was £1,653. The sum of £600 was transferred to the depreciation and contingencies account, which now stands at £5,818, and the balance of £2,000 was carried forward.

**India.**—The Nagpur Electric Lighting Co. has been started to provide the chief city of the Central Provinces with electric light and power. Work has already been commenced, and it is expected to have some of the engines and dynamos running by next hot season. An arrangement has been come to with the local Government, whereby a minimum load is guaranteed; current is required for 14 miles of street lighting, private bungalows, and railways and lighting. In time to come, the local cotton mills might be induced to buy power in bulk from the company. The machinery is to be provided by Messrs. Crompton and Co.—*Indian Textile Journal.*

**London.**—Last week the South London Electric Supply Corporation, Ltd. held a five days electric heating and cooking exhibition at Raleigh Hall, Brixton, S.W. A representative selection of apparatus for domestic purposes was shown, including breakfast cookers, toasters, kettles, flat irons, radiators, convectors, &c., many of which bore labels stating the cost of running per hour. A "Belenus" water heater, several portable vacuum cleaners, and choice lighting fittings were also in evidence. The *pièce de résistance* of the exhibition was the "Eclipse" cooker, comprising large oven, grill and two boiling rings. This apparatus was most ably demonstrated to full assemblies twice daily by Mr. Miller, of the Electric and Ordnance Accessories Co. Visitors who wished to put Mr. Miller's statements to a practical test were enabled to do so in the electric café, which adjoined the main hall. We note that the South London Co. has now introduced the "assessment" system; the fixed charge per annum is 12½ per cent. on the net assessment, payable in four equal quarterly payments, and ½d. per unit is charged for all current consumed. Or alternatively, and for the convenience of those consumers preferring to be charged through a separate meter for current used for heating and cooking purposes, the following flat rates have been introduced for apparatus installed up to 1 kw. capacity, 2d. per unit; over 1 kw. to 2½ kw., 1½d. per unit; over 2½ kw., 1d. per unit. All apparatus is supplied on the hire-purchase system, and is installed by the Corporation's own contracting department. We understand that up to Friday last, the "Sales Department" had received a great number of inquiries from prospective consumers, and it is expected that good business will result. The Corporation has our best wishes in this connection.

**MARYLEBONE.**—The Electric Supply Committee states that Mr. J. F. C. Snell has now presented his full report upon the question of extensions of plant necessary to enable the Council to meet next winter's supply. In this report Mr. Snell urges the necessity of the plant being installed at once. There are, he continues, five possible methods of dealing with the problem:—(1) Continuous-current extension on similar lines to the existing plant; (2) Three-phase alternating-current plant at the power station, and high-tension transmission cables to converters (to continuous current) fixed at the sub-stations; (3) Diesel engine generators at the sub-stations; (4) Battery extensions at the sub-stations; and (5) bulk supply, *i.e.*, the purchasing of current in bulk from some outside source, and of these he recommends the second. With regard to the converting plant, the scheme recommended provides that 1,000-kw. machines should be used and standardised; and that four such machines be installed at present, namely, one at the station, two at Manchester Square sub-station, and one at Rathbone Place sub-station. So far as the transmission system is concerned, it is proposed to use three 15 sq. in. three-core E.H.T. cables from the station to Manchester Square sub-station, and two similar cables from Manchester Square to Rathbone Place sub-station. As to the condensing plant, British-made condensers are recommended, one to be worked in conjunction with the canal water and one with the cooling towers. The present equipment of boilers is ample for some time to come, so far as steam-raising plant is concerned. The cost of this scheme, based upon one turbo-alternator and on actual tenders, is put at £32,612. The losses in transmission and conversion would not exceed 10 per cent., and the available amount for distribution would be 2,700 kw. (normal) and 3,375 kw. (overload). The annual capital charges would be £3,195, or £117 per kw. (normal rating), and the running cost per unit available for distribution, including wages for extra staff, 168d. With the addition of the second alternator the capital outlay is raised to, say, £42,000, to allow for contingencies, the corresponding annual capital charges being £4,195, or £125 per kw., taking the maximum output of one set only, and counting the other wholly as reserve. Mr. Snell does not advise the entire change of system of generation and supply to alternating current which would involve considerable alterations both at the works and on the mains, and recommends that the present plant be unaltered, and used only for peak load purposes and as a reserve to the three-phase plant during lighter loads. After considering this report the Committee recommends the adoption of the scheme, and that application be made to the L.C.C. for sanction to a loan of £42,500, and that contracts be entered into with the Oerlikon Co. for the supply, in addition to the turbo-alternators authorised, of condensing plant to be manufactured by the Worthington Pump Co., at a cost of £8,964, making, with the £8,600 already authorised, a total of £17,564; Messrs. Ferranti, Ltd., for the supply of switch-gear, &c., at a cost of £2,384; the Oerlikon Co. for the supply of condenser motors and control switchgear, at a cost of £1,709; British Westinghouse Electric and Manufacturing Co., Ltd., for the supply of four 1,000-kw. converters, &c., at a cost of £8,908.

At the meeting of the Council last week these recommendations were opposed on the ground that, as the matter had only been in the hands of the Committee about 24 hours, there was not time enough for the matter to be mastered. Alderman Debenham, supporting the Committee's recommendations, said that it was very necessary to have the new plant, as the business was increasing much more rapidly than was supposed. The saving in coal alone would practically pay all the capital charges.

Councillor Maude asked for more information about the £42,500, and about the actual liabilities of the undertaking. It was over two millions in debt, though they had been paying off for seven years and now there was this fresh loan. It was a very serious matter for Marylebone to consider. Councillor Warren protested against the Committee going to Switzerland for plant. Councillor Garrould said it was impossible to give the order to a

British firm. The machinery could only be obtained from one particular firm. Councillor O'Brien thought the need for the new plant had been shown very clearly. In 1907 they only sold seven million units, but last year they sold 13 million, and in 1916 they would be selling 16 millions or more. In the result the recommendations were carried.

**LEWISHAM.**—At a meeting of the B. of G. on Monday, the General Purposes Committee reported it had considered the question of lighting the workhouse by electricity, and recommended the board to take the necessary steps for the installation of the electric light throughout the workhouse and offices. The board has already decided to install the electric light in the infirmary. A letter was read from the L.G.B. stating that it would be prepared to consider favourably the granting of a loan for a definite scheme for the electric lighting of the infirmary and workhouse. Letters had also been received from the South Metropolitan Gas Co. submitting a scheme for providing and erecting a gas-driven electricity generating plant, and instructions were given for application to be made to the company for a list of authorities, &c., where such a scheme was in force. The board decided to install the electric light in the workhouse, and to call in an expert for advice.

The L.C.C. on February 20th, 1912, appointed a special committee to consider and report on the whole question of electricity supply in London and to confer with Government Departments and local authorities and companies generating or supplying electricity in London.

Sixteen meetings have been held and a preliminary survey of the question has been made, but no conclusions have yet been arrived at, and the committee makes no detailed report at this stage. It is suggested that a committee should again be constituted to complete the inquiry.

**ST. PANCRAS.**—The Electricity Committee, reports with reference to the tender of the Brush Co., which was accepted by the Council for the supply of a 5,000-kw. Ljungstrom turbine, that the company has asked that the penalty of £40 per week, for any delay that may occur in the supply of the turbine, should be deleted, inasmuch as the 1,000-kw. Ljungstrom turbine, which in the meantime is to be supplied on loan, may be retained for use by the Council without extra charge in the event of the delivery of the 5,000-kw. machine being delayed. It has been decided to comply with this request. Application is to be made to the L.C.C. for sanction to borrow £15,000 in connection with the turbine in question.

**SOUTHWARK.**—The Electric Light Committee of the B.C. has had under consideration a report from the electrical engineer embracing a scheme of extension in connection with the undertaking, which is required to be carried out at a very early period. Having regard to the importance of the subject, and the expenditure involved, it has been decided to engage expert advice at a cost not exceeding 150 guineas.

The North Metropolitan Electrical Power Co., at its Winchmore Hill sub-station on Wednesday, last week, held a very instructive gathering to fittingly inaugurate the new system of electric lighting in Green Lanes, Southgate. Many Councillors and officials from neighbouring authorities were present, the idea being to exhibit what could be done. Mr. Devonshire, the managing director of the company, presided in an informal sort of way, and referred to the high ideals which the electrical experts had set before themselves. Mr. Ruthven Murray, the company's engineer, gave a short address upon the scheme, the technical details of which aroused much interest. After votes of thanks had been passed, the party boarded a special tramcar and were taken for several miles along the main road to see the new lighting, which is on the "Barrow" system.

**Loughborough.**—At a meeting of the T.C. in committee on Monday last week, a report was presented from the Gas and Electricity Committee, in which it was stated that owing to the embarrassing position arising from the many changes made from time to time by the Brush Electrical Engineering Co., and the delays in negotiations for giving it a bulk supply of electricity, the Committee felt bound to report that several questions of vital importance still remained unsettled, one being as to the time required by the company for the delivery of the plant to be supplied by it. The company now intimated that it declined to be bound to give delivery in less than nine months, which the Committee regarded as a prohibitive period, having regard to the general demand on the undertaking for next winter. The Committee, therefore, recommended that the negotiations with the company be postponed for the present, and that the Corporation proceed without delay to make extensions of the plant, to be available for the ordinary supply next winter. The approximate cost was estimated at £10,000. The report was adopted.

**Pendlebury.**—Messrs. Andrew Knowles & Sons, Ltd., are about to introduce electric power for haulage purposes in the Pendlebury and Clifton Hall mines. The announcement was made at the shareholders' meeting last week. Current will be delivered from the Lancashire Power Co.'s mains to a sub-station, where it will be reduced to a suitably low voltage. The electric haulages will supersede the compressed air engines which have hitherto been used for haulage purposes. The installation will probably be commenced about Easter.

**Peterborough.**—In the course of a report to the Council, presented on Tuesday, the electrical engineer, Mr. J. C. Gill, drew attention to the probably overloaded condition of the station plant next winter, and urged the necessity of purchasing additional plant. He proposes that two extra boilers (£1,230) and a 500-kw. turbo-generator (£3,400) should be installed. The Electric Lighting Committee has approved the engineer's report, and recommends the borrowing of £7,000 for carrying out the scheme, which would complete the equipment of the existing station.

**Plymouth.**—The Electricity Committee has approved of a resolution that the Embankment Road should be lit by electricity.

**Rawtenstall.**—The borough electrical engineer and the borough surveyor have been requested to consider and report upon the proposed lighting by electricity of the workmen's dwellings to be erected on Carr Farm estate.

**St. Mary Cray (Kent).**—A large new power house is being erected at St. Mary Cray Paper Mill, by Messrs. Joynton and Son.

**Siberia.**—According to the *Board of Trade Journal*, a complete project for equipping the port of Vladivostok with cranes, elevators, repair shops, refrigerating and electrical plant has been drawn up, and some £15,000 has been allotted for the building of an electric power station.

**Silsden.**—The application of the Airdale Shed Co. for permission to lay an electric cable to serve the proposed shed has been withdrawn.

**Skipton.**—To celebrate the completion of a rearrangement of premises and installation of electrical driving and lighting, the directors of Messrs. John Dewhirst & Sons, Ltd., dyers and spinners, of Skipton, have invited the whole of their employes, numbering about 1,000, to a series of entertainments and socials on March 7th. The work of addition and reconstruction has occupied about four years. The whole of the machinery is driven by a newly-installed Westinghouse 1,250-kw. turbine and generator. The 40 motors in the works are of British Thomson-Houston make.

**Southport.**—The General Purposes Committee of the T.C. on February 24th passed a recommendation to the Council that the management of the tramways and the electricity undertakings should be separated, and not a joint affair as at present.

**Swanage.**—The Dorset Electricity Supply Co., which has been promoted by Dr. Purves, of Exeter, in order to provide an electricity supply for the town, has approached the U.D.C. on the question of public lighting. The company offers to light 60-c.p. lamps until 11 p.m. at a charge of £2 10s. 6d. per annum, 100-c.p. lamps at £2 17s. 6d., 200-c.p. lamps at £4 10s., with a minimum yearly payment of £150.

**Swinton.**—The L.G.B. has given sanction to the Swinton and Pendlebury District Council for the borrowing of £600 for laying cables for the supply of electricity to Broad Oak Park.

**Walkden.**—A number of looms which have been put down in the Boatshed Mill, Walkden, by Messrs. E. Lane & Sons, of the Hope Mills, are to be electrically driven.

**Wednesbury.**—The profits of the Corporation's electricity undertaking amounted last year to only £23. In consequence of this, it is stated that the charges to consumers are to be raised, and that an increase of 15 per cent. may be anticipated.

**West Ham.**—The electrical engineer suggests that, owing to the continued increase in connection with the supply of current, arrangements be made with Messrs. Babcock & Wilcox to extend their present contract for two boilers to three. The amount which it will be necessary for the Council to raise for this purpose is £7,363, of which £4,785 represents the amount of the quotation for boiler and accessories to complete the pair already in hand. The electrical engineer's suggestions have been agreed to.

**Willesden.**—In connection with the Council's decision to erect a sub-station in Barret's Green Road, application is to be made to the L.G.B. for sanction to borrow £3,318, of which amount £2,545 will go towards the cost of the new plant required.

**Worsley.**—The Lancashire Power Co. will shortly open a new sub-station at the Crescent, Worsley, established in connection with a big lighting scheme for Worsley district.

## TRAMWAY and RAILWAY NOTES.

**Canada.**—A company has just been formed at Walkerville, Ont., under the name of the Tate Electric Co., to establish works for the construction of electric motor-cars for the Canadian market.

**Continental Notes.**—**SWITZERLAND.**—The Commission d'Etudes charged by the Federal Railway Administration to study the electrification of the St. Gothard Railway, has submitted its last report. It advises the adoption of single-phase traction at 15 periods and 15,000 volts. To obtain the power required, it is proposed to construct a station on Lake Ritom in the south and stations at Gothenen and Amsteg in the north, which will furnish an aggregate of 96,000 h.p. The installations to be carried out include works for the production and distribution of energy (29,000,000 fr.); supply and distribution mains (9,770,000 fr.); rolling stock, depots and repair shops (21,900,000 fr.); conversion of power-stations (3,500,000 fr.). The Commission has again considered what power will be necessary to supply the whole

of the Swiss railways, on the assumption of double the traffic of the year 1904. The five Federal networks and the private lines will need yearly from 1,000 to 1,300 million h.p.-hours at the turbines. The generating stations should, therefore, be built for a total output of 500,000 h.p. According to expert calculations there exist a dozen falls still unappropriated or reserved for the use of the Federal railways, which, in combination, could supply 1,800 million h.p.-hours per year at the turbines; the generating stations might therefore be built for a maximum capacity of 625,000 h.p.

**FRANCE.** The Conseil Général has voted a sum of 30,000,000 fr. for the construction of the third network of local railways in the Department of the Pas-de-Calais, of an aggregate extent of 611 km., divided into four groups, two of electric lines and two of steam.—*La Lumière Electrique.*

**RUSSIA.**—The "Telephon" Co., of Moscow, has secured a concession for a proposed electric railway between Vaulograd and Bachmut.

**ITALY.**—The plans for an electric railway between Aosto and Pré-St. Didier having been approved by the local authorities concerned, application for a concession to the Consiglio Superiore dei Lavori Pubblici is being made. The line will prove a benefit to the forestry industry, and supply transport facilities to the collieries of Cogne and La Thuile.—*Giornale dei Lavori Pubblici.*

**GERMANY.**—A concession has been granted in respect of a projected light electric railway between Niederursel and Königstein, near Frankfort-am-Main.

**East Ham.**—The electrical engineer and manager has been instructed to report upon the question of duplicating the tramway track in High Street North.

**Edinburgh.**—A report by the burgh engineer on the subject of the double-decked tramway cars in the city, and suggesting that a request might be made to the tramway company to increase the number, was before a meeting of the Tramway Committee, and it was agreed to communicate with the company.

**Hong-Kong.**—Recently the Chinese community have systematically boycotted the tramways, the reason given being the decision of the company to accept only Hong-Kong money. As it was found that the real reason was a political one, the Government passed a special Ordinance imposing penalties for improper interference with business. It is stated that these measures have already had a salutary effect on the Chinese community.

**Huddersfield.**—The Tramways Committee has decided to double the tramway from Salendine Nook to Mount.

**Leeds.**—It is anticipated that the extension of the Corporation tramways from West Park to Lawnswood will be completed within a few weeks. The track has been laid over the greater part of the route, and it is probable that the extension will be ready for opening by Easter.

The tramways authorities have decided to try, as an experiment, the system of fare collecting on the platforms of the cars. For a long time this system has been actually in practice in an irregular manner, the observance of the rule against it having been very much relaxed.

**London.**—The L.C.C. tramways department has decided to enlarge the capacity of the Camberwell, New Cross, Stockwell, Tooting, Camden Town and Clapham sub-stations, by substituting three large rotary converters for six small motor-generators at present in use at the Shoreditch sub-station, and transferring the small machines to the other stations. The cost of the converters, transformers, switches, crane, &c., is estimated at £14,000, and the work of transferring the plant, &c., at £4,000.

The Council has introduced an innovation in the form of numbered cars for denoting the different services; the system has been divided into nearly 90 services.

As a result of the strong protests, the scheme for a tramway subway along the east of St. Paul's Cathedral has been withdrawn, necessitating the abandonment of the proposed tramway across the suggested new St. Paul's Bridge.

With reference to the L.C.C. (Tramways, Trolley-Vehicles and Improvements) Bill, the Kensington, Hammersmith and Westminster Councils have decided to call the attention of their Parliamentary representatives to the matter, and ask them to resist any proposal for the equipment of any overhead system of traction which dispenses with the necessity of the County Council first obtaining the approval and consent of the local highway authority concerned. Southwark, Wandsworth, Hammersmith and Kensington Councils have decided to express their objection, in a similar manner, against the Metropolitan Electric Tramways (Railless Traction) Bill, Clause 16 of which apparently authorises the Board of Trade to grant provisional orders to the company to run railless cars on any routes which it thinks convenient, a power which might be exercised over the head of any local authority, if, in the opinion of the Board, such consent was unreasonably withheld.

Speaking at the meeting of the North London Railway Co., Lord Rathmore said that the passenger traffic receipts were the worst they had ever experienced and were the result of the competition of the tube railways and motor-buses, a competition which seemed to grow stronger and more destructive every day. He was afraid that they must make up their minds that they would not have any effective means of fighting that competition until their line had been electrified, in conjunction with the London and North-Western Railway to Watford. He thought they might reasonably hope that when that had been done they would receive constantly increasing receipts from passenger traffic coming over their line, and especially from the Willesden and Watford districts.

**Mexborough.**—The U.D.C. has petitioned against the preamble of the Mexborough and Swinton Tramways (Railless Traction) Bill. The petition calls attention to the statutory limitations of the company concerned in the scheme, with respect to capital powers, and the Council maintains that it is better able to carry out such a scheme if it is necessary, having already an up-to-date electrical station, &c., and being at present supplying current for lighting purposes at 3½. per unit, which is cheaper than in any other place in Yorkshire.

**Midland Railway Electrification.**—At this company's half-yearly meeting, the chairman, referring to the question of electric traction, said the company would have to go to Parliament next year for powers to electrify the Tilbury line.

**Newcastle-on-Tyne.**—At a meeting of the Tramways Committee, on February 21st, a deputation was received from the Gosforth U.D.C. urging that no extra fares should be charged for running cars to Gosforth and Gosforth Park, while the race meetings were being held and on other special occasions. Counsel's opinion had been taken, and it was said that the Committee had no power to increase the fares. The Committee decided to call a special meeting of the members in a fortnight's time to consider the matter. The ordinary fare to Gosforth is 2d., and to Gosforth Park 4d., but on the occasions to which attention is drawn, special cars are put on with an upstanding charge, usually of 1s. The contention of the Committee is that the Corporation would lose money if the fares were not increased on the occasions referred to. Extra cars, they claim, had to be brought into requisition, and the Tyneside Tramways and Tramroads Co. had to have a share of any balance left after paying expenses.

**Plymouth.**—The Tramways Committee has instructed the town clerk to interview the representatives of the Plymouth, Stonehouse and Devonport Tramways Co. with respect to its request for the reconstruction of the track in Union Street. It has also been resolved that books of 12 tickets of face value be issued on the tramways.

**Southport.**—On Saturday a poll of ratepayers was taken as to whether the Corporation should run cars on Sundays, and the result was:—For, 1,763; against, 2,242; majority against, 479. This is the second plebiscite on the matter, the previous one in 1903 resulting as follows: For, 1,843; against, 3,639; majority against, 1,805. For some time there has been a loss on the running of the Corporation cars, and some of this is ascribed to the absence of a Sabbath service. Strong opposition to Sunday running was offered by the local Free Church Council and other religious bodies.

**Stirling.**—Another step forward has been taken in the movement to provide the town with an up-to-date system of electric tramways. For some time past, the T.C. has had the matter in hand, and the town clerk has been instructed to write to Mr. George Balfour, London, informing him that the Council is anxious to secure an electric tramway system, and inviting him to look into the matter with the view of such a tramway being undertaken by the parties whom he represents. It has also been agreed to make inquiries as to the railless system of traction, and with this in view the town clerk and burgh surveyor are to ascertain the experience of the towns where the system is in operation.

**Tipton.**—A letter has been received from the Birmingham and Midland Tramway Joint Committee intimating that it was of opinion that there would not be sufficient traffic between Great Bridge and Ocker Hill to justify the heavy expenditure of laying a tramway along this route, but if the Council had reason to believe otherwise, and would obtain the powers and build the tramway, the company would be prepared to provide the necessary rolling stock, and run a service of cars on terms to be agreed. The matter has been referred to the Tramways Committee for consideration.

## TELEGRAPH and TELEPHONE NOTES.

**Imperial Wireless System.**—The Postmaster-General has informed the Marconi Co. that he does not share the company's view that it is entitled to retire from the contract for the Imperial wireless chain, and will hold himself free to enforce all his rights against the company.

A report of the Select Committee to the House of Commons was published on Tuesday, embodying resolutions which the Committee agreed to report to the House. The resolutions are to the effect that the Committee proposes to retain the conduct of the inquiry entirely in its own hands, but asks leave to hear counsel when necessary; and that the Committee invites any person in possession of evidence bearing upon the negotiation and completion of the agreement to communicate with the clerk.

**Liverpool.**—The Mersey Docks and Harbour Board has adopted a recommendation of the Marine Committee that the Board should enter into an arrangement with the B. of T. and the Post Office for the establishment of several wireless stations, on lightships and at the dock office, for the benefit of navigation at the mouth of the Mersey.

**Long-Distance Telephony.**—The trans-Continental telephone circuit between New York and San Francisco, to be built by the American Telephone and Telegraph Co., will be equipped throughout with Pupin coils, two coils per 8 miles. The copper wire will weigh 940 lb. per mile of route, and as the distance is 3,500 miles, the total weight will be 3,290,000 lb. There is a difference of three hours in time between New York and San Francisco, so that the business day will be limited to about five hours.—*Telegraph and Telephone Age.*

**New Zealand.**—The Government will shortly put into operation in New Zealand regulations making it compulsory for passenger ships to carry wireless apparatus.

The Government has decided to adopt the full automatic telephone system for centres requiring new equipment, and has been calling for tenders for full equipments for Auckland, Wellington, Hamilton, Masterton, Blenheim and Oamaru. The original intention was that switchboards carrying 10,000 lines each should be installed in each of the four cities, and smaller systems in the provincial towns. Ultimately the Auckland and Wellington exchanges will be enlarged to a capacity of 15,000 lines. It is estimated that the new system will be completely installed in the two largest cities by the end of 1913. Meanwhile the pressure on the existing manual systems in Auckland and Wellington is to be relieved by the installation of small switchboards carrying 400 or 500 lines, which will be adapted for use with the present switchboards.—*Australian Mining Standard.*

**Suffragist Outrages.**—On Saturday morning a large number of telegraph wires in Chester Moor Dene, a mile south of Chester-le-Street, near Newcastle, were cut, and during the week-end the wires in four public telephone boxes in Birmingham were cut, and the instruments rendered useless. Similar outrages are reported from Belfast.

**Trans-Atlantic Communication.**—Tests made with a temporary antenna 400 ft. high, at the new Telefunken tower at Nauen, in Germany, on January 11th, showed that there was no difficulty in communicating with the station at Sayville, U.S.A., and messages transmitted from the latter station with 45 H.P. were clearly received at Nauen.

Mr. H. Bredow, managing director of the Telefunken Co., is in New York with a view to establishing a wireless service between Europe and the U.S.A.—*Telegraph and Telephone Age.*

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—March 3rd. Service materials, for the U.D.C. electricity department. See "Official Notices" February 14th.

**Aberaman.**—March 10th. Electrical goods, for the directors of the Powell Duffryn Steam Coal Co., Ltd. Stores Manager, Aberaman, near Aberdare.

**Argentina.**—April 15th. Tenders will be received at the Dirección General de Minas, Geología e Hidrología, Buenos Ayres, for the supply of motors, cables, dynamos and kindred material required for the generation of motive power.—*Board of Trade Journal.*

April 15th.—The Ministry of Agriculture of the Argentine Republic in Buenos Ayres is inviting tenders for plant, including three-phase alternators and motors, switchboard, mains, &c., for a new electricity generating station.

**Australia.**—April 14th. H.M. Trade Commissioner for Australia reports that tenders are invited for plant required to generate three-phase current for the high-power radio-telegraph station at Darwin, Northern Territory, and for lighting and power purposes in the neighbourhood:—Four Diesel oil engines, two to drive a 500-kw. alternator each, and two to drive a 250-kw. alternator each; an air-compressor set; an overhead travelling crane of 20 tons capacity; four alternators and exciters, two of 500 kw. capacity and two of 250 kw. capacity; and a switchboard. The earliest date of delivery must be stated. Tenders to the Secretary, Postmaster General's Department, Melbourne. Deposit 5 per cent. on the first £1,000, and 2½ per cent. on the amount above that sum. Specification and form of tender obtainable from the Australian High Commissioner in London, 72, Victoria Street, S.W., where also preliminary deposits may be paid. Specification and form of tender may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.* The matter is referred to in our "Official Notices" to-day.

**Ayr.**—The Town Council invites tenders for advertising on the tramcars for five years. Mr. P. A. Thomson, Town Clerk.

**Barrow-in-Furness.**—March 3rd. Electrical stores for a year, for the T.C. Borough Electrical Engineer.

**Bedwas.**—March 5th. Electrical goods for a year, for the Bedwas Navigation Colliery Co., Ltd. (Form 4). The Secretary.

**Belfast.**—March 12th. The Harbour Commissioners are inviting tenders for four 5-ton electric gantry cranes for the Queen's Quay and Abercorn Basin Quay. Specifications, &c., from the Harbour engineer, Mr. W. Realfen Kelly, Belfast.

**Birmingham.**—March 1st. Electrical stores for a year, for the Birmingham, Tame and Lea District Drainage Board. Mr. John D. Watson, engineer, Tyburn.

**Bosnia.**—LIVNOI.—March 20th. Tenders are required for the erection of a power station and public and private electric light installations, according to a special programme. Particulars of the Municipal Administration, Livnoi, Bosnia.

**Bridgend.**—March 21st. One 100-K.V.A. steam alternator and accessories, for the U.D.C. See "Official Notices" to-day.

**Brighton.**—March 10th. Storage battery (800 amp.-hours) for the T.C. See "Official Notices" to-day.

**Colchester.**—March 10th. Sundry stores for the Corporation Electricity Department. Mr. W. Frisby, electrical engineer, Osborne Street.

**Croydon.**—March 31st. Stores for a year, for the Corporation Electricity Department. See "Official Notices" Feb. 21st.

**Dundee.**—March 7th. Two water-tube boilers, mechanical stokers, economiser, steel bunkers and coal-handling plant, for the Corporation electricity department. See "Official Notices" February 21st.

**Eastbourne.**—March 10th. Combined coal elevator and conveyor for the Corporation Electricity Department. See "Official Notices" to-day.

**Edinburgh.**—The Corporation invites tenders for arc lamp globes, cast-iron pavement boxes, underground conduits for electricity cables. Mr. F. A. Newington, engineer.

**Egypt.**—July 1st. Egyptian Government Public Works Ministry. Machinery and pumping plant for Baltim pumping station, including 15 Diesel or 12 steam engine plants and electric lighting and power plant, workshop equipment, cranes and weigh-bridge, boiler plant, fuel economisers, steel chimneys, coal and ash handling apparatus. Particulars (£1 per copy) at Office of Public Works Ministry, Cairo, or of Sir A. Webb, Queen Anne's Chambers, Westminster.

**Erith.**—March 6th. Electrical work for three years, under U.D.C. assisted wiring scheme. See "Official Notices" Feb. 21st.

**France.**—PARIS.—March 8th. Supply of copper wire covered with gutta-percha and cotton. March 11th.—Supply of extensible telephone switch tables. March 12th.—Supply of electric cables. Particulars of cahier des charges, &c., from Bureau des Postes et Télégraphes, 103, Rue de Grenelle, Paris.

March 6th.—Supply of electric cable for the service of the Postes et Télégraphes de l'Indo-Chine. Guarantees: provisional, 550 fr.; final, 1,100 fr. Particulars of the Ministère des Colonies, 57, Boulevard de la Invalides, Paris.

**DUNKERQUE.**—March 15th. Tenders are required for the supply and erection of the mechanical and electrical appliances to work a 61-metre swing bridge to be erected in the Freyanet Docks at Dunkerque. Particulars of M. Bourgeois, ingénieur-en-chef, Dunkerque.

**G.C.R.**—March 4th. The Great Central Railway Co. are inviting tenders for stores during the year ending April 30th, 1914. For further particulars see this column last week.

**Heston and Isleworth.**—March 8th. Stores and materials for a year, for the U.D.C. electricity department. See "Official Notices" February 21st.

**Hungary.**—SZÖD.—Tenders will be received for a concession to establish an electric installation and supply public and private lighting and power current, for a period of 50 years, to Szöd and ten neighbouring districts. Guarantee deposit, 10,000 kronen. Particulars of the Gemeindeamt, Szöd.

**Ilford.**—March 1st. Council Education Committee. Tenders for the electric lighting installation at the South Park School extension, Water Lane, Ilford. Mr. C. J. Dawson, architect, 11, Cranbrook Road, Ilford.

March 1st.—Stores for a year, for the Tramways Department of the U.D.C. Mr. L. E. Harvey, manager, Ley Street dépôt.

**India.**—March 14th. Motors, transformer and motor-generator, for the B.B. and C.I. Railway. See "Official Notices" February 21st.

March 4th.—Starting and controlling pillars, for the Bombay, Baroda and Central India Railway. See "Official Notices" February 21st.

**King's Lynn.**—March 1st. Lancashire boiler, economiser and pipework, for the Corporation Electricity Department. See "Official Notices" February 21st.

**Liverpool.**—OXTON.—Electric light installation at St. Saviour's Church, for the Vicar and Wardens.

March 10th.—Electrical fittings for a year, for the Select Vestry Mr. C. W. Custer, clerk, Brownlow Hill

**London.**—L.C.C.—March 4th. Two 2,000-kw. turbo-generators, with condensing plant, &c. (extension of time). See "Official Notices" February 21st.

March 5th.—Electrical installation at the Curtain Road Elementary School. See "Official Notices" February 21st.

March 12th.—Electrical installation at Hawley Crescent School, St. Pancras. See "Official Notices" to-day.

It is also proposed to put in hand at an early date, the electric lighting of the following schools:—North Camberwell (Leipsic Road); Walworth (Victory Place); and Woolwich (Avery Hill Training College Hostels). Tenders are being advertised for, and a sub-committee is to be authorised to accept tenders during the recess.

The Fire Brigade Committee recommends that tenders be invited from selected firms for two electrically (one petrol-electric) driven motor fire escape vans and two motor turntable ladders.

Tenders are to be invited by the Highways Committee for the erection of the Leighton Road, Kentish Town, tramways permanent way dépôt.

The Committee also recommends that three rotary converters, transformers and accessories, switchgear and cabling be substituted for other plant at present in use at Shoreditch tramway power station.

ST. PANCRAS.—March 4th. Arc lamp carbons, for the B.C. See "Official Notices" February 7th.

STEPNEY.—March 17th. Boilers and boiler house accessories, turbo-alternators, condensers, accessories and switchgear, for the B.C. See "Official Notices" February 14th.

BATTERSEA.—March 19th. One water-tube boiler, mechanical stoker, superheater and pipework, and one motor-driven centrifugal pump and pipework, for the B.C. See "Official Notices" to-day.

**Macclesfield.**—March 11th. Electrical goods for the Cheshire County Asylum, Parkside. Mr. Wm. Tingay, clerk of the Asylum.

**Merthyr Tydfil.**—March 3rd. Electrical accessories for a year, for the B.G. The Workhouse Master.

**Morecambe.**—March 19th. 2,500 tons of coal or slack for the Corporation Electricity Department. See "Official Notices" to-day.

**Morocco.**—March 27th. Tenders are invited for the supply of 15,000 insulators and brackets. Particulars from Monsieur le Président de la Commission générale des Adjudications et des Marchés, Dar-en-Nia'ba, Tangiers.

**Neath.**—March 3rd. One 400-kw. high-speed engine, direct-coupled to a two-phase alternator, and accessories, for the R.D.C. See "Official Notices" February 14th.

**Newport (Mon.).**—March 4th. Electric light fittings for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

**Pontypridd.**—March 5th. Stores and materials for the U.D.C. electric light and tramways department. See "Official Notices" February 21st.

March 17th.—Tramway men's uniforms for the U.D.C. See "Official Notices" to-day.

**River Plate.**—April 5th. The Municipality of La Paz (Entre Rios) is calling for tenders for the erection of an electric light station.—*Review of the River Plate.*

**South Shields.**—March 10th. Stores for a year for the Corporation Electricity Supply Department. Mr. H. S. Ellis, electrical engineer, Mill Dam.

**Swindon.**—March 8th. General stores and materials for a year, for the Corporation electricity and tramways departments. See "Official Notices" February 14th.

March 10th.—One 500-kw. mixed-pressure turbine and condensing plant, boiler feed pump and pipework, and one switchboard panel and cables, for the Corporation. See "Official Notices" February 14th.

**Swinton and Pendlebury.**—March 10th. One 25-kw. transformer and switchboard, main along Chatsworth Road, and annual supply of materials, for the U.D.C. Electricity Department. See "Official Notices" February 21st.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

**Wallasey.**—March 15th. Fuel oil (400 tons) for a year, for the Corporation electricity department. Mr. J. A. Crowther, electrical engineer, Seaview Road, Liscard.

**Walthamstow.**—February 28th. Four double-deck tramcars complete with magnetic-brake equipments for the U.D.C. See "Official Notices" February 7th.

**War Office.**—Cables, electrical stores, iron telegraph poles, &c. See "Official Notices" to-day.

**Warrington.**—March 5th. Motors and transformers for a year, for the Corporation. See "Official Notices" Feb. 14th.

**Waterford.**—The Asylum Committee has decided to invite tenders for the installation of an electric plant, in accordance with the estimate of Mr. Lawless, which amounted to £3,929.

**Wimbledon.**—March 5th. Stores and materials, for a year, for the Corporation Electricity Department. See "Official Notices" February 14th.

**Wrexham.**—March 1st. Stores for a year, for the Borough Electrical Engineer's department. See "Official Notices" February 14th.

**York.**—March 10th. One 3,000-kw. turbo-alternator, with condensing plant, pipework and switchboard, water-tube boilers with chain-grate stokers, &c., storage battery and H.T. cables, for the Corporation. See "Official Notices" February 21st.

**CLOSED.**

**Barnsley.**—The T.C. has accepted the tender of Mr. Jas. Taylor, of May Day Green, for telephone fittings for inter-block communication at the hospital, at £19.

**Belgium.**—Several Belgian and German concerns submitted tenders last week for the supply and laying of two lots of telephone cables in the Brussels district, for the Belgian Post and Telegraph authorities, the lowest offer in both cases being that of the Deutsche Kabelwerke Gesellschaft, of Lichtenberg, Berlin.

**Chase Town.**—The Staffs. Education Committee on Saturday accepted the tender of the Electric Construction Co., Ltd., for electric plant and machinery for the Mining Institute at Burntwood, at £365.

**Colwyn Bay.**—The U.D.C. has accepted the following tenders for extensions at the electricity works:—

- Browett, Lindley & Co., Ltd.—Steam set, £650 (dynamo by Messrs. Dick, Kerr & Co., £323), and field coil, £18.
- Bertram Thomas.—Extension of switchboard, £125.
- R. Hughes-Williams.—Engine room extension, £167.

**Douglas (Isle of Man).**—The Tramways Committee of the T.C. has accepted the tender of Messrs. Milns, Voss & Co. for a single saloon tramcar with improved lighting, at £261.

**Durham.**—The Education Committee of the Durham County Council has accepted the tenders of Messrs. F. Reid, Ferens and Co., Sunderland, for the electric light installations at its schools, viz., New Training College and Hostel for Women, at Durham, Easington Schools, Fatfield Schools, Wingate School, Wheatley Hill School, Newbottle School, and Peases West.

**Glasgow.**—With reference to our note under this heading last week, we learn that the contract placed with Messrs. James Howden & Co. was for a set of "Howden-Zoelly" turbo-alternators, not "Rateau-Zoelly." Further, orders for four boilers each were placed with both Messrs. Howden and Messrs. Babcock & Wilcox—not two each.

**Harrogate.**—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a 1,250-kw. horizontal turbo-alternator, at £4,279. The tender of the same firm to reconstruct and rewind the generator of the present vertical set, at £612, has also been accepted.

**Horsham.**—The U.D.C. has decided to obtain all sizes of meters from the Electrical Apparatus Co., Ltd., for the next 12 months.

**Huddersfield.**—The Markets and Fairs Committee has accepted the tender of Messrs. E. Brook, Ltd., for a three-phase electric motor for the cold stores.

**London.**—HAMMERSMITH.—The Electricity Committee received the following tenders for cable ducts:—

Builders' Material Association .. .. .	£284
H. R. Mansfield .. .. . (accepted)	231
Sharp, Jones & Co. .. .. .	238
Oates & Green, Ltd. .. .. .	234
Sessions & Sons .. .. .	234
J. Woodward, Ltd. .. .. .	234
Albion Clay Co. .. .. .	234
Domtton & Co. .. .. .	234
John Knowles .. .. .	234
J. R. Fyfe & Co. (plain joint) .. .. .	151

Arc lamp globes are ordered from Messrs. Johnson & Jorgensen, Ltd., and electric light sundries from the B.T.H. Co.

For cable joint boxes and fuse boxes, the prices quoted were:—

W. Lucy & Co. .. .. .	(accepted) £166
Sykes & Sugden, Ltd. .. .. .	533
B.I. & Helsby Cables, Ltd. .. .. .	647
Callender's Cable & Construction Co., Ltd. .. .. .	682
Siemens Bros. & Co., Ltd. .. .. .	757
W. T. Glover & Co., Ltd. .. .. .	1,284

The tender of Messrs. Chamberlain & Hookham, Ltd., for ordinary meters from 3 to 500 amps. has been accepted, also that of the Electrical Co., Ltd., for meters (hour).

The General Electric Co., Ltd., is to supply insulated wires for £147; there were four higher tenders ranging up to £216.

**Mexborough.**—The Electricity Committee has accepted the tender of Messrs. G. H. Smith & Sons, for extensions to the electricity works, at £3,891.

**Peterborough.**—Messrs. Callender's Cable Co. have secured the contract for the cable for the lighting of the new bridge over the Great Northern main line at Peterborough, for £187.

**Redditch.**—The Worcestershire Education Committee has accepted the tender of Messrs. J. Andrews & Son (£94) for installing electric light at the new school.

**Southend-on-Sea.**—The T.C. has accepted the tender of the British Thomson-Houston Co., Ltd., for a switchboard, at £81; that of Mr. Geo. Waller, of Stroud (Glos.), for screening and elevating machinery, at £831; and those of Messrs. Dawson and Manfield, of Manchester, for new refuse destructor cells, at £1,760.

**West Ham.**—The T.C. has accepted the tender of Messrs. Leslie & Co., at £1,235, for pipework, &c., in connection with the river service. The tenders of Siemens Bros. Dynamo Works, Ltd., and Messrs. Chamberlain & Hookham have also been accepted for an annual supply of house service A.C. wattmeters.

**FORTHCOMING EVENTS.**

**Royal Institution.**—Saturday, March 1st.—At 8 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture IV.)

Friday, March 7th. At 9 p.m. Discourse on "Photography of the Paths of Particles Ejected from Atoms," by Mr. C. T. R. Wilson.

Saturday, March 8th. At 8 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture V.)

**Salford Technical and Engineering Association.**—Saturday, March 1st. At 7 p.m. At the Royal Technical College, Salford. Lecture on "Wireless Telegraphy," by Mr. J. McKeever.

**Society of Engineers.**—Monday, March 8rd. At 7.30 p.m. At the I.E.E., Embankment, W.C. Presentation of premiums by Mr. J. Kennedy. Presidential address by Mr. A. Valon.

**Institution of Mechanical Engineers.**—Tuesday, March 4th. At 8 p.m. Paper on "City Passenger Transportation in the United States," by Mr. G. D. Snyder.

**Institution of Electrical Engineers (London).**—Thursday, March 6th. At 8 p.m. Paper on "Recent Developments in the Street Lighting of Manchester," by Messrs. S. L. Pearce and H. A. Ratcliff.

(Manchester Students' Section).—Tuesday, March 4th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Paper on "Practical Testing of Transformers," by Mr. W. Parry.

(Glasgow Students' Section).—Tuesday, March 4th. At 8 p.m. At the Royal Technical College, Glasgow. Annual general meeting. Paper on "Illumination," by Mr. N. McCaskill.

(Students' Section, London).—Wednesday, March 6th. At 7.45 p.m. At the Institution. Paper on "Electrical Heating and Cooking Apparatus," by Mr. S. M. Hills.

**Charing Cross, West End and City Electricity Supply Co., Ltd.**—Friday, March 7th. At 8 p.m. Staff Smoking Concert. The Pillar Hall, Victoria Station (S.E. and C. Railway).

**Association of Electrical Station Engineers.**—Friday, March 7th. At 8 p.m. At Exeter Café, Deansgate, Manchester. Meeting to form Manchester branch.

**THE ELECTRICAL ENGINEERS**

(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, March 8rd.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, March 4th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, March 6th.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Friday, March 7th.—"D" Company. Company training, 7 to 10 p.m.

Saturday, March 8th.—Headquarters will be open from 10 a.m. till 12 noon for regimental business.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.

For Officer commanding L.E.E.

**The Post Office Railway Scheme.**—The *London Gazette* for February 25th contains the full particulars of the scheme proposed by the Postmaster-General for the construction of electric underground railways for the service of the Post Office, which is to form the subject of an application in the 1913 Parliamentary Session.

## NOTES.

**British Manufacturers in Australia.**—The Australian Association of British Manufacturers and their Representatives held its annual meeting on February 7th, at Melbourne. The report for 1912 then submitted showed a balance in hand amounting to £148. The Association is preparing for distribution among buying houses, &c., throughout Australia, a directory of members of the Association. Seven thousand five hundred copies will be circulated, and it is believed that both members of the body, and British trade in general, will be benefited by purchasers being enabled to ascertain with the minimum of trouble where their requirements may be procured from British sources. It is also hoped that the Association membership will be added to in consequence of the greater publicity thus given to its doings, and if additions to the membership are found to justify such a course, the publication may be issued annually. The following other matters are referred to in the report:—

**Tariff.**—It was expected that a revision of the tariff would be undertaken by the Commonwealth Government during the year, but such has not been the case. With the approaching Federal elections, it is impossible to forecast whether or not anything in this direction will be done during the ensuing year, but representations have been made by the Association regarding a large number of items in which members urge for alterations in the present tariff, and have been promised by the Minister "careful consideration when the tariff is next under review."

**Government and Municipal Tenders.**—The matter of putting up a cash deposit on tendering for Government and municipal contracts, and increasing same in the event of acceptance, has been receiving the attention of the Executive Council, and expressions of opinion have been obtained from members interested; but as there appears to be a considerable difference in members' views, it is proposed to call a meeting at an early date to decide what steps should be taken.

**Statistical Information.**—During the year statistical tables, relating to the trade of the United Kingdom with the Commonwealth in items in which there is competition with foreign countries, for the years 1910 and 1911, have been prepared by H.M. Trade Commissioner in Australia, and distributed by the Association to members and others. These figures have been found of considerable value and interest to members, and it is intended to supply members with similar figures annually. It may also be mentioned that more detailed figures relating to the particular trade of individual members may be obtained from the secretary.

Many matters have been and are being dealt with to the benefit of British trade, the details of which it is not advisable to make generally known. A system has been inaugurated whereby early information is obtained from the Department of Trade and Customs regarding tariff decisions, rulings and alterations, and all such information is passed on to members interested at the earliest possible moment. The Executive Council feel very pleased with the progress which has been made by the Association, and with its reception in official and other quarters, and feel confident that, given the support of representatives of British manufacturers and of their principals in the United Kingdom, much useful work will be accomplished and the Association will become a powerful factor in connection with trade between the United Kingdom and the Commonwealth.

Mr. Percy Rosling, the president, was up for re-election. Mr. R. H. Butler, the secretary, if addressed at the new permanent offices of the Association—430, Little Collins Street, Melbourne—will be only too pleased to forward to principals in this country information relating to membership, &c. There are now 195 members, 105 of these being British manufacturers, and 90 representatives of British manufacturers, and the annual subscriptions amounted to £348.

**The E.T.B.I. and National Insurance.**—The Secretary of the Electrical Trades Benevolent Institution (Mr. F. B. O. Hawes) recently laid before the Committee a report regarding the bearing of the National Insurance Act on such persons as benefit by the Institution. The position of the working classes is, of course, different, and for the sake of brevity, the benefits to women, which, in nearly all cases are less than those conferred upon men, are not dealt with.

"As the unemployment portion of the Act will affect practically no members of the staff of electrical firms, its bearing need not be considered. The following observations, therefore, only refer to the health insurance portion of the Act:—

"The monetary benefits in the case of sickness conferred under the Act as regards men briefly are as follows: 'If the contributions have been paid continuously, 10s. a week is paid for a maximum period of 26 weeks, provided the insured person is under 50; if over 50 the amount is 7s. a week, and if over 60 6s. a week. When the contributions are in arrear these amounts are considerably reduced, for instance, in the case of a man who is ten contributions a year, on an average, in arrear, the sickness benefit will only be 6s. 6d. a week. Besides, other reasons may cause the insured person to receive sickness benefit only counting from some days after the commencement of the illness.

"The above figures all relate to insured persons who are members of a friendly society, and whose incomes do not exceed £160 per annum. Persons whose health is bad may be unable to get into a friendly society, and in such an event become deposit contributors. Speaking generally, the person of bad health who is a deposit contributor obtains practically no monetary benefits from the National Insurance Act, owing to the fact that a very small irregularity in the payments of the contributions prevents such

benefits being given, and a person in bad health is certain to be irregular in his payments.

"It will be seen that the benefits mentioned above are far too small to meet the requirements of the average person employed on the staff of an electrical concern, and it may be taken for certain that in the case of an extended illness, assistance of some other kind would be absolutely necessary in spite of the fact that the employer and the employe had both been compelled to pay the Insurance contributions.

"The grants made by this Institution are those which the Committee considers are required to meet the individual wants of each case.

"Persons who apply to this Institution for assistance have generally been outside the scope of the Insurance Act for several years, and consequently their position is in no way altered by the existence of the Act. They are generally people who have lost their capital through misfortune of some kind or another, or persons who have been receiving good salaries, but have lost their appointments owing to ill-health, and are unable to obtain employment.

"The advantage of this Institution as regards the employer who has come to grief, needs no demonstration. The Insurance Act, of course, will never do anything for him.

"The above observations relate only to temporary relief. In considering the whole subject, it is frequently forgotten that the principal object of the Electrical Trades Benevolent Institution is to grant pensions. This is a matter which the Insurance Act mentions as a possibility, but there is nothing in it to indicate that pensions will ever be paid, or to indicate whether they are likely to be of a sufficient amount to be of any practical use to anyone who has been in the position of a member of a staff of an electrical concern.

"In view of the fact that the payments by employers and employed under the National Insurance Act will probably always be insufficient to meet the ordinary sickness benefits, the matter of pensions is left in a very uncertain state, and this Institution merits the support of those who would place pensions on a firm basis, even if they are already paying under the National Insurance Act.

"The time is undoubtedly drawing near when pensions will be required for members, and the invested funds must be very materially increased in order to meet such demands.

"In the above the position of members of the Institution has been considered, but there is a still further very important duty of the Institution, namely, pensions to the widows of members and assistance to the children. The National Insurance Act does nothing for such persons.

"In conclusion, I would ask everyone who is considering this subject to bear in mind that the Institution does not exist merely for the purpose of granting assistance during sickness or other difficulties, but that larger duties, which, up to the present, have not been exercised, are far and away beyond anything which is contemplated in the National Insurance Act. These duties can only be properly carried out by larger increases in the invested funds."

**Electrical Wages in Belfast.**—A local correspondent writes:—"The efforts of Belfast electricians, assisted by their organiser, Mr. Thomas Stewart, to have the wages of their fellow-workers employed in the building trade raised to £2 per week, have been successful. On Saturday last the employers concerned, with one exception, granted the increase, and electricians working for building contractors are now on the same level as electricians serving in other branches of employment."

**Institution and Lecture Notes.**—**BIRMINGHAM AND DISTRICT ELECTRIC CLUB.**—The fourth annual dinner of the Birmingham and District Club was held at the Swan Hotel on Saturday, the 16th inst. Mr. Roberts presided, supported by Mr. J. L. Morgan (treasurer of the club and secretary of the local section of the Institution of Electrical Engineers), Alderman David Shanks, the vice-presidents, Messrs. E. R. Phillips and V. D. Green, the assistant secretary, and others. Mr. Fell (of the Wednesbury Electricity Department), Councillor Lench, and others were present as guests of the club. Mr. J. Hill (past president) proposed the toast of the club, which had been in existence nine years: some of the founders, he said, were present that night. That interest in the club had never been allowed to flag was proved by the fact that over 40 papers had been given relating to the electrical industry. Mr. H. Roberts, in responding, said he thought the present competition between gas and electricity was likely to die out before long, and instead of each striving to adapt its method of illumination or power to every case, it would be acknowledged that each had its special field. For instance, in view of the present protests against the rapid rise of the Birmingham rates, there was one step, at any rate, which might be made towards economy—the substitution of electric street lamps for the present gas lamps. There were 219 lamp-lighters employed in the greater city, and they had to light and extinguish daily 22,000 lamps. Here was a case in which the advantages of electricity were manifest. Mr. V. D. Green proposed "The City of Birmingham," giving a humorous sketch of its history and recalling its associations with Boulton, Watt and Murdoch, the birth of electroplating, and other notable events. Alderman Shanks, responding, referred to the cry for economy in the City Council. Was it economy to grant £15,000 to the University and at the same time refuse an increase in teachers' salaries? Economy was not necessarily a matter confined to finance. It also bore upon another matter, as to how far the portion of the community as represented by that gathering of manufacturers and contractors was affected. It might be good to grant a sum to the University, to raise the teachers' salaries and to be progressive in all other activities and civic life. Yet they would find this meant

a still further increase in the rates, and that raised the question whether the time had not come for a very serious alteration in the methods of rating local manufacturing concerns. Manufacturers got an undue share of the burdens, and it was for them to consider whether the time had not come to put a stop to those burdens. Ground rents, for example, were not paying as heavy a share of the rates as factories. Other toasts were "The Electrical Industry," proposed by Mr. Brewerton, and responded to by Mr. Steventon, and "The Visitors," proposed by Mr. W. Y. Anderson, and responded to by Councillor Lench. Songs and recitations were given by Messrs. H. Smith, A. Whatmore, Willett Raine and F. N. Dowling, and the evening proved to be a very entertaining and enjoyable one.

**INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM SECTION).**—On Wednesday last, papers were to be read by Mr. W. E. Milns on "The Economical Use of Electric Power," and by Mr. T. P. Wilmshurst on "Electrical Power, Heating and Cooking." After the meeting a demonstration of heating and cooking apparatus was given by Mr. Milns.

**MANCHESTER SECTION.**—At a meeting of the Section on the 25th inst., a paper was read by Messrs. S. L. Pearce and H. A. Ratcliff on "Recent Developments in the Street Lighting of Manchester." A discussion followed, which was replied to by the authors.

**YORKSHIRE SECTION.**—On Friday last the annual dinner of the Yorkshire Local Section took place at the Hotel Metropole, Leeds, the chairman of the Section, Mr. Wilson Hartnell, presiding. Representing the Council there were present the President (Mr. W. Duddell), Messrs. J. F. C. Snell, W. Judd, J. E. Kingsbury, Robert Hammond, and the secretary, Mr. P. F. Rowell, and amongst others well known locally one may mention Mr. Harold Dickinson (late city electrical engineer), Mr. A. G. Lupton, Pro-Chancellor (Leeds University), Mr. John McLaren, Mr. E. Kitson Clarke, Mr. A. S. Keith, Mr. J. B. Hamilton (Corporation Tramways Department), Mr. W. B. Woodhouse (Yorkshire Power Co.), and Mr. W. C. Mountain, Chairman of the Newcastle Section, I.E.E.

After the loyal toasts, Mr. A. G. Lupton briefly proposed "The Institution of Electrical Engineers," referring to the world-wide use of electricity and its influence on progress generally. It seemed to him that the Institution was a descendant, in theory, of the spirit which carried on the old trade guilds, but on a more extended scale.

The President, in responding, referred to the efforts of the Institution on behalf of its members, and the pleasure which it gave him to meet and keep in touch with the members of the Local Sections. There were 73 members 41 years of age, and now some 7,300, with whom it would be impossible to keep in touch were it not for the Local Sections. The latter also facilitated the extended discussion of matters brought forward. After referring to the work of the Electrotechnical Commission and the friendly intercourse which arose therefrom with Continental engineers, he said he hoped many of the members would take part in the forthcoming visit to Paris, the details of which were being arranged.

Mr. Robt. Hammond, to whom fell the toast of "The Yorkshire Local Section," remarked that the Institution, being flush with money, had invested £3,000 recently, and was in a flourishing condition. Yorkshire had four record works costs amongst its central stations, and the average price of electricity in Yorkshire was lower than in any other county. The chairman, in replying to the toast, dwelt on the rapidity of electrical progress, pointing out that steam engineering had required about 150 years to arrive at a similar stage of development; this might be due to the scientific study devoted to electrical matters.

In proposing the toast of "The Electrical Industries," Alderman Smithson said he had been accused of hindering the development and extension of the Leeds electricity department, but he thought they would look at the matter from a broader point of view. In his opinion it would be established on a firmer basis, and would certainly benefit from industrial electrical work, when the trade boom was past and the local manufacturers had time to think over things. After referring to local traction developments, and the introduction of railless traction, he said he believed that they were entering on an era of railway electrification. Messrs. J. E. Kingsbury and W. B. Woodhouse responded; Mr. Kingsbury remarked that the electrical industry needed no monument, it was only necessary to look round to gain some idea of its importance. He recalled an early paper by Mr. (now Sir) William Prece on the application of electricity to domestic purposes, which discussed the question of electric bells: if one compared that with the present day use of electricity, he asked what would be the future in view of the rapid development now taking place. It was a characteristic of electricity that it had to replace other methods; in every direction this was taking place, and he saw no reason for the pessimism which one found amongst electrical men. One could not overlook the fact that there had been some retardation due to legislative causes, and the item of goodwill was not always included when electrical undertakings were compulsorily transferred: he thought the electrical industry could do with some goodwill, and was entitled to it. Mr. Woodhouse said it was very generally considered that the electrical industry was on the eve of a boom in all departments, modestly adding that he had thought that it might be due to the work of the power companies.

Mr. Walter Emmott proposed "The Guests," remarking (with an eye on the clock and the extended toast list) that it was their one occasion for speech making in the year. Mr. J. F. C. Snell and Mr. E. Kitson Clarke replying.

At the conclusion of the speeches, Mr. Harold Dickinson was the recipient of a pair of silver candlesticks, presented by the Yorkshire Section of the I.E.E. of which he had been hon. secre-

tary for some years. Mr. Dickinson, in thanking his late colleagues for their gift, referred to his connection with the Leeds Section since its inauguration, and to the great interest and ready assistance of the Council of the Institution in connection with their work.

Orchestral selections and topical songs, in the intervals of speech-making, assisted towards a pleasant evening, for which all credit is due to Mr. J. D. Bailie, the hon. secretary, and those associated with him.

**PHYSICAL SOCIETY OF LONDON.**—At the annual general meeting held on February 14th, the officers for the ensuing year were elected as follows: President, Prof. A. Schuster; Secretaries, W. R. Cooper and S. W. J. Smith; Foreign Secretary, Prof. S. P. Thompson; Treasurer, W. Duddell.

At the 1913 congress of the AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, which was opened on January 7th at Melbourne University, about 550 delegates were present, representing the various States of the Commonwealth and New Zealand. A paper was read on the domestic uses of electricity, especially for cooking, by Mr. W. H. Alabaster, assistant electrical engineer for the Melbourne City Council.

**TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.**—The dinner of this Association took place last night at the Trocadero.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS.**—At a meeting of the East of Scotland branch, held at Dunfermline, on Friday last, a paper was read by Mr. E. Kilburn Scott, London, on "Electric Cables for Shafts of Mines."

The monthly meeting of the West of Scotland branch was held on Saturday last at Glasgow. Mr. James McCan read a paper on "The Electrical Coal-Cutter; its Installation and Manipulation." The author said that there were two points which would reduce the saving effected by the use of coal-cutters. These were:—(1) That a very bad roof made cutting dangerous and expensive, sometimes impossible; and (2) the saving must be small where the coal was easily won by hand. He gave a series of hints for the benefit of machinemem:—Don't switch on too quickly, give the machine time to gradually attain full speed. If the load is very heavy, switch on slower, not faster. Don't increase the size of fuses because they blow often. It is easier to change a fuse than an armature. Don't raise or lower the cutting level in quick steps when driving a disk or chain machine; the only machine that will do this is the bar. Don't force the machine through a hard holing with blunt picks; it is quicker, not slower, to change picks. Don't neglect such trifles as a loose screw or a broken spring, because it is a small detail; either repair it or report it, because a stitch in time saves nine; and don't bury the machine in the cut because of cutting by contract. Work out the costs properly, and see if it does not pay better to cut with crown wheel clear.

**FARADAY SOCIETY.**—On March 12th there will be a general discussion on "Colloids and their Viscosity"; Dr. R. T. Glazebrook will preside, and a number of papers will be read. The meeting will be open to members of the Institution of Electrical Engineers and of the Physical Society of London.

**Annual Socials and Dinners.**—**HANLEY.**—The eighth annual dinner of the British Electrical Friendly Society (Potteries District) was held at Hanley on February 14th, Mr. F. W. Chanter, a director of the Potteries Electric Traction Co., presiding. A watch and chain were presented to Mr. C. Shorthouse, in appreciation of his work as contributors' Central Committee man for 11 years.

**MAIDSTONE.**—On Tuesday evening, last week, the employés of the Maidstone Corporation Tramways held a very successful concert, promoted by the members of the Sports Club. The room was tastefully decorated, and during the interval refreshments were served. The general manager furnished the company with tobacco and cigarettes. After a few remarks by the chairman (Mr. A. T. Lambert, general manager), a programme of music and song was carried out in an excellent manner. We understand that motorman W. Hayes "simply brought the 'depôt' down with his patter song, 'The Inquisitive Kiddy.'"

**Large Continental Turbo-Alternators.**—The Rheinisch-Westfälische central station, which was the first in Germany to employ 10,000-h.p. turbines, now possesses three 30,000-h.p. turbo-alternators, each of which is rated at 21,500 k.v.a.—i.e., about 15,000 kw. at 0.7 power factor. The overload capacity of the turbines and generators is 25 per cent. Two of these sets have been in satisfactory operation at Dusseldorf-Reisholz since last summer, and the third set is to be placed in service at Essen. The Dusseldorf station is interesting in that its generating equipment is entirely driven by turbines, and includes three 7,150-k.v.a. units (5,000 kw. at 0.7 p.f.), and the two new units mentioned above. There is, therefore, available in five sets, 60,000 k.v.a. or 45,000 kw. at 0.7 power factor. The power house measures 80 x 180 ft. The various auxiliary pumps are driven by steam turbines or electric motors, and for these auxiliary services each 15,000-kw. set requires 230 kw. and 1,100,000 gallons of water per hour. Generation is at 5,250 volts, three-phase, and excitation at 220 volts. Comparing the dimensions of the new sets with those of the 5,000-kw. units, the remarkable advances embodied in the construction of the former may be realised:—

Makers.	15,000 kw. at cos $\phi$ = 0.7.		5,000 kw. at cos $\phi$ = 0.7.	
	Length.	Width.	Length.	Width.
	Ft. in.	Ft. in.	Ft. in.	Ft. in.
A.E.G. ...	50	2	15	7
Brown-Boveri ...	52	10	14	0
Escher-Wyss and Siemens-Schuckert ...	49	10	14	0
	51	0	14	6
			49	1
			12	4

—E.T.Z.

(Continued on page 353.)

## TWO EUROPEAN SINGLE-PHASE RAILWAYS.

*The Mittenwald Electric Railway.*—This railway system between Innsbruck - Scharnitz - Garmisch - Partenkirchen-Griessen and Reutte is sub-divided into four lines; the eastern line from Innsbruck to Scharnitz, 33 km. long, is frequently referred to as the Karwendel Railway, and, like



TYPICAL VIEW, MITTENWALD RAILWAY, SHOWING POWER TRANSMISSION LINE.

the western line, 32 km. long, from Reutte to Griessen, passes through Austrian territory; between these lines comes the Scharnitz-Griessen section, which runs through Bavaria and has a length of about 40 km. This curious inter-connection of the sections lying in different countries is, of course, emphasised in the electrical equipment and the arrangement of the service.

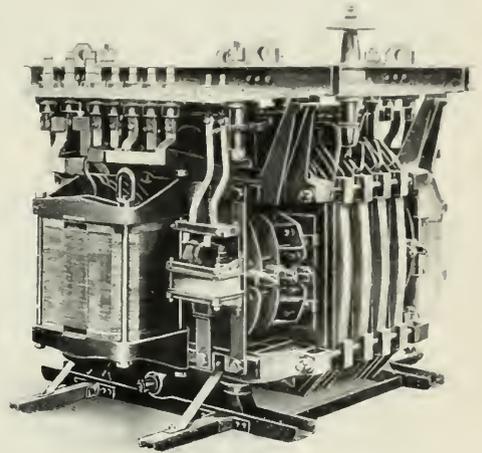
On the Austrian sections there are 18 tunnels with a total length of 4,305 metres, one of which alone is 1,787 metres long. In addition there are numerous viaducts and bridges.

The constructional difficulties formed one of the reasons for the selection of electric traction. This, in fact, allowed the railway track to be better adapted to the nature of the ground and permitted a gradient of 36.4 per mille to be used on a large scale; the railway reaches a height of 1,185 metres above sea level at Seefeld, so that in a distance of 21.2 km. a difference of 600 metres has to be overcome. The adoption of steam traction would have necessitated the lengthening of the line by at least 4 km. just at the most difficult part, and the saving effected amounted to more than the total cost of the electrical equipment. Another factor making electric traction more economical is the cheap water power, the Tyrol occupying a still more unfavourable geographical position as regards coal supply than the adjoining country of Bavaria.

The Mittenwald Railway possesses a power station of its

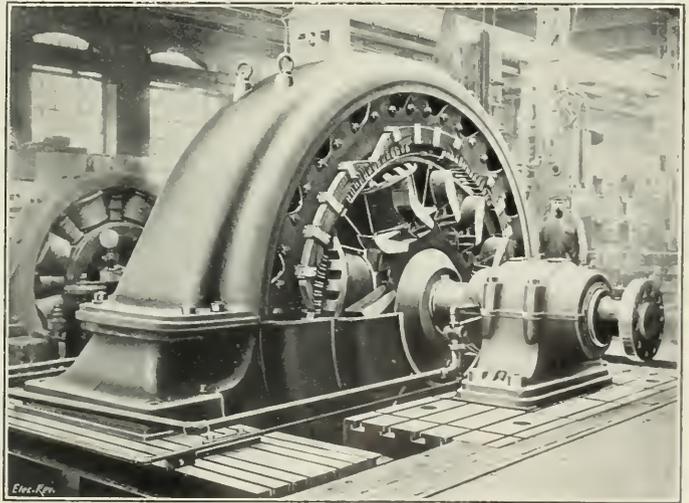
own, which is situated about 6 km. to the south of Innsbruck in the vicinity of the Sill Works, and utilises the power of the Ruetzbach, a river close to the Sill.

In the Ruetz Works two 1,000-h.p. Voith-Pelton turbines have been installed for the time being, which are direct-coupled to single-phase generators with continuous outputs of 3,000 K.V.A. and maximum outputs of 4,500 K.V.A. The turbines and generators have been designed with due regard to the special conditions involved in railway operation, so that the plant cannot be endangered by heavy short-



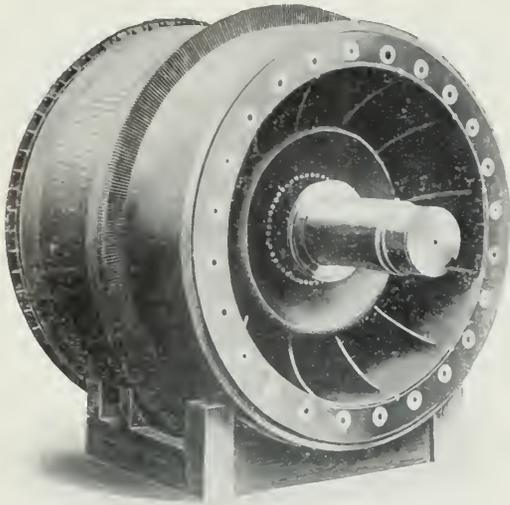
LOCO. TRANSFORMER, WITH TANK REMOVED.

circuits or sudden alterations of load. The generators, which ran at a speed of 300 R.P.M., have six poles corresponding to the frequency of 15 cycles per second, which entails a somewhat higher cost as compared with the four-pole type, but enables the pole cores to be fixed with absolute rigidity



GENERATOR FOR THE RUETZ POWER STATION IN THE SHOPS.

to the rotor hub. The generators are wound for a pressure of 3,000 volts, and are self-ventilated, the magnet wheel being fitted with fan blades, and the stator enclosed by covers.



ROTOR FOR 800-H.P. MOTOR.

On entering the power station, one is struck by the perfectly noiseless running of the generators. The energy from each generator is led to a transformer which raises the pressure to 50,000 volts; from the point of view of the switchgear, each generator forms a separate unit with its transformer. As there are, therefore, no bus-bars or switches for 3,000 volts, extreme simplicity in switching operations is ensured.

Each transformer has the same maximum output as the generator, the continuous rating, however, is 1,800 k.v.a. The transformers are of the core type with disk windings and have oil and water cooling. The core with its windings is 23 tons in weight. Each transformer is placed in a separate fire-proof compartment provided with an effective air circulation; the 50,000-volt switchgear is also enclosed in concrete cells, so arranged that the switchroom, in the event of a breakdown, may be entered from two sides without danger. Switches are only provided on the

50,000-volt side: for the transmission line these switches are doubled.

All switches have electromagnetic remote control operated from the switchboard in the engine-room: they are fitted with automatic overload releases which can be adjusted for a time limit and are also arranged for hand operation. Lightning arresters, excess pressure dischargers and choking coils for checking short-circuits are provided.

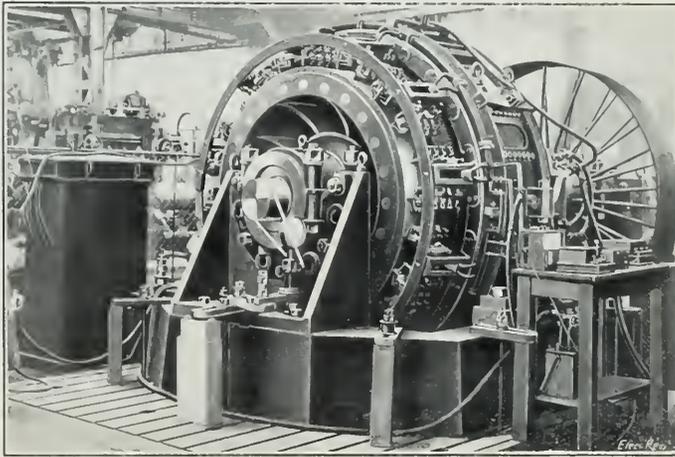
The energy generated at the power station is carried by a 50,000-volt line to two transformer stations where it is stepped down to the contact line pressure of 15,000 volts. The transformer stations, which will also supply current to the Bavarian line pending the completion of the Walschensee Works, are situated at Reith, 19 km. from the Eastern, and at Schanz, 3.3 km. from the Western boundary of Austria.

The transmission line, which is carried mainly on the poles for the overhead contact line, consists of two wires, each having a section of 35 sq. mm. Only the connection between the power station and the railway track (about 6 km. in length) is carried on a separate line of poles.

The first important section of the 50,000-volt line is situated in a desolate district, which is difficult of access in winter; increased care was, therefore, required in its design and construction. On this account, the line in this part

consists of three wires, two of which are usually in service, the third serving as reserve to replace a defective wire.

As a protection against atmospheric discharges, a copper earthing wire is mounted above the H.T. line on the tops of the poles, and is carefully earthed to the depth of ground water at each pole. Lattice poles are employed exclusively for carrying the line, and are erected at distances of 80 metres apart; every fourth or sixth pole will stand firm, even



800-H.P. LOCO.-MOTOR ON TEST-BED.



LOCOMOTIVE AND TRAIN, MITTENWALD RAILWAY.

when the line breaks on one side, the intermediate poles being flexible. The 50,000-volt line, for the section from 8.8 km. to 16.3 km. on the Innsbruck-Scharnitz line, has also been erected on a special row of poles, the number and length of tunnels in this section being too considerable for the line to be laid out on the contact line supports.

On account of the transmission pressure of 50,000 volts, which is rather high for Continental practice, special care had to be taken in choosing a suitable type of insulator, as far at least as its mechanical strength was concerned. The overhead line follows a series of sharp curves, and the poles have to stand the jerks produced by the swift motion of the current collectors. Investigation showed that only chain-link (disk) insulators would stand this heavy stress, no part of these insulators being exposed to traction or inflection strains. The type of insulator ultimately developed by the A.E.G.-Union Co. possesses a breaking strength of 7,800 to 8,000 kg. with a weight of only 2.8 kg. Moreover, it also possesses excellent insulating qualities.

An essential difference between this insulator and those used by American engineers is that the channels are not of circular cross-section, and instead of a wire rope exposed to rusting, steel bands applied throughout their width on the porcelain (so as not to injure the enamel) are used to fix it. After fitting the insulators in position, the channels are filled in, thus preventing any water from entering and freezing within the insulator. Another distinctive feature is the flexible armature of the insulator, which absorbs all shocks, thus preventing any damage to the enamel.

Chain suspensions, without any automatic tightening devices, are used for the contact wire, which is exclusively carried by lattice poles.

The rolling stock of the Mittenwald railway at present comprises nine locomotives, each of a normal output of 800 h.p. As previously mentioned, the maximum gradient of 36.4 per mille is found extensively on this railway; each locomotive will haul over this gradient a gross train weight of 124 tons at about 30 km. per hour, which corresponds to a tractive effort of about 7,500 kg. What this performance really means will be gathered from the fact that the locomotives during several months' experimental work on the Dessau-Bitterfeld Railway hauled goods trains of 1,100 tons in schedule time over the level track.

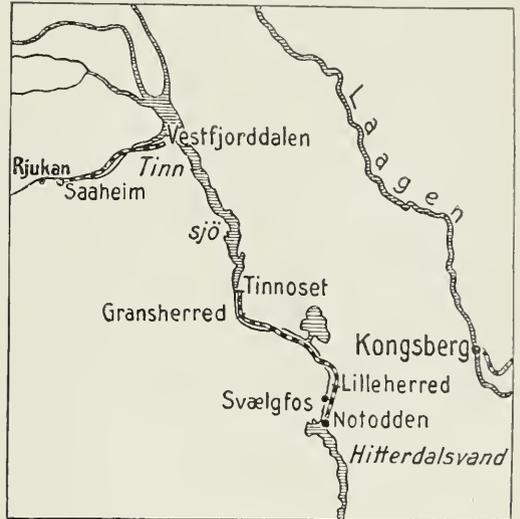
Each locomotive, inclusive of the driver and the oil and sanding tanks has a weight of 53 tons in working order.

The current is taken off the overhead wire by two bow

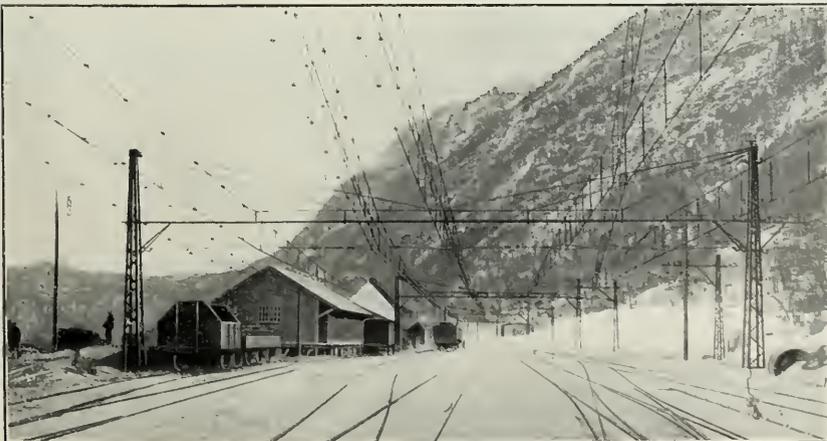
collectors each having two sliding sections, and is conducted by a bare high-tension wire arranged above the roof, to a lightning arrester choking coil, and thence into a transformer room where the line is connected up to the H.T.



CONTACT LINE AT SHUNTING STATION, MITTENWALD RAILWAY.



THE RJKUAN SINGLE-PHASE RAILWAY.

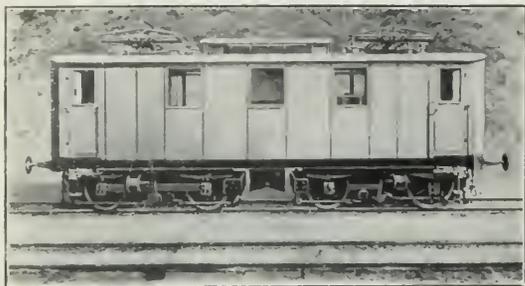


ARRANGEMENT OF CONTACT LINE, SAAHEIM STATION: RJKUAN RAILWAY.

oil switch. The latter has a quadruple break, and includes an extra resistance for reducing any strain produced in switching in the transformer. From the front driver's platform the oil switch is operated directly by the switch lever; from the rear platform it is switched out by a button fed through a series resistance from the controller coil, while a lever system is used for switching in. Between the lightning arrester coil and the oil switch there is inserted a grounding

switch operated automatically as soon as the protective cap of the oil switch is removed.

The driving motor is a 12-pole single-phase commutator machine of 800 h.p. normal output, at a speed of 30 km. per hour. It is designed on the A.E.G. system, in accordance with which (contrary to directly-fed pure series motors), the



SINGLE-PHASE LOCOMOTIVE, RJKUN RAILWAY.

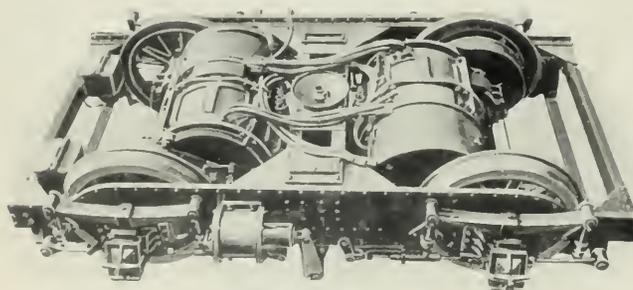
current in the armature is induced by transformer effects. The rotor winding is, in fact, closed by short-circuiting brushes, thus obtaining the secondary winding of a transformer, the primary winding of which is the field winding of the stator.

Excitation is effected from the rotor, current being supplied to the armature through another pair of brushes from a special exciter transformer connected up in series with the stator winding. The armature slots are nearly closed, and are arranged slanting to the direction of the axis.

Regulation of the motor speed is effected by altering the supply pressure by means of contactor switches, which are connected up to tappings of the power and exciter transformers, and are actuated by the controlling current. The controlling current is derived from a special (300-volt) coil of the power transformer.

Each of the two controllers has two separate switch-drums, one of which operates the contactor switch of the power transformer, and serves to regulate the power consumption, whereas the other operates the exciter switches, thus controlling excitation. The exciter drum moves the reverser into its proper position in a preliminary stage to "forward" and "backward" respectively. Each of the two switch-drums is entirely self-contained, so that any position of one can be combined with any position of the other, thus obtaining a minimum K.V.A. consumption for each speed of the motor.

The contactor switches are electrically interlocked by auxiliary contacts, so that the working of any one group interrupts all the remaining switch coils.



SHOWING ARRANGEMENT OF BOGIE TRUCK.

Provision is made for two locomotives to be joined up in multiple connection for hauling train weights of up to 250 tons. This arrangement allows both locomotives to be controlled by a single driver. The conductors for the motor-compressor and the lighting and heating of the locomotives are connected up to the same switchboard with the controller

circuit and are fitted with hand switches. All these circuits are fed from the 300-volt controller coil, which has a 19-volt tapping for the lighting circuit. The motor-compressor, which supplies compressed-air for the Westinghouse and Henry brakes, as well as for actuating the current collectors, sanders and signal whistles, is thrown into and out of circuit automatically.

Each of the radiators provided for heating the locomotives has an output of 1 kw. Heating sockets are provided at the ends of the locomotives for heating the train, which are connected up to the cars by coupling cables.

*The Rjukan Railway.*—This is the first standard gauge



TUNNEL ON THE RJKUN RAILWAY, NEAR NOTODDEN.

electric railway in the South of Norway to be installed on the single-phase system. It comprises two sections separated by the Tinn Lake, the northern section (from Saaheim to the Tinn Lake) being the Vestfjorddals Railway, 16 km. in length, and the southern section, about 30 km. long, the Tinnos Railway, running from Tinnoset to Notodden, along the Hitterdals Lake. A ferry across the Tinn Lake will connect the two sections.

The Rjukan Railway is mainly intended for the transport of the artificial saltpetre manufactured in Saaheim, to Notodden. Trains with a maximum trailer weight of 290 tons are drawn on the section from Notodden to Lilleherred, which has a constant gradient of about 2.7 per cent. by two locomotives, and on the remaining sections by a single locomotive.

The rolling stock comprises three four-axle, and two two-axle locomotives. The former have two bogie trucks, and are fitted with four alternating-current motors, each having an hourly rating of 125 h.p., and weighing approximately 46 tons. The two-axle locomotives have two motors of the same size, and weigh about 23 tons. The locomotives are constructed for a line pressure of 10,000 to 11,000 volts, 15 to 16 cycles, and are designed for contactor control.

The track equipment consists of a single catenary suspension overhead contact line, the distance between the poles

being about 60 metres. On some sections bracket suspension is used, while on others cross-suspension is employed. We illustrate the form of suspension adopted for the overhead line in a tunnel.

The power supply is derived from a separate converter station for each section of the line, only 50 cycles, three-phase current at a pressure of 10,000 to 11,000 volts being available; the converter station feeding the northern section is situated at Vestfjordalen, and contains two converter sets. Each of these comprises a three-phase transformer which steps down the pressure from 10,000 to 5,000 volts, and feeds an asynchronous motor driving an alternating-current generator with an output of 400 k.v.a., which supplies the line. The converter station receives its energy from the Rjukan power station, which is about 5 km. distant.

The southern section is fed from the Svaelgfos converter station, which is situated in the same building as the power station and consists of three converter sets similar to those above described.

Both the railways described were equipped by the A.E.G.

## NOTES.

(Continued from page 348.)

**Wholesale Traders' Association.**—We have received a copy of the report which was adopted at the annual meeting of this Association, which watches over the interests of the hardware, furnishing and metal industries (and has an Electrical Trades Section), at Birmingham on Monday. The number of inquiries as to status of customers handled during the year was 127,846. In regard to "long firms" who are continually defrauding the trading community, it is remarked that "in most instances these frauds could be checked in their earlier stages if only victims would at once lay the circumstances before the Association and co-operate with its officers in bringing the offenders to justice." In the debt recovery department, there were placed in its hands for collection during the year 34,500 debts, amounting in all to £283,341, out of which no less than £174,873 was recovered without legal proceedings. A speciality is made of collection of debts in Scotland, Ireland, and abroad. Mr. T. Cumberland is the chairman of the Association, and Mr. C. G. Poppleton is secretary. The offices are at 26, Corporation Street, Birmingham.

**The Manchester Electro-Harmonic Society.**—We congratulate this Society on its most successful concert, held on Friday evening last. We understand that it was undoubtedly the best of the season. The large audience, something like over 300 being present, was a very gratifying feature, and further members were enrolled. The programme consisted of classical music for strings and piano, interspersed with high-class songs, while we have it on the best of authority that, perhaps, the finest item was Mr. Hamilton Harris's rendering of Schubert's "The Wanderer." Amongst the audience were Alderman Walker (vice-chairman of the Electricity Committee), Mr. Eckstein, Mr. Bruce Anderson and Councillor Westcott. In the unfortunate absence of Mr. Pearce, Mr. William Cramp took the chair, and his masterly control of the meeting assisted in a very great measure to make the success of the evening. A vote of thanks was accorded to the musical director (Mr. W. J. Smith) and Mr. J. Hill (secretary) with great acclamation. Mr. J. W. Rook (of London) proposed, and Mr. T. Cartwright (of Glasgow) seconded, a vote of thanks to the chairman, which was equally well received, and carried with musical honours. The next concert, and the last of the season, will be held on March 28th, when Mr. T. S. Sells will be in the chair.

**New Associations.**—The inaugural meeting of the Production Managers' Association was held yesterday (Thursday) evening, at the Holborn Restaurant, when, after various proceedings had been carried through relative to the formation of the association, it was intended to have a discussion, introduced by Mr. J. W. Stannard, on "American Methods v. British Conditions." The secretary *pro tem.* is Mr. Chas. F. Warren, of 42, Queen Anne's Chambers, S.W.

We have received a lengthy communication from Mr. J. Sutherland Warner, with reference to "The Associated Manufacturers of Tramway and Railway Material," of the Council of which he is chairman. He says that: "Having regard to the enormous annual purchases made by tramway and railway officials, and the well-known difficulties experienced in framing specifications and suitable standard clauses governing conditions of tender, acceptance and completion of contracts, those officials who act as purchasers have every right to expect of the manufacturers some authoritative expression upon standard forms of clauses, acceptable alike to both buyer and seller. In almost every industry to-day the work of association for the concrete expression of views is being performed." The writer states that it is only by a recognised association that such work as the settlement of acceptable standard clauses, &c., can be arranged for and maintained, and occasional special

references on extraordinary points receive representative consideration leading to smooth working, and the avoidance of disputes.

"The subject of exhibitions, their support and encouragement, will receive consideration from time to time.

"Exhibitions, for the manufacturer, invariably involve a very appreciable burden of direct expenditure, not alone in money, but of time and energies, usually of their most able officials; so that however beneficial exhibition gatherings may be to buyer or to seller, there is a limit beyond which the disadvantages outweigh the good which the industry may effectively derive. Furthermore, many of the large International Exhibitions are a comparatively worthless burden upon manufacturers of tramway and railway material, and it is necessary that the decision of the Association should be issued advising manufacturers whether to partake in any particular exhibition or not. The Council having been influenced by the fact that manufacturers other than British do actually take their part in the supplies of tramway and railway material purchased in Great Britain, they have decided to admit to the Association, and thereby control, foreign manufacturers. The Council have noted with admiration the well-recognised work of the British Electrical and Allied Manufacturers' Association, to whom they will probably look, not without avail, for advice and assistance in relation to the particular electrical specialities enumerated in the publications of that Association; but in regard particularly to the enormous quantities and kinds of manufacture for tramways and railways other than electrical, it is felt that a purely British policy would be narrow to a decidedly detrimental degree. "An examination of the lists of membership of Associations which are avowedly "British" reveals the prominent position taken by members who can by no proper construction be lending their aid out of an enthusiasm for the British, unless it be taken to mean the British buyer."

We learn that many influential manufacturers are already members; the subscription is £2 2s. annually, and further particulars may be obtained from Mr. Wm. Hopkins, Hon. Sec. of the Association, Westminster Palace Hotel, Westminster, S.W.

**A Siemens Concert.**—The directors and staff of Messrs. Siemens Brothers & Co., Ltd., and Siemens Bros. Dynamo Works, Ltd., are holding a smoking concert in the King's Hall, Holborn Restaurant, on Wednesday, March 19th, at 7 p.m. Mr. Alexander Siemens will be in the chair. The artistes are as follows:—Mr. Harry Gooding's Imperial Orchestra; Miss Annie Bartle, Miss Olive Fox, Mr. Ivor Walters, Mr. Thomas Howell, Mr. Will Edwards, Mr. Ernest Hastings, Mr. J. P. Ling, Mr. Jock Walker and Mr. Mansell Stevens. Mr. George Lakeman, of the "Owls" Musical Society, is honorary musical director. From the foregoing it will be obvious that the evening should be a most enjoyable one. With feelings of regret, be it stated, the stern necessities of editorial life will compel us at the hour of King's Hall to be correcting proofs the while the printer's representative waits imperiously at our elbow. However, may there be a good time for everybody, and if we can by any chance escape the printer's lash, we'll be there.

**Educational Notes.**—SOUTH-WESTERN POLYTECHNIC INSTITUTE, CHELSEA.—Sir C. Alfred Cripps, K.C.V.O., will present prizes and certificates to students of evening classes and day College on March 14th, at 8 p.m. The laboratories and workshops, including the new building, will be open to public inspection at about 9.15 p.m.

**Appointments Vacant.**—Fire wire lineman, for the Leyton U.D.C. (32s.); rolling stock and works superintendent, for the Liverpool Corporation Tramways (£350); correspondence clerk for the Corporation Electricity and Tramways Department (Swindon) (£58 10s.) See our advertisement pages in this issue.

The Newcastle-upon-Tyne Electric Supply Co., Ltd., are now advertising vacancies for junior assistant engineers, and the pay for the first year has been increased by 5s. per week, making the terms now 15s. per week for the first year and 20s. per week for the second year. The area of supply of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and its associated companies, now covers about 700 square miles. At the present time large extensions are taking place.

**Inquiry.**—The makers of the "Oldham" coupling are asked for.

**Business Announcement.**—THE BRITISH THOMSON-HOUSTON CO., LTD., announce that the telephone numbers of their Birmingham branch office have been altered from "1016 Midland" to "Midland 2401 and 2402."

**Profit Sharing and the Workman.**—One of the greatest difficulties in dealing with workmen, says a correspondent, is the curious and multifarious complexity of the minds of working men. "Those who have had much to do with this branch of the human family will agree that there are peculiar modes of thought. One of the particularly curious cases which came directly under the writer's notice was that of one of his own men, who had been at one time a soldier in India. He could, amongst other things, set bricks in cement mortar as well as a regular bricklayer, and would do so to get his employer out of the hands of the Union on such few minor jobs as came along necessitating any brickwork. But he could set, or did set, many times more bricks per day than the Trade Union bricklayer would, or could. His regular wage was 35s. per week, and his work was of a special kind, which has usually been done by men of the labouring class who have shown special aptitude, and have drifted into the work more or less casually. The rate at which the man worked was very much less than what he could easily manage, and, con-

vinced that more work could easily be done, the same man was promised one penny per unit for every unit he did. This was to be additional to his wages, which still remained at 35s. even if no units of work were accomplished, as might happen if a breakdown occurred. The first week on the new system showed 48 units of work done, and the man received 39s. The next week only 24 units were done, owing to some special difficulty. His pay was, therefore, 37s. This began the trouble. He had "been done out of 2s.," and was miserable and discontented, and declared he would have no more of it, but would go back to his regular pay of 35s., and would not have any bonus. Now, in two weeks he had averaged over 8 per cent. additional pay, and he was upset by it. He could not stand an irregular rate of pay, though he was never to have less than his old 35s. It seems incomprehensible, but the above are the facts, and there was nothing said to the man to cause discontent.

"The same man having one week to receive 39s. 11d. for wages and certain expenses was given a couple of sovereigns, and asked for the change of 1d. Nothing could get it from him. He could not give back a penny without feeling injured; and when it was pressed for, he finally parted with a curious bit of elliptical copper bar bearing an Indian device, and collected by him years before. This is still in the writer's possession, and serves as a reminder of what a workman will do.

"Recently a man came literally begging for a job. He was given one. By luck he got another job before the next day, when he was to have made a start. He did not even inform the man who had given him the first job, but left him to find it out by not turning up to the job. Thus, the employer was left in the lurch. The same man, only a few days ago, was begging again for a job from the very man he had served so badly.

"Thus, these two men afford three instances of the workman's ways of thought, and probably every employer could add numbers of cases equally curious and puzzling. Schemes for profit sharing only upset great numbers of the men to whom they are offered, and are better left alone. Many men on receiving a bonus will go and spend it forthwith on a fiery fuddle, and then curse the man who has brought them to this state by disturbing the regular stream of wage-earning life. When sober again they will curse their careful fellowmen who have saved the bonus. Now, the Trade Unions appear to be dominated by men of a curious twist of mind, and the fairest systems of profit sharing stand a poor chance of success. One would like to know how Sir Geo. Livesey succeeded,

"Piecework, of course, will not always answer, for it is too usual to cut the price when a man earns "too much." As part of this question, the writer has been informed on credible authority that there is a black list system in nearly every town, and men against whom there is no real fault to be found, will be driven out of the town by this black listing. It is more particularly rife in the machine-tool shops."

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—Appreciative reference was made last week by the Mayor of Darwen (Mr. Fritz Hindle) to the work of MR. BOYCE, the assistant electrical engineer, who is about to leave the town to take up the management of the electricity works at Todmorden.

MR. PERCY TAYLOR will be appointed to succeed MR. JOSEPH BOYCE (now of Todmorden) as chief assistant engineer at the Darwen Electricity Works. Mr. Taylor has been a member of the works staff for some years.

MR. J. D. SPARK, assistant mains superintendent at the Croydon Electricity Works, has been appointed mains superintendent to the Swansea Corporation Electricity Department.

On Friday, February 14th, the staff at the St. Pancras Borough Electricity Works presented to MR. W. E. RUSSELL, shift engineer, an engraved silver cigarette case, on his leaving to take up the position of shift engineer at the Davies Street station of the Westminster Electric Supply Corporation.

MR. H. T. BATES, resident engineer at Sutton (Surrey) to the South Metropolitan Electric Tramways and Lighting Co., who has been appointed resident manager to the Rothesay Tramway Co., has been presented by his colleagues with a marble clock.

MR. J. PHILLIP, assistant manager of the Fife Electric Power Co. at Dunfermline, has received an important appointment under the Derby and Nottingham Power Co. He went to Dunfermline from Dundee.

On the occasion of his leaving to take up the post of senior switchboard attendant at Salford Corporation, MR. S. R. HOWARD, of the Kilmarnock Electricity Works staff, was on February 12th presented by the members of the staff with a Masonic seal and travelling bag. Mr. W. C. Bexon, chief engineer, made the presentation, referring to Mr. Howard's long connection with the works. On February 22nd MR. D. SINCLAIR, accounts clerk, was presented with a set of books and a fountain pen, on the occasion of his leaving Kilmarnock to take up a better position at the Workop U.D.C. Electricity Works. Mr. Bexon also made this presentation, and said he was sorry to lose Mr. Sinclair's services. Mr. Sinclair has been in the Kilmarnock offices for the past five and a-half years.

**Tramway Officials.**—The L.C.C. Highways Committee recommends the following annual revisions of tramways department staff:—MR. J. TERRY, district traffic superintendent, increase from £325 to £350 a year; MR. R. E. FARRIDGE, assistant accountant, increase from £325 to £350 a year; the salary (£140) of MR. T. R. IERLAND, assistant in Section (a) of the fourth class in the tramways department, is to be increased to £150 a year. Special duty pay is to be granted to MR. H. VORLEY, accountant (£52 10s.), and MR. H. HOLLAND, assistant in the first class (£10).

**General.**—MR. STAFFORD SINCLAIR has relinquished the Scottish representation and management of Messrs. Ward & Goldstone, and for the present all correspondence should be addressed care of the Ideal Electrical Co., 26, Alexandra Park Street, Glasgow. He will shortly take up the representation of a well-known manufacturer, and will be back at 50, Wellington Street, Glasgow.

On February 20th, a dinner was given to MR. WALTER FINLAY, W.S., by the electrical trade of the City of Edinburgh. Mr. Alex. Pratt, vice-president of the Electrical Contractors' Association of Scotland, was in the chair. Presidents of several allied trade associations were present. The toasts included "The Corporation of the City of Edinburgh," proposed by Mr. Basil A. Pilkington, and responded to by Councillor F. J. Robertson; "Our Guest," proposed by Mr. Geo. Wishart, and, of course, replied to by Mr. Finlay; "The Electrical Trade," proposed by Mr. R. K. Hill, and replied to by Mr. Thomas Wright; "Kindred Associations," proposed by Mr. J. Plunkett and responded to by Mr. Peter Dick; and "The Chairman," moved by Mr. R. Graham. About 50 gentlemen were present, and during the evening a presentation was made to Mr. Finlay in recognition of his services to the Association. In the course of some of the speeches, a hope was expressed that there was a good time coming, when the Edinburgh Corporation would help rather than hinder the efforts of local firms.

MR. C. H. GASSON has recently left the firm of Messrs. Siemens Bros. Dynamo Works, Ltd., Dalston, and is now representing the Imperial Lighting Co.

## NEW COMPANIES REGISTERED.

**International Telephone Co., Ltd. (127,301).**—Registered February 20th, by W. E. Hart, 3, Mincing Lane, E.C. Capital £100, in £1 shares. Objects: To acquire in any part of the world any concessions, grants, decrees, rights, powers, and privileges, for the construction and working of a telephone system or systems, to establish, control and regulate telephones and works for the supply of electric light, heat and motive power, to transmit and facilitate the transmission of telephonic and telegraphic communications and messages, &c., provided that no telephonic or telegraphic business within the exclusive privilege conferred upon the Postmaster-General by the Telephone Acts shall be carried on in the United Kingdom without his previous licence or consent. The signatories (with one share each) are:—A. H. Harris, 58, Brookville Road, Waltham Green, S.W.; clerk; J. A. Hewitt, 180, Trandlers Road, Deptford, S.E.; clerk; A. E. Hurdle, 32, Cremorne Road, Cheyne Walk, S.W.; clerk; A. Morrison, 21, Duckett Road, Harringay, N.; clerk; R. J. Coaks, 37, Lilleshall Road, Clapham, S.W.; clerk; H. Foyle, 21, Belhurst Road, South Norwood, S.E.; cashier; H. E. West, 19, Kay Road, Stockwell, S.W., clerk. Registered without articles of association. The first directors are G. Franklin and J. E. Kingsbury.

**Scott's Starter Syndicate, Ltd. (127,256).**—This company was registered on February 18th, with a capital of £5,070 in £1 shares (5,000 preferred) to acquire the benefit of certain existing inventions, and to adopt agreements (1) with Laurence, Scott & Co., Ltd., and Wm. H. Scott and (2) with Laurence, Scott & Co., Ltd., relating to the manufacture of electric starters. The subscribers (with one preference share each) are:—W. H. Scott, Oaklands, Thorpe St. Andrews, Norfolk, engineer; G. N. Cornwallis Mann, Roselands, Alhambra Road, Norwich, engineer; F. W. Doggett, Hill House, Hethersett, Norfolk, engineer. Private company. The number of directors is not to be less than two or more than five; the first are Wm. H. Scott, G. N. Cornwallis Mann, F. W. Doggett and E. Cozens-Fardy; Laurence, Scott & Co., Ltd., may, while holding 50 shares, appoint a director in place of E. Cozens-Fardy; qualification, 50 shares. Registered office, Gothio Works, Thorpe, Norwich.

**Kine Appliances and Repairs, Ltd. (127,323).**—This company was registered on February 21st, with a capital of £1,000 in £1 shares to carry on the business of manufacturers of and dealers in photographic, cinematographic projection and scientific apparatus and requisites, electric lamps, &c. The subscribers (with one share each) are:—B. S. Dunning, 45, St. George's Square, S.W., gentleman; A. B. Allen, 20, Endell Street, W.C., instrument maker. Private company. The number of directors is not to be less than two or more than three; the first are B. S. Dunning, A. B. Allen and W. Smith (all permanent); qualification, £10. Registered by F. B. Smith, 17, Burrey Street, W.C.

**Cremer Lamp and Engineering Co., Ltd. (127,273).**—This company was registered on February 19th, with a capital of £2,000 in 25 shares to carry on the business indicated by the title. The subscribers (with one share each) are:—R. Cremer, Highfield, Mootown, Leeds, mining engineer; J. M. Servaes, 13, Rumlford Place, Liverpool, merchant; R. L. P. Bell, 79, St. George's Place, Glasgow, iron and steel merchant. Private company. The number of directors is not to be less than two or more than five; the first are R. Cremer, J. M. Servaes and R. L. P. Bell. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**Lux Lamp and Engineering Co., of Glasgow, Ltd. (8,543).**—This company was registered in Edinburgh on February 14th, with a capital of £2,000 in 25 shares to carry on in Glasgow the business of lighting and heating engineers. The subscribers (with one share each) are:—A. H. Schow, 27, Renfrew Street, Glasgow, merchant; J. H. Broadfoot, 27, Renfrew Street, Glasgow, engineer. Private company. The number of directors is not to be less than three or more than seven; the first are A. H. Schow and J. R. Broadfoot. Registered office, 27, Renfrew Street, Glasgow.

**De Coster & Co., Ltd. (127,343).**—This company was registered on February 22nd, with a capital of £500 in £1 shares (200 preference), to carry on the business of electrical, gas, hot water and general engineers, smiths and machinists, makers and patentees of and dealers in electrical, gas and hot water machines and appliances, &c. The subscribers (with one share each) are:—J. F. de Coster, Elm Grove, Cricklewood, N.W., electrical engineer; Louisa A. de Coster, 120, Boundary Road, St. John's Wood, N.W., draper; C. de Coster, 951, Fulham Road, S.W., draper. Private company. The number of directors is not to be less than two or more than three; the first are J. F. de Coster and C. de Coster; qualification, one share. Registered by Scott-Lawson & Palmer, 22, Essex Street, Strand, W.C.

**Smith Electrical Co., Ltd.** (127,353).—This company was registered on February 22nd, with a capital of £1,000 in £1 shares, to carry on the business of electrical, mechanical and general engineers and merchants, cable makers and contractors, &c. The subscribers (with one share each) are: J. H. Smith, 10, Rose Mount Terrace, Keshigley, electrician; F. W. Dowhirst, The Limes, Keshigley, solicitor. Private company. Table "A" mainly applies. Registered office, 7, Cavendish Street, Keshigley.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Westinghouse Cooper-Hewitt Co., Ltd.** (89,947).—Capital £90,000 in £1 shares. Return dated December 10th, 1912. 10,000 shares taken up. 5s. per share called up. £2,500 paid. Mortgages and charges: Nil.

**Pontlec Welding Patents, Ltd.** (107,735).—Capital, £30,000, in £1 shares (20,000 ord. and 10,000 pref.). Return dated January 13th, 1913. 20,000 ord. and 5,000 pref. shares taken up. £5,000 paid on the pref. £20,000 considered as paid on the ord. Mortgages and charges: £1,800.

**Salerno Syndicate, Ltd.** (111,301).—Capital, £8,300, in 4,000 first series "A" and 4,000 second series "A" shares of £1 each, and 6,000 "B" shares of 1s. each. Return dated January 13th, 1913 (filed January 23rd), 1,480 first series "A" and 6,000 "B" shares taken up. £1 per share called up on 1,430 first series "A," 1s. per share on 540 "B," and 6d. per share on 5,460 "B." Mortgages and charges: Nil.

**Traffic Indicators, Ltd.** (107,237).—Return dated January 14th, 1913. Capital, £7,600 in £1 shares, 4,750 shares taken up, £500 paid, £4,250 considered as paid. Mortgages and charges: Nil.

**Corona Lamp Works, Ltd.**—Issue on February 5th, 1913, of £4,650 debentures, part of a series of which particulars have already been filed.

**Foster Engineering Co., Ltd.**—Issue on February 14th, 1913, of £2,000 debentures, part of a series of which particulars have already been filed.

**X.L. Electric Co., Ltd.**—Debentures dated February 8th, 1913, to secure £300, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Capt. C. Wiener, Ewell Castle, Ewell, Surrey.

**Insulators, Ltd.**—Particulars of £300 debentures, created by resolutions of December 6th, 1912, and February 3rd, 1913, filed pursuant to Sec. 33 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

**Electrical Distribution of Yorkshire, Ltd.**—Mortgage on company's undertakings, authorised by Provisional Orders granted under Electric Lighting Act 1882 to 1909, and its other assets, including uncalled capital, dated February 17th, 1913, to secure all moneys due or to become due from the company to Barclay & Co., Ltd., 54, Lombard Street, E.C., not exceeding £5,000.

## CITY NOTES.

### Mansfield and District Tramways, Ltd.

MR. A. R. HOLLAND presided on 17th inst. at the meeting held at Mansfield. The directors, he said, had recommended an increase of 1 per cent. in the dividend, making 5 per cent. in all. Last year could not be fairly considered a normal year, for in the early part they were face to face with terrible labour troubles, and the disastrous coal strike must have affected to a great extent many of the people who would otherwise have patronised the tramways. In spite of this the company had not only held their own, but had done a little better. According to their manager's calculation, the coal strike had, however, lost the company in net profit certainly £1,000. A tramway service must be kept running whether the receipts went up or down. The traffic receipts during the year showed the slight increase of £640, which would doubtless have been much larger but for the strike. They had spent £2,393 on repairs and maintenance, and the depreciation account had been increased by £200, making £1,400 in all. The traffic expenses were slightly in excess of those of 1911, and power alone had cost £3,084. All sections of the system continued to show a fair development, and given freedom from serious labour troubles, coupled with the development of the great natural resources of the district, there was no reason whatever why the system should not continue to enjoy a steady measure of success. In 1912 the cars ran over 500,000 miles, and carried 3½ million ordinary passengers and nearly 700,000 workpeople.

MR. A. H. BEATTY seconded the adoption of the report.

### Westminster Electric Supply Corporation, Ltd.

MR. J. BROWNE MARTIN presided on Wednesday at the offices, Eccleston Street, Belgravia, S.W., over the annual meeting of this company.

In moving the adoption of the report (see ELEC. REV., page 314), the CHAIRMAN said they would expect him to give them some idea of the work of the company and of the outlook for the next few years. They had a thoroughly sound and growing business, new lines were constantly opening out, and it was their aim to

foster these in every way. For instance, the increase in the cost of petrol had turned some people's thoughts towards electric vehicles, and it was possible they might hear more of these before long. If so, they were ready to do their part. They were one of the earliest undertakings to realise that electric cooking was bound to supersede older methods. There were already a fair number of stoves in use, many others were proposed, and they were now making arrangements to hire out cooking ranges, and maintain them. But they did not confine themselves merely to encouraging new developments; they also supported the efforts which were being made to improve the older methods of utilising electricity. Their showroom had been open since May, 1910, and had been of great assistance to them in getting new business by giving consumers an opportunity of seeing for themselves the new apparatus which they wished to bring to their notice. They would see a system of lighting in that room, and downstairs in the showroom others might be inspected. In place of direct lighting, reflecting or semi-reflecting bowls were now being used which got rid of shadows and gave a much more pleasing effect for a small increase in cost. Heating by electricity was becoming better known, and was more used. There were new types of heating stoves which were more effective and pleasing than the older makes, and they might see the best of them in the showroom. Electric lifts were now considered almost as a necessity in large houses, and as regarded electric power, the gas and steam engines in their area were slowly but surely being supplanted by electricity. The old argument that "electricity is too expensive" had completely died out now that the metal lamp had been introduced, and he was sure they might be satisfied they were keeping abreast of the times and that they might anticipate continued and increased prosperity. They would see from the accounts that the receipts for the year showed an increase of £900 and the costs a decrease of £1,100. They were thus £2,000 to the good in their trading as compared with 1911. They should have done better had it not been for the coal strike a year ago, which cost them nearly £3,000, and for the subsequent rise in the price of coal, which amounted, on the average, over the various qualities they used, to about 15 per cent.

THE RT. HON. W. HAYES FISHER, M.P., seconded the motion.

MR. W. J. FISHER asked how the company stood with regard to the Special Committee appointed by the London County Council on the electric lighting undertakings. Had they been called on to give evidence, or was the Committee doing anything which the shareholders might advantageously know?

MR. W. HAYES FISHER said the company had been asked to give evidence, and had done so; but the present London County Council came to an end on March 6th, and the Special Committee had reported, merely advising that it should be reappointed by the new Council to continue its deliberations, which must occupy a considerable period.

MR. W. J. FISHER: At present they are only deliberating, and have not outlined any scheme?

MR. HAYES FISHER: None whatever in their report.

The report was then adopted.

THE CHAIRMAN, in reply to a question, said the coal situation was in a much happier position than it was a year ago. He could not say anything very definite about it, because these things varied from time to time, but they felt much more confident than they did a year ago.

**Yorkshire Electric Power Co.**—This company held its half-yearly meeting, on 18th inst., at Leeds. In referring to the report (see ELECTRICAL REVIEW, page 229), the chairman (according to the *Financial News*), said that the expenditure during 1912 on capital account (£53,036) had been made principally in strengthening the system of the company and in providing generating plant to meet the increasing demands for current, rather than upon new mains in search of customers. In spite of this conservative policy there had been an increase of 25 per cent. in the sale of current, the revenue from which had risen from £34,269 in 1911 to £43,480 in 1912. Under ordinary conditions this would have resulted in a satisfactory margin of profit; but the coal strike of March last and the abnormal conditions under which their business had been carried on in the latter half of the year, owing to the large turbine being out of commission, had so raised the works costs as to absorb the profit which the directors should otherwise have hoped to put before the meeting.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Mexico Tramways Co.—Further issue of \$9,512,600 common stock, in shares of \$100 each.

Tilling (Thomas), Ltd.—£200,000 5½ per cent. cumulative participating convertible income debenture stock.

Toronto Power Co., Ltd.—Scrip, fully and partly paid, for a further issue of £616,438 4½ per cent. consolidated guaranteed debenture stock.

And to allow the following securities to be quoted in the Official List:—

Adelaide Electric Supply Co., Ltd.—£25,000 additional 5 per cent. debenture stock.

Birmingham District Power and Traction Co., Ltd.—£51,453 additional 4½ per cent. first debenture stock.

**Mirrlees Watson & Co., Ltd.**—The *Times* reports that the directors announce a dividend of 10 per cent. and a bonus of 5 per cent., less tax—the same as a year ago.

**Bristol Tramways and Carriage Co., Ltd.**—Sir George White presided at the annual meeting held at Bristol on 19th inst., and the report, as already published, was adopted.

### Underground Electric Railways Co. of London, Ltd.

The half-yearly meeting was held on Monday, at Westminster Palace Hotel, S.W., Sir Edgar Speyer, Bart., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 269), said it was again his pleasure to point to further considerable progress made during the half-year. The important events during that period—viz., the acquisition of a controlling interest in the Central London, and City and South London Railways, and the consolidation of the interests of the London United Tramways, Ltd., and the Metropolitan Electric Tramways Co., Ltd.—and the public statement he then made with regard to these developments, were of so recent a date that he had little to add to what he then said. All these schemes had since been satisfactorily carried through, and it remained now to develop and co-ordinate that great system of railways, tramways, and motor-buses, which force of circumstances more than anything else had brought and welded together. He could only repeat and emphasise that in their opinion the only hope for the shareholders to get a return on their capital, and for the travelling public to get the best possible service, lay in the combination of these various transport agencies which ministered to the transit requirements of London. The fear had been expressed in some quarters that the concentration of the transport facilities of London would tend towards an increase in fares and a reduction in service. His reply to this suggestion was that a true safeguard against any possible abuse was to be found in the fact that the interests of the shareholders and the travelling public were identical. There was a second and not less important reason for their policy of concentration, and that was that large sums of money would be required from time to time for extensions and improvements to the system, and it was easier, and probably cheaper, to raise these amounts with the combined credit of all the companies than by individual effort alone; and this was all the more emphasised if it was borne in mind how poor the return on the capital invested in all the underground lines of London still was. The capital so invested amounted to the huge sum of nearly £60,000,000, on which the return to-day was 2½ per cent. This was for the entire underground railways, including the Metropolitan and the Great Northern and City Railways, which did not belong to their system. If they took their own railways the result was practically the same. On the District it was only 2½ per cent., on the London Electric 2½ per cent., on the City and South London 2½ per cent., on the Central London 3½ per cent.—in the aggregate only 2·6 per cent. The yield on the cost of the company's holdings of London Electric ordinary shares which it had received for construction, and of those District second preference and ordinary stocks which it had received for electrification, was only 1½ per cent. and 1·55 per cent. respectively. The total capital of all the companies now identified with the company was £48,550,000, divided as follows:—Railways, £39,700,000; tramways, £5,700,000; omnibuses, £3,150,000. The total mileage was 520, made up of 80 miles of underground railways, 112 miles of tramways, and 348 miles of omnibus routes. For the year ending December 31st, 1912, the combined undertakings carried a total of 893,000,000 passengers, of which the railways carried 247,000,000, tramways 153,000,000, and the omnibuses 493,000,000. The combined properties employed a staff of nearly 25,000 men. Regarding the various companies comprised in the system, he could only refer them to the speeches of the respective chairmen which had been made at their recent shareholders' meetings. He could summarise the situation by saying that they showed continued progress and gave good hope for the future. The railways showed consistent improvement, and with the completion of the various extensions now under construction—namely, Paddington, Charing Cross and Queen's Park—this progress should be more marked in the future. With regard to the City and South London Railway, they could not hope for much better showings until the tunnels had been enlarged and the train service modernised. This would take at least two years after the necessary Parliamentary powers had been obtained. The Central London Railway was benefiting from its Liverpool Street extension, and when the Ealing extension was opened further increases in earnings should be shown. These factors, together with various economies which it was hoped could be effected, should substantially reduce the apparent deficiency upon the guaranteed stock. The fusion of the interests of the London United Tramways and Metropolitan Electric Tramways and the motor-bus service, which would be run in conjunction with them, should prove a source of considerable profit to the London and Suburban Traction Co., Ltd., although the best results would not be obtained until the full number of new 'buses was running. The chairman of the London General Omnibus Co., in his speech, mentioned the considerable increase of the fleet and the inauguration of new routes, which it took some time to develop. It was, therefore, natural that the earnings per 'bus in the interim should show a decrease, for it took time for the new routes to become remunerative. But there was nothing discouraging in this. On the contrary, the business stood on a very sound basis. Reference was made in the report to the Parliamentary Bills which had been promoted by the various railways. The schemes embodied in these Bills, if sanctioned by Parliament, would greatly add to the travelling facilities of London. The City and South London Railway Co.'s Bill sought power to enlarge its tunnels to a diameter similar to that of the other tube railways. The scheme was of special importance, and involved engineering problems of considerable magnitude. The widening of the tunnels would enable the company to use rolling stock of modern design, and thereby greatly increase its capacity and efficiency. The London Electric Railway Co.'s Bill provided for a physical junction with the City and South London Railway at Euston, so as to give a through service of trains

from the North to the South of London *via* the City. It also provided for a physical junction with the London and South-Western Railway at Hammersmith. This was for the purpose of running a through service of trains to Richmond. The Central London Railway Co.'s Bill provided for an extension from Shepherd's Bush to Gunnersbury. This extension would serve a thickly-populated district, and should improve the company's position. The District Railway Co.'s Bill provided for a widening of a section of the Putney line, which would considerably add to its facilities and assist in dealing with its rapidly growing traffic. Powers were also sought to enter into agreements with the Wimbledon and Sutton Railway. The Metropolitan Electric Tramways, Ltd., in which the company now had an interest through their holdings of the shares of the London Suburban Traction Co., was promoting a Bill to provide for railless traction on certain routes in the urban districts of Wood Green, Tottenham, and Walthamstow, for the purpose of connecting with the Walthamstow tramway system. A word of explanation regarding the Associated Equipment Co. might not be out of place. The share capital amounted to £500,000, all of which was owned by the company. As stated in the report, the company owned large works at Walthamstow. It also owned the Metropolitan Steam Omnibus Co., which was now running a fleet of 100 modern petrol 'buses. The works at Walthamstow were of modern design, and completely equipped for the manufacture of chassis, and also for certain repair parts required by the several companies, and all indications were that they would be fully occupied. The revenue from this company should prove a source of continuing profit to the company. The revenue accounts showed total receipts of £279,220, as against £156,549 for the corresponding half-year of 1911. The latter item, however, included £45,918 income from the operation of the power house then owned by the company. Deducting this item there remained an increase of £163,589, of which £154,540 was due to the income from the company's holdings in London General Omnibus ordinary shares and Associated Equipment Co. shares acquired in 1912. The net revenue, including a balance of £2,676 brought forward, but before providing interest on income bonds, was £198,480, a gain of £144,465 over the corresponding figure for 1911. This increase enabled the company to pay for the first time the full interest on the 6 per cent. income bonds of 1913, carrying forward a balance of £2,996. This compared with 2 per cent. per annum paid on the income bonds outstanding at December 31st, 1911. The total net revenue available for distribution amongst the income bondholders for the whole year of 1912 was £328,251, as compared with £93,511 in 1911, and the rate of interest paid on the income bonds in the two years was 5 per cent. and 1½ per cent. respectively. He thought he was justified in congratulating the security holders on the fact that they were for the first time in their history paying the full interest upon the 6 per cent. income bonds. This had been accomplished notwithstanding the conservative financial policy pursued by the various enterprises under the company's control. They were all making full provision for depreciation and reserve, and were in a sound financial condition, and he need hardly add that they should not have paid the full rate unless they felt reasonably certain of maintaining this distribution. They had made very rapid strides in the last few years, and he did not think he was going too far if he expressed the hope that the shareholders would, before long, begin to receive some return on their capital after having patiently waited so long.

LORD GEORGE HAMILTON seconded the motion, and the report was adopted without discussion.

**National Electric Supply Co., Ltd.**—At the annual meeting held in Prestor, last week, Mr. John Booth, chairman, in moving the adoption of the report, said there was a substantial increase in the profits, and the prospects were brighter than for several years past. Prices of coal had increased since the strike, and they were paying 40 per cent. more than a few years ago. Regarding taxes, they were the most highly rated electric lighting company in the kingdom. They appealed, and, after a long fight, agreed to a compromise, the result of which was a reduction of about 15 per cent. On the credit side they had about £500 more for lighting, and about £1,000 more for power, notwithstanding the increased use of the more economical metallic-filament lamps. The net result was a profit of £14,017, which was £1,243 more than last year. They were getting new consumers, and they now had more than made up for the loss of revenue caused by the metallic lamps. Dividends at 4 per cent. for the year on preference shares, and 4s. 6d. per share on the ordinary shares for the half-year, making 7s. 6d. per share for the year, also £1 7s. 2d. per share on the founders' shares, were declared.

**The Bastian Meter Co., Ltd.**—In their report for the year ending December 31st, 1912, the directors show a slight improvement in the trading results as compared with the previous year. The sum of £600 having been written off patents and goodwill, the net amount of profit for the past year as shown in the balance-sheet is £276, plus £587 brought forward, making £863. The directors recommend the payment of the 6 per cent. dividend on the cumulative preference shares, amounting to £121, and also a 4 per cent. dividend on the ordinary shares amounting to £397 for the year, absorbing £517, leaving £345 to be carried forward.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the five weeks ended January 31st, 1913, amounted to 1,021,662, compared with 887,647 units in the corresponding five weeks of 1912.

**Charling Cross, West End and City Electricity Supply Co., Ltd.**

The directors' report for 1912 first expresses regret at the death on the 18th inst. of Mr. H. C. Pulley, who joined the board as recently as 1910. The result of the year's working has been very satisfactory.

**West End Undertakings.**—The gross earnings of these undertakings from sales of current, rents, &c., were £146,676 in 1912, as compared with £140,922 in 1911; the expenses, excluding depreciation, were £66,686, as compared with £63,408; and the net earnings were £79,990, as compared with £71,514. After bringing in the balance of £15,949 from 1911, and £1,915 for interest accrued in 1912, paying interest on the debenture stock, and making £15,000 provision for depreciation as against £11,000 last year, there is a balance on net revenue account of £65,054, out of which have been paid the dividend for the year on the preference shares, amounting to £18,000, and an interim dividend for the first half-year at the rate of 5 per cent. per annum on the ordinary shares, amounting to £10,000, leaving a balance to be dealt with of £37,054. The directors recommend that a final dividend be paid on the ordinary shares for the second half-year at the rate of 5 per cent. per annum, making 5 per cent. for the whole year, absorbing £10,000; that there be carried to general reserve (income) account £9,054; carrying forward £18,000, as against £15,949 last year. The company has now connected to its West-end mains a total equivalent of 687,593 8 C.P. (30-watt) lamps. The total is made up as follows: 452,092 in lighting, 26,066 in heating, and 209,435 (8,406 H.P.) in motive power.

**City Undertaking.**—The gross earnings of this undertaking from sales of current, rents, &c., were £148,513 in 1912, as compared with £145,062 in 1911; the expenses were £81,959, as compared with £84,356; and the net earnings were £66,554, as compared with £60,716. After bringing in the balance of £36,158 from 1911, and paying interest on the debenture stock, loans and advances, there is shown a balance on net revenue account of £68,821, out of which has been paid the dividend on the preference shares amounting to £18,000, leaving £50,821, as compared with £36,158. The directors have transferred £32,821 to general reserve (income) account, and propose to carry forward £18,000. The company has now connected to its City mains the total equivalent of 651,488 8-C.P. (or 30-watt) lamps. The total includes 312,947 in lighting, 47,610 in heating, and 290,931 (11,701 H.P.) in motive power.

The chief engineer certifies that the plant and machinery at the several stations of the company have been maintained in a high state of efficiency.

The annual meeting is called for March 4th, at the offices.

	West End undertakings.	City undertaking.
Units generated .. .. .	9,299,853	29,697,565
Units bought .. .. .	9,380,304	1,827,715
Units sold—Public lamps .. .	470,754	—
Other sales .. .. .	13,557,716	—
Total .. .. .	14,058,470	24,866,345
Used on works and transmission and distribution losses .. .	4,621,687	6,718,435
Total accounted for .. .. .	18,630,157	81,525,280
Public lamps .. .. .	288	—
Total max. supply demanded, kw. . .	6,679	12,555

**Bath Electric Tramways, Ltd.**

The annual report for the year ended December 31st, 1912, states that the traffic and other receipts show an increase of £2,164. Owing to the coal strike, the greatriise in the price of petrol, as well as the advance in price of all materials, the benefit of the additional traffic has been more than absorbed. The following are the earnings for the past five years:—1908, £38,395; 1909, £40,136; 1910, £42,372; 1911, £43,834; 1912, £45,998. The traffic receipts for the first six weeks of 1913 show an increase of £303, compared with those of 1912. During the year certain special repairs and alterations have been effected, principally in the improvement of the fleet of motor vehicles, while four new torpedo-type cars have been purchased and brought into service. The above expenditure amounted to £3,772, which has been reduced to £1,772 by the appropriation of the reserve for depreciation (£2,000), shown in last year's accounts, is not directly applicable to the year 1912, but has been charged against the accumulated revenue of previous years, thus providing for depreciation in a most effective form. The foundry acquired by the company, and referred to in former reports, has been improved by the addition of certain extra plants, and has given excellent results. After charging the expenses of operation and administration for the year ended December 31st, 1912, there remains a balance of £14,649, to which is added the amount brought forward after deducting £1,772 net expenditure referred to above £8,366, making a total of £23,015. From this is to be deducted interest on the 4½ per cent. first mortgage debenture stock paid and accrued to date, £8,973; fourth instalment of sinking fund for the first mortgage debentures, £1,000; interest on loans, £1,055; dividend on preference shares for the year to December 31st, 1912, paid July 1st, 1912, and January 1st, 1913, £3,750, a total of £11,809, leaving a net amount of £11,207. Of this there has been appropriated for contingencies and renewals account £8,000, leaving a balance of £3,207, which the directors recommend should be carried forward pending the completion of arrangements which are being made for meeting the loan standing in the balance-sheet of £21,150. No dividend is recommended for payment to the holders of ordinary shares, but the company is improving its position. The reserve account and the reserve for depreciation have been amalgamated into one fund, and it now stands at £10,000. By a

sinking fund, £5,864 of the debentures has been purchased and cancelled, and, as indicated, a useful reserve fund has been built up with the surplus of past years.

**Newcastle and District Electric Lighting Co., Ltd.**

The annual meeting was held in Newcastle on February 21st.

Dr. J. B. SIMPSON, the chairman, in moving the adoption of the report (see *ELEC. REV.*, page 316), said that at the last general meeting attention was drawn to the fact that the directors had under consideration the most advantageous method of making an issue of £150,000 second mortgage debentures, and it would be observed from the report that they had been offered to the public, and that practically the whole of the amount was taken up. That had enabled them to pay off the bank overdraft, certain temporary loans, &c. The reserve fund stood at £8,778, and the directors recommended that £2,000 be transferred to this account. On the other side of the accounts the increase under the heading of stores was represented by the increased stock of coals which experience showed to be necessary to carry in order to provide against strikes and labour troubles. He drew attention to one item in the profit and loss account under the heading of stores, fuel, water, &c. At the time of their last general meeting the coal miners' strike had been in existence nearly a month, and it was expected daily that an agreement with the men would be arrived at; when, however, the termination of the strike became very uncertain, the directors thought it wise—although events proved it unnecessary—to make arrangements for a further stock of coal in order to make quite sure of keeping their customers fully supplied with electrical energy, and that, of course, increased their expenses. The weekly half-holiday under the Shops Act had affected their revenue to some extent, but, notwithstanding this and the effect of these labour troubles on the profits of the company, the gross receipts had increased considerably. With regard to the agreement with the Newcastle Corporation to supply the electrical energy for the Newburn tramways, good progress was now being made with the laying of the lines, and they were informed that the first section would be opened to the public in May this year, so that some benefit would accrue during the latter half of the year.

MR. ARTHUR SCHOLEFIELD seconded the motion, which, as well as the dividend and re-election resolutions, was carried.

**Launceston and District Electric Supply Co., Ltd.**

The first annual meeting was held recently. MR. R. B. ROGERS, who presided, said that the report showed that the company had had a good start, there being 3,800 lamps connected, while fresh connections were being made. Since December 31st, 1912, the remainder of the issued shares had been taken up, the number now issued being 6,400. He paid a warm compliment to Mr. Willey, the resident engineer, and his assistants, and to Mr. W. Vosper, the secretary.

The report, which was adopted, showed that the company had paid its way from the first working year. A contract for a portion of the street lighting for a period of three years had been entered into. The directors had thought it necessary to purchase a second suction engine from Messrs. Crossley.

**Lancashire United Tramways, Ltd.**—The directors report, says the *Financier*, that the result of the working of this and the operating companies comprised in this company's system, worked out as though they were one combined undertaking, is as follows:—Traffic receipts, £71,465; miscellaneous receipts, £4,631; total, £76,096; less working expenses, £47,847; general charges (including direction, management, interest, &c.) £5,356; rent of leased lines, &c., £4,961, leaving £17,932; and dividend on holding in the New St. Helens and District Tramways Co., Ltd., £1,534; profit of combined undertaking, £19,466. The receipts, compared with those of the previous year, show an increase of £1,390, which includes an increase of £738 from the sale of electrical energy. The traffic earnings per car-mile amounted to 3'21d. The expenditure has increased by £1,109, largely due to the coal strike and the advance in the price of coal. The interest and dividends received by this company from the operating companies, together with sundry receipts, amount to £13,853. After deducting interest on the prior lien debenture stock and expenses, there remains the sum of £59, which has been carried to depreciation account. The undivided surplus of the operating companies, after payment of the interest and dividends before mentioned, is £6,905. The depreciation and renewal accounts and amounts carried forward in the combined companies amount to £16,429.

**Scarboro' Electric Supply Co., Ltd.**—The annual report of the directors, to be presented to the meeting on March 5th, states that during the past year there has been connected to the mains the equivalent of 4,142 (30-watt) lamps, making 116,329. The number of units supplied during the year, including the 300,000 minimum supply to the tramways, has been 939,120, an increase of 79,268, or over 9 per cent.; the number of consumers has also increased by 10 per cent. The accounts show that after placing £1,000 to depreciation account, there is a balance on revenue account of £3,402. The directors recommend that a dividend be paid, free of income-tax, at the rate of 3 per cent. for the year, which will absorb £3,000, leaving to be carried forward £402.

### Para Electric Railways and Lighting Co., Ltd.

THE directors' report for the year ended November 30th, 1912, shows that the revenue, after providing for all expenses in London and Para, was £133,038, plus £1,442 brought forward, and difference in exchange, and interest on deposits and transfer fees, £2,090, making a total of £136,570. Deducting interest and sinking fund on debenture stock, £38,500; and interim dividends paid on the preference and ordinary shares, £24,100, there remained £68,970. Out of this there is to be placed to depreciation and renewals reserve, £15,000, and to contingencies reserve, £15,000; final dividend on the 6 per cent. cumulative preference shares absorbs £4,600, and a final dividend of 5 per cent., less income-tax, on the ordinary shares for the half-year to November 30th, 1912 (making 10 per cent. for the year) requires £19,500, leaving to be carried forward, £9,870. A new D.C. unit of 600-KW. capacity, and a new large boiler, have been installed in the power station, displacing a smaller old unit and a smaller old boiler, of the value of £4,654, which amount has been charged against the renewals reserve and credited to construction capital account. Other minor improvements have also been carried out. A charge of £20,639 has been made against contingencies reserve, representing a balance of certain debts and charges, which have been settled during the current year. This reserve account has in the past been maintained at a high figure in view of the possibility of large reserve being required to offset these charges which have now been cleared up. The operating expenses have been considerably decreased during the year, the difficulties referred to in last year's report have been overcome, and the operating conditions generally are greatly improved.

### Notting Hill Electric Lighting Co., Ltd.

SIR W. CROOKES presided on Tuesday at Winchester House, E.C., over the annual meeting of this company.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 316), said that they were still progressing satisfactorily, showing increasing profits year by year. The only money spent on capital account was for mains and meters, and this outlay was compulsory so long as they were able to obtain new customers, and they showed no sign of falling off at present. The total capital receipts amounted to £209,352, which was only about £10,000 less than the expenditure, the balance being provided by using the reserve fund in the business, instead of issuing new capital upon which dividends would have had to be paid. With regard to revenue account, it would be seen that the net profit increased from £23,557 to £24,436. The directors believed this to be a very satisfactory result, especially taking into consideration the increasing cost of fuel. Nearly the whole of the increase in the cost of producing the current was due to the higher price of coal, and, unfortunately, this rise in price was likely to be permanent. The credit side of the account was most satisfactory, and showed an increase of about £1,700, the total revenue being £44,780, against £43,059 in the year 1911. On the net revenue account, after allowing £3,000 for depreciation, and over £6,000 for interest on debentures, &c., a balance remained of £15,718 for division, against £14,486 the previous year. The balance of the depreciation, renewal and reserve fund account had now reached a total of £40,189, which they thought was sufficient to cover the depreciation to date on the plant, mains, &c., of the undertaking, kept as they were in an efficient condition out of revenue. Their contribution to the Kensington and Notting Hill joint debenture stock sinking fund now amounted to £14,302. As this fund was being invested at compound interest, it was increasing rapidly, and the total was over £52,000. The only item in the balance-sheet he need refer to was the deposit on the sale of property, £400. It appeared that their undertaking would never require to utilise some of the surplus property at present let on rental, and the directors accepted a satisfactory offer to purchase it. The amount appearing in the accounts was the deposit, and they expected that the sale would be completed shortly. The number of consumers had increased since last year from 3,513 to 3,771, representing the equivalent of an additional 12,000 8-c.p. lamps. The profit had steadily risen, and he believed would continue to do so in the future. Last year he mentioned that the directors had under consideration a scheme of co-partnership for the company's staff. The idea was heartily received by many shareholders, and during the year the directors had been able to bring it into operation. The scheme was very much appreciated by the staff, and the men showed a keenness in their work, and continued their loyal attitude to the company, which was a great advantage in case of any difficulties arising. As an example of the economies effected, he might mention that, although the total units sold increased by 145,565, the number of units used in transforming and distributing the current decreased by over 60,000. The scheme was fixed on such a basis that the bonus to the staff rose or fell according to the increase or decrease in the amount of profit available for distribution to the shareholders. The amount of bonus to be divided this year was £286, which would give the men an additional 8 per cent. on their wages. A man who got 30s. a week would receive £6 4s. After paying this bonus, there remained a balance of £7,297 for dividend on the ordinary shares, and the directors recommended the payment of a dividend of 5s. a share on the ordinary shares, which was a record in the history of the company. This would leave a balance of £928 to carry forward, being some £300 more than last year. Mention was made at last year's meeting that the London County Council had appointed a special committee to consider the question of the electric lighting of London, and they had been invited to give evidence, and would do their best to assist the committee in their deliberations. They

still felt to a large extent the result of the introduction of the metal-filament lamp, but, happily, their continual increase in consumers had more than compensated for the lower consumption of current by these more economical lamps. There was no reason to take anything but an optimistic view of the future, and he looked forward to maintaining their steady rate of progress. The higher price of coal was almost bound to continue, owing to the increased cost of production since the strike, but he hoped the other materials they used would remain at their normal level.

SIR R. B. MARTIN seconded the motion.

MR. DAWES expressed his pleasure at the amount of money the directors had been able to give to the men, and he considered the co-partnership arrangement was one of the happiest things they had ever done. He did not consider it was altogether an altruistic thing, because all connected with the company benefited from it as much as the employes, who would naturally take a greater interest in their work. He thought the shareholders must be satisfied with the position of the company.

The motion was carried.

MR. DAWES next moved that the remuneration of the directors be increased from £1,100 to £1,500 per annum, and remarked that it was merely a tardy act of restitution on the part of the shareholders, because year after year in the past the directors had surrendered a large proportion of their fees. He gathered that the total amount they had surrendered up to 1907 was £5,249.

MR. MCMAHON seconded the motion.

MR. BUSH suggested whether it would not be a better way to remunerate the directors by giving them their present remuneration and also a percentage on the profits above a certain sum.

This was not seconded, and accordingly the resolution of Mr. Dawes was carried.

The CHAIRMAN, in acknowledging the vote, said he thanked Mr. Bush for his suggestion, which the directors would consider, and, perhaps, at the next meeting, it might be brought up for discussion. The meeting closed with a vote of thanks to the board and staff.

### London Electric Supply Corporation, Ltd.

THE directors' report for the year ended December, 1912, shows that the profit on working was £68,670, against £61,412 last year. Adding the amount brought forward, viz., £4,186, less interest on temporary loan and balance of expense of issue of debenture stock, viz., £2,380, makes a total of £70,477. From this there have been paid interest on debenture stock, £17,494; sinking fund for redemption of debenture stock in 1931, £12,000; leaving to be appropriated £40,983; dividend of 6 per cent. on the preference shares absorbs £26,952; a dividend of 2½ per cent. on the ordinary shares, £8,325; there is put to contingencies account £1,000, and £4,706 is carried forward. It will be noticed that the board has opened a new reserve fund in the form of a sinking fund account. £12,000 will be invested in this fund annually (the first payment, being shown above), and the accumulation of these payments, with interest, together with the fund shown at the bottom of capital account, will be sufficient to redeem the whole of the existing debenture stock in 1931. The supply has been efficiently maintained during the year. The number of units sold amounted to 28,409,755 as against 20,476,982 last year; the total costs per unit sold being '66d., as against '82d. last year—a reduction of 20 per cent. The power supplied for traction purposes shows 75 per cent. increase, while the power supplied for industrial purposes shows 26 per cent. increase over last year. The plant and machinery have been maintained out of revenue and are in efficient condition. The L.B. and S.C. Railway have decided to electrify the whole of their suburban system. To meet the large demands which this will entail, the directors recommend the creation of £250,000 new capital, and a resolution to this effect will be proposed at the meeting. The death of the Earl of Crawford, K.T., is deplored by the board, and Viscount Duncannon has been elected in his place.

### W. T. Henley's Telegraph Works Co., Ltd.—The

directors' report shows a profit of £92,069 for the year 1912. From this are deducted directors' and auditors' fees, debenture interest, income-tax, and amount written off for depreciation on buildings and machinery, £23,986, leaving £68,083, to which have to be added the amount brought forward, £36,862, and the value of securities received in respect of the Bahamas-Florida Cable Repairing Fund, £4,041, making £108,987. The following are deducted: Transfer to reserve in respect of depreciation of Consols and other trustee securities £4,219, transfer to reserve account £15,000, bonus paid to shareholders in distribution of the Bahamas-Florida Cable Repairing Fund £4,000, dividend on preference shares £9,000, interim dividend on ordinary shares £10,000, leaving an available balance of £66,767, out of which the dividend on the ordinary shares of 15 per cent., free of income-tax (of which an interim dividend of 5 per cent. has already been paid) will require £20,000, income-tax on total ordinary dividend £1,760, leaving to be carried forward £45,017. Ordinary share dividend warrants are to be posted to-day.

**Aberdeen Suburban Tramways Co.**—The directors have been considering as to the extension of the company's business, either by the use of motor-buses or by cars run on the trackless trolley system. They hope before long to submit formal proposals to the shareholders with reference to the matter. For the half-year ended January 31st, 1913, the profit earned amounted to £1,404.

**Paisley District Tramways Co.**

MR. O. H. SMITH presided on February 20th at the offices, 83, Cannon Street, E.C., over the meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, p. 271), the CHAIRMAN said that the share capital stood as at June 30th last. The loan capital had been reduced by a further £800—making £2,300 to date—being the amount of debentures purchased during the half-year by the trustees for the sinking fund. General reserve account had been increased by £3,000 transferred from revenue and £653 for interest—an increase for the half-year of £3,653. The reserve created by the sinking funds stood at £6,237 as compared with £4,350—an increase for the half-year of £1,886, the debenture sinking fund being increased by £838 and the preference share sinking fund by £1,048. Sundry credit balances were £180 less than at June 30th. On the other side of the balance-sheet the capital expenditure had been increased by £1,700 during the half-year. This, with the expenditure in the first half of the year, was mainly expended on the four additional cars. Their investments in trustee securities stood at £12,950, and it was very gratifying to note that the market value of these securities at December 31st was above the cost price. The amount of £3,937 against the trustees for the sinking funds compared with £2,851 at June 30th. This item was, of course, increased each half-year by the contribution of £1,000 for the preference share sinking fund and by the accrued interest and dividends on the investment made by the trustees. Sundry debit balances were £323 in excess of the figure at June 30th. The traffic receipts for the half-year were £1,115 in excess of the receipts for the corresponding half-year of 1911. Unfortunately their expenses were very heavy, and the gross profit showed a reduction of £670. The additional services run during the half-year involved increased charges for electrical energy and for traffic wages, and the cost of maintaining the rolling stock was heavier than in the corresponding half-year of 1911. Local rates were also £250 in excess of the amount for the second half of 1911.

MR. JOHN YOUNG seconded the motion, and the report was adopted without discussion.

**Oxford Electric Co., Ltd.**

For the year ended December, 1912, the revenue account shows a profit (including £1,145 brought forward) of £15,832. After providing £2,000 for debenture interest, and writing off £1,072 on account of hire-purchase installations, the balance available is £12,760, which the directors propose to appropriate as follows:—Dividend at the rate of 7 per cent. per annum, less income-tax, on the ordinary share capital (whereof 3 per cent. was paid in September), £7,000; dividend at the rate of 5 per cent. per annum on the preference share capital ranking therefor (whereof 2½ per cent. was paid in September) £2,414, to credit of reserve and renewal of plant account £2,500, leaving to be carried forward £846. Reserve and renewal of plant account has been charged with the cost of plant replaced. The lamp, heating and motive-power connections continue to increase satisfactorily. The plant has been maintained in thoroughly efficient order. The supply mains of the company have been extended in Hill Top, Cowley, and Charlbury Roads, also in Princes and St. Aldate's Streets. The directors record the death of Sir Irving Courtenay, and to the vacancy on the board, Prof. Thomas Lowndes Bullock, M.A., has been appointed. The annual meeting is called for Friday, March 7th.

**Bruce Peebles & Co., Ltd.**—The directors' report for the year ended December 31st, 1912, states that the results for the year are not as satisfactory as those for 1911. The profit from manufacturing, trading, &c., after appropriating £4,138 for maintenance, amounts to £3,865; but after deducting expenses of administration, the interest paid on the mortgage debentures and accrued on the unsecured debentures, there is an adverse balance of £4,594 for the year. The trading for the year has been seriously affected by labour strikes and consequent disorganisation of business. The prospects for the current year are better, owing to the recent improvement in prices and in the demand for the company's manufactures. All buildings, machinery and plant have been properly maintained during the year. Mr. C. H. M'Enen retired from the Board in December last, and Mr. Lee Murray who resigned the post of general manager at the end of the year, has been elected to fill the vacancy.

**British Electric Transformer Co., Ltd.**—The directors report that they consider the result of operations in 1912 satisfactory. The accounts show, after paying all manufacturing costs and expenses of administration, a net profit of £21,552, plus £3,162 brought forward. There is to be placed to reserve account £9,000. Preference dividend of 6 per cent. absorbs £2,597; a dividend of 10 per cent. on the ordinary shares requires £7,895, extra remuneration to the directors £1,106, and £4,117 is to be carried forward.

**Erith's Engineering Co., Ltd.**—The annual general meeting was held at 70, Gracechurch Street, E.C., on February 20th, when the directors' report was adopted, and the dividends for 1912, of 6 per cent. on the preference shares, and of 10 per cent. on the ordinary shares (as in previous years) were authorised.

**South Metropolitan Electric Light and Power Co., Ltd.**—The annual meeting was held on Wednesday. Our report will appear next week. Warrants for dividends payable to-day on the preference shares have been posted.

**Waste Heat and Gas Electrical Generating Stations, Ltd.**

THE directors report for the year ended January 31st, 1913, states that the profits earned, after deducting administration expenses, amount to £36,610 (£25,071 last year); less transferred to credit of reserve account, £9,000 (£7,500 last year); making £27,610 (£17,571). Adding the balance brought forward, £7,955, and deducting further remuneration voted to the directors at the last annual meeting £100, the profits available are £31,565, as compared with £23,619. The directors propose to declare a dividend at the rate of 8 per cent, absorbing £25,600, of which an interim dividend of 2½ per cent. was paid in August, 1912, amounting to £8,000. Last year the dividend was at the same rate. The balance to be carried forward is £8,965, as compared with £7,953. The balance of dividend is payable on March 15th, less income-tax. The total of the reserve account now amounts to £33,351, and the funds for the redemption of plant supplied under hire-purchase agreements amount to £2,493. The construction of the company's new generating stations at Port Clarence and Ayresome was finished during the course of the year, and the stations are now running satisfactorily and have added to the revenue; some retention moneys under the contracts for construction have yet to be paid to the contractors. The Bankfoot Power Co.'s new station at Bowden Close was put into operation in September, 1912, and is working satisfactorily. The new shares which the company subscribed in the Bankfoot Power Co., Ltd., have lately been called up to the extent of 10s. per share, making 12s. 6d. per share called up; the directors have also paid the balance of 7s. 6d. per share in advance at interest. The company suffered a considerable loss in revenue during the period of the coal miners' strike in the early part of the year, most of the stations being completely closed down for a period of some weeks. The company's plant has been maintained in thoroughly efficient repair by the electrical power companies in accordance with the terms under which the stations are operated. The directors have under consideration some proposals for the erection of further plant in the North-Eastern district for the utilisation of gas to be produced from coke-ovens.

**London Electric Wire Co. and Smiths, Ltd.**—The directors have declared a dividend of 7s. 6d. per share, less income-tax, on the ordinary shares for the half-year to December 31st, making 10 per cent. for the year, £40,000 being placed to reserve, making £70,000, £500 reserved against fall in market price of investments, and £20,793 carried forward.—*Financier*.

**Continental.**—RUSSIA.—It is reported from St. Petersburg that the Société Russe d'Electricité Schuckert & Co. is about to increase its capital with the object of taking over the Russian business of the Siemens & Halske Co. The title of the company is to be altered to the Société Russe des Usines Siemens-Schuckert.

**Australia.**—The *Australian Mining Standard* states that the capital of the Electric Light and Power Supply Corporation, Ltd., Balmain, N.S.W., is to be increased by £50,000. This move was decided upon at a largely attended meeting of the shareholders held in Sydney. Reports submitted by the directors, general manager, and chief engineer showed the business of the company to be in a flourishing condition.

**United Alkali Co., Ltd.**—After paying the preference dividend, £50,000 is placed to the depreciation portion of the reserve fund and £31,000 is to be carried forward. There is no dividend on the ordinary shares, as compared with 4s. last year.

**County of Durham Electrical Power Distribution Co., Ltd.**—The directors have declared a dividend of 5 per cent. on the preference shares for the year ended December 31st.

**County of London Electric Supply Co., Ltd.**—The directors have declared a final dividend upon the preference shares at the rate of 6 per cent. per annum, less income-tax, and on the ordinary shares at the rate of 8 per cent. per annum, less income-tax, for the half-year to December 31st, making 6 per cent. for the year on the ordinary shares. £27,500 has been placed to reserve for depreciation.

**Northern Light, Power and Coal Co., Ltd.**—It is announced in the financial papers that certain bondholders in this company who are dissatisfied with the manner in which the company's affairs are conducted, have called a meeting for to-day at Salisbury House, E.C., to discuss the present position of the company and to consider proposals for united action.

**South American Electric Light and Power Co.**—According to the *Financial News*, after transferring £4,000 to depreciation account, writing £2,000 off preliminary expenses, and providing for the full dividends on the first and second preference shares, the accounts for 1912 show that the credit balance of £3,067 brought forward was increased to £5,471. This amount it is proposed to carry forward.

**Tyneside Electrical Development Co., Ltd.**—The directors' report states that the profit for the 12 months to January 31st amounted to £3,212, plus £1,989 brought forward. The directors recommend a dividend of 15 per cent. for the year transferring to general reserve account £1,000 (making £6,000) leaving to be carried forward £2,601.

MARKET QUOTATIONS.

STOCKS AND SHARES.

Tuesday Evening.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, February 26th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. .. "	22/-	..
a " Oxalic .. .. .. per lb.	23d.	..
a " Sulphuric .. .. .. per cwt.	6/6	..
a Ammoniac Sal .. .. .. "	4/7	..
a Ammonia, Murate (large crystal) per ton	£23 10	..
a Bleaching powder .. .. .. "	£6 5	..
a Bisulphide of Carbon .. .. .. "	£18	..
a Borax .. .. .. .. "	£17 10	..
a Copper Sulphate .. .. .. "	£23	..
a Lead, Nitrate .. .. .. "	£23 10	..
a " White Sugar .. .. .. "	£27 10	..
a " Peroxide .. .. .. "	£32	..
c Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks .. .. "	84d.	..
a Potash, Caustic (88/90 %) .. .. per ton	£23 10	..
a " Chlorate .. .. .. per lb.	84d.	..
a " Perchlorate .. .. .. "	44d.	..
a Potassium, Cyanide (98/100 %) .. .. "	74d.	..
(for mining purposes only)		
a Shellac .. .. .. .. per cwt.	85/-	12/6 inc.
a Sulphate of Magnesia .. .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. .. .. "	£6 10	..
a " Recovered .. .. .. "	£5 10	..
a " Lump .. .. .. .. "	£5	..
a Soda, Caustic (white 70/72 %) .. .. "	£10 6	..
a " Chlorate .. .. .. per lb.	84d.	..
a " Crystals .. .. .. per ton	£8 6	..
a Sodium Bichromate, casks .. .. per lb.	8d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£95	£2 inc.
b " Wire, in ton lots .. .. "	£112	..
b " Sheet, in ton lots .. .. "	£120	..
b Babbutt's metal ingots .. .. .. "	£38 to £146	..
c Brass (rolled metal 3/4 to 12/8 basis) per lb.	8 1/2d.	2d. dec.
c " Tube (brazed) .. .. .. "	10 1/2d.	1d. dec.
c " " (solid drawn) .. .. .. "	9d.	1d. dec.
c " Wire, basis .. .. .. "	8 1/2d.	1d. dec.
c Copper Tubes (brazed) .. .. .. "	11 1/2d.	1d. dec.
c " " (solid drawn) .. .. .. "	10 1/2d.	1d. dec.
e " Bars (best selected) .. .. per ton	£81	£2 dec.
e " Sheet .. .. .. .. "	£81	£2 dec.
e " Rod .. .. .. .. "	£81	£2 dec.
d " (Electrolytic) Bars .. .. .. "	£63	£7 dec.
d " " Sheets .. .. .. .. "	£66	£7 dec.
d " " Rods .. .. .. .. "	£74	£7 dec.
d " " H.C. Wire per lb.	9 1/2d.	3d. dec.
f Ebonite Rod .. .. .. .. "	5/8	..
f " Sheet .. .. .. .. "	1/0	..
f German Silver Wire .. .. .. "	4/9	..
h Gutta-percha, fine .. .. .. "	7/- to 8/-	..
h India-rubber, Para fine .. .. .. "	4/8	8d. inc.
l Iron Pig (Cleveland warrants) .. per ton	60/-	4/8 dec.
l " Wire, galv. No. 8, P.O. qual. .. "	£14	..
g Lead, English Pig .. .. .. "	£16 15 to £17	7/6 dec.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. .. .. "	£7 15	6/6 inc.
e Mica (in original cases) small .. per lb.	6d. to 8s.	..
e " " medium .. .. .. "	8/6 to 6/-	..
e " " large .. .. .. "	7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. .. "	3/6 to 4 1/8 nom.	..
p Phosphor Bronze, plain castings .. "	1/2 to 1/3 1/2	..
p " " rolled bars & rods .. .. "	1/2	..
p " " rolled strip & sheet .. .. "	1/2 1/2	..
o Platinum .. .. .. .. per oz.	185/-	..
d Silicon Bronze Wire .. .. .. per lb.	11d.	2d. dec.
Steel, Magnet, in bars .. .. .. per ton	£65	..
g Tin, Block (English) .. .. .. "	£223 to £223	£1 dec.
g " Wire, Nos. 1 to 18 .. .. .. per lb.	..	1d. dec.
g White Anti-friction Metals .. per ton	£45 to £228	..
z Zinc, Sh't (Viellet Montagne bnd.) .. "	£29 5	15/- d. c.

Quotations supplied by—

- a G. Boor & Co.
- b The British Aluminium Co., Ltd.
- c Thos. Bolton & Sons, Ltd.
- d Frederick Smith & Co.
- e F. Wiggins & Sons.
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- h Edward Till & Co.
- i Bolling & Lowe.
- k Morris Ashby, Ltd.
- l Richard Johnson & Nephew, Ltd.
- m W. T. Glover & Co., Ltd.
- n P. Ormiston & Sons
- o Johnson, Matthey & Co., Ltd.
- p W. F. Dennis & Co.

**Electrical Irrigation Scheme.**—An association has been formed at Tondern (Schleswig-Holstein), to handle a proposition to dam the Bredau estuary. The cost of the scheme is estimated at £68,500, towards which sum the State is to advance £16,200 and the province of Schleswig-Holstein £2,450, the remainder being subscribed by shareholders. It is proposed to build across the estuary a large steel sluice which will retain water required for irrigating purposes, and will enable surplus water to be discharged at ebb tide while preventing inundation of the surrounding low-lying land at flood tide. A pumping station is to be erected to control the water level in the irrigated area, and a central station is to be built to supply electrical energy to the pumps. The landowners in the neighbourhood are wealthy, and the scheme is so much to their advantage that no difficulty is anticipated in raising the £50,000 capital still required.—Zeit. f. E. u. M.

MARKETS, as a whole, continue very unsettled, although part of the depression wore off on Monday upon the outlook for foreign politics becoming a little less gloomy. From the news which came in, it was thought that the war in the Balkans might march to a conclusion quicker than had been expected, since Turkey apparently is not eager to continue the struggle. However, the change was more in sentiment than in volume of business, and prices tended to recede after having been better at the opening of the week.

The managing director of one of the big trust companies told us the other day that his board had decided unanimously to cease all business in stocks and shares for at least a fortnight. However tempting might be the underwriting or other proposition put before them, these directors resolved to set their faces against it. The determination is typical, no doubt, of what is happening in many other quarters, individual as well as joint stock. So it is not surprising that prices should dwindle in the absence of support other than that adventitious aid which is afforded by the occasional climbing in of the bears.

New issues are very chary of putting in an appearance just now, and several which were promised for February still repose in the pigeon-holes of their promoters. In view of the chilly reception afforded to others which have been bolder—not to say more rash—the postponements are natural enough. Underwriters themselves are beginning to agree that discretion is by far the better part of valour.

The Home Railway market has been disturbed by the difficulties which have arisen between the Midland Railway Company and its employes over the case of the guard Richardson. The Midland Company, by the way, seems to be somewhat unfortunate in its relations with the staff. The incident had its effect upon prices in the market at large, and Districts fell 1 1/2. Beyond this there is no particular change, except in the prices of the pre-ordinary descriptions, which have receded still further. City and South London 5 per cent. Preference stocks, after their quartet of falls of 2 1/2 last week, have continued to slump. District 6 per cent. Debenture lost 4 points, and the First Preference 2. Metropolitan 3 1/2 per cent. Debenture stock fell 1, and the 3 1/2 per cent. Consolidated Preference stock shed 2. The same movement has been going on amongst all the gilt-edged stocks of the Home Railway department, and the best class Home Railway Debentures can be bought now at levels which pay the round 4 per cent. on the money; while in the case of Preference issues, 4 1/2 to 4 3/4 per cent. can be obtained, with nearly 5 per cent. on City and South London Preferences.

Underground Electric Railways shares are 5s. better after their sharp fall, and the 6 per cent. Income bonds regained their drop of 1 1/2, the meeting on Monday being helpful. London United Tramway Preference have been flat, falling 7s. 6d. to 4 1/2; and declines have occurred in some of the British Electric Traction issues. Great Northern and City Preferred Ordinary is 1/2 lower.

Dividend declarations are having little effect upon prices in the English electricity supply market. St. James', Charing Cross and London Preference all fell 1/2, while Cities lost the 10s., which they rose last week. The County of London declares its usual dividend of 8 per cent., making 6 per cent. for the year, with £27,500 to reserve for depreciation. There is no change in the price of the shares. South Londons are the turn better. In the manufacturing group there is little of interest to notice. Edison and Swan "A" shares (£3 paid) strengthened a trifle, there being a buyer in the market, and the price is nominally 1/16 up at 3 1/2 middle.

Affairs in Mexico seem to go from bad to worse, but the fall in the various utility securities has been arrested, and a rather better tone prevails in some of the bonds. Mexican Light and Power First Gold bonds have rallied 3 points, and the Tramways Company bonds are both better, Mexico Tramways Common being a point higher at 107 1/2; while Mexican Electric Light 5 per cent. First Mortgage bonds are 3 points up after their severe fall, so that the pronounced fitness is being quietly wiped out. From the various scrappy items of news that come through with regard to the amount of damage done, it would appear that the soldiers have not done much hurt to private property up to the present, except in the case of some of the railways, upon which, if reports are to be believed, considerable destruction has been wrought in the way of blowing up bridges, and so on.

Other Traction issues are steady, with a fall of 5 in Kalgoolie "B" Debenture, and one of 1/2 in Anglo-Argentine Tramways 4 1/2 per cent. D. debenture. Lisbon Fives are a point higher at 9 1/2 middle. An informal meeting has been called for Friday in this week to discuss the position of the affairs in the Northern Light, Power and Coal Company. Having regard to the parlous state into which the market for the bonds has fallen, and to the fact that they are practically unsalable at about 15, it is not surprising that steps should be taken to inquire into things generally. The London board was by no means anxious to encourage the meeting, on the ground that a formal meeting of the bondholders will be convened by the directors in the near future.

There is so little going on in the Telegraph market that its affairs can be dismissed in a few lines. The depression of other markets has caused a slight dulness amongst the leading issues, but the only noticeable changes are small falls in Eastern Extensions, West India and Panama, and West Coast of America shares. The Mackay issues are a little duller, and telephone descriptions, as a whole, tend to the lower side. National Telephone Deferred is almost a nominal market, and its quotation was removed from the Stock Exchange Official List on Tuesday, when the company's books closed finally. Marconis are a little easier at 4 1/2 middle.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 25th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 25th.	Rise or Fall	Present Yield p.c.	
		1911.	1912.						1911.	1912.				
Bournemouth & Poole, Ord.	10	54	51	94-104	..	5 4 9	Kensington & Knightsbridge, Ord	5	9	81	71-81	..	5 9 1	
Do. 4 1/2 % Pref.	10	44	44	81-94 xd	..	4 14 9	Do. 4 % Deb.	Stock	4	4	90-93	..	4 5 0	
Do. Second 6 % Pref.	10	8	8	93-104 xd	..	5 17 1	Kent Elec. Power, 4 1/2 % Deb.	Stock	43	43	75-80	..	5 12 8	
Do. 4 1/2 % Deb. Stock	Stock	43	43	96-98	..	4 11 10	London Electric, Ord.	..	8	23	14-2	..	3 15 0	
Brompton & Kensington, Ord.	5	10	9 1/2	82-98	..	5 8 8	Do. 6 % Pref.	..	6	6	14-5 1/2	..	5 14 8	
Do. 7 % Cum. Pref.	5	7	7	84-9	..	3 17 9	Do. 4 % First Mort. Deb.	Stock	4	4	89-92	..	4 7 0	
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95-98	..	4 1 8	Metropolitan	..	5	4	84-4	..	5 0 0	
Charing Cross, West End & City	5	5	5	44-5	- 1/2	5 0 0	Do. 4 1/2 % Cum. Pref.	..	6	43	44 1/2	..	1 17 4	
Do. 4 1/2 % Cum. Pref.	5	43	43	42-43 1/2	..	4 14 9	Do. 4 1/2 % First Mort. Deb.	Stock	43	43	57-100	..	4 10 0	
Do. "City Undertaking" 4 1/2 % Cum. Pref.	5	43	43	82-42	..	6 2 10	Do. 8 1/2 % Mort. Deb.	Stock	83	83	84-85	..	1 1 6	
Do. Do. 4 % Deb.	100	4	4	92-94	..	4 5 1	Midland Electric Corporation 4 1/2 % First Mort. Deb.	100	43	43	98-101	..	1 9 1	
Chelsea, Ord.	Stock	43	43	41-54	..	4 15 3	Newcastle-on-Tyne 5 % Pref.	5	6	6	42-44	..	5 2 7	
City of London, Ord.	10	8	6 1/2	17-18 1/2	- 1/2	4 6 6	North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	6	99 1/2-102 1/2	..	4 17 7	
Do. 6 % Cum. Pref.	10	6	6	12 1/2-13 1/2	..	4 9 0	Notting Hill, 8 % Non-Cum. Pref.	10	6	6	94-10 1/2	..	5 11 7	
Do. 5 % Deb.	Stock	5	5	116-120	..	4 3 4	Oxford	5	7 1/2	6 1/2	64-68	..	5 9 6	
Do. 4 1/2 % Second Deb.	100	43	43	100-102	..	4 8 8	St. James' and Pall Mall, Ord.	5	10	10 1/2	89-94	..	5 5 8	
County of London, Ord.	10	6	4 1/2	114-12	..	5 0 0	Do. 7 % Pref.	..	100	83	84-87	..	4 13 4	
Do. 6 % Pref.	10	6	6	113-12 1/2	..	4 19 9	Do. 8 1/2 % Deb.	..	100	83	84-87	..	4 6 6	
Do. 4 1/2 % Deb.	Stock	43	43	104-106	..	4 4 1 1/2	Smithfield Markets, Ord.	5	2	2	8-1 1/2 xd	..	8 8 1	
Do. 4 1/2 % Second Deb.	Stock	43	43	98-101	..	4 8 8	South London, Ord.	4	5	5	23-24	..	5 0 0	
Edmundson's, Ord.	£3	Nil	8	44-48	..	Nil	Do. 5 % First Mort. Deb.	100	5	6	97-100	..	5 12 0	
Do. 6 % Cum. Pref.	5	Nil	8	44-48	..	..	Do. 7 % First Mort. Deb.	1	7	7	14-1 1/2	..	5 12 0	
Do. 6 % Non-Cum. Pref.	100	43	43	82-85	..	5 5 1 1/2	Do. 4 1/2 % First Deb. Stock	100	43	43	96-99	..	4 11 3	
Do. 4 1/2 % First Mort. Deb.	100	43	43	82-85	..	5 5 1 1/2	Urban, Ord.	£3	Nil	..	..	..	..	
Folkstone	5	6	6	42-6 1/2	..	5 17 1	Do. 5 % Cum. Pref.	..	6	2	2	28-2 1/2	..	..
Do. 5 % Cum. Pref.	5	6	6	42-6 1/2	..	4 17 7	Do. 4 1/2 % First Mort. Deb.	100	43	43	81 1/2-87 1/2	..	5 2 10	
Do. 4 1/2 % First Deb.	100	43	43	90-92	..	4 17 10	Westminster, Ord.	5	10	9 1/2	8-9 1/2	..	5 8 1	
Hove	5	9	8 1/2	74-8	..	5 12 6	Do. 4 1/2 % Cum. Pref.	..	6	43	43	44-8 1/2	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 8 % Pref.	5	6	6	54-58	..	5 6 8	Monterey Rly. Lights & Power, 5 % 1st Mort. Deb.	100	6	6	83 1/2-85 1/2	+ 1/2	5 17 0
Calcutta, Ord.	5	8 1/2	7 1/2	63-7 1/2	..	5 19 4	Montreal, Lt., H. and Power	\$100	8	9 1/2	233-238	..	3 15 8
Do. 5 % Pref.	5	5	5	43 1/2-5 1/2	..	4 16 5	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$500	5	5a	10-20	..	..
Calgary Power, 1st Mort. Bds.	100	6	5	92-94	..	5 6 5	River Plate, Ord.	Stock	10	..	217-227	..	4 8 0
Canadian Gen. El. Com.	\$100	7	7	115-119	-1	5 17 8	Do. 6 % Non-Cum. Pref.	..	8	8	104-109	..	5 10 1
Do. 7 % Pref.	100	7	7	120-124	..	5 13 0	Do. 5 % Deb. Stock	Do.	5	6	100-102	..	4 18 0
Cordoba Lt., Power and T., Ord.	100	5	5	93-99	..	5 1 0	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	43	43	100-103	..	4 8 8
Do. 5 % Deb.	100	5	5	96-99	..	5 1 0	Shawinigan Water, Capital	\$100	5	5	133-142	..	3 10 5
Elec. Lt. and P. of Coahuila, 3 % Bonds	100	6	6	98-95	..	6 6 4	Do. 5 % Cum. 1st Mort. Bonds	\$500	5	5	106-108	..	4 12 7
Elec. Supply Victoria, 6 1/2 % 1st Mort. Deb.	100	5	6	95 1/2-97 1/2	..	5 2 7	Do. 4 1/2 % For. Deb.	Stock	43	43	100 1/2-102 1/2	..	4 7 10
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	6	6	95 1/2-97 1/2	..	5 2 7	Toronto Power, 4 1/2 % Deb.	Do.	43	43	98 1/2-100 1/2	..	4 9 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	..	..	Nil	Victoria Falls Power, Pref.	1	1 1/2 d.	17 1/2 d.	91-94	..	5 6 5
Do. 6 % Pref.	1	6	6	101 1/2-103 1/2	..	9 16 2	West Kootenay Power and Lt., 1st Mort. 5 % Gold	100	6	6	106-108	..	6 11 1
Kaminitz Electric Power, 5 % G. B.	\$500	5	5	101 1/2-103 1/2	..	4 16 7							
Madras, Ord.	5	Nil	..	..	..	..							
Melbourne, 6 % 1st Mort. Deb.	100	5	5	101-104	..	4 16 2							
Mexican El. Lt., 6 % 1st M. Bds.	100	5	5	82-86	+3	5 16 3							
Mexican Lt. & Power, Common	\$100	4	4 1/2	77-81	..	4 18 9							
Do. 7 % Cum. Pref.	7	7	7	100-105	..	6 13 4							
Do. 6 % 1st Mort. Gold Bds.	..	6	6	92-95	+3	5 5 3							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4 1/2	7-7 1/2	..	6 0 0	Monte Video Telephone, Ord.	1	6	6 1/2	42-1 1/2	..	5 18 0	
Do. 5 % Deb. Red.	Stock	5	5	97 1/2-99 1/2	..	5 0 6	Do. 5 % Pref.	1	6	6	..	..	5 14 8	
American Telep. & Teleg., Cap.	\$100	5	5	134 1/2-136 1/2	- 1/2	5 17 8	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	90 1/2-92 1/2	..	4 10 8	
Do. Collat. Trust	1000	4	4	31-33	..	4 6 0	Oriental Telep. and Elec.	1	8	5 1/2	1 1/2-1 1/2	..	4 11 5	
Anglo-American Telegraph	Stock	8	8	66-68	..	4 8 8	Do. 6 % Cum. Pref.	..	1	6	6	13 1/2-15 1/2	..	4 16 6
Do. 8 % Pref.	Do.	6	6	110 1/2-111 1/2	..	6 7 7	Do. 4 % Red. Deb.	..	Stock	4	4	88-90	..	4 8 1 1/2
Do. Def.	Do.	80/-	..	242-242	- 1/2	6 1 10	Pacific and European Tel., 4 % Guar. Deb.	Do.	4	4	97 1/2-99 1/2	..	4 0 5	
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	6	6	102-104	..	4 16 2	Reuter's	10	10	10 1/2	11 1/2-11 1/2	..	3 10 2	
Chili Telephone	5	7	8	73-78	..	5 1 7	Submarine Cable Trust	Cert.	6	6	127-130	..	4 13 4	
Commercial Cable, Stg. 4 % Deb.	Stock	4	4	79-81	..	4 18 9	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	Stock	43	43	95-97	-1	4 12 9	
Cuba Telegraph	10	6	6 1/2	16-17	..	6 9 9	United River Plate Telephone	5	8	..	7 1/2-7 1/2	..	5 5 10	
Do. 10 % Pref.	10	10	10	16-17	..	5 17 8	Do. 5 % Cum. Pref.	..	5	6	6 1/2-6 1/2	..	4 8 1 1/2	
Direct Spanish Telegraph, Ord.	5	4	4 1/2	84-93	..	5 6 8	West Coast of America	2 1/2	2 1/2	..	12-1 1/2	..	4 3 4	
Do. 10 % Cum. Pref.	5	10	10	84-93	..	6 16 7	Do. 4 % Deb., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	95-98	..	4 1 8	
Direct United States Cable	10	5	4	84-93	..	6 16 7	West India and Panama Tel.	10	2 1/2	1 1/2	3-8	- 1/2	5 14 3	
Direct W. India Cable, 4 1/2 % Reg. Deb.	100	4 1/2	4 1/2	99-101	..	4 9 0	Do. 6 % Cum. 1st Pref.	..	10	6	5-10 1/2	..	8 0 0	
Eastern Telegraph, Ord. Stock	Stock	7	7 1/2	128-136	..	6 3 0	Do. 6 % Cum. 2nd Pref.	..	10	6	8	10-10 1/2	..	4 17 1
Do. 8 1/2 % Pref. Stock	Do.	8 1/2	8 1/2	78-80	..	4 7 6	Do. 5 % Deb.	..	100	5	5	101-103	..	5 2 9
Do. 4 % Mort. Deb.	Do.	4	4	96-98	..	4 1 8	Do. 4 % Deb.	..	Stock	4	4	96-97	..	4 2 6
Eastern Extension	10	7	7 1/2	127-133	..	5 4 8	Western Telegraph, Ltd.	10	7	7 1/2	137-138	..	5 2 9	
Do. 4 % Deb.	Stock	4	4	96 1/2-97 1/2	..	4 2 1	Do. 4 % Deb.	..	Stock	4	4	96-97	..	4 2 6
East and S. Africa Tel., 4 % Mt. Db. Mauritius Sub.	25	4	4	98-101	..	3 19 8	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	4 1/2	97 1/2-100 1/2	..	4 10 0	
Globe Telegraph and Trust	10	6	6 1/2	102-111	..	5 9 1								
Do. 6 % Pref.	10	6	6	102-103	..	4 13 2								
Great Northern Telegraph	10	18	18	29-31	..	5 14 3								
Indo-European Telegraph	25	13	6 1/2	67-69	..	5 10 2								
Mackay Companies Common	100	4	4	84-87	-1	5 14 1 1/2								
Do. 4 % Cum. Pref.	\$100	4	4	67-70	-1	5 14 4								
Marconi's Wireless Telegraph	1	20	..	4 1/2-4 1/2	..	4 10 1								
Do. 7 % Cum. Partic. Pref.	1	17	..	38-42	- 1/2	4 7 9								

\* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 1/8 in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 25th.	Rise + or Fall	Present Yield p.o.	NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 25th.	Rise + or Fall	Present Yield p.o.
		1911.	1912.						1911.	1912.			
Bath Trams, Pref. Ord. . . . .	1	Nil	Nil	5 1/2	..	Nil	Metropolitan Railway Consol. . . . .	100	1 1/2	1 1/2	51 - 52 1/2	..	8 2 2
Do. 5% Pref. . . . .	1	5	5	76 - 81	..	5 8 1	Do. Surplus Lands . . . . .	100	2 1/2	2 1/2	61 - 63	..	4 6 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	76 - 81	..	5 11 1	Do. 8% Deb. . . . .	100	8 1/2	8 1/2	84 - 86	-1	4 1 5
Brit. Elec. Trac., 6% Pref. . . . .	100	..	..	103 - 113	..	..	Do. 8 1/2% Pref. . . . .	100	8 1/2	8 1/2	82 - 84	..	4 3 4
Do. Do. . . . .	100	..	..	44 - 64	..	..	Do. 8% Con. Pref. . . . .	100	8 1/2	8 1/2	81 - 83	-2	4 4 4
Do. Do. 6% Cum. Pr't. . . . .	100	6	6	85 1/2 - 86 1/2	-1	6 15 7	Metropolitan Districts Ord. . . . .	100	Nil	Nil	38 1/2 - 39 1/2	1 1/2	Nil
Do. Do. 7% Non-Cum. Pr't. . . . .	100	..	..	85 1/2 - 86 1/2	-1	..	Do. 6% Deb. . . . .	100	8	8	186 - 197	-4	4 7 7
Do. Do. 6 1/2% Perp. Deb. . . . .	100	..	..	91 - 95	..	5 6 3	Do. 4 1/2% Deb. . . . .	100	4	4	83 - 95	..	4 2 6
Do. Do. 4 1/2% 2nd Deb. . . . .	100	4 1/2	4 1/2	77 - 81	..	5 7 2	Do. 4% Prior Lien . . . . .	100	4	4	88 - 100	..	1 3 1 8
Central London Railway, Ord. . . . .	100	3	3	77 - 79	-1	3 15 11	Do. 4 1/2% First Lien . . . . .	100	4 1/2	4 1/2	85 - 87 1/2	-2	5 1 2
Do. Pref. . . . .	100	4	4	82 - 84 1/2	..	4 15 3	Do. 8 1/2% Gtd. . . . .	100	8 1/2	8 1/2	75 - 77	..	4 10 11
Do. Def. . . . .	100	2	2	77 - 79	..	2 10 8	Metropolitan Elec. Trams, Ord. . . . .	1	6	5 1/2	..	..	5 18 6
Do. 4% Deb. . . . .	100	4	4	88 - 100	..	4 10 0	Do. 5% Pref. . . . .	1	5	5	..	..	5 14 8
City & South London, Ord. . . . .	100	1 1/2	1 1/2	..	..	..	Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	84 - 92 1/2	..	4 17 10
Do. 5% Pref., 1891 . . . . .	100	5	5	100 - 103 1/2	..	4 17 1	Do. 5% Deb. . . . .	100	5	5	94 - 97	..	5 14 4
Do. Do. 1896 . . . . .	100	5	5	100 - 103 1/2	..	4 17 1	Potteries, Ord. . . . .	1	8 1/2	..	..	..	..
Do. Do. 1901 . . . . .	100	5	5	98 - 101 1/2	-3 1/2	4 19 0	Do. 5% Pref. . . . .	1	6	5	..	..	6 19 0
Do. Do. 1908 . . . . .	100	5	5	98 - 101 1/2	-3 1/2	4 19 0	Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	85 - 88	..	5 2 8
Do. 4% Deb. . . . .	100	4	4	97 - 99	..	4 10 0	South Metro. Trams, 6% Pref. . . . .	1	6	..	..	..	7 7 8
Dublin United Trams, 6% Pref. . . . .	100	1 1/2	1 1/2	113 - 121 1/2	..	4 18 0	Do. 4% Deb. . . . .	4	4	4	65 - 70	..	5 11 4
Great Northern & City, Pr't. Ord	100	Nil	Nil	..	..	Nil	Underground Elec. Railways	100	..	..	..	..	..
Hastings Trams, 6% Pref. . . . .	1	6	6 1/2	..	..	7 7 8	Do. "A" . . . . .	1	1	..	..	..	..
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	69 - 74	..	6 1 7	Do. 6% First Cum. Inc. Deb. . . . .	100	..	6	111 1/2 - 113 1/2	..	5 5 9
Isle of Thanet Trams, 5% Pref. . . . .	100	5	5	25 - 28	..	4 15 3	Do. 4 1/2% Bonds . . . . .	100	4 1/2	4 1/2	95 - 96	..	4 10 0
Do. 4% Deb. . . . .	100	4	4	75 - 80	..	5 0 0	Do. 6% Income . . . . .	100	1 1/2	1 1/2	94 - 95 1/2	+1 1/2	..
Lancashire United, 5% Deb. . . . .	100	5	5	73 - 80 1/2	..	5 0 0	Yorkshire (West Riding), Ord. . . . .	5	3	3 1/2	24 - 25 1/2	..	..
London Elec. Railways, 4% Deb. . . . .	100	4	4	84 - 86	..	4 8 4	Do. 6% Pref. . . . .	3	3 1/2	3 1/2	..	..	4 12 4
London United Trams, 5% Pref. . . . .	100	Nil	Nil	..	..	..	Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	80 - 84	..	6 7 2
Do. 4% Deb. . . . .	100	4	4	68 - 71	-1	5 12 8							

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . . . .	5	5 1/2	5 1/2	4 1/2 - 5 1/2	..	5 7 4	La Plata Elec. Trms, Ord. . . . .	1	Nil	..	..	..	..
Do. 2nd Pref. . . . .	5	5 1/2	5 1/2	4 1/2 - 5 1/2	..	6 14 8	Lisbon Elec. Trams, Ord. . . . .	1	6	6 1/2	14 - 13	..	4 7 3
Do. 4% Deb. . . . .	100	4	4	92 1/2 - 94 1/2	-1 1/2	4 9 7	Do. 6% Pref. . . . .	1	6	6	1 - 1 1/2	..	4 16 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	98 1/2 - 100 1/2	..	4 19 6	Do. 6% Deb. . . . .	100	5	5	92 - 97	+1	5 3 1
Do. 5% Deb. . . . .	100	5	5	98 1/2 - 100 1/2	..	4 17 1	Madras Elec. Tr. (1904), Deb. . . . .	100	5	5	101 - 103	..	3 17 1
Auckland Trams, 5% Deb. . . . .	100	5	5	101 - 103	..	5 0 0	Mansos Trams & Lt., 1st Deb. . . . .	100	5	5	87 - 90	..	5 11 1
Bombay Elec. S. & Trams, Pref. . . . .	100	6	6	11 - 12	..	4 11 10	Manila Elec. R. and Ltg., Bonds	1000	6	5	98 - 102 1/2	..	5 0 0
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	96 - 99	..	5 1 0	Mexico Trams Com. . . . .	1000	7	7 1/2	165 - 169	+1	8 5 5
Do. 5% 2nd Deb. . . . .	100	5	5	97 - 99	..	..	Do. Gen. Con. 6% Bonds . . . . .	..	5	5	92 - 95	+1	6 5 3
Brazilian Traction Light and Power	100	..	..	97 - 99	-1 1/2	..	Do. 6% Bonds . . . . .	100	8	6	98 - 101	+1	5 15 10
Brisbane Trams Invst., Ord. . . . .	5	8	8 1/2	7 1/2 - 7 1/2	..	5 5 0	Para Elec. Rlys. & Lt., Ord. . . . .	5	10	10 1/2	72 - 75	..	6 7 0
Do. 5% Pref. . . . .	5	5	5	4 1/2 - 5 1/2	..	4 15 3	Do. 6% Pref. . . . .	5	6	6	4 1/2	..	5 11 7
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	100 - 103	..	4 7 5	Do. 5% 1st Deb. . . . .	5	5	5	93 - 101	..	4 19 0
B. Columbia Elec. Rly., Def. . . . .	100	8	8	139 - 143	..	5 12 0	Perth (W.A.) Elec. Tr., Ord. . . . .	100	5	5	135 - 144	..	3 13 6
Do. Pref. Ord. . . . .	100	6	6	119 - 123	..	4 17 7	Do. 5% 1st Deb. . . . .	100	5	5	105 - 108	..	4 12 7
Do. 5% Pref. . . . .	100	5	5	105 - 108	..	4 12 7	Rangoon El. Tr. & Sup., Pref. . . . .	5	6	6	52 - 54	..	5 0 0
Do. 4 1/2% 1st Mort. Deb. . . . .	100	4 1/2	4 1/2	100 - 103	..	4 7 5	Do. 4 1/2% 1st Deb. . . . .	100	4 1/2	4 1/2	97 - 99	..	4 10 11
Do. 4 1/2% Vancouver Deb. . . . .	100	4 1/2	4 1/2	101 - 103	..	4 7 5	Rio de Janeiro Trams, 1st Mort. . . . .	..	5	5	101 - 103	..	4 17 1
Do. 4 1/2% Con. Deb. . . . .	100	4 1/2	4 1/2	96 1/2 - 100 1/2	..	4 6 4	Do. 5% Mort. Bonds . . . . .	100	5	5	96 - 98	..	5 2 0
Calcutta Trams, Ord. . . . .	5	7	7	63 - 63 1/2	..	4 17 7	Sao Paulo Tram, Lt. and P. . . . .	5	5	5	103 1/2 - 105 1/2	..	4 14 9
Do. 5% Pref. . . . .	5	5	5	41 1/2 - 43 1/2	..	4 17 7	Singapore Trams, 5% Deb. . . . .	100	5	5	86 - 90	..	6 11 1
Do. 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	97 - 100	..	4 10 0	Southern El. Tr. B.A., 5% Deb. . . . .	100	5	5	97 - 99	..	5 1 0
Cape Electric Trams . . . . .	1	2 1/2	..	..	..	..	Un. Elec. Trams Monte Video . . . . .	5	7	6 1/2	64 - 64 1/2	..	6 5 1
City Buenos Aires Trams (1904)	5	5	5	8 - 8 1/2	..	4 6 11	Do. 6% Pref. . . . .	5	8	8	..	..	5 11 7
Do. 4% Deb. . . . .	100	5	5	97 - 100	..	6 0 0	Do. 6% 1st Deb. . . . .	100	6	6	99 - 102	..	4 18 0
Colombo Elec. Tr. & Lt., 5% Deb. . . . .	100	5	5	99 - 97	..	4 17 1	Winnipeg Elec. Rly., 4 1/2% Deb. . . . .	100	4 1/2	4 1/2	100 1/2 - 103 1/2	..	4 7 0
Havana Elec. Rly., 5% Bonds	1000	5	5	99 - 103	..	..							
Kalgoorlie Elec. Trams . . . . .	1	Nil	..	..	..	Nil							
Do. 5% A Deb. . . . .	100	6	6	83 - 88 1/2	..	5 13 8							
Do. 6% B Deb. . . . .	100	6	6	25 - 35	-6	..							

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	6	..	..	..	8 0 0	Crompton & Co. . . . .	8	Nil	..	..	..	..
Do. 6% Pref. . . . .	1	..	6	..	..	7 2 2	Do. Deb. . . . .	100	5	5	65 - 67	..	9 15 6
Babcock & Wilcox . . . . .	1	22	14 1/2	..	..	4 0 0	Dieb, Kerr . . . . .	1	5	Nil	..	..	..
Do. Pref. . . . .	1	6	6	13 - 14	..	..	Do. Pref. . . . .	1	6	6	..	..	6 17 2
British Aluminium, Ord. . . . .	1	Nil	..	..	..	..	Do. Deb. . . . .	100	4 1/2	4 1/2	95 - 98	..	4 11 10
Do. 6% Cum. Pref. . . . .	1	Nil	..	..	..	..	Edison & Swan, A, 23 paid	5	Nil	..	..	..	..
Do. Do. 6% Prior Lien Debts. . . . .	100	5	5	91 - 94	..	5 6 5	Do. fully paid . . . . .	5	Nil	..	..	..	..
Do. Deb. Stk. . . . .	100	5	5	87 - 90	..	5 11 1	Do. 4% Deb. . . . .	100	8	8	61 - 65	..	8 5 1
B. & H. Cable . . . . .	5	10	8 1/2	64 - 68	..	4 16 0	Do. 5% Second Deb. . . . .	100	5	5	72 - 75	..	6 13 4
Do. Pref. . . . .	5	8	8	52 - 61	..	4 16 0	Do. 6% Pref. . . . .	2	2 1/2	2 1/2	1 1/2 - 1 1/2	..	5 14 4
Do. Deb. . . . .	100	4 1/2	4 1/2	102 - 104	..	4 11 7	Do. Pref. . . . .	2	7	7	1 1/2 - 2	..	7 0 0
British Thomson Houston, Deb. . . . .	100	4 1/2	4 1/2	90 1/2 - 95 1/2	..	4 6 5	Greenwood & Batley, Pref. . . . .	10	7	7	7 1/2 - 8	..	8 5 8
British Westinghouse, Pref. . . . .	8	Nil	..	..	..	..	Do. Deb. . . . .	100	5	5	92 - 94	..	5 4 2
Do. Deb. . . . .	100	4	4	58 - 61	..	6 11 2	General Electric, Pref. . . . .	10	6	6	92 - 100	..	..
Do. 6% Prior Lien . . . . .	100	8	8	100 - 103	..	5 18 6	Do. Deb. . . . .	100	4	4	90 - 95	..	4 4 8
Browett, Lindley, Ord. . . . .	1	..	..	2/6 - 3/8	..	..	Henley's, Ord. . . . .	5	17	5 1/2	18 - 19 1/2	..	6 8 8
Do. Pref. . . . .	1	..	..	4/6 - 5/4	..	..	Do. Pref. . . . .	5	4 1/2	4 1/2	4 1/2 - 5 1/2	..	4 7 10
Brush, 7% Pref. . . . .	2	Nil	..	..	..	..	Do. Deb. . . . .	100	4 1/2	4 1/2	101 - 103	..	4 7 5
Do. 5% Prior Lien Deb. . . . .	10												

## AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYEES. XI.

(Continued from page 292.)

TAKING first the case of Adelaide. In Article IX (Vol. 72, page 191) it was stated that after the evidence as to the cost of living in the various cities of Australia had been taken that conferences between the parties might effect an agreement. When the Court met on December 6th, the Judge was informed that the Adelaide Trust had met the men. The suggestions, *re* "battlers," were not in their present form acceptable to the men and required consideration, but the Trust also demanded that the agreement should be made under Part 6 of the Act, making it a voluntary agreement. The Judge stated this was not allowable, as it must be under Sec. 24, to make it binding, and he would allow no other course, the case having come before him.

Mr. Goodman then argued that the dispute did not extend beyond one State, and consequently did not come within the scope of the Act, and proceeded to deal with various points in the Union's claims.

The Judge intimated on several of the points the form his award would take. While reserving all rights of the Trust, Mr. Goodman met the Judge wherever possible, accepting his decision that, provided the management were the sole judge of efficiency, promotion should go by efficiency, and in the event of equal efficiency, by seniority. Mr. Goodman objected to the claim that a non-employed should have access to the depôts to collect the men's Union subscriptions, and also to the claim for three minutes' waiting time at termini.

In conclusion, Mr. Goodman asked the Judge to take into consideration the financial position of the undertaking and the cost to the ratepayers which increases in the working expenses would entail, since it was not possible to increase the income by raising the fares. The Judge dissented from the view that these financial considerations should be allowed to influence him. These deficits were caused by payments to a sinking fund which was equivalent to a repayment of capital, and he did not consider that this ought to be done at the expense of the workers. He would take wages first and then consider their financial position.

The Adelaide award when published was in general similar to the Brisbane one already referred to. The schedule of wages are practically identical. Although they are an improvement in most cases on the rates at present paid, and to British readers seem very high, they fall considerably short of the men's request.

Take the principal cases—motormen and conductors. The men asked for 11s. per day; they are awarded, first year of service, 8s. 6d.; second, 9s.; third and subsequent years, 9s. 6d. Overhead wiremen, including linemen.—The sum asked was 12s. per day; they were awarded 10s. Firemen in charge of less than four fires asked 12s., and were awarded 10s. Labourers asked 9s. per day and obtained 8s.

The Adelaide award principally differed from the Brisbane one in not demanding preference for members of the Union. Minor differences are a definite minimum of 27 minutes for motormen and conductors' meal relief and a definite minimum two minutes' wait at termini. The men asked for 30 minutes and a minimum wait of three minutes.

The Judge, in making the award, pointed out that the men's Union wanted higher rates than the 8s. 6d., 9s. and 9s. 6d. awarded to motormen and conductors, while the Trust urged him to award the conductors less, as they employed a large number of young men. As it was impossible for him to please both parties, he had kept the two rates equal, as he saw no sufficient ground for differentiation. He had also gone carefully into the question raised by the men that, owing to the high cost of rents and living in Adelaide, they should be awarded higher rates than in the eastern cities. This much was certain, that the cost of living had been increasing more or less steadily throughout the eastern States, and that in Adelaide rent called for at the present time a considerably larger proportion of a poor man's income than in Melbourne. But he could not find any justification for making a difference in a rate ruling for four or five years, in what might be a temporary variation.

With reference to the remaining cases, the Judge stated that he did not consider there was any real dispute in the case of the small horse-car undertaking at Coburg.

Melbourne and Perth had settled their differences by definite agreements, as already stated in these articles.

The remaining cases, namely, North Melbourne, Northcote, Ballarat and Bendigo, Hobart, Prahran-Malvern and Fremantle, gave considerable trouble. There were several conferences between the parties, at some of which the Judge was present, and eventually agreements were made in each case, though too late for binding signatures to be obtained before the close of the year.

In the case of North Melbourne, the motormen and conductors were to receive 8s. 6d. per day first year, 9s. second, and 9s. 6d. subsequent years. It differed from Melbourne in that it did not provide for annual leave, or extra pay on Sundays or extra time on holidays.

At Northcote a flat rate of 9s. 2d. per day was agreed on for gripmen and conductors; the working day to consist of eight hours, with overtime at the rate of time and a quarter for the first hour, and time and a half afterwards. Ordinary rates for Sunday

work and no annual leave. For work on public holidays time and a quarter for first hour, and time and a half later.

The Hobart agreement follows Brisbane and Adelaide in granting 8s. 6d., 9s. and 9s. 6d. per day to motormen, and gives minor conductors 1s. per hour. Ten days annual leave on nine days pay, double rates for Sunday work, and overtime rates for public holidays.

At Ballarat and Bendigo the agreement was to take effect from December 1st, and continue till June 13th, 1916. The working hours were to be 101 per fortnight. The rates of pay to be—Motormen, 1s. 14d. per hour; conductors, over 21 years of age, 1s. per hour; under 21, 32s. 6d. per week for first six months, 36s. 10d. afterwards. At least 50 per cent. of the conductors were to be over 21 years of age. Casual motormen were to be guaranteed 15s. per week, or two-thirds of the statutory wage. Casual conductors to be guaranteed 12s. per week. Seven days' annual leave for six days' pay, and time and a quarter for Sunday work and public holidays. Time and a quarter for first hour's overtime, and time and a half afterwards.

At Fremantle and Prahran-Malvern there were differences, principally on small points; at Fremantle they were finally surmounted and the agreement was sealed, but at Prahran-Malvern the proposals were not accepted by the men. The Judge finally stated that he should make an award which would be suspended by a direct agreement between the parties if arrived at before January 1st. The general terms were comparable to those agreed on in the other cases.

The final proceedings in this long case consisted of the choice of the representatives of both companies and Union for the various Boards of Reference provided for in the awards and agreements. The Judge then stated that in the event of any of the agreements not being completed and filed by January 14th, awards based on the Melbourne Tramway Co.'s agreement would be made and come into operation. It remains to be seen whether this almost historic dispute which has demanded the close attention of the leaders and managers on both sides, withdrawing them from their proper work for so long a period, will result in peaceful and harmonious working between the two essential factors in tramway success, workers and employers.

**The Constitution of Matter.**—In the course of an address at a Science Exhibition which is being held at Surbiton, Sir J. Crichton-Browne referred to the recent researches of Sir Wm. Ramsay and others, and Sir J. J. Thomson, and pointed out that the view supported by the latter, that every atom consisted of an unchanging core combined with an outer shell which was subject to modifications, strongly reminded the biologist of the ultimate organic cell, which also possessed an inner core (the nucleus) and an outer shell. Similarly Sir J. J. Thomson had said that an atom was a part of an element which had a certain individuality, but was liable to modification by association with other atoms, a view which the lecturer compared with the unchangeable heredity of the living being, whose development, however, was capable of being modified by association with other living beings. He suggested that there might be great fundamental ideas such as these which were common to both the organic and the inorganic world, and which, studied in connection with design, would lift us above a shallow materialism and deepen in us a sense of reverence.

**L.C.C. and Electrical Workers' Hours and Wages.**—A Committee of the L.C.C. reported at Tuesday's meeting having given careful consideration to the representations of the Electrical Trades Union that the rates of wages and hours of labour paid by the Council to armature winders and magnet or coil winders should be increased from 9d. to 10½d. an hour, and from 7d. to 8½d. an hour, respectively. "The representations appeared more particularly to be directed to the rates paid at the central car repair depôt at Charlton, and the minimum asked for appeared to be based on the nature and quality of the work there performed. From inquiry made we are satisfied that the minimum rate at present recognised in London for armature winders is 9½d. an hour, and we recommend that this rate should be inserted in the Council's list. We have asked the Highways Committee to consider the representations of the Union that a rate higher than the minimum should be paid to the men employed at the central car repair depôt. We are not yet prepared to report as to the rate of wages of magnet and coil winders." It was recommended: "That the list of rates of wages and hours of labour be amended by increasing to 9½d. an hour the rate of wages of armature winders."

**Miners' Safety Lamp.**—On January 23rd, says the *Electrical World*, the American Museum of Safety, New York, awarded the Rathenau gold medal to Mr. T. A. Edison for his electric safety lamp. Two of his nickel-iron storage cells are used, in a nickelled steel case, which may be locked. The lamp is carried on the miner's cap, and is mounted in a fitting provided with a parabolic reflector and a thick glass lens, the miner cannot tamper with the lamp without breaking a mechanical seal. The connection between the lamp and the battery (which is attached to a waist-belt) is made by means of a twin-conductor flexible cord, provided with a plug terminal which, when pushed into a socket on the battery case, becomes locked and cannot be removed without unlocking the case. The battery weighs about 2 lb., and has an E.M.F. of 2½ volts, and a capacity of 1 ampere-hours. The tungsten lamp gives 2 C.F.

## WAGES AND HOLIDAYS IN CENTRAL STATIONS.

By JOSEPH S. AINSWORTH, A.M.I.E.E.

In recent years in many central stations a general feeling of dissatisfaction has existed over the very important question of wages paid. The success of recent strikes, and the frank admission of the Government that the cost of living has increased in greater proportion than the increase of wages, have tended to bring the various sections of a central station together, and led them to request for a consideration by the Electricity Committee of the altered conditions in the cost of living and the necessity of a general increase in payment of their employees.

Charge engineers have been grumbling over their ridiculous maximum of 35s. per week; switchboard attendants have been disheartened at their level 20s. per week; drivers and firemen have said that theirs was a non-living wage, and that for years they have had no Sunday off. In a few stations the different sections of the staff have discussed methods suggested by the Electricity Committee to improve conditions. In one or two stations the men have united and have affiliated with some powerful Trade Union. Some have, indeed, already obtained better treatment in both time and pay.

Leaving the other sections for a more convenient season, this article deals with that of charge engineers and switchboard attendants only, who, without having, like the men, recourse to applying pressure by votes, or the seductive persuasions of a threatened strike, which would throw the whole town into darkness, made use of personal and written applications for increases of salary and for the fixing of a sliding scale from a minimum to a maximum, with the view, which was quite legitimate, of knowing exactly what the prospects were in their station.

In a certain provincial central station, after several *individual* applications for an increase of salary had each been promptly acknowledged, but had not, however, proved successful, it was considered high time to take the next step and send in a *collective* application to the Electricity Committee, showing the much larger output of the generating station, its greatly increased capacity of plant, and the consequent larger number of duties. The result was as unexpected as it was curious. One of the applicants received an increase of 5s. per week, while a new arrival, who, by the way, was more experienced than a few of his predecessors, was taken on to fill a vacant position with 5s. per week less!

Another method of procedure had to be adopted. It was argued that if it could be proved that in other central stations of similar capacity and output better conditions prevailed, then a clear case would have been made out for better treatment. The chief was interviewed, and in a few days reported that the Committee would like to be shown that a better state of matters existed elsewhere.

Accordingly, a covering letter was sent to some 58 electricity works; answers to the following questions were asked for, and a definite reason was given:—

(a) *Charge Engineers*: (1) Number employed; (2) Minimum salary; (3) Maximum salary; (4) Average hours per week; (5) Sunday arrangements; (6) Holiday arrangements; and (7) Emergency arrangements.

(b) *Switchboard attendants*: The same seven questions.

About 47 replies arrived in time to be of use. In every case a stamped addressed envelope had been enclosed. In many of the replies a request was made for a copy of the tabulated results. As there is no central station but takes in at least two or three copies of the *ELECTRICAL REVIEW*, it is certain that this contribution will furnish more than interesting reading. It is a pity those stations that asked for a copy of the tables accompanying this short article forgot to enclose a stamped addressed envelope, as had been done when they had been written to. However, we now thank them all for the valuable information placed at our disposal for the betterment of central-station charge engineers and switchboard attendants.

It is to be regretted that several of the questions drew blanks, as can be seen by the many question-marks in the

tables. No answer at all is the only reply to be expected when no maximum salary has been fixed. How about Sundays or emergency arrangements? In most stations week-ends and holidays are arranged amongst the engineers. It would have been interesting to know if it was one Sunday off in three, or in two, or two in three, while a reply of 14 days may mean just 14 shifts.

A couple of stations pay overtime to their engineers on Bank Holidays and on Sundays.

With reference to "emergency arrangements" for charge engineers, information was required to determine *who* took shift when a charge engineer, on very short notice, wanted to have a shift or more off, as occasionally happened through some accident, or when a wedding or funeral had to be attended. Who took shift during, say, the six weeks that the three charge engineers were away on their 14 days' spell each? From both tables it is clear that this brief question was not at all understood, for out of the 47 central stations, only 22 have replied. In 14 out of the 22 stations the charge engineer is relieved by a switchboard attendant, improver, relief engineer, junior charge engineer, or apprentice. In only two cases does a general engineering assistant do relief work. In four stations the chief assistant or station superintendent acts as relief charge engineer. In one station "longer hours" are worked in cases of emergency; but how about during the precious seven days' holidays? One station sagely replies, a "sub" is found!

Eliminating the last two stations owing to their unsatisfactory answers, and omitting the two stations where a general engineering assistant takes charge, we have in 14 out of the 18 stations a junior acting for a senior during an emergency, or while the holidays are on. In only four cases does a chief assistant or station superintendent act in a subordinate capacity—quite possible for a couple of hours, but absolutely unworkable during the fortnight off of each engineer.

A chief assistant's time is more valuable to the well-being of the plant than a charge engineer's, and hence continued relief duty should be undertaken by a junior, *provided* all these are men capable of performing duties more responsible than those of the positions they occupy, a standard which is gradually being arrived at, though occasionally even now an alderman or a councillor, divesting himself of self-respect and manliness, hinders progress by worming in some inexperienced individual.

While the covering letter clearly implied that the procedure in ascertaining the information had had the previous approval of the Electricity Committee and the chief engineer, besides being signed by a responsible engineer, it appeared somewhat in the nature of a waste of time to reply and explain in the case where a chief wrote that the information could only be furnished to another chief. Fortunately for the profession, we had only two such communications.

Where some central stations go in for a low-salaried chief engineer, the strategical method of inaugurating a scale for his charge engineers, with a maximum and a minimum to accord with other stations of similar capacity and output, might, by *pay pressure* from below, produce a goodly scale for the chief himself, gifted with foresight.

But duties are by no means similar in central stations of similar capacity and output. The number of sets in use may be vastly different. One station may generate for lighting and power only, while another may have a combined lighting, power, and tramway traction load controlled from two distinct switchboards.

However much the difference in the amount of responsibility, it is clearly evident that some stations have badly paid staffs. If such stations can make use of these tables, and, encouraged by the success already achieved by one central station, send a covering letter to their chief and the Electricity Committee, a change for the better is bound to take place.

This procedure has been carried out with success by one of the 47 stations. "You have proved your case," said the chief to one of the representatives. A scale has been fixed, and a former level 35s. has become 50s. for charge engineers, while a previous 20s. has been converted into 27s. 6d. for switchboard attendants.

It should, however, be expected that a badly-paid staff on "proving their case," will not obtain a scale to accord with

the best paying station of similar size and output, but will obtain a scale to accord with the averages of the better

payer and the cheap station. Half a loaf is better than none!

TABLE I.

No.	Station.		Charge engineers.					Switchboard attendants.					Holidays.	Emergency arrangements.	
	Units sold.	Plant capacity.	No.	Pay.		Hours.	Sundays.	No.	Pay.		Hours.	Sundays.			
				Min.	Max.				Min.	Max.					
1	These stations have sold from one to two million units each for the last official year.	The capacity of over two-thirds of these stations ranges from 1,000 KW. to 2,000 KW.	3	30/	35/	53½	1 in 6	2	20/	25/	52	1 in 4	11 days	S.A. taken shift	
2			3	45/	55/	56	1 in 3	3	21/	22/	48	off	11 days		
3			2	55/	?	53	2 in 3	2	32/6	40/	53	2 in 3	14 days		
4			2	30/	45/	56	2 in 3	2	20/	30/	56				
5			2	40/	50/	56	1 in 3	1	25/	32/6	56	1 in 3	14 days	S.A. taken shift	
6			3	30/	50/	56	1 in 3	3	8/	15/	56	1 in 3	?	Apprentice takes shift	
7			2	40/	55/	52	1 in 2	2	12/6	25/	52	1 in 2	14 days		
8			4	30/	50/	52	1 in 3	2	15/	20/	48		14 days		
9			4	35/	42/	53½	1 in 3	3	10/	15/	53½	1 in 3	14 days	Junior C.E.	
10			3	27/6	50/	48	?	?	?	?	?	?	14 days		
11			3	£120	£160	52	?	?	?	?	?	?	?	14 days	
12			2	37/6	45/	58	?	7	20/	25/	56		14 days	Chief assistant	
13			1	65/	?	48	?	3	3/	10/	56				
14			5	30/	50/	53½	1 in 3	3	10/	?	53½	1 in 3	14 days		
15			2	35/	45/	61	?	2	10/	14/	?		14 days	Relief engineer	
16			3	30/	35/	56	1 in 3	2	15/	20/	56	1 in 2	10 days		
17			4	30/	54/	52	long wk.-end	2	15/	20/	48	2 hrs. on	14 days		
18			4	25/	37/6	51	1 in 2	2	15/	20/	51	1 in 2	14 days		
19			2	35/	45/	56	?	3	27/	30/	56		14 days	Spare man	
20			3	27/6	36/	96	1 in 3	2	15/	20/	56	off	7 days		
21			3	40/	50/	56	1 in 3	1	25/	?	?		14 days	General eng. assistant	
22			3	37/	45/	56	1 in 3	4	5/	15/	50	2 in 3	14 days		
23			1	40/	50/	48	on 1 hours	4	22/6	40/	53½	1 in 3	14 days	Improver	
24			3	£80	£120	56	?	3	10/	15/	56		14 days	Senior improver	
25			3	35/	40/	56	1 in 3	?	?	?	?		7 days		
26			—	—	—	—	—	5	21/	30/	56	2 in 3	14 days		
27			—	—	—	—	—	3	30/	32/	56	1 in 3	14 days	General assistant	
28			3	£104	£130	56	1 in 6	3	28/	35/	55	1 in 6	14 shifts		

TABLE II.

No.	Station.		Charge engineers.					Switchboard attendants.					Holidays.	Emergency arrangements.	
	Units sold.	Plant capacity.	No.	Pay.		Hours.	Sundays.	No.	Pay.		Hours.	Sundays.			
				Min.	Max.				Min.	Max.					
1	Quite 15 of these stations have sold between two millions and five millions during the last official year.	The capacity of two-thirds of these stations ranges between 2,000 KW. and 4,000 KW.	4	£120	£150	48	1 in 4	4	30/	42/	48	1 in 4	?	Asst. shift engineer	
2			—	—	—	—	—	—	3	21/	40/	sen. 56 jun. 60		14 days	
3			3	40/	55/	55	1 in 3	7	10/	30/	56	1 in 3	14 days		
4			5	35/	42/6	56	time & half	7	5/	25/	56	time & half	7 days	Longer hours	
5			3	40/	50/	53½	?	3	20/	25/	53½				
6			3	40/	60/	56	?	2	20/	30/	52	1 in 2	14 days	Senior S.A.	
7			3	35/	?	56	?	4	22/6	?	56		14 days		
8			3	35/	55/	50	1 in 3	2	25/	30/	50	1 in 2	14 days		
9			3	40/	60/	56	1 in 3	3	30/	35/	56	1 in 3	?	S.A. takes shift	
10			3	35/	40/	53½	1 in 3	3	26/	30/	53½	1 in 3	14 days	Stn. supt. takes shift	
11			3	45/	?	56	1 in 3	2	23/	?	52	1 in 2	14 days	Sub. found	
12			3	40/	?	56	1 in 3	2	25/	35/	56	1 in 3	14 days		
13			3	35/	45/	56	1 in 3	3	20/	?	56	1 in 3	14 days	Stn. supt. takes shift	
14			2	30/	35/	49	1 in 2	3	25/	27/6	56	1 in 3	7 days	Chief asst. takes shift	
15			3	45/	50/	48	?	1	35/	?	48		14 days		
16			4	40/	60/	48	?	1	48/	?	48		14 days	Relief shift engineer	
17			4	40/	60/	52½	1 in 3	7	15/	27/6	54	1 in 3	16 days		
18			3+2	35/	37/6	53½	1 in 3	3+3	8/	12/	50	1 in 2	14 days	Junior charge	
19			4	£130	£200	52	1 in 2	3	25/	27/6	54	1 in 3	21 days	Junior charge	

RESULTS.

Number of central stations in Table	Charge engineers.			Hours.			Salary.					Sundays.		Holidays.				
	Less.	3	More.	Less.	56	More.	Less.	35/	More.	Less.	50/	More.	Less.	1 in 3.	More.	Less.	14 days	More.
II	9	12	5	12	12	2	11	5	10	12	9	3	2	12	4	3	21	None
	1	11	6	11	7	None	1	6	11	5	2	8	1	9	2	2	12	2
	Switchboard attendants.			Hours.			Salary.					Sundays.		Holidays.				
	Less.	3	More.	Less.	56	More.	Less.	25/	More.	Less.	30/	More.	Less.	1 in 3	More.	Less.	14 days	More.
II	12	9	4	11	12	None	18	2	5	14	3	6	2	6	8	3	21	None
	6	7	6	10	8	1	9	4	6	5	4	5	1	8	4	2	12	2

PROCEEDINGS OF INSTITUTIONS.

Cables for Shafts in Mines.

IN opening the London meeting of the ASSOCIATION OF MINING ELECTRICAL ENGINEERS, held at the I.E.E. Building, Victoria Embankment, on February 7th, the chairman (Mr. W. C. MOUNTAIN) said that the Association had now 1,000 members, 11 home branches and one branch in Australia. Ten members were resident in Dover, which was destined to become a most important colliery centre. The London membership had doubled during the past year, and a number of consulting engineers in various parts of the country had joined the Association. The examination system adopted had proved a success; there were already 120 certificated members, and the next examination was to be held in March at the Northampton Institute. Mr. E. Kilburn Scott then read a paper on "Cables for Shafts in Mines."

Broadly speaking, the author recommends that high-tension aluminium cables should be used in mine shafts: that armouring should be dispensed with on shaft cables, a return path for current being provided by metal work already in the shaft or by steel ropes specially suspended to serve this purpose: that siliceous tire rubber be employed in place of steel to provide mechanical protection on cables exposed to moisture and hard wear; and that split telegraph poles be used in place of the sawn casing hitherto used when cables have been enclosed. Shaft cables cannot be handled by men or touched by animals in the ordinary way of working, and there is little danger of their mechanical injury, hence there is correspondingly little need for armouring as a mechanical protection. There is already, or there can cheaply be provided, sufficient continuous metal work in the shaft to act as a return path for current, hence armouring is unnecessary from this standpoint. A haulage rope, originally costing £50, may be worth only £5 when unfit for haulage, yet it will form as perfect an earth return, when suspended in the shaft, as a cable armouring costing several times as much as the original rope. In the shaft of the Frickley Colliery Co. (Doncaster), there is available about 30 sq. in. of continuous steel and iron, which could be used for return current purposes, and which has a conductance equal to that of 3 sq. in. of copper. The sectional area of the steel armouring actually used for return current, which cost about £160, is 2 sq. in., i.e., about one-tenth the section of the wire ropes already in the shaft.

The revised rules require the armouring on mine cables to have a conductance 50 per cent. that of the conductors enclosed; in addition, the armouring must conform to the Engineering Standards Regulations. In H.T. cables there is no difficulty in complying with both sets of rules, but in L.T. cables the 50 per cent. rule calls for heavier armouring than the Engineering Standards Regulation. It is very desirable that there should be no joints in shaft cables, and other things being equal, it is easier to supply cables of great lengths without than with armouring.

Sector cores do not greatly reduce the over-all size of cables designed to operate above 3,000 volts. At 6,000 volts and higher pressures, sector core cables are more costly than, and are nearly as large as, circular core cables. The weight of the conductors is of great importance to shaft cables, and, in this respect, as also by its immunity from attack by bad water, aluminium offers considerable advantages over copper. For equal conductance, the ratio of weights of aluminium and copper cables is approximately as 1 : 2. Comparing three-core, medium voltage, paper-lead-steel-jute cables, those with aluminium cores are about 17 per cent. heavier than those with copper conductors, but the price of the aluminium cables is 5 per cent. less with round and 8 per cent. less with sector cores. From the point of view of supporting its own weight, aluminium is practically equivalent to steel; the maximum lengths of strand which can be suspended vertically are as follows:—

	Hard drawn.	Annealed.
Copper ... ..	15,500 ft.	5,950 ft.
Aluminium ... ..	25,000 "	13,600 "
Steel ... ..	20,700 "	14,750 "

Aluminium wires of No. 12 s.w.g. have been drawn in continuous lengths up to two miles for years past, and there is a ready market for scrap aluminium, though its relative value, as compared with new metal, is less than in the case of copper.

Aluminium is much more difficult to join than copper, but shaft cables are really main feeders, and are only tapped at the ends. Stranded aluminium cables are best jointed by the use of split sleeves, stepped so as to accommodate and clamp the several layers of each cable at the joint, the layers being cut back so as to permit of this.

The author believes that 11,000-volt shaft cables will soon be in general use, one important point in favour of such practice being the consequent reduction in the starting current to be applied to induction motors. In reviewing the characteristics of various cable insulating materials, the author remarks that the elastic pitch compound used in bitumen cables softens at about 120° F.,

hence this insulation is not suitable for use on cables in upcast shafts. Rubber is at present largely displaced by paper and bitumen for power cables, but, as the supply and quality of plantation rubber improves, and possibly owing to the development of the synthetic production of rubber, the use of this material for heavy cable insulation will become more general. Silicious, or "cab-tire," rubber, has proved very successful as a mechanical sheathing for cables. Rubber insulation must necessarily be used in shaft sinking cables, and it appears reasonable to use a somewhat similar material for the protective coating. Bitumen sheathing is preferable to lead on paper-insulated shaft cables, owing to its lighter weight and the liability of stretching lead sheathing when suspending the cable in the shaft. "Indestructible" insulation consists of layers of paper with a cotton or jute braiding, the whole being impregnated with red lead and linseed oil; cables thus insulated resist chemical action and abnormal climatic conditions.

Coir yarn, made from the fibres of the coconut, is a likely substitute for jute. It is practically incompressible, very tough and less absorbent than jute, besides being cheaper. At present, coir plaiting is done by hand, and is uneven, but this objection could be overcome.

The methods at present employed to place shaft cables in position, are:—(1) Lower the cable from its drum by a winch at the shaft bank; (2) Suspend the drum in or under the cage, and pay out cable as the cage descends; (3) Lower the drum to the bottom of the shaft, fasten the cable end to the cage, and haul up; and (4) Run out the cable on the surface, attach one end to a locomotive, and lower the cable by moving the locomotive towards the shaft. The applicability of each method, and the precautions to be observed in its application, are considered in some detail in the original paper.

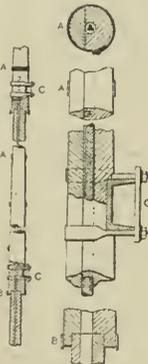
Better than the cone type of single suspension for armoured cables, is a suspension in which the armour wires are bent back at right angles on to the flange of the suspension sleeve, and clamped by a top plate and end-bolts. The elongation of the armouring determines the limiting weight that can be held by single suspension, long before the limiting breaking safety factor is reached. Clipping the cable to two steel ropes provides a suspension which is flexible, and offers less lodgment for dust and slime than cleats, but which introduces trouble in hot shafts by the high coefficient of expansion of the steel ropes as compared with the cable. An armoured cable fixed by cleats practically constitutes a solid bar down the shaft, and if the cleats be suspended from the tubing by chains, the risk of injury by the impact of objects falling down the shaft is much reduced.

The objections usually urged against casing for shaft cables, are: (1) The risk of damaging the cable when fixing capping, or by malleting where the troughing is out of alignment; (2) the difficulty of keeping out water at the lidding joints and between lengths; and (3) the cost of sawn timber, bolts and erection.

The author suggests that split telegraph poles be used for casing, as shown in the accompanying figure. The pole is sawn longitudinally in unequal parts, and the larger one is grooved. When the cable is in place the two parts of the pole are secured by steel "bracelets" A clipped over and driven down towards the butt of each length. The poles would be erected with the butts downwards, and the small end of each would be let into the butt of the length above it (B). By cutting "gains" in the poles, each could be simply and securely attached to the buntons by steel straps, as at C. Unarmoured aluminium cables could then be used with advantage, and excellent mechanical protection would be afforded by the casing.

In dealing with preservatives for timber, the author spoke at length of the Powell process; this will be specifically treated in these columns at an early date. In conclusion, the author considered the special requirements of sinking cables, and pointed out that tire rubber sheathing offers advantages over steel armouring, in respect of flexibility and imperviousness to water. The V.D.E. have issued special regulations for sinking cables, and these rules are reproduced in the original paper.

In opening the discussion, Mr. NELSON (Electrical Inspector of Mines) complimented the author on the exhaustive and practical nature of his paper, and endorsed the chairman's remarks as to the value of the Association and the discussions on its papers. The amount of electrical power used in mines had increased at least 100 per cent. since 1906, yet the latest reports showed the fatal accidents in mines to be fewer than in any year since 1906. This gratifying result was largely attributable to the direct and indirect influence of the Association. Mr. Nelson agreed that it was less necessary to armour shaft cables than cables in-by, but, in his opinion, the ideal system would continuously armour all current-carrying parts, from the generator to the motors, with a sheathing strong enough to resist all destructive agencies which could be foreseen. The difficulty of repairing shaft cables was greater than that of repairing cables in-by, and this probably accounted for the early practice of armouring shaft cables but not the in-by cables. Too much importance was attached by the author to the strength of aluminium as regards supporting its own weight. Taking into account the lower tensile strength and conductivity of aluminium as compared with copper, the lighter metal did not appear to offer great advantages for shaft cables. The difficulty of making joints in aluminium conductors and the larger overall size of the latter for equal conductance were practical objections which became particularly serious in in-by cables. There was no merit attached to the use of very large shaft cables; personally, he would always prefer two small cables to one equivalent larger cable. The larger the cable the stronger the armouring required, and this was secured by the revised rules, which required the conductance of the



armouring to be 50 per cent. that of the conductors enclosed, and which, in large L.T. cables, therefore required heavier armouring than was called for by the Engineering Standards Committee's Regulations. The revised rules were designed to indicate minimum precautions and factors of safety; in some cases it would be desirable to design more liberally than was required by the rules. The case in New South Wales, where armoured cables were destroyed by bad water in less than six months, afforded no argument against the use of armouring. It was presumably possible to protect the conductors from the water, and hence it would have been equally easy to protect the armouring. The German (V.D.E.), regulations quoted by the author called for armouring on shaft sinking cables, and with this rule Mr. Nelson was in complete agreement.

Mr. LUPTON commented on the remarkable extension of the use of electricity in mines since 1881, when its applications were limited to signalling and shot firing. Electrical transmission had proved its advantages over compressed-air transmission in respect of economy and convenience, particularly in deep mines. The speaker was responsible for the sinking of two shafts in Yorkshire over 800 yd. in depth, and in such cases the question of the weight of the shaft cables was undoubtedly of great importance. In dry shafts there were possibilities in the use of bare lines. Most accidents in mines were due to conditions not foreseen; every mishap provided fresh experience and usually led to the evolution of means for preventing its repetition or reducing the seriousness of the consequences. The speaker pointed out that the "earthing" of mine circuits now consisted rather in the provision of a bare metallic return path at earth potential to the generator than in real earthing such as was practised in earlier days.

Other speakers offered the following information and opinions: The armoured & unarmoured controversy was analogous to most others in that the supporters of both sides of the question were, to some extent, correct. Generally, armouring was advisable in mining work, but there were cases in which it possessed practical disadvantages. The limiting temperature (120° F.), suggested by the author for bitumen cables was a very conservative limit, but one which it was advisable to retain in designing colliery equipment since overloading was frequent. There was already a 1'00 sq. in. bitumen-insulated aluminium cable in use in a Durham shaft and bare aluminium lines laid in wood were being used for L.T. distribution in Cornish tin mines. The oxide film on aluminium formed readily in heat and moisture, so that the insulation of a L.T. aluminium line might increase under conditions that would destroy the insulation of a copper feeder. It was not easy to joint aluminium cables; a number of solders had been produced which would unite small wires and strips satisfactorily, but which were useless for jointing large stranded cables. In Messrs. Callender's installation in Brussels—not Ostend, as stated by the author—the cast joint described had proved the best type available. Stepped sleeve joints increased the size of connecting boxes, &c., 100 or 200 per cent., and the clamping screws were generally too small to ensure thorough contact between the conductor and the sleeve. The reduction in the current-carrying capacity of the cable by covering it with a thick layer of wood must be considered before deciding to adopt telegraph poles in place of sawn casing.

The advantages of the Powell system of wood preservation were discussed, and it was pointed out that its rapid adoption in tropical countries was due to its offering a perfect solution to the white ant difficulty, in addition to affording thorough protection to timber in other respects and considerably increasing its mechanical strength.

A visitor pleaded for the standardisation of whatever should be decided to be the best shaft-cable construction; the cost of manufacturing cable accessories and switch-boxes, &c., would be thereby reduced. Since enclosed switchgear had become standard for mining use, the manufacturing costs had fallen almost as low as those of the early open switchgear, owing to the greatly increased production of each particular type.

It was decided that the paper should be read and discussed before other branches of the Association.

### Advertising Electricity.

By H. CLIFFORD PALMER.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester, February 11th, 1913.)

THE population of the British Isles is 42 millions, out of which the approximate total number of consumers of electricity is very little more than half a million; whilst the number of users of such articles as electric heaters, cookers, irons, kettles, sweepers, and other potential popular domestic appliances, is but a few thousands. A comparison of these figures will give much food for thought.

In the matter of public education as to the benefits of electricity, we have left undone much that we might have done. The subject of how electricity can and should be advertised is one that interests all alike—manufacturers, station engineers, and contractors. The subject of selling electricity merits the same care, thought, and action as that of plant and apparatus manufacture. Unfortunately, we have been too apt to overlook this important fact in the past.

A few years ago if we got electricity in the home for lighting we felt highly satisfied, and were content to leave it at that; now, lighting is only the beginning, and should in reality merely act as the missionary for electricity. Heaters, toasters, irons, kettles, breakfast-grills, sweepers, and many other current-consuming devices, should follow. But it cannot be expected that the public will adopt such apparatus unless they are educated as to its existence, its use, its advantages, and even its economies.

The natural tendency nowadays is to economise time to avoid inconveniences to study hygiene, and to save unnecessary labour, therefore we should play upon the sensibilities of mankind and womankind in these directions. Within limits electricity has extensively advertised itself. From its inception, its distinctiveness, its obvious advantages, and its many other qualities always ensured for it progress, but progress without "push" must be very tedious. Gas, although fighting a losing battle, is fighting it valiantly, and unless met in the field with equally modern weapons might easily stay our progress longer than any of us would desire. The gas interests have realised the value of co-operative effort, and have organised extensive advertising action accordingly. How much more successful might we be with similar measures?

What we need to popularise the domestic uses of electricity amongst all classes (and upon this depends, to a large extent, our future rate of progress) is a combination of effort in which all interested—i.e., manufacturers, supply authorities and contractors—should join. An educative campaign is necessary.

The public can be educated on extensive lines only by systematic, judicious, and practical advertising. That advertising is work for specialists there can be no doubt. Because a man may have had a commercial training, he is not thereby qualified to conceive and carry out comprehensive and profitable advertising. Practical experience, study and ability are required.

The manufacturing section of the industry has done, and is doing, much in this matter of "Advertising Electricity," but the advertising of the manufacturer is directed to those who are already users of electricity; he is merely driving home his individual claims against those of his competitors. Our concern as an industry is not with those who have been converted, but with those whom we desire to convert.

The supply undertakings are already represented in London by what is known as the Electricity Supply Publicity Committee; the manufacturers are represented by the Publicity Section of the British Electrical and Allied Manufacturers' Association; whilst the contractors are represented by the Electrical Contractors' Association. A joint Electrical Publicity Association should be chosen to be composed of selected members from each of the before-mentioned Associations. The duty of this main Association would be to direct the operations (upon expert advice), and control the general policy, of a national educative electrical advertising campaign. Sub-committees could be formed by each Association for the purpose of obtaining the necessary funds.

No measure of success will be achieved unless the response is general. We are now a large industry, and if all contribute, the subscription need be only quite nominal. It cannot be expected that a few enterprising manufacturers and supply authorities would find the necessary funds for such a national scheme which would benefit all sections of the industry alike.

As to the money required to enable a comprehensive scheme to be organised to cover the entire country, I should like to see a sum of not less than £30,000 raised for a 12 months' campaign.

In order to demonstrate what class of advertising scheme could be carried on in a specified area for a given sum and for a given period, I propose to give a few facts depicting an imaginary campaign for London and the area within 50 miles thereof.

For the purpose of an "opening" campaign in the interests of electricity I would advocate the widest and most powerful methods of publicity. I am calculating on a total expenditure of £12,000, which amount would be necessary to enable a 12 months' comprehensive advertising effort in the area mentioned. I should therefore divide the operations as follows:—

- (a) Daily Press advertisements (five-twelfths total expenditure).
- (b) Literature and circularising (this to a considerable extent would be self-supporting) (one-twelfth total expenditure).
- (c) Central information bureau (one-twelfth total expenditure).
- (d) Billposting (two-twelfths total expenditure).
- (e) Expenses of management and staff (one-twelfth total expenditure).
- (f) Illuminated animated signs for night advertising (two-twelfths total expenditure).

Editorial notices in the daily and weekly Press would be covered by the Press advertising.

Of available styles of media for a campaign of this nature, I would recommend the principal daily (morning and evening) papers, as they give more desirable publicity for a stated amount than any other. The Press campaign should be divided into two periods of three months each. The first period, say, the middle of March to the middle of June, should be devoted to cooking, ventilating, and other domestic applications, with power intermixed. The second period, from the middle of September to the middle of December, should be devoted to lighting and heating, also with power intermixed. I would recommend that the insertions should appear not less than one per week in each paper, the size of the advertisement varying from time to time according to the total sum allocated to the paper in question. For the opening of the campaign and for any special occasion (such as the opening of the London Electrical Information Bureau referred to later), full pages should be taken in papers enjoying the greatest and most influential circulation.

Editorial notices come as a sub-heading to Press advertising, since to some extent the one carries the other. By this I do not desire to indicate that the money spent on advertising would positively buy for us the editorial columns of London's leading daily papers without further question; but no matter what may be said to the contrary, it would be bound to obtain for us greater recognition by the Press than we enjoy to-day. After all, it is only reasonable that the papers should expect some *quid pro quo*. Never at any time throughout our scheme (if we succeed in organising it) need we ask the papers for "puff"; but we shall need constantly to

advise them of current items of interest which may affect our industry. Every week we could undoubtedly circulate to the editorial departments of various papers little paragraphs which they would welcome, and which would interest us all indirectly.

If such a scheme as I am now suggesting does mature, I can foresee the day when the London and provincial papers will be willing enough to insert pages of popular Electrical Notes in similar manner to the pages which now exist in most of our premier papers on Motor Notes, Fashion Notes, Empire News, Cycling Notes, &c. It is merely a question of proper recognition and support. Surely the diversity of domestic interests in electricity are sufficient to warrant such action by the Press. We do not want the daily and weekly papers to labour with the technicalities of our industry, as for this purpose we have our own excellently-conducted trade organs; but we do want the general Press to dilate upon the subject of electricity from a domestic and popular point of view; and this they will be ready enough to do if we recognise them as we desire they should recognise us.

I illustrate a few examples of Press advertising, in order to portray a style which might be adopted in connection with a scheme such as I advocate.

Full pages in London's daily papers are somewhat costly, so that their number in such a scheme would require to be limited. Following, therefore, upon first announcements, the size of space would be reduced to possibly a full double-column announcement, such as "Just switch on." Then, perhaps, a half-page, such as "Cleanliness, comfort, safety," following with a variety of other sizes, such as half double-column, quarter double-column, &c.

A considerable number of inquiries would be received by the Publicity Association from its members for the supply of suitable literature descriptive of the various applications of electricity. Provision would, therefore, have to be made for the origination and supply of this. Circularising can be termed "intensive" advertising. If properly carried out, it can, no doubt, be made very

There would be little gained in using this Bureau as a demonstrating showroom, as this work would be too restricted at one address and could be better administered from local showrooms in all districts.

One of the most valuable functions of the Central Bureau would be the arrangement of cooking demonstrations, and lectures in connection therewith. This is a form of publicity which should bring electrical apparatus most closely to the notice of the public.

Opinions are divided as to whether the contractor or the supply undertaking, or both, should run local showrooms, with the result that in many cases instead of the two interests running in harness they run in opposition. In the interests of the general cause this might be properly organised on co-operative lines. Where the contractors have already been sufficiently enterprising and have established good showrooms, station engineers should officially recognise them as sources of electrical information and should recommend the local public to make use of them as if they were actually established by the undertaking itself. In other directions the showrooms already established by the supply undertaking would be the more desirable.

What is required in connection with a national scheme is undoubtedly the establishment of, at any rate, one first-class showroom in every centre, where all the most modern appliances can be viewed and capably demonstrated, where every possible information as to cost, comparative rates, advantages of electricity over coal or gas, manufacturers' list prices, addresses of local contractors, new developments, &c., will be properly registered and always kept available for the benefit of the public.

All such showrooms—whether already established or yet to be arranged for—should be more or less uniform as far as style and lay-out are concerned. Also, they should be properly equipped with all possible information needed by the public, and each should be under the control of a man who is accustomed to deal with the public. Only such a body as that suggested could possibly under-



SUGGESTED EXAMPLES OF PRESS ADVERTISING

effective, but it is, of course, limited in its sphere of operations, and for this reason should be handled independently by the various supply undertakings, manufacturers and contractors.

All subscribers to the Publicity Association desiring to do so should be entitled to purchase the Association literature at special rates, which undoubtedly would enable them to effect considerable savings on their present expenses in this direction, whilst at the same time obtaining the right material.

The supply authorities in all parts of the country should not diminish their individual publicity operations on account of the fact that a broader scheme might be in operation; the one is merely intended to support the other.

To meet the requests for ready-made literature I suggest a series of, say, six booklets. These should be made as attractive as possible, yet should differ widely in appearance from one another. It must be remembered that repetition begets familiarity; and familiarity breeds contempt. The points to be emphasised throughout are the convenience, cleanliness, hygienic qualities, reduction of fire risks, simplicity, and economy of electricity for all purposes.

I would advocate an extension at a later date by issuing separate booklets appealing to distinct industries.

Wherever "intensive" advertising is concerned, avoid generalities so far as possible. Know as much as is possible of the local conditions under which electricity would be used, and convince the reader that his particular requirements have been carefully studied.

I believe there will be general agreement as to the desirability of having a London address for the Publicity Association, no matter what class of scheme is decided upon. Even with the national scheme London would undoubtedly from all points of view be most desirable for the headquarters. From there all the "extensive" advertising of the scheme would be conducted. Moreover, such headquarters would act in an advisory capacity as far as publicity is concerned for the benefit of all members of the Association.

take this work, and then probably only in connection with a scheme for national advertising. Sales should not be effected at these authorised showrooms.

For outlying districts where local showrooms would not be justified, it might be possible to organise a small travelling exhibition, to move from district to district, staying for four to six days in each. Practical demonstrations should be given by a capable lecturer, with lectures on the subject of heating and cooking by electricity.

Bill posting, again, is "extensive" advertising—in fact, the most extensive of all. Press advertising and bill posting work in entirely different directions, and yet posters and Press work to a very considerable degree. If I were asked to describe the difference between advertising by poster and advertising in the Press, I should class the former as a "shop window" and the latter as a salesman therein. We cannot expect actually to sell by poster, but we can obtain magnificent publicity, which can be followed up in the most desirable and effective manner possible by augmentative copy in the daily papers.

In bill posting, bold methods should be adopted, first in the size of the bill, secondly in the selection of colour scheme, thirdly in the design, and fourthly in the point made. As a general rule, the less said on a poster the more effective the bill is likely to be. No attempt should be made to make more than one point.

In the scheme which I have discussed I would make provision for a permanent display over two periods of three months each, of about 1,100 16-sheet d.c. bills on selected bill-posting stations in the most prominent thoroughfares in London and Greater London. For the spring and summer campaign I suggest two bills, one advertising electric cooking and the other advertising ventilation by electricity. In fair weather it is generally safe to reckon that two bills must be allowed for each position for a three months' display, so that, if the cooking bill went up first, when [a renewal was necessary the

ventilating bill could be put in its place, or *vice versa*. In winter time, an average of 2½ bills per position should be allowed, as renewals are naturally more frequent, on account of rougher weather. In the autumn campaign, I recommend the adoption of similar measures, showing first an advertisement of electric lighting and replacing it with electric heating.

The size of bill which I suggest measures 10 ft. x 6 ft. 8 in. upright. Bill posting requires thoroughly careful handling, otherwise leakages are bound to occur.

By the employment of illuminated animated signs, it would be possible to make one of the most powerful appeals to the public. Again "extensive" advertising, this follows on the same course as bill posting. It never fails to attract, as it stands out in strong contrast with the darkened surroundings, and we, as an industry, have every facility for the production of novelty in this direction. Positions should be chosen with every care, and our appeal made in the most animated form possible. After a suitable "run" in the metropolis, the signs could be re-erected in prominent provincial centres, and so go on perpetually doing good.

Rents for good positions are usually heavy, and this fact, combined with the excellent publicity value obtainable, would prompt me to allocate two-twelfths of my proposed expenditure for this particular purpose.

The proposed Publicity Association should do the "extensive" work only; its establishment need in no way interfere with the individual efforts of supply authorities, manufacturers or contractors, each of whom would continue to advertise "intensively" as hitherto.

Individual efforts, whilst highly desirable, are not sufficient; results of infinite value might be obtained by co-operation. Local efforts might interest a town, but a general campaign would set the nation thinking.

It is a policy which has been openly advocated for some time past by several of the electrical trade journals.

#### DISCUSSION.

MR. W. E. WARRELOW said that this important subject had already been hammered at during a recent discussion in London on the wider uses of electricity. The Press men had also been hammering at the same thing in their columns, and endeavouring to bring about the crystallisation of the various interests concerned. The gas people had already got ahead on this matter, the B.C.G.A. having pursued a line of action for some time similar to that suggested by the author. The B.C.G.A. levied a toll on its members based upon the output of each undertaking, and was supported by the municipalities and gas companies throughout the country. The Electricity Supply Publicity Committee was supported by the London companies by contribution, but he did not know of any Municipal Supply Committee which subscribed direct to that body, though the municipalities purchased pamphlets and booklets from the Committee. The fact that the I.E.E. had formed a Publicity Section, showed that the manufacturers were getting together on a most important question. The author had suggested that the London and Provincial papers would write up electrical notes on the same lines as cycling and fashion notes; he did not think this procedure would appeal to the public. In the case of money spent by the Gas Association, there was nothing to show that they had been able to influence the Press to put in articles and notices as to the delights of gas. Many firms who had been purchasing space for many years, had used this space for communicative articles set up in almost the same type as the text of the paper. The B.C.G.A. did not advertise electricity in any way by depreciating it, and in advertising electricity the advertisements should be free from reference to gas matters. Station engineers did not care for stereotyped material. They preferred to add local colour to the publications, and in view of additional business, to give the order for printing to a local firm. The central information bureau should act almost entirely in an advisory capacity.

MR. A. G. SEAMAN said it was only by making people realise that something greatly to their advantage was offered that they could push the industry along, and the time was now ripe for so doing. The domestic applications of electricity were rapidly coming within the reach of an ever-increasing circle of people, and these facts ought to be brought prominently to the public notice. The expenditure necessary for carrying out such a scheme of publicity would have to be borne by all concerned in the industry, and a combined effort would be essential in order to carry out a comprehensive and thorough campaign.

MR. F. C. RAPHAEL said it was obvious that to advertise electricity more fully would benefit everyone concerned, and it was only a matter of ways and means. Had the author really thought out, not the desirability of such an association, but whether the proposition was within the bounds of practical politics? What would he offer to members who joined the Association? The whole industry would benefit equally, whether they joined the Association or not; and the only benefit that members would obtain would be advice gratis, which was never well received. Publicity literature was also offered at reduced rates, but, as already stated by a previous speaker, a great many engineers preferred to buy this locally. In his opinion, the author would find much difficulty in forming such an Association as was suggested. He had some time ago tried to make much of the point that advertising in the daily Press should be indulged in to a greater extent. If every electrical supply undertaking would contribute an average of £50 a year, a sum of about £25,000 a year would be available. The figure quoted in the paper for daily Press advertising was not enough. Local advertising was permissible, but he did not know whether in municipal undertakings this power was extended to general

advertising. Billposting should not be carried to excess. Press advertising was much more remunerative and warranted a much larger proportionate outlay. Notices written by an advertiser were nearly always recognisable, and they could only be made unrecognisable by much labour on the part of the sub-editor to whom such duties were usually relegated, and further, the advertising man did not look kindly upon such mutilation. There was more friction and trouble in connection with these "puff" notices than in connection with any other branch of paper work, and they were more difficult to handle than any amount of technical work. The same applied to some extent to the daily Press work. If it was desired to get electrical notes into the daily Press, they must have first-class lectures by first-class lecturers, embodying new ideas on electrical subjects. He did not believe in the ordinary showroom, and considered it an inefficient way of selling goods. If a supply undertaking had a showroom it should be able to sell the articles displayed.

MR. B. WELBOURN said that in the United States and Canada much greater use was made of electricity by the public than at home. He was not convinced that there was need for the Association suggested, but he did think that the scheme should be placed under the auspices of the parent Institution. Manchester appeared to be a much more central position for an association headquarters than London. The author appeared to lay too much stress on the domestic uses of electricity and not enough on the power side of the industry. There was nothing like the electric iron for bringing home the advantages of electricity for domestic purposes. In the case of a large London supply undertaking, a striking feature of the last year's business was the extraordinary number of extensions to installations for both lighting and power purposes.

MR. F. WALKER did not think the author went far enough in speaking of a total outlay of £30,000. Many firms spent that amount individually on advertising in a single year. A recent exhibition in Scotland cost £200 for a week, and the engineer made the manufacturers pay most of the bill. The advertising of the domestic uses of electricity was primarily for the purpose of selling electricity, and, in consequence, was a supply company's job. The electricity supply undertakings were far behind the gas companies in advertising the sale of their product.

MR. A. J. GREENLY said that everyone agreed that there should be such an association, but would it control the advertising manager and advertising, or would it confine itself to the raising and administration of funds? The present Publicity Committee saw all advertisements and passed on all ideas for advertisements, and the result was not what it might have been. He thought the best way of obtaining new power consumers in all trades was through the medium of the trade organs.

MR. L. F. K. HOLMAR said the point at issue appeared to be the getting of funds for the propaganda. The settlement of the different methods of advertising to be adopted would not be a difficult matter.

MR. F. SELLS approved of the principle of co-operation. If the idea were possible at all, it should be handled by an independent association; in the event of a subject of this kind being tacked on to the Publicity Committee of the I.E.E. and left half done, nothing further could be done. London was not the right centre for a movement of the kind suggested; if the meetings were held in London, the provinces would hear nothing further of the matter. Most of the money for the big electrical exhibitions, which had done a good deal of good to the industry, came from the manufacturers. A scheme of the kind proposed should be supported mainly by the supply undertakings. The attitude of station engineers was shown by their absence from the meeting; they were usually present when curves and technical papers were under discussion, but there were very few present to listen to a discussion on a purely commercial question. Mr. Sells agreed that showrooms did not help selling, they were bound to be a failure.

MR. S. RENTELL agreed with Mr. Sells in regard to showrooms. As already stated, the gas undertakings contributed towards their association, and there was no apparent reason why the electricals should not, through the M.E.A., adopt electrical advertising in a simple way on a similar basis.

The AUTHOR, in reply, said that many of the details in the paper had brought forth useful criticism, but it was not his intention to go further than indicate methods whereby a start might be made. He wished to emphasise the fact that he did not ask for editorial "puffs," as it would be quite possible to supply information to the Press generally in such a way that they would be glad to make use of the information as news purely and simply.

**A Curiosity Abolished.**—Visitors to Bournemouth, especially electrical men, will have noticed with great interest the old method of trimming the arc lamps on the very high poles which are so distinguishing a landmark of the town. Three men pushing a truck, containing a large cage, used to proceed to the foot of the mast; the cage was got into position, and all hand-lowered a circular attachment, which was normally kept suspended at the top. The cage was hoisted with one man in it, who proceeded to trim and clean the lamps at the top of the pole. Now, this has all been done away with, and the modern, safe, and cheaper method of lowering the lamps has been substituted. The work, including erection, was done by the London Electric Firm, using their well-known patent contact-suspender and self-sustaining winch.

## LEGAL.

## EDINBURGH TRAMWAY COMPANY'S APPEAL.

THE First Division of the Court of Session has decided not to disturb the verdict of the jury in the action by an Edinburgh grocer who sued the Edinburgh and District Tramways Co., Ltd., for £1,000 damages in respect of injuries sustained by his son. Pursuer attributed fault to the defenders in respect that the driver of a car failed to keep a proper look-out and give warning of the approach of the car. Defenders denied fault and pleaded contributory negligence. The jury awarded pursuer £200 damages and the company applied for a new trial, but the First Division held that they could not disturb the verdict of the jury.

## ELECTRICAL SUPPLY APPEAL CASE IN THE LORDS.

THE House of Lords has been occupied with the appeal in the case London Electric Supply Corporation, Ltd., v. Westminster Electric Supply Corporation, Ltd. The matter is *per heard*, and will come on again to-day, when, in all probability, judgment will be reserved.

## SLANDER ACTION AT ABERDEEN.

IN the Second Division of the Court of Session, Lord Hunter heard counsel on the question of the allowance of issues for jury trial in an action by Mr. James Alexander Bell, M.I.E.E., M.I.M.E., electrical engineer of the City of Aberdeen, against Mr. Alfred Edward Milne, solicitor, 31, Adelphi, Aberdeen, hon. secretary of the Aberdeen Branch of the Electrical Contractors' Association, for £1,000 damages for alleged slander in respect of a letter written to the town clerk.

MR. WILTON, counsel for defender, argued that there was no issuable matter, and that the action should be dismissed. Quoting from the concordance, he said: "In carrying out his work, the pursuer was recently applied to by Mr. Alex. Davidson, solicitor, to advise him regarding the installation of a system of electric lighting and heating at his house, Broomhill Park, Aberdeen. Mr. Davidson had received an offer from Messrs. A. B. Robertson & Son, plumbers, Aberdeen, to execute the work of merely wiring in wood-casing, exclusive of lamps, distribution boards, or fittings of any kind. The pursuer, when thus applied to by Mr. Davidson, gave it as his opinion that the charge was excessive and that the installation could be carried out at a very much lower rate per point."

Counsel for defender next read the following letter (in which, he said, the alleged slander was contained), to Dr. Gordon, the town clerk, from 31, Adelphi:—

Aberdeen, November 27th, 1912.

## ELECTRICAL CONTRACTORS' ASSOCIATION.

Dear Sir,—At a meeting of the above Association, held on Tuesday, 26th inst., the members had under discussion a complaint by one of the members against Mr. Bell, city electrical engineer.

The circumstances are as follows:—One of the contractors had been asked to tender for an electrical installation in Aberdeen. The gentleman for whom the work was to be executed met Mr. Bell, and in course of a conversation between them Mr. Bell expressed himself very strongly on the question of the immoderate cost of the installation in Aberdeen, and in reference to the particular contract stated:—"The work is done, and well done, in Edinburgh for 12s. 6d. per point, while your rate is 22s." Following upon this conversation the contractor received a letter from his client, in which he stated:—"I have no choice but to take in competitive offers, or throw up the whole idea if—for the reason indicated by Mr. Bell—none of the offers is at least moderately fair."

From the above you will, no doubt, observe that Mr. Bell has made very grave and slanderous charges against the Aberdeen contractors, reflecting upon their honesty. The Aberdeen contractors emphatically deny that work of the same quality and materials can be done at 12s. 6d. per point, and in evidence thereof refer you to any of the leading architects in Aberdeen, or to the Glasgow contractors, whose charge for the same work is from 25s. to 27s. per point. It will be within your recollection that similar charges were made by the city engineer in reference to the City Hospital contract. In particular, he stated that that contract could be done for half of the amount of the lowest Aberdeen tender, and in support of his contention he invited tenders from the south, which all exceeded those made by the Aberdeen contractors, thus conclusively showing that Mr. Bell's knowledge of electrical contracting work was very elementary.

Apart from this, however, the members consider that it is out-with the jurisdiction of the city engineer to interfere between contractor and client, and that all along Mr. Bell's attitude towards contractors has not been conducive to harmonious working between ratepayers and the official of a public department. In this particular case, Mr. Bell has asked one of his assistants to make a full specification for the electric installation. Mr. Bell and his assistants are paid salaries to look after the ratepayers' interests, but not to take work out of the contractors' hands. His actions, I am sure, must appeal to the members of the Town Council as most intolerable. In Glasgow, where there are many more contractors than in Aberdeen, the relations between the city engineer and the contractors are of a most harmonious nature, and there each endeavours to help the other as much as possible: whereas in Aberdeen there seems to be continuous trouble between the city engineer and the contractors.

Matters have now come to such a pass that steps must be taken to safeguard the interests of the contractors. They consider that they are being most harshly and unfairly treated by the city engineer, and they respectfully beg that the members of the Council will take such steps as they deem best for the protection of the contractors and the safeguarding of their interests.

I shall be glad if you will submit this letter to the Council at their meeting to be held on Monday first, and shall be glad to hear from you.—Yours faithfully,

A. E. MILNE,  
Hon. Sec.

Counsel (proceeding) said Mr. Cooper must admit or deny the truth of the statements he had read.

MR. COOPER, K.C., for pursuer: I say the whole of the statements are false and untrue.

LORD HUNTER: I see no reflection upon anyone's honesty. Supposing you extract a slanderous meaning from an innocent expression, can you describe that as in itself slanderous? It says that in Aberdeen they desire such heavy profits that they want twice as much as what contractors in Edinburgh want. That might be an idiosyncrasy of Aberdeen.

MR. WILTON said it was maintained by the other side that the letter imputed to the pursuer ignorance, incompetency and want of skill in professional duties, but he submitted it was not innuendo borne out at all by the particular passage in the letter. It merely meant that this gentleman had held his position for 15 years, that the electrical trade had developed very much since then, and although he might have been well up in matters at that particular time, he apparently was not abreast of modern conditions. Counsel submitted that the letter, on the whole, was a most reasonable production, and contained no malice and no excessive language.

LORD HUNTER: That would be a privileged letter.

MR. WILTON: Yes: I submit that there must be malice, and there are no facts so far as this particular defender is concerned inferring malice.

A reference by counsel to the Trades Disputes Act, 1906, drew from his Lordship the observation that it would require very strong authority to convince him that, if the letter was slanderous, the Act of 1906 protected the defender.

MR. LIPPE, counsel for pursuer, pleaded that all the issues should be allowed. He quoted a Trade Union precedent where it was held that although the law protected the Trade Union, it did not protect the official who was the mouthpiece of the Union in uttering a slanderous statement. There was nothing in this case in the fact that defender happened to be a solicitor. He was there simply and solely as an official of a Trade Union, by whose hand the injurious statements were written reflecting upon the character of the pursuer. Referring to the third paragraph in defender's letter, Mr. Lippe pointed out that defender did not say, "In my opinion your electrical engineer does not have a great knowledge of his duties," but rather, "It conclusively shows he has a very elementary knowledge of his business." That, counsel thought, had been held in a case much weaker to be a direct charge of incompetency against a person in his professional duties. The Association took the opportunity to write to pursuer's employers to say that "this servant of yours knows little or nothing about the duties he has to perform"—clearly with a view to injuring him. If he had been dismissed for incapacity, what chance would he have had of getting another situation? The slander, if it was slander, was one of the gravest character. Accordingly he held that the language employed in the letter would amply bear the innuendo which the pursuer put upon it—that of "ignorance, incompetence, and want of professional skill." Therefore, he contended that the first issue should be allowed.

Counsel, proceeding, said there could be no possible privilege.

LORD HUNTER: If you interfere with individual members of an Association and the interests of these members, the secretary of the Union may have an interest.

MR. LIPPE: But I don't see how that will give him a privilege.

LORD HUNTER: It may arise from the circumstances.

MR. LIPPE argued that defender himself, not being a member of the Electrical Association, cut himself adrift entirely from the plea of privilege. What privilege could he have except the privilege of his Association? He did not see how defender was different from any private individual in Aberdeen. He got no benefit from the Association.

LORD HUNTER: Do you aver that in writing the letter he exceeded instructions?

MR. LIPPE: My contention is that defender cannot claim privilege and throw upon us the onus of imputing malice.

LORD HUNTER: Any member of the public would be entitled to write.

MR. LIPPE: What right would the man in the street have to interfere in a dispute between the Electrical Association and the electrical engineer? If an ordinary member of the public had written a letter of this sort he would have pleaded in vain that he was privileged. In regard to the second issue, counsel's contention was that it was slander to say of another that he had committed slander. Defender distinctly charged Mr. Bell with having uttered slanderous charges. In their concordance they said:—"The letter further falsely and maliciously states that pursuer was guilty of making very grave and slanderous charges against the Aberdeen contractors reflecting upon their honesty, and that he has made similar very grave and slanderous charges on a previous occasion." If defender had charged them with saying that and it was not true, counsel thought it was perfectly obvious that that was a slander committed against them. Therefore the second issue, subject to his Lordship's suggestion as to the innuendo, should also be allowed.

MR. WILTON said it was not disputed that the letter was written

so that the facts might be put before the Corporation. Plainly no malice was attachable to the association and the members of it, and equally no malice was to be attached to the solicitor or other official who was asked to convey the information. Surely a trader had a right to complain to the Corporation of the actings of one of their officials?

LORD HUNTER: Not in respect of his actings towards a different member.

MR. COOPER, K.C., for the pursuer, said their contention was that the so-called criticism in the letter was not criticism founded upon facts accurately set forth. Defender did not merely indulge in his letter in criticism, but he went into a criticism which was *per se*, and apart from everything else, libellous. Every day, he supposed, people were saying that particular people were charging too much for what they were doing. That was not a charge of dishonesty. If the defender had said that it was very unfair of Mr. Bell to go and do these sort of things that would have come within the region of fair comment upon facts accurately set forth, but he attributed to Mr. Bell the levelling of slanderous charges against Aberdeen contractors. The idea that a body holding extraordinary protection under the law could constitute itself a sort of censor on the public officials of a town, and although not monetarily interested in the matter at all, could send libellous letters to the Town Council about their officials, was a monstrous one. Regarding the question of privilege, he submitted that the defence had not produced a single authority that came within miles of the position.

LORD HUNTER reserved judgment.

#### DAMAGES AGAINST THE LONDON ELECTRIC RAILWAY CO.

In the King's Bench Division of the High Court, on Monday, Mr. Justice Coleridge and a Common Jury heard an action in which Mr. Daniel Badcock, of Winchendon Road, Teddington, sued the London Electric Railway Co., Ltd., for damages for personal injuries.

Mr. Badcock's case was that, owing to a defect in the footway leading to the Bakerloo Tube at Waterloo, he fell and seriously injured his right shoulder, and Dr. E. R. Dawson, of Teddington, who gave evidence in support of the claim, said the use of the joint was permanently impaired.

The railway company disputed the claim, with a contention that the accident occurred on a part of the path that did not belong to them, but the jury eventually returned a verdict in favour of Mr. Badcock for £172 damages, and judgment was entered accordingly.

HIS LORDSHIP granted the railway company a conditional stay of execution, with a view to a possible appeal.

#### OSRAM LAMP PATENTS.

In the Chancery Division, before Mr. Justice Parker, on Friday, February 21st, the alleged infringement of Osram lamp patents was the subject of a motion for an interim injunction.

MR. HUNTER GRAY, counsel for the Osram Lamp Works, Ltd., Brook Green, Hammersmith, plaintiffs in the action, said he was moving for an injunction to restrain the defendant, M. L. Apple, from selling lamps which the plaintiffs contended were an infringement of their lamps. He understood that the defendant, who was appearing in person, had filed one affidavit which he would read, and that defendant would produce evidence at the trial with the object of showing that an essential difference existed between the Osram lamps and the Brewer lamps sold by the defendant. The filaments used in the Osram lamps were made by a chemical process, and the plaintiffs had evidence to show that that process was infringed. Counsel then read the affidavit of Dr. Oberlander who had examined the Brewer lamps. The affidavit was as follows:—"The whole of the lamps examined by me contain filaments made of tungsten, and from my examination I am satisfied that the process adopted in the manufacture consisted in mixing finely divided tungsten with an organic binding medium, subsequently carbonised, and that the greater part of the carbon was afterwards removed therefrom chemically. I know of no method of commercially effecting such chemical removal other than by the use of an atmosphere of steam and hydrogen as described in letters patent 23,899,\* 1904, or the use of hydrogen and nitrogen as described in letters patent 18,622 of 1906."

Counsel then read defendant's affidavit in reply. Defendant said that Dr. Oberlander's expert opinion in the use of the words "finely divided" was too general, and was misleading. He (counsel) submitted that that was no answer, and that a chemical process was involved in the Brewer foreign-made lamps. Defendant got his lamps from abroad, but did not say in his affidavit by whom they were made nor by what process. The case was curious, in that it was impossible by analysis to find out the exact process involved. But he contended that where there was carbon left in the finished filament, then that filament could not have been made without infringing one of the two processes covered by the Osram patents.

THE DEFENDANT, addressing his Lordship, said that, as a matter of fact, he did not supply Osram lamps or lamps like the Osram lamps at all, either by himself or by agents. His lamp was of an entirely different make, and the plaintiffs were a great company, who merely wanted to crush him down. He was fully prepared to offer evidence to prove that his lamps were entirely different.

MR. JUSTICE PARKER: You will have full opportunity to do that at the trial.

Defendant, who was a foreigner, said something in reply which was inaudible.

HIS LORDSHIP: You don't say how your lamps are made, though you say you are prepared with evidence, and I am afraid I shall have to restrain the sale of your lamps pending trial. But you will have an undertaking as to damages from the plaintiffs, and if your contention is right you will recover heavy damages.

Defendant repeated that he did not sell Osram lamps.

MR. GRAY: He (meaning defendant) is one of those gentlemen who gets his lamps from abroad, and it is practically impossible to stop them.

HIS LORDSHIP, in granting an injunction, referred to the defendant's affidavit, and said that though defendant swore that he got his lamps from abroad, he did not condescend to say how they were made nor by whom. That was not satisfactory, although he said he was going to give evidence at the trial, for it was impossible to say from what source that evidence was coming. He would, therefore, grant an injunction pending the trial with a proper undertaking as to damages. Costs of the motion to be costs in the action.

HIS LORDSHIP to the defendant: "You must not sell these things pending the trial, and you quite understand that if you are right you will get damages."

#### ISAACS v. CHESTERTON.

AT Bow Street Police Court, on 20th inst., Sir Albert de Rutzen granted a summons on behalf of Mr. Godfrey Isaacs, managing director of the Marconi Wireless Telegraph Co., Ltd., against Mr. Cecil Chesterton, editor of the *New Witness* (formerly the *Eye Witness*), in respect of a series of libels published between October, 1912, and January, 1913. The hearing began on Wednesday, February 26th.

#### OSRAM LAMP CO., LTD. v. SCHLOSS.

IN the Chancery Division on Friday, February 21st, before Mr. Justice Swinfen Eady, Mr. Gray mentioned a motion in this action which, he said, was to restrain infringement of patent. Defendants, however, required further time to answer evidence; and plaintiffs, with his Lordship's sanction, were disposed to give them another week.

HIS LORDSHIP granted a week's adjournment.

**Austria's Foreign Trade.**—The foreign trade of Austria in electrical goods during the year 1912 was of a satisfactory character, the imports showing an increase of 10,000,000 kronen, and the exports of 2,500,000 kronen. In detail, there was an increase of 30 per cent. in the imports of dynamos, low-pressure apparatus, measuring and calculating instruments, glow lamps, high-pressure apparatus and carbons; of the imports, 90 per cent. came from Germany. The exports of dynamos reached values more than double those of the previous year. A considerable rise marked also the exports of switch and contact appliances, cable and wire. On the other hand, only a moderate increase was shown in the shipments of glow and arc lamps and carbons compared with the previous year. The shrinkage in the export figures is due less to the falling-off in the Eastern, than to the declension in the general European, shipments. The exports for the year totalled 76,028 quintals, of a money value of 41,556,900 kronen, of which dynamos stood for 42,599 quintals, worth 14,480,800 kronen. The exports were 37,982 quintals, valued at 12,532,200 kronen, of which dynamos were 6,150 quintals, of a money worth of 1,344,100 kronen. As stated previously, Germany almost monopolises the Austrian import trade, 10 per cent. of it only being left to other countries, of which Switzerland appropriates the larger portion, the British share being restricted to small shipments (27 quintals) of dynamos, motors and transformers; measuring and calculating instruments (52 quintals); electric lamp fittings (23 quintals); electrical apparatus (200 quintals); cable and insulated wire (30 quintals); and carbons (58 quintals). The chief customers for Austrian exports of electrical goods were the Balkan States, Greece, Russia, Italy, Turkey, Egypt, Spain, the United States, &c., England's small purchases comprising glow lamps (451 quintals), cable and insulated wire (409 quintals), gutta-percha-covered cable and wire (36 quintals), asbestos and paper-covered cables and wire (304 quintals), and carbons (2,052 quintals).—*Elektrotechnik und Maschinenbau.*

**Cinematograph Films of Cable Manufacture.**—We are informed that the A.E.G., of Berlin, have just produced a series of cinematograph films showing the process of manufacturing electric cables from start to finish, and are prepared to lend these films to technical Societies and Institutions for lectures. Every stage of manufacture is shown, from the arrival of the copper ingots to the dispatch of the completed cable, and the A.E.G. have prepared an explanatory lecture to accompany the exhibition of the films. If necessary, they are willing to send an expert to deliver a special lecture. The company only provide the films, and societies using them must make their own arrangements for exhibition, and must provide the apparatus. If possible, the exhibition should take place in a properly equipped cinematograph theatre, but if an ordinary lecture hall is used, care should be taken to keep down the noise of the apparatus as much as possible, so that this does not interfere with the delivery of the lecture. Most of the pictures being of interiors, it is recommended that a 70-ampere projector lamp be used, in order to give the necessary clearness to the pictures on the screen. Application for the loan of these films should be made early to the ELECTRICAL CO., LTD., Charing Cross Road, London, W.C., the British representatives of the A.E.G.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 3,351. "Process of and means for moulding telegraph, telephone and like insulators." D. G. NORMAN. February 10th.
- 3,357. "Fuse or joint boxes or the like electrical fittings." C. P. MELANDER. February 10th.
- 3,370. "Apparatus for heating liquids electrically." K. P. H. SYNDICATE, LTD., and C. KRATT. February 10th.
- 3,387. "Receptacles for diaphragm guards for telephone mouthpieces." F. LOWENSTEIN. February 10th. (Complete.)
- 3,404. "Shade or globe holder for lamps." F. A. BASNETT. February 10th.
- 3,431. "Circuit arrangements for automatic or semi-automatic telephone systems in which there are several lines to a station or group of stations." SIEMENS & HALSKE ART.-GES. (Convention date, February 9th, 1912, Germany.) February 10th. (Complete.)
- 3,432. "Telegraph system, unaffected by static charges from neighbouring high-tension lines." SIEMENS & HALSKE ART.-GES. (Convention date, February 13th, 1912, Germany.) February 10th. (Complete.)
- 3,446. "Protective device for the circuits of electric motors." S. L. GLENN and BRITISH PNEUMATIC RAILWAY SIGNAL CO., LTD. February 10th. (Complete.)
- 3,462. "Electric switches." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 10th.
- 3,466. "Electricity meters." J. ELSTER. February 10th. (Complete.)
- 3,487. "Ignition gear for internal-combustion engines." W. H. MOORE and A. SHARDLOW & Co., LTD. February 11th.
- 3,512. "Electrodes for electric arcs." H. AYRTON. February 11th.
- 3,625. "Process for the production of a tungsten compound for use in the manufacture of electric incandescence filaments or bodies." F. BANSEK and W. F. MONA. (Divided application on 9,911, 1912. July 25th.) February 11th. (Complete.)
- 3,638. "Method of and apparatus for increasing the effect of variations of electric current." A. C. FULLER. February 11th.
- 3,662. "Electrical advertising signs, devices, or the like." L. MARTIN and G. NIKET. February 11th. (Complete.)
- 3,665. "Electric motor control systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 11th.
- 3,666. "Manufacture of a material suitable for electrical insulation and other purposes." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 11th.
- 3,682. "Automatic telegraph transmitter." E. J. KESSELS. (Addition to 21,332/12.) February 11th.
- 3,687. "Telephone receivers." E. GRISINGER. (Divided application on 7,482/12, March 27th.) February 11th. (Complete.)
- 3,691. "Device for packing eggs, incandescent lamp bulbs, and other breakable articles." J. B. WARREN. February 11th. (Complete.)
- 3,697. "Field magnets for dynamo-electric machinery." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, February 17th, 1912, Germany.) February 11th. (Complete.)
- 3,658. "Sockets for incandescent electric lamps." H. HUBBELL. February 12th. (Complete.)
- 3,670. "Electric ignition devices." H. A. PALMER. (F. J. Palmer, India.) February 12th.
- 3,680. "Apparatus for printing tickets or the like automatically by selectors." ALLGEMEINE ELEKTRICITÄT GES. (Convention date, February 23rd, 1912, Germany.) February 12th. (Complete.)
- 3,682. "Sockets for incandescent electric lamps or the like." H. HUBBELL. February 12th. (Complete.)
- 3,684. "Motor control systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 12th.
- 3,685. "Electric motor control systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 12th.
- 3,695. "Metal-filament electric light bulb." E. MILNES. February 13th.
- 3,719. "Electrically-propelled vehicle or locomotive trolleys." W. DUFFY. February 13th.
- 3,732. "Revolver-switch safety-fuse plug." O. WEISS. February 13th.
- 3,749. "Tungsten-filament and a process of manufacturing same." M. M. HUBNER, executor of J. Hubner. (Julius Pintsch Akt. Ges., Germany.) (Divided Application on 8,681/12, April 13th.) February 13th.
- 3,759. "Electric driving mechanism for spindles, flyers, or similar parts used in machines for working textiles." SOC. D'ÉCLAIRAGE ÉLECTRIQUE. (Convention date, April 16th, 1912, France.) February 13th. (Complete.)
- 3,771. "Wireless signalling." J. L. FENMORE, jun. February 13th.
- 3,779. "Electric candle fittings." F. HODGSON. February 13th. (Complete.)
- 3,790. "Telephone sub-station circuits." E. GRISINGER. (Divided application on 7,482, 1912, March 27th.) February 13th. (Complete.)
- 3,805. "Electric lamps." W. E. BLADON. February 14th.
- 3,817. "Electric control on three or more wire circuits." E. E. TASKER. February 14th.
- 3,820. "Portable apparatus for generating electric currents for lighting or other purposes." R. V. MOSTYN. February 14th.
- 3,825. "Time switches." F. KRUPP ART.-GES. (Convention date, March 15th, 1912, Germany.) February 14th. (Complete.)
- 3,833. "Submarine telegraphy or telephony." SIGNAL GES. M.B.H. (Convention date, February 17th, 1912, Germany.) February 14th. (Complete.)
- 3,855. "Electric regulating liquid resistances." H. C. E. BOUTARD. February 14th. (Complete.)
- 3,867. "Trolleys for electric traction systems." E. M. MONRO and R. E. T. CONSTRUCTION CO., LTD. February 14th.
- 3,861. "Primary electric batteries." G. S. ENGLE. (Convention date, October 8th, 1912, United States.) February 14th. (Complete.)
- 3,864. "Electric heating and lighting devices." A. C. MICHE and SIR R. A. S. PAGE. February 14th.
- 3,880. "Alternating electric current generators." H. K. WHITEHORN and STEPHENSON & J. L. MOTORS, LTD. February 14th.
- 3,883. "Method and apparatus for suppressing the interruption arc on switches." W. BURTON. February 14th. (Complete.)
- 3,893. "Automatic transmitters for telegraphic signals." CREED, BILLE and CO. (Harold Bille, United States.) February 14th. (Complete.)
- 3,923. "Electric contact plug." J. S. HOLMES. February 15th.
- 3,931. "Shade-holders for incandescent, electric, and other lamps." D. G. SACKMAS, JUN. February 15th. (Complete.)
- 3,934. "Testing the sound-receivers of submarine signalling apparatus." SIGNAL GES. M.B.H. (Convention date, March 9th, 1912, Germany.) February 15th. (Complete.)
- 3,943. "Electro-vacuum safeguard alarm against burglary and fire." W. S. VALE. February 15th.
- 3,962. "Call or alarm apparatus for use in wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO. and H. DOBELL. February 15th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

- AUTOMATICALLY-CONTROLLED ELECTRIC SWITCHES. F. P. Clifford. 3,915. February 16th.
- ELECTRICAL SWITCHES. H. W. COX. 5,280. March 2nd.
- APPARATUS FOR CHARGING ACCUMULATORS. K. VON DREGER. 5,434. March 4th. (March 3rd, 1911.)
- ELECTROLYSIS OF LIQUIDS. J. G. PAULIN. 6,261. March 13th.
- ELECTRICAL FURNACES. I. RENNERFELT. 7,967. March 26th.
- ELECTROTYPE AND PROCESS FOR THE PRODUCTION THEREOF. J. MURRAY. 8,746. April 13th.
- PORTABLE ELECTRIC READING LAMP. S. J. LEVI, A. H. ROSE and T. A. ROSE. 9,442. April 22nd.
- ELECTRIC FUSE. W. B. BOYD and J. B. TANNABILL. 12,278. May 23rd.
- TELEGRAPHIC PHOTOGRAPHY. C. STILLE. 12,709. May 29th. (June 2nd, 1911.)
- MERCURY SWITCHES AND ARRANGEMENTS FOR STARTING ELECTRIC MOTORS BY MEANS OF THE SAME. SIEMENS-SCHUCKERTWERKE GES. 14,087. June 17th. (June 21st, 1911.)
- PROCESS FOR MANUFACTURING FIREPROOF ELECTRICALLY-CONDUCTING MOULDED BODIES. Geb. Siemens & Co. 16,044. July 9th. (July 20th, 1911.)
- FEEDING MECHANISM FOR THE ELECTRODES OF ELECTRIC ARC LAMPS. F. STEINERT. 19,425. August 24th. (Divided application on No. 1,755 of 1912, January 22nd.)
- ELECTRIC ANIMAL AND INSECT EXTERMINATORS. C. C. TUCH. 22,861. October 7th. (October 17th, 1911.)
- SELF-ACTING ELECTRIC SWITCH DEVICES. Schott & Gen. 25,518. November 17th. (November 15th, 1911.)
- DEPOLARISING AGENTS FOR GALVANIC CELLS. British Ever-Ready Electrical Co. (Heil.) 25,784. November 9th.
- MOVING COIL, ELECTRICAL MEASURING AND LIKE INSTRUMENTS. J. W. RECORD. 26,341. November 15th.
- MOVING COIL, ELECTRICAL MEASURING AND LIKE INSTRUMENTS. J. W. RECORD. 26,342. November 15th.
- TYPEWRITERS AND ANALOGOUS DEVICES ADAPTED TO BE OPERATED BY A PER FORATED TAPE OR THE LIKE. A. FRASER and Eastern Telegraph Co. 1,822. January 23rd.
- AUTOMATIC BATTERY OVER DISCHARGE PREVENTER. H. LEIDNER. 2,310. January 29th.
- ELECTRICAL WATER-HEATERS. M. H. SCHOENBERG. 2,522. January 31st. (April 29th, 1911.)
- ELECTRIC SWITCHES. H. LEIDNER. 2,747. February 2nd. (Cognate application, No. 8,224 of 1912.)
- ELECTRICAL DEVICE FOR CATCHING AND DESTROYING FLIES AND OTHER SMALL INSECTS. A. J. WRIGHT and W. W. NIBLOE. 2,572. February 3rd.
- ELECTRICAL MEASURING AND SIGNALING INSTRUMENTS OF THE MOVING-COIL TYPE. J. W. RECORD. 3,454. February 12th.
- ELECTROMAGNETIC SPEED-VARYING AND REVERSING GEAR. B. BRUKWICKI. 4,458. February 22nd.
- CONNECTORS OR LUGS FOR ELECTRIC CONDUCTORS. J. E. M. ROBB and J. SHAW. 5,907. March 8th.
- ELECTRIC INSULATORS. Bullers, Ltd., and G. V. TWISS. 6,287. March 18th.
- WIRELESS TELEGRAPHY. A. E. J. VIUG. 10,111. April 29th.
- PORTABLE ELECTRIC BATTERY LAMP. B. PORTES. 11,859. May 13th.
- INCANDESCENT LAMP SOCKETS. A. SCHUCHARDT. 12,612. May 29th.
- ELECTRIC SWITCHES. Vender Time Switches, Ltd., and R. C. GRIESBACH. 15,366. July 1st.
- TIMING DEVICES FOR OPERATING ELECTRIC SWITCHES AND OTHER APPARATUS. S. CHIGER. 16,142. July 10th.
- ELECTRIC FURNACES. L. GONNET. 19,287. August 22nd. (March 16th, 1912.)
- PRODUCTION OF SHEET MICA AND THE LIKE FROM MICA WASTE AND OTHER MATERIALS. F. BÖLLING. 21,445. September 20th.
- REGULATION OF THE SPEED OF ELECTRIC MOTORS. Siemens-Schuckertwerke G.m.b.H. 23,341. October 12th. (October 13th, 1911.)
- ELECTRIC CONDUIT JUNCTION BOXES OR LIKE ELECTRIC FITTINGS. F. H. TERRY, H. M. BIGWOOD and Brotherton Tubes & Conduits, Ltd. 24,492. October 26th.
- IGNITION PLUGS FOR INTERNAL-COMBUSTION ENGINES. A. RUPRECHT. 28,412. December 3th. (December 11th, 1911.)
- DRIVING OF VEHICLES BY MEANS OF INTERNAL-COMBUSTION ENGINES COMBINED WITH DYNAMOS, ACCUMULATORS AND MOTORS. H. PIEPER. 29,638. February 8th. (February 20th, 1911. Divided application on No. 8,281 of 1912, February 9th.)

**New Showrooms.**—The full provision made by the GENERAL ELECTRIC CO., LTD., for the display of various classes of its manufactures has been increased by the opening of a show-room in the basement of 71, Queen Victoria Street, E.C., where there is on view a comprehensive exhibit of arc lamps and accessories, Witton motors and machinery, ventilating and engineering supplies, telephones, electric light supplies, switchgear, &c. The new show-room is open for inspection by the public, and contractors are invited to send their clients to view it. The exhibits are set out on stands down the centre and round the sides of the rooms, the arrangement being such as to give every opportunity for close inspection. A large proportion of the apparatus is wired up, and can be seen in actual working.

**Osram Costumes.**—During the past few months an "Osram Lady" or an "Osram Man" has put in an appearance at entertainments, dances, balls, skating rink carnivals, &c., and we understand that those who have availed themselves of the outfit provided by the publicity department of the GENERAL ELECTRIC CO., LTD., have found it an easy matter to make up fancy costumes sufficiently attractive to win prizes. We have received illustrations showing several simple, attractive combinations of Osram literature and lamps, which have been affected by prize-winners at Watford, Long Ditton and Weybridge carnivals, but the literature lends itself to many other attractive designs.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

MARCH 7, 1913.

No. 1,841.

## ELECTRICAL REVIEW.

## THE ENDS OF THE RAINBOW.

Vol. LXXII.]

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DURING the past year, in connection with the electrical industry, a fact has again been noticeable which has from time to time recurred in a striking manner. Concurrently with the reports of abundance of work and general signs of progress everywhere, the statement has been persistently made that the wages to skilled employes have been low. For proof of this statement one has only to turn to the "Correspondence" columns of the ELECTRICAL REVIEW and note the comments which have been made upon the salaries of central-station assistants.

This raises an important problem in the economics of the electrical industry, and indeed of most modern branches of skilled labour, and without in any way professing to discover a remedy, it may be advisable to emphasise truths which have before been enunciated in these columns. To do so we may venture to use a metaphor even at the risk of the accusation of poetical tendencies. Where a complete rainbow is seen, certain portions of the landscape at its beginning and end are apparently transfused with a peculiar glamour caused by the prismatic effect of the light coming from that direction. In the same way, we venture to say that those portions of industrial activity which correspond with the beginning and end of the developmental period of a branch of industry, present features of unusual interest that draw particular attention, and as the tendency to run in masses is a human instinct which is almost irresistible, we observe great quantities of promising material gravitating either in the direction of the initial stages of a new branch of industry or to the opposite pole when the industry becomes stereotyped. In both these directions lie the fewest opportunities; the greatest opportunity lies in the somewhat humdrum region intermediate between these two extremes, when prosaic development is actually and steadily in progress.

We believe this fact to be so important that we think it worth while to insist upon it a little further, and in doing so we will deal first of all with the initial stages of the development of an industry. It is hardly necessary to remind our readers that fortunes have been repeatedly lost in experimenting. As one somewhat cynical authority has stated, "First steps are the most dangerous, because they are usually taken innocently." There is, however, a great temptation, immediately a new form of industry appears to be developing, to get into the new movement as quickly as possible, regardless of the fact that unforeseen and unestimated dangers lie in front which may wreck the most promising career. Even at the present day we believe we are correct in saying that the aeroplane industry, which is so new that it cannot be called fully standardised, and has hardly reached the point of commercial utility, has become swamped with young men tendering their services at nominal wages, and even offering premiums in view of advantages

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION

Ready.

**H. ALABASTER, GATEHOUSE & CO.,**  
4, Ludgate Hill, London, E.C.

which they may reap if they succeed in reaching a decent post in the problematic future.

Turn to the other extreme. It is equally fatal to enter a profession when that profession has become a stereotyped affair. During the days of the renaissance of learning, the term "clerk" was one that signified culture and deep reading. It was a title of honour. In the present day, when free education has turned its myriads into poorly paid office positions, the term "clerk" has been shorn of much of its dignity. It is a well-known fact that in most of the older professions, in which there are no new developments and which are reckoned respectable and safe, the entrant pays for his respectability by having to wait for dead men's shoes. There is probably not to be found in the whole country a more respectable, hard-working and intelligent body of skilled men than in the banking profession. On the other hand, the salary received by a bank clerk for a very considerable part of his life is notoriously low. These are used as illustrations of the principle that we are trying to lay down that after the stage of development has passed, it is a mistake to enter a profession with the idea of making money. In engineering we have the case of the central electric power station, which is nowadays to a very large extent a standardised production. Hence, in very many cases (with notable exceptions), wages are low on the part of the operating staffs. Where dissatisfaction as to remuneration occurs, it is worth while ascertaining whether on the one hand the industry referred to is in its pioneering stages, or on the other it is in such a state of standardisation that there is no room to move.

We have laboured these points somewhat, because it is necessary to drive home the truth that the greatest chances of success are in the intermediate stage of steady development, and unless a man can get into some employment where such development is proceeding, he stands a minimum chance of success. It is even better, rather than to go into a pioneering industry too soon, to go into an old industry with a new training. For example, it is quite conceivable that a bright engineering student with a thoroughly good grasp of mechanical principles and up-to-date methods of doing work would make a success financially of such an old-established branch of mechanical engineering as ordinary mill-wrighting work, provided that he brought to bear upon that old profession modern methods. In other words, success, as a rule, in an engineering career depends on doing an old thing in either a better, a quicker, or a cheaper way, and it is here that the prosaic stage of development of industry lies. Here it is also that the money is to be found.

We would like to leave the subject at this point. Readers who examine the argument will find in practice a large number of instances of the truth of the principle laid down, and as nothing is more important to a man than a clear idea of his objective, it has been considered worth while to put forward these remarks, not in a dogmatic spirit, but in order that they can be thoroughly discussed. It is pitiable at the present time to see the enormous waste of good material which is going on among the personnel of engineering activities. Many a good man has been stifled through being in the wrong place, and the reason for his being in the wrong place has been that he has attempted to make his fortune at the ends of the rainbow instead of steering for the middle region.

#### Constantinople Electrical Schemes.

It is advisable that the fact should not be overlooked that the recent grant of a concession for the construction of an underground railway in Constantinople forms part of an international combination for the amalgamation of certain interests in the Turkish capital, which has been proceeding for some time past. The combination, which is specially attributed to the efforts made by the Belgian Société Financière de Transports and the Banque de Bruxelles, bears the title of the Consortium de Constantinople, with headquarters at Brussels, and its technical management is, or was, in the hands of the Société Financière de Transports.

As will, perhaps, be remembered, the Consortium or its associated group already owns the Constantinople tramways, which have been converted to electric traction; the Galata-Pera tunnel railway, which was purchased from an English company; the Stamboul Gasworks; and the Ganz electric lighting concession. The addition of the proposed underground electric railway from Taxim to Bajadiz apparently completes the schemes, which are expected to involve an expenditure of £3,600,000. At least, this is the total share and loan capital which was nominally subscribed a few months ago by the numerous members of the Consortium, which is led by the Deutsche Bank. One portion of the capital has been formed by the assets brought in by the tramways, gasworks and lighting concession, whilst the remainder has been subscribed by four subsidiary groups. Besides the Deutsche Bank, the German list contains the names of 15 other financial institutions, including the Electric Light and Power Investment Co., of Berlin, and the Electrical Enterprises Co. of the same city. The Belgian group contains 11 names, inclusive of those of the two banks previously mentioned; the French group also comprises 11 names, of which the Imperial Ottoman Bank, the Banque de Paris, Comptoir National and the Compagnie Française Thomson-Houston may be cited; whilst Switzerland is represented by the Zurich Bank for Electrical Enterprises and the Swiss Credit Anstalt. It has, however, to be borne in mind that the Consortium is merely a preparatory syndicate for the Union Ottomane, Société d'Entreprises Electriques à Constantinople, which was formed last September, and which will presumably be required by its interested group to proceed with the construction of the underground railway when circumstances are favourable.

The fact that the railway concession has been entrusted to the Consortium is not particularly new in itself, as it was reported last autumn that the Consortium would be victorious over the rival scheme which was promoted by the French Omnium group, headed by the firm of Perrier & Co. As affairs now stand, the Germans expect to receive a considerable portion of the orders for the execution of the work, whilst the balance may be the share to be allotted to French and Belgian works.

#### Manufacturing in Russia.

ACCORDING to reports circulating in interested circles in Russia, the electrical manufacturing companies of German origin in that country, in which Teutonic capital of considerable amount is invested, experienced very favourable working results in 1912. On the one hand, it appears that quite a number of central stations were carried out in different towns, in consequence of the municipal authorities being able to raise loans for the purpose, and several of these loans were floated in England. The latter cases, therefore, represent further examples of British capital being advanced in order to provide contracts for German works. On the other hand, extensive orders were placed with the electrical firms by manufacturing works in which the use of electric light and power is being extended, and the long-expected orders from the Government authorities also provided good employment.

A further step in connection with the consolidation of the foreign undertakings in Russia is in contemplation. Several years ago the Helios Co. was compelled to suspend its

Russian branch, and a little later the separate cable departments of three works were combined in the form of the United Cable Works Co. Now the Russian Siemens & Halske Co., which has a share capital of £560,000, is to be merged into the Russian Schuckert Co., whose share capital amounts to £300,000. It was only in 1912 that the latter company made an issue of £100,000 for the purpose of defraying the expenditure incurred on extensions of works, and thus advanced the total to £300,000. The dividend paid in 1909-10 and 1910-11 was 4 per cent. for each year, and 5 per cent. was distributed for 1911-12. On the other hand, the Siemens & Halske Co. paid 5 per cent. in 1909, 5 per cent. in 1910, and 6 per cent. in 1911. This company has also made large extensions of works in recent years, and has developed its scope of activity by participating in various undertakings.

The combination of the two companies, which takes the title of the Russian Siemens-Schuckert Works, found its counterpart in the case of the parent undertakings in Germany a few years ago. It is intended to be carried into effect by increasing the share capital of the Schuckert Co. by £1,200,000 to £1,500,000, and the object is to facilitate financially the solution of the lighting, power and traction problems arising in that country. The Russian Allgemeine Electricity Co., which is the only remaining German manufacturing company of importance, now has a share capital of £1,200,000, of which the sum of £400,000 was issued last November. The rate of distribution paid was 6 per cent. in 1909, 7 per cent. in 1910, and 8 per cent. in 1911, whilst from 9 to 10 per cent. is expected for 1912.

### Electric Cooking.

THE paper read before the I.E.E. by Mr. Wilmshurst, which we abstract in this issue, and the interesting discussion

which followed, are welcome indications that the subject of electric cooking is now receiving serious attention at the hands of central-station managers. It will be noticed that there is general agreement on the necessity of letting out the larger apparatus on hire, a proposition which we have frequently supported; there is no doubt at all that that is the method which has enabled gas suppliers to develop their cooking load to such an amazing extent within the last 10 years, and there is no other way to do it. As we have pointed out, this involves the manufacture of electric cookers in quantity, on standard lines, and at the lowest possible cost. Those firms which realise the need and lay themselves out to meet it satisfactorily will be the firms to profit by the developments which will follow. So long as the manufacturers wait for the demand before making the plunge, and the would-be users wait for the reduction in price, we are merely travelling in a "vicious circle," and no progress can be made.

We are glad to note that the design of the heating elements—the crux of the problem—is steadily improving, and that want of reliability no longer avails as a serious argument against the use of electric cookers. The remarkable guarantees that some makers are now prepared to give with their heating elements sufficiently indicate the advance that has been made. The importance of standardisation will make itself felt more and more as electric cooking becomes more popular, and makers ought to give close attention to this subject, though at the present stage of evolution it would be premature and ill-advised to attempt to formulate rigid standards. However, each maker can at least see to it that his own products follow some systematic order, which will enable users to replace parts of their apparatus at any time at the minimum of expense.

We believe that the splendid pioneer work that has been, and is being, done by the gas suppliers not only affords most valuable guidance to electrical men, but is of direct service to the electric cooker, for the public, having learnt to appreciate the convenience and efficiency of the gas cooker, will find it a short and easy step onward to the greater convenience and efficiency of the electrical apparatus, which is free from the offensive fumes and dirt which, beyond question, are the usual accompaniments of a gas cooker.

### HINTS FOR ELECTRICIANS.

By E. A. BELCHER.

It very often happens that the electrician in charge of a number of motors finds, on testing a direct-current motor with a Megger, that the armature has developed a bad earth.

As very few have the advantage of a supply of alternating current to turn to, the following tip may prove of use: the writer has been able to locate and repair faults, thereby saving an enormous amount of valuable time and expense, when otherwise there would have been no alternative but to return the defective armature to the makers, thus stopping machinery for an indefinite period and incurring the wrath of his employers for not being able to effect a repair, as half of them cannot understand what is wrong, when to the eye nothing appears amiss.

Having removed the armature from the frame, proceed as follows:—Connect up wires to armature as in fig. 1, having in circuit a low-reading voltmeter; the writer uses a central-zero cell-testing meter. Put a lamp of small candle-power

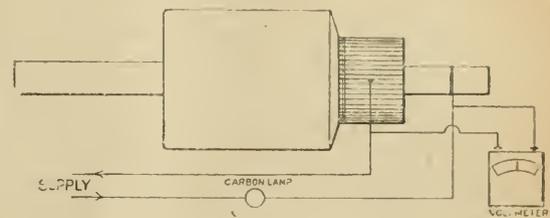


FIG. 1.

into holder (this is essential, as using too big a lamp may spoil the low-reading meter, if by any chance the wires are removed from the commutator). The writer uses a 16-c.p. carbon lamp on a 200-volt circuit.

Mark the segment on which the wire is placed, and switch on current, when a certain reading will show on the voltmeter; move the wire round the commutator one segment at a time, and note the readings. Continue doing this until you find a segment or segments which give no deflection on the meter; this will be the end of the coil on which the earth is situated, and having ascertained this, it will be comparatively easy to find the exact spot.

It will be readily understood that connection is made from the spindle through the fault and through the coils to the segment; there will be a drop in volts in proportion to the size of the lamp used, and the nearer the wire is moved

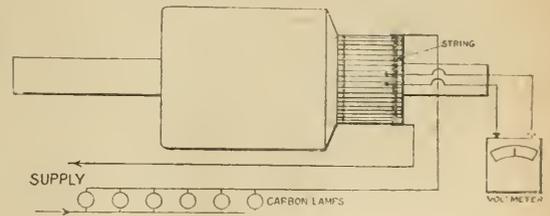


FIG. 2.

towards the coil which is earthed, the less will be the drop in volts, until the faulty coil is reached, and no reading is indicated on the meter.

To find either a broken connection or a short-circuited coil proceed as follows:—

Connect the armature up to any supply, as shown in fig. 2, fixing the wires to the commutator directly opposite one another by means of a piece of string tied tightly round it. Take a cell-testing voltmeter and find the voltage drop between two adjacent segments: if the meter does not show a big enough reading, put in more lamps. The writer uses six 50-c.p. carbon lamps on a 200-volt circuit. Continue testing round, in like manner, segment by segment, until a plate is reached which shows no deflection on the voltmeter, or a very decidedly lower reading; this segment will be the end of the faulty coil if short-circuited. On the other hand,

if there is a disconnection in a coil, the readings in the faulty half of the armature will be *nil* until the faulty coil is reached, when a large reading will be obtained.

The writer has had considerable trouble with various motors to get them to run sparklessly, but has effected a cure in some really bad cases in the following manner:—

After the commutator has been turned and ground, procure a hack saw blade with teeth set to as nearly as possible the width of the mica between the segments; fit over the back of the saw, the whole length, a piece of sheet-iron in order to stiffen it, and with this cut out the mica to about  $\frac{1}{2}$  in. below the level of the commutator surface. As the commutator gets slightly scratched, finish it off by polishing with a very fine piece of emery cloth. The above does not take so long as many may anticipate, and any intelligent labourer can be easily instructed to carry out the work. The writer is in charge of over 40 motors of various horse-power, and has found the above tips very handy in time of need. No novelty is claimed for them.

---

## THE FUTURE OF BRITISH ELECTRICAL INDUSTRY IN NORTH CHINA.

By HSI CH'UNG CHI.

EVERY engineer who has lived in the North of China for any length of time will be painfully aware of the total lack of energy displayed by British manufacturers in placing their plant and material within reach of the Chinese. With the exception of one firm in Tientsin there is no British manufacturer who has had the enterprise to send a representative here to open an office and get in touch with the big contracts which are now frequently being let. All through the slack time during the revolution the Germans have been organising their methods of business, with the result that it is virtually impossible for British firms to compete with them.

It is of no use to quote the Chinese for engineering material unless prepared to do so delivered with all charges, duty, &c., paid, in good condition at the customer's go down, and there is no British firm in North China which is able to do so. If material is bought f.o.b. London against bills of lading, it is very likely lost during transshipment at Shanghai, and it is necessary in the case of material for towns such as Peking arriving at Tientsin, for someone to journey to the port to clear it through the Customs and put it on the train.

On the other hand, the German engineering firms are perfectly organised both at Peking and Tientsin, having a staff of commercial and technical men who are able to advise the Chinese, quote prices, deliver samples with their tenders *via* Siberia (a benefit which our Postmaster-General considers quite unnecessary), and see their cargo through to its destination, taking back all damaged material.

In the future, nearly all large Government contracts will be decided in Peking, and, under the present conditions, British firms have no earthly chance against the large German ones.

Another fatal error of our manufacturers is their treatment of would-be Chinese engineering students, and a pamphlet has been circulated in North China with the idea of inducing (?) the Chinese to send their sons to England to learn their profession.

Most of the Chinese that I have met who wish their sons to have an engineering education have selected England or America, as English is still the leading foreign language amongst the Chinese, and most of the boys learn it in the secondary schools here, but the idea of spending £220 a year for each boy puts it entirely out of the question. On the other hand, the Germans are encouraging Chinese apprentices in every way they can, and the large Berlin firms will accept apprentices from good families, pay their railway fares to Germany, article them for five years without a premium, and pay them a living wage of, I think, 10,000 marks for the five years.

In return for this when the men come back to hold good appointments, they have a full knowledge of the German language and of German plant and machinery, with a result that they recommend the purchase of German material which they understand in preference to British which they do not.

This is a matter which ought to have the serious consideration of the new British Engineers' Association, but all we have heard of that august committee of gentlemen up to the present is a great deal of after-dinner talk. If this association is to do any real good, the absurd subscription of £10 per firm per annum will have to be very considerably increased, as even if 100 firms subscribe, the revenue will be quite useless to achieve any object here.

Mr. Beilby Alston, of the Foreign Office, came out here about six months ago, but no one seems to know what good he did, as three-quarters of the engineering fraternity had no opportunity of meeting him and expressing their views. It is true that the Tientsin Englishmen gave him a dinner the day before he went away, and hoped to hear something on that occasion about future prospects for British trade, but they were disappointed, as the matter was hardly alluded to.

In conclusion, I would repeat that North China electrical engineering is almost entirely in the hands of the Germans, and it will require a great deal of enterprise to regain for British manufacturers what they have already lost through indifference and lack of enterprise.

---

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Testing the Continuity of Earth Conductors.

Mr. Davis is correct in saying that each set of conditions should be considered separately. Referring to the bridge test, what I mean is this: Suppose I want to take a test in a section where haulages, conveyors, coal-cutters and pumps are operating, one or other, over the whole 24 hours, then arrangements for clearing switches, &c., and, perhaps, short-circuiting a mile inbye, take, say, 15 minutes, test 5 minutes, arrangements for switching on 10 minutes, = half-an-hour, or 15,000 gals. on a 500-gal. pump, walls unstripped, or a train of coal left at the pit bottom at the day's end. His "volt drop" test is only applicable where direct-current is available.

I agree with him that it would be best to use a fairly heavy current for testing, where this can be done, with alternating currents; it would be interesting to get at the "choking" effect of a tape or wire armouring. The former is spirally wound and would have a higher value than the latter, which is placed on with a lay or twist. This, however, presents no difficulty with a small testing transformer having a variable low voltage secondary.

Would Mr. Davis or "Continuity" be inclined to include this in the final result called for under Rule 8 (b) or Rule 12 (e)? I think this would be a proper test to apply with the other.

Individual conductors are mentioned under Rule 8; individual cables under Rule 12. What about the total result, with joints, cross bonds, tee connections, &c., all in series? 1 ohm often means a big difference, or even .05 ohm, on a large conductor.

Again, are we bound down to operating at 1,000 amps. to the square inch? The I.E.E. standard makes a considerable difference on the smaller sizes. This increases the volts drop on the armouring in the event of a fault, when the current is flowing.

It would simplify matters if Mr. Davis and Mr. Field would agree with me that it is practically impossible to have a fracture on the armouring of a three-core double-armoured cable, protected against corrosion. "Continuity" does so in his last letter.

I have seen the cables crushed flat many times, and the copper conductors almost severed, but never yet have I seen the conductivity of the armouring seriously impaired. Would Mr. Davis note that the Home Office do not consider

any other regulations but their own. I know, however, that B. of T. regulation 5 (b) is the rule aimed at.

Perhaps "Continuity" has got into two separate geological "pockets" with his earth-plates. As an experiment, he should try the effect of pouring a few pailfuls of dilute sulphate of copper (a good handful to a pail of water) along the ground between his plates, and test after a few days. I ask him not to use soda or other alkaline matter.

Although I stated in my last letter that the Home Office set a definite value, theoretically, on the armouring and earth conductors, I still maintain that Rule 14 calls for no measurement. If the "electrician," as defined by Rule 14, makes a test to prove efficiency under Rules 8 and 12, he proves continuity under Rule 14.

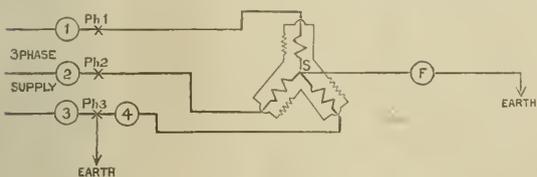
John P. C. Kivlen.

Uddingston West, March 1st, 1913.

**Earthing the Neutral.**

In reply to Mr. Kenelm Edgcombe's letter of February 11th, I would point out that there is not any limiting resistance in the earthed neutral other than the transformer itself. Below is a series of readings taken, which show the conditions under which the transformer works when a fault occurs.

TRANS. 3-2 K.V.A., RATIO 200 TO 2,000, DELTA CONNECTED ON H.T. SIDE AND STAR ON L.T. SIDE, AS SHOWN IN SKETCH.



Current readings.				Pressure readings.				Remarks.
1	2	3	F	1&S	2&S	3&S	1&2 2&3 3&1	
0	0	0	0	20.5	20.5	20.5	86.25 86.75 86.25	Open circuit.
85.0	17.5	17.5	17.5	50.0	21.0	21.0	86.50 86.60 21.50	Fault on Ph. 1.
17.5	86.0	18.0	18.0	52.0	21.0	21.0	25.50 25.60 35.50	" " Ph. 2.
17.0	17.5	85.75	17.5	60.5	26.0	21.5	85.25 22.60 25.0	" " Ph. 3

You will notice from the above test that the currents in the two healthy phases are always one-third of the fault current, and the current in the faulty phase two-thirds.

S. E. Fedden, Manager.

Electric Supply Department, Sheffield, February 26th, 1913.

**The Electro-Harmonic Society.**

As a visitor at the Electro-Harmonic Ladies' Evening at the Holborn Restaurant on Tuesday last, I was very much surprised that smoking was prohibited, although smoking lamps, matches and ash trays were placed on the tables. Surely the ladies would not object to smoking, at any rate, after the interval. I understand that several gentlemen petitioned the Chairman to be allowed to partake of the fragrant weed.

Perhaps this letter may recommend itself to the attention of the Committee of the Electro-Harmonic Society.

Gerald S. Fletcher.

February 27th, 1913.

[We think this letter (which, by the way, seems in very bad taste from a visitor) should have been addressed to the Secretary of the Electro-Harmonic Society. In any case we do not suppose it will have any effect with the Committee, for we have no recollection of a member of the Society ever expressing surprise that smoking is prohibited on Ladies' Nights—which, by the way, are not "Bohemian" concerts—during the 25 years or so of the Society's existence. The Chairman, we may add, had to call the attention of several gentlemen to the fact that it was a "Ladies' Night."—EDS. ELEC. REV.]

**Cost of Running Small Generating Station.**

In further answer to your correspondent, Mr. Gray, I give below the average cost per unit over the last 10 weeks of a small 200-kw. power station driven with suction gas plant. The plant consists of a Kynoch tandem gas engine with a suction gas plant by the same maker, coupled to an E.C.C.

generator of modern type. The auxiliaries which take current from the mains before reaching the motor are one direct-coupled air compressor and one direct-coupled circulating pump:—

AVERAGE WORKING COSTS OVER 10 WEEKS

Coal	...	...	187d. per unit.
Oil, waste, &c.	...	...	913d. "
Wages	...	...	112d. "
Repairs	...	...	634d. "
Total	...	...	345d. "

These figures do not include stand-by losses, which usually amount to an additional 10 per cent. on the total. The load factor is approximately 60 per cent., which is, of course, very favourable.

During the year some extra item of expenditure may be anticipated, which may possibly double the item of repairs.

If your correspondent is interested, I shall be pleased to show him this plant, and give any information that will be of use to him. I may mention the coal costs 28s. per ton delivered to the bunkers.

H. Robinson.

Perry Barr, February 26th, 1913.

**Morse Signalling on Submarine Cables.**

With reference to your notice in the ELECTRICAL REVIEW of the 28th ult., respecting Mr. Edward Raymond-Barker's article on the Morse sounder in "Submarine Telegraphy," and in view that the following facts may be interesting to your readers, I beg to inform you that the method of operating Morse characters over a submarine cable by inverse or alternating currents is not, by any means, new.

In 1907 I was granted a British patent (No. 16,462) for an invention which embodied the principle of telegraphing over submarine cables in type or roman characters, by means of consecutive alternating impulses.

Whilst constructing this typing system, it was apparent to me that the principle could also be applied to the transmitting of Morse characters in the sense implied by the description of Mr. Gott's discovery. An instrument was, accordingly, constructed with this object.

The slip here enclosed shows, beyond doubt, the fact that



I had at that particular date practically established the principle, and obtained Morse characters by consecutive alternating-current impulses (as per Mr. Raymond-Barker's description) for use over submarine cables.

I have submitted these facts for your information, with a view to showing once more that it is possible for two men, entire strangers, to be working on an invention for many years, with precisely the same object in view.

P. O'Neil, Electrician.

London, E.C., March 4th, 1913.

**LEGAL.**

LONDON ELECTRIC SUPPLY CORPORATION, LTD., v. WESTMINSTER ELECTRIC SUPPLY CORPORATION, LTD.

THIS appeal case was last week before the Lord Chancellor and Lord Atkinson, Lord Shaw and Lord Mculton, in the House of Lords. The two companies obtained statutory powers to supply electric energy within certain parts of the City of Westminster. The current supplied by the London company was alternating, and that of the Westminster continuous current. In May, 1910, the two companies entered into an agreement which, in substance, was this: That the Westminster was to work both undertakings, paying the London a yearly sum of about £22,000. The dispute arose in this way: The London said that the position of the Westminster was that of an agent or manager; that the general principle that an agent must do nothing to destroy or diminish his principal's business applied, and that they were bound to supply any customer asking for an alternating current with energy from their (the London's) main, and could not push their continuous current upon him instead, nor could they go to a customer, or a prospective customer, and advise him to take the continuous, instead of the alternating current, which he was then taking, or thinking of taking. Mr. Justice Joyce refused to grant the London, the plaintiffs in the

action, an injunction against the Westminster to restrain the defendants from, as it was alleged, acting *ultra vires* to the agreement. The Court of Appeal upheld the decision of the learned Judge. The London Corporation then carried the matter to their Lordship's Bar.

Mr. Danckwerts, K.C., Mr. Buckmaster, K.C., and Mr. J. Austen Cartmell, appeared for the appellants; and Sir Robert Finlay, K.C., Mr. Younger, K.C., and Mr. W. S. Kennedy, represented the respondents.

MR. DANCKWERTS, K.C., in opening the appeal, submitted that upon the true construction of the agreement of May 4th, 1910, the Westminster company having assumed the management and working of the London company's undertaking within the Westminster area, came under an obligation to the latter to preserve and maintain that undertaking, and that there was a warranty to be implied from the relation of the parties that the Westminster company would do nothing to destroy, diminish, or injure that undertaking. They could not, therefore, refuse to supply a customer, whether new or old, with electric energy from the London company's supply, nor could they solicit customers who desired an alternating current to take instead a continuous current.

LORD ATKINSON: Your case shortly is that the Westminster company are your agents to work your undertaking, and that they have failed to perform the statutory obligation under which you are liable to supply the public generally with an alternating current.

MR. DANCKWERTS: Yes, I say that occupying as they do a position as our agents they are bound by the established principle of law that an agent may do nothing which is against the interest of his principal. The learned counsel then went on to say that the course of management adopted by the Westminster must be prejudicial to the interest of the London company.

MR. BUCKMASTER, K.C., followed on the same side. He said that the construction which the London company put upon the agreement was in accordance with the powers given by the Electric Lighting Act of 1908, and Sec. 20 of the Electric Lighting Act of 1909; whereas the construction put upon it by the Westminster company made it an agreement which was *ultra* the statutory powers of the parties to enter into. The respondents said, "whether it is *ultra vires* or not, you cannot set up that it is, even on our construction of it, because you have chosen to sue us upon the contract." That was the view which, erroneously as he respectfully submitted, was taken by the Courts below. But the answer to that was this:—"It is not *ultra vires* when properly construed, as we construe it, and so construed the Westminster company have committed breaches, which entitled the London company to an injunction and the declaration as asked."

SIR ROBERT FINLAY, K.C., for the respondents, submitted that the decision of the Courts below was right. The only obligation which the agreement put upon the Westminster company was that of paying the various sums mentioned in the agreement as they became due, and this the respondents had faithfully done.

LORD MOULTON pointed out that at some date the City of Westminster Corporation could acquire the undertaking at a valuation of both companies. The quantum of business which the London company was then doing would be important in estimating the sum to be given for that undertaking.

SIR ROBERT replied that the agreement provided for all that, but the important question was what was the relation created by the agreement? He submitted that the respondents were not managers of the appellants' business in the sense that there was any fiduciary relation between the two. On the true construction of the agreement, the appellants had wholly failed to establish that the Westminster company had committed, or threatened, or intended to commit any breach of any obligation imposed upon them.

LORD ATKINSON: In short, do you say that Mr. Justice Joyce was right when, in his judgment, he said the effect of the agreement was to enable the Westminster company to say "We are in a position to supply you with either alternating current or continuous current, but we have, under the Act of Parliament and the rules and regulations of the Board of Trade, a right to say which of the two we will supply"?

SIR ROBERT replied that that was the construction which he asked their Lordships also to hold was the true one. Later in his argument, the learned counsel said that the object of the Westminster company in entering into the agreement was to promote competition, which would be killed if an injunction such as that sought by the London company, was sanctioned.

LORD ATKINSON asked whether starving or strangling the London company to death would promote competition. In such an event there would be one company only, and it could not be said that there was competition then. As it was, customers had a choice, but if there was only one company which offered a supply, that choice would cease to exist.

The LORD CHANCELLOR remarked that it was only natural that a company would say that the article they supplied was the best.

LORD MOULTON thought that if Sir Robert's contention was upheld, the Westminster company could diminish the business of the London company by coaxing their customers away.

LORD SHAW observed that if they were free to do that it would enable the Westminster to reduce the receipts of the London to an enormous extent. It was a question of most vital financial importance, and one which was also of vital importance in keeping up the standard of electrical energy.

MR. YOUNGER, K.C., followed on the same side. He referred to the correspondence between the companies and the Board of Trade. He pointed out that it would be against the interest of the consumer that there should be a double set of mains worked by agreement *inter parties* by the same company within the same area. It would be also to the advantage of the ratepayer, when the

time came for the City of Westminster to acquire the undertakings, to have them merged in one complete system.

LORD MOULTON: That, I suppose, is how you attempt to justify this policy which must end in practically wiping out the London company.

MR. YOUNGER did not agree. It was admitted that £100,000 was the very utmost value of the London company's undertaking. It was their capital. Whenever the City acquired the undertakings they were to have all their capital paid them back. If the City gave less than £100,000 for the London company's undertaking the Westminster were to make up the balance. Meanwhile, not a penny piece would the London company be called upon to find, no matter what expense the Westminster had to meet, and no matter how much the demand for alternating current might increase and new distributing stations be required to meet the demand.

LORD MOULTON pointed out that the Westminster had no statutory power to supply alternating current. If lamps of lower voltage came into general use, alternating current might become almost universal. The agreement, *inter parties*, by which the Westminster were able to supply the alternating current, was, therefore, one which might be very valuable to them.

MR. YOUNGER replied that while that was so, the London had got a very good bargain. At the time that the contract was made, they had only 750 consumers on the books.

The LORD CHANCELLOR: If that statement is true, it suggests that the Westminster expected that the alternating current would come into favour, and that it would be to their advantage to enter into some arrangement by which they could supply it.

In conclusion, MR. YOUNGER said an injunction in the form asked for was one that the Court of Chancery could never sanction. The injunction was not to restrain the Westminster from doing a particular specific thing, but to do nothing which might be calculated to destroy, diminish, or impair the undertaking. Such an injunction would lead to endless litigation, and at any time the Westminster might be called upon to answer a motion for contempt.

MR. BUCKMASTER, K.C., in reply, said that an injunction could be granted in view of the circumstances which led to this case. Two customers, at any rate, both living close to a distributing main belonging to the London company, had been refused an alternating supply by the Westminster, acting on behalf of the London company. The Westminster said they were under no obligation to supply alternating current to anyone who was not a consumer, and that if they did supply, the customer would have to take the supply from the point where it suited them best to connect his house to. An electric supply company had to keep a map showing their mains, and, naturally, a consumer would want to be connected to one near his house, because only 60 ft. of connecting wire was supplied free. If the obligation upon the London to supply was discharged by supplying, not from the nearest point, but from any point on their system, a would-be consumer might have an indefinite length of wire to pay for, although he was entitled to see the map for a fee of 1s., and on that map there was a main close to his house, and presumably he had a statutory right to be supplied from that main.

The learned counsel referred to the powers which a company was given by the Acts of 1908 and 1909 of entering into an agreement for another company to take and supply energy from the producing company. The Act of 1908 was a local Act. The Act of 1909 was a public statute.

In conclusion, he pressed their Lordships to allow the appeal. The LORD CHANCELLOR said the matter was one of importance, and they would take time for consideration.

#### ABERDEEN CITY ELECTRICAL ENGINEER'S SLANDER ACTION.

(Continued from page 370.)

LORD HUNTER, in his judgment, has allowed issues for the trial of the action by jury.

In the course of his judgment, his LORDSHIP states that it was averred that the letter was slanderous in respect, first, that it contained a false charge of professional incompetence against the pursuer; and second, that it falsely alleged that the pursuer, as city engineer, recklessly and without justification imputed dishonesty to the Aberdeen contractors. If the statements of, and concerning, the pursuer amounted to either of such charges, they would be slanderous, as to impute slander was itself a slander. For the defender, Lord Hunter continued, it was maintained that the letter narrated certain facts, and then contained an expression of opinion with reference thereto. It had, no doubt, been decided in the case of a newspaper commenting upon the acting of a public man that, as put by Lord McLaren in the case of Archer v. Ritchie and Co., 1891: "The expression of an opinion as to a state of facts truly set forth was not actionable, even when that opinion was couched in vituperative or contumelious language." His Lordship, however, did not think that that doctrine protected a communication written to the employer of a public official alleging that action taken by him had arisen, not from error of judgment, but from incompetence or recklessness. Besides, the pursuer did not admit the accuracy of the facts alleged by the defender in the letter complained of. His Lordship did not, of course, determine that the statements in the letter were slanderous. They appeared to him to be capable of bearing a slanderous meaning, and it was for the jury, therefore, to say whether they were used in an innocent or slanderous sense. The defender maintained that, in any event, he was privileged, as he was writing on behalf of the Association. No action lay against that body for slander in virtue of the provision of the Trades Disputes Act, but it had been decided that an official of a Trade Union might be sued. His Lordship did

not think that an official so sued enjoyed any greater privilege than the Association would have done. In the present case, the contractors, whose work was criticised by the pursuer, would have been privileged; but, so far as the averments in the present case with reference to the Association were concerned, he did not think he could hold, at all events, at this stage, that they were privileged. If at the inquiry it appeared that the Association were entitled to privilege, the jury might be directed that the pursuer was not entitled to succeed unless malice on the part of the defender were proved. His Lordship should also notice the averment made by the pursuer to the effect that the defender, in making the statements which he did, exceeded the instructions he received from the Association. If that were established, he would, or might, lose the benefit of the plea of privilege to which, otherwise, he might have been entitled.

Counsel for the pursuer, Mr. Cooper, K.C., and Mr. Lippe. Agents, Scott & Glover, W.S. Counsel for the defender, Mr. Murray, K.C., and Mr. Wilton. Agents, Davidson & Syme, W.S.

#### TRAMCAR OBSTRUCTION.

At the Bradford West Riding Court, on Thursday, a teamster, named George Rhodes, of Keighley, was summoned for obstructing a tramcar belonging to the Bradford Corporation. Mr. J. G. Gunter prosecuted, and in the evidence it was stated that the defendant had obstructed the car for a distance of some 700 yd., totally disregarding the persistent ringing of the bell on the car by the driver, and the driver had had to leave the car and lead the horse from the tramlines before the car could pass. The defendant was fined 20s. and costs.

#### GLASGOW CAR MISHAPS.

In the Court of Session a settlement was intimated to Lord Dewar in the action by a Govan riveter, against the Glasgow Corporation for £1,000 damages for injuries sustained through being knocked down by a Corporation tramway car. Pursuer agreed to accept £75 and expenses.

After hearing evidence in an action by a woman whose husband had been fatally injured by a Glasgow Corporation car, a jury in the Court of Sessions awarded the widow £250, £50 to her pupil son, and £5 to each of her four other children. The Corporation denied fault, contending that the accident was entirely brought about, or materially contributed to, by deceased's own carelessness or recklessness in suddenly and unexpectedly stepping back on to the tramway track after clearing it.

#### OSRAM LAMP WORKS, LTD., v. SCHLOSS & Co.

On Friday, February 28th, Mr. Justice Swinfen Eady had again before him in the Chancery Division the motion in this case. This was a motion by the plaintiffs, who asked for an injunction to restrain an infringement of their lamps. It was stated on behalf of the defendants that the plaintiffs desired to answer their evidence, which had just been received by plaintiffs, and subject to his Lordship's sanction, it had been arranged that the motion should stand over for a week. This his Lordship agreed to.

#### COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD. v. J. SALOMON AND Co.

In the King's Bench Division, on Tuesday, March 4th, before Mr. Justice Bankes and a common jury, an action was brought by plaintiffs against defendants, leather dealers, Rotheray Street, Weston Street, Bermondsey, to recover £1,880 for electricity supplied to the factory of the defendants at Mina Road, Old Kent Road, S.E., over a period ranging from June, 1908, to November, 1911, the claim being based upon a contention that through the misreading of the dial of the registering meter, the defendants had only been charged about one-tenth of the proper amount, viz., for 33,428 Board of Trade units instead of 334,272 at 1d. per unit.

The defendants pleaded various defences. They said they had paid for the electricity consumed, alternatively they said it was plaintiffs' duty to supply and maintain a suitable meter, and that any loss that had occurred through mistaken reading must be borne by the plaintiffs; they also pleaded breach of statutory obligations by the plaintiffs, and entered a counterclaim against the plaintiffs, saying that they had carried on their factory upon a certain understanding as to the cost of electric power—as represented by the accounts presented by the plaintiffs and duly paid by the defendants—that they had based their estimates of cost of production on the prices charged by the plaintiffs for light, and that they would never have carried on their works if the charge had been on the scale now sued for by the plaintiffs.

For the plaintiffs, Mr. T. R. Atkin, K.C., Mr. Colefax, K.C., and Mr. Slumper appeared, and defendants were represented by Mr. Duke, K.C., and Mr. Spokes.

MR. ATKIN, K.C., said that the defendant company, it appeared, employed a certain amount of machinery in connection with their business for extracting water from hides, &c., and they took over some works at Mina Road that had been supplied with electric

power, and the defendants had used the power since 1908. The defendants made a contract with the plaintiff company whereby they were to have the power at 1d. per Board of Trade unit, the current to be registered in the ordinary way by the electric meter. The meter now concerned was in regular use, and no complaint had been made of its working. In this case the last unit in the total shown on the dial had been erroneously read as a decimal, and the result was that for 34 years the defendants had been charged just about one-tenth of the proper charge for the current actually consumed. The mistake was undoubtedly a very unfortunate one, and it brought about the result that this leather factory had had its power for one-tenth of the correct charge as shown by the meter, the accounts submitted to the defendants being based entirely on the misreading referred to. The plaintiffs now came to Court and submitted that defendants should be called upon to pay for the power supplied to them. The mistake was discovered in 1911, and the defendants were informed, but they declined to pay and the proceedings were begun. The defendants had put in a number of different defences. They said there was a clause in the contract which barred going back more than one quarter, but this clause actually applied in the case of an incorrect meter. Here the plaintiffs contended the meter was accurate—it had only been misread. The defendants had also pleaded that the current they had had was the current they had actually been charged for, and they had acted on that basis in estimating their cost of production and the cost of carrying on their works, and they said that for three and a half years the works had been carried on at a loss, and if they had known they were using the amount for current now contended by the plaintiffs, they would have closed their works down, and therefore the plaintiffs ought to pay the defendants money in respect to the loss incurred in carrying on their works. Apparently (said Mr. Atkin, K.C.) the attitude of the defendants was like this: "If your grocer makes a mistake in his bill, and he charges you only half as much as he ought to, you can say to him, 'I will not pay your bill, because if I had known what the real bill was I should not have eaten so much jam and drank so much tea. Therefore, I will not pay for the goods that have been supplied to me.'" It was also pleaded by the defendants that the plaintiffs, in breach of their statutory powers, had supplied the current from Camberwell instead of from Southwark; but the plaintiffs would say that it was supplied to the defendants through Southwark, and that this defence could not be supported.

Counsel went on to detail the history of the electrical installation at the defendants' factory. The original company under the contract was a company carrying on business in the same premises, called the Mina Chemical and Dye Works, Ltd., and the contract was dated 1906. There was a 7½-H.P. engine, and later a 25-H.P. motor. The price was 1d. per Board of Trade unit. It was found that defendants had had 334,272 units, and they had been charged for 33,428, so that 300,844 units had not been paid for at all. Roughly speaking, the charge for power was £600 a year, but the defendants had only been charged, in fact, £60 a year. In the autumn of 1911 a meter reader went to take his quarterly reading, and read the meter correctly. He had noticed what the figure for the previous quarter had been, and he could not understand how it could be that the consumption had jumped up ten times. He put the reading down, treating the last figure as a decimal, but he reported at headquarters the doubt he felt about the matter, and on November 7th two inspectors visited the factory and discovered the error that had been made. Certain correspondence ensued, the plaintiffs presented their account, and ultimately defendants wrote to say that they could not accept liability for irregularities in the meter; they had had the current since July, 1908, and the meter had been regularly inspected by the plaintiffs' representatives.

MR. ATKIN added that as a fact it had been found that the meter showed a slight tendency to under-register intermittently, so that this was an advantage to the defendants. Counsel also said that the defendant company had entered into a new contract to have the power at 1d. per unit. Although the defendant company had in their pleadings said they would have closed their works, they had not, in fact, closed them, and counsel said he would submit that a *bona fide* mistake had been made, and the plaintiffs were entitled to recover. He would submit that the defendants could not support their defence of an estoppel. Counsel subsequently called evidence in support of his case.

MR. CHARLES SPARKS, M.Inst.C.E., M.I.E.E., said he was engineer-in-chief to the plaintiff company, and was responsible for the generating stations, the system of distribution, the supply and the meters. Witness spoke to the history of the electric installation at the works, and said that the meter now in question was of the type known as the "K.G.," and it was supplied by an electrical company. This type was approved by the Board of Trade in 1910, and it was supplied in 1906 to the defendants, it having not been approved at that date. He regarded this meter as the same in principle as the one approved in 1910. It was a sealed meter, and he could not see inside it to see if it was exactly the same in the details of construction as the K.G. approved type, but he believed it to be the same in principle. They had used the K.G. type for seven to eight years, and they used hundreds of them.

What's your opinion as to the suitability of the meter for registering current used at the defendants' works?—In every way it is a most suitable meter. Witness further testified that the figure that had been read as a decimal was, in fact, a unit, and should have been charged as such, and that the current was supplied through the Southwark district. Witness handed in a table, which he said was to show that the power that had been actually charged for could not be sufficient for the requirements of the defendants' machinery.

MR. DUKE, K.C., in cross-examination, suggested to the witness that the Board of Trade had never approved of a meter that carried on its face the marks that had caused the alleged misreading by the plaintiff company's servants.—Witness said they had many of the K.G. type that bore the decimal mark, but it was possibly true that never had one been approved that had a dial just like this one.

The K.G. type has only been approved for a capacity not exceeding 10 amperes? I do not know that. Witness added that the K.G. type was made in Germany and was made for the English market.

MR. DUKE, at this point, applied to his Lordship for consent to amend the defence so as to raise the point that the plaintiffs had, in contravention of their powers, supplied power from other than the Southwark area.

MR. ATKIN, K.C., opposed the allowing of the amendment, and pointed out in the course of his argument that the defendants were still having the electricity under a new contract.

MR. JUSTICE BANKES said the amendment sought to raise the question as to whether the plaintiffs were acting within their powers, and he was inclined to think that he ought to explain it and assist that investigation, subject to all questions of costs being reserved.

Subsequently, evidence was called to prove that there was always a supply by the plaintiffs from Southwark, that the red-line indicated on the meter dial was used as a test, and that the K.G. type was very extensively sold on the Continent and in a smaller measure in the United Kingdom.

After the closing of the plaintiffs' case, MR. DUKE, K.C., addressed the jury for the defence. He said that the attitude the defendants took here was that they had been led to carry on their leather business for years on the footing that the cost of electricity was a certain cost, and had been paid, and that the matter must rest there, and if plaintiffs had made a mistake they must lose on their side by their error. The defendants were for a very long time in doubt as to whether it would be of advantage to them to have electric power at their works: the introduction was made on the representation of the plaintiffs that it would be cheaper than either steam power or suction gas. The defendants had gone on with their business, on the footing that the cost of the power was that which they were being charged by the plaintiffs, and the defendants now contended that plaintiffs were estopped on the ground of their own conduct. It came as a complete surprise to defendants to be told that they ought to have paid 10 times more than they had done. The defendants had, at considerable expense, laid out their works in such a way as to use electricity in the future. If this meter was one that misled every accustomed person who came to see it and misled the plaintiff company's own servants, then it was difficult to see how it could be regarded as a suitable meter. He would call evidence to show that the red line on this dial, to the ordinary understanding indicated that the figure was a decimal and not a unit.

For the defence, MR. DAVID SALOMON gave evidence to the effect that there was nothing whatever to indicate that the meter was only registering one-tenth. Witness gave evidence at length as to his interviews with Mr. Scott before the electricity was introduced, and said he was assured that it would be cheaper than other means. He would not have used the electricity had the cost been such as now contended, and if he had known that the meter was only indicating one-tenth of the cost, Witness showed in further evidence how he had based his prices and estimates of cost of production in relation to the cost of electricity.

Cross-examined, he was still continuing his business; he had "sunk" £35,000 in it. He made a good profit last year, as the prices for leather were higher through the shortage.

MR. ERNEST EDWARD SHARPE, M.I.E.E., and associated with meter manufacturing for many years, deposed that he would read the last figure on the dial of this meter as a decimal, because of the red line in front. He said this mainly because of the red colour. Red was always associated with a decimal point. The German meters invariably had red to indicate the decimal point.

Other evidence of a similar character was called to show that the dial was unsuitable, that the figure on the extreme right would be read as a decimal, and that the meter was not of a type approved by the Board of Trade.

After other evidence, counsel addressed the jury, and Mr. Justice Bankes summed up. His Lordship left the following questions to the jury, and they were ultimately answered by the jury as indicated:—

Did the plaintiffs, in rendering their quarterly accounts, represent to the defendants that the quantity of electricity supplied was materially less than was actually the case?—Yes.

If so, did the plaintiffs intend in making such representation that the defendants should act upon it in determining (a) to continue to take a supply; (b) whether or not to continue to carry on their business; (c) the selling price of their goods; and (d) whether to extend their plant?—No.

Did the defendants act upon such representation to their detriment in respect to any of the above, or either of them?—They did act on it, but there is no evidence as to detriment.

Was the meter supplied a suitable one?—Yes.

Were the plaintiffs' servants negligent in reading the meter?—Yes.

Did the plaintiffs keep the meter in proper order for correctly measuring the supply?—Yes.

Ought the defendants by the exercise of reasonable care to have discovered that they were consuming more electricity than they were paying for?—Yes.

The case was ordered to be set down at a future date for legal arguments to be heard on the jury's answers.

#### WOOLLEN v. LONDON UNITED TRAMWAYS, LTD.

In the Divisional Court of King's Bench, on March 4th, Mr. Justice Channell and Mr. Justice Bray heard an appeal from a judgment of Judge Woodfall given in the Westminster County Court in this action. The plaintiff, at about 4 o'clock in the morning, was driving from Ealing to London in his motor-car a party of ladies who had been to a dance, and he came into collision with a rail scrubber which was at work on the tramline. The evidence at the trial was very conflicting as to upon whom the blame rested, and the County Court Judge found for the plaintiff.

MR. HAYDEN, who appeared for the respondent (the plaintiff in the action), contended that the Court had no jurisdiction to hear the appeal, as the defendants raised no point of law at the trial. Their Lordships, however, decided that the case would have to be heard before they decided whether a point of law could have been raised.

MR. RAYNER GODDARD, for the appellant, stated the facts of the case, and said that although the plaintiff had been found to have been guilty of contributory negligence, the Judge had decided in his favour, on the ground that the driver of the "scrubber" had also been negligent in not sounding his gong. If he had sounded his gong, said the County Court Judge, the plaintiff would not have been entitled to recover. There was no evidence that the defendants' servant was responsible for the accident, and upon the facts found by the County Court Judge, he (counsel) asked for judgment for the defendant company, or a new trial.

MR. JUSTICE CHANNEL said that, without saying whether the result of the trial was right or wrong, he was of opinion that the case had been decided upon a question of fact, and not of law. The fact of the trial having been unsatisfactory was no ground for a new trial, and the appeal would, therefore, be dismissed.

MR. JUSTICE BRAY concurred, and the appeal was dismissed with costs.

## BUSINESS NOTES.

**Lamp Tests.**—The Westminster Electrical Testing Laboratory has just completed a series of life tests on 13 of the best-known makes of metal-filament lamps. These tests indicate the relative values of the different makes now on the market, and show, when compared with the previous tests, the progress that has taken place during the last 12 months. Five 200-volt 32-watt lamps were ordered of each maker, and were run for 2,000 hours on an automatically regulated 200-volt circuit. The candle-power and consumption of each lamp were measured at the start and afterwards every 250 hours. The report contains all individual results, as well as various tables of averages. The tests show very clearly the need for including in a specification a specified life as well as specified limits of efficiency, which should be, in many cases, quite outside the makers' regular standard.

**For Sale.**—The Dewsbury Corporation has for disposal a quantity of steam-driven generating plant. See our advertisement pages in this issue.

**Air Filters.**—MR. H. R. WITTING, 41, Berners Street, London, W., the sole British representative of Messrs. K. & Th. Möller, G.m.b.H. of Westphalia, informs us that he has recently booked orders for patent single pocket air filters from the following:—James Simpson & Co., Ltd.; Wellman, Seaver and Head, Ltd.; C. A. Parsons & Co., Ltd.; W. Beardmore & Co., Ltd.; the Brush Electrical Engineering Co., Ltd.; the Glangarnock Iron and Steel Co., Ltd.; Dick, Kerr & Co., Ltd.; the British Westinghouse Electric Co.; the Newcastle-on-Tyne Corporation Tramways, and others.

**"Lux" Electric Candles.**—THE LUX CANDLE CO., Ltd., of 36, Whitfield Street, Tottenham Court Road, London, W., announce improvements in these candles in a leaflet just issued. A different make of metal-filament lamp of improved efficiency and strong filament is now employed, which is made for up to 125 volts, without increasing the size of the bulb at the candle point or spoiling the candle-like appearance.

**Book Notices.**—"The C.D., 1913." Melbourne: Critchley Parker. This is the Australian Mining Standard Classified Directory of makers of mining, electrical, and industrial machinery and other manufactures for the mine. "The Newspaper," by G. B. Dibblee. Home University Library, No. 69. London: Williams & Norgate. 1913. Price 1s. net.

**Catalogues and Lists.**—MESSRS. GILBERT GILKES AND CO., LTD., Kendal.—New catalogue of 16 pages, containing a full description, with line drawings and half-tone illustrations, of their "Centuri" centrifugal pumps, which embody entire revision of designs and patterns. Tabular information is detailed respecting single-cell and multi-cell pumps, and other useful matter, is given, including notes on installation and working. A loose sheet tabulates prices of the pumps.

ADNIL ELECTRIC CO., LTD., Artillery Lane, London, E.C.—Effective newspaper folder, issued with the object of showing how their indirect lighting fittings eliminate possibility of "glare."

MR. H. C. SLINGSBY, 142-146, Old Street, London, E.C.—Eight-page list (No. 142), effectively illustrating their extension ladders.

THE WESTINGHOUSE COOPER-HEWITT Co., LTD., 80, York Road, King's Cross, London, N.—List No. 40 relating to the special adaptability of Cooper-Hewitt lamps to the production of cinematograph films. The leaflet sets forth the prices and general advantages, one of which, apart from the high actinic value of the light, is the economy in current consumption.

MESSRS. OZONAIR, LTD., 96, Victoria Street, London, S.W.—New pamphlet No. 3 (32 pages), containing a description of the Ozonair system of pure air ventilation. Introductory notes deal with the principles of ideal ventilation. The apparatus is finely illustrated, and there are also many pictures of buildings, &c., where the system is in use.

THE EMANDA ENGINEERING Co., LTD., Emanda Works, Sumner Avenue, Peckham, S.E.—Sheet of illustrations showing their switch and fuseboards, distribution boards, &c.

MESSRS. SIEMENS BROS. & Co., LTD., Woolwich.—Abridged illustrated price list of round pattern switchboard instruments, electromagnetic and moving coil.

MESSRS. J. H. HOLMES & Co., 17, Soho Square, London, W.—New pamphlet of 48 pages (newspaper printing section) containing a description, with illustrations, of their improved Holmes-Clatworthy system, with hand or push button control for electrically operating rotary web presses. A number of improvements have been introduced.

MESSRS. FREDK. BRABY & Co., LTD., Ida Works, Deptford, London, S.E.—In a small pocket pamphlet of eight pages the firm give information respecting economical storage of petrol, and the underground storage tanks, pumps and overhead measuring tanks and other apparatus supplied by them for that purpose.

MESSRS. MELDRUMS, LTD., Timperley, near Manchester.—Several new publications describing respectively the Meldrum improved forced-draught furnace; patent refuse destructors; and the "Koker" and "Sprinkler" mechanical stokers.

MESSRS. RICHARDSONS, WESTGARTH & Co., LTD., Hartlepool.—Admirably got-up pamphlet of 36 pages, containing a full account (with numerous clear sectional diagrams and beautifully-executed photographic reproductions of completed plants) of the combined impulse and reaction turbine built by the firm. This is of the same type as that built by Messrs. Brown, Boveri & Co., of Baden, and Messrs. Richardson, Westgarth have supplied, and have in hand, a large number of machines of this type of various sizes. In addition to general and constructional particulars, there are test curves given. Turbines for special purposes (back-pressure and bye-pass) are also included.

THE POWER PLANT Co., LTD., West Drayton, Middlesex.—Four-page leaflet, giving a specification of their self-contained mill gears for low and medium ratings.

THE STEARN ELECTRIC LAMP Co., LTD., 47, Victoria Street, London, S.W.—Illustrated and priced leaflets respecting the new Stearn "Globolite" lamp, heating and the "Leuconium" lamps.

**Strike Settlement.**—We are informed that the strike at the works of MESSRS. EVERSHED & VIGNOLES, LTD., caused by the dismissal of a workman for reading instead of going on with his work, has been settled by the withdrawal by the men of the demand for his reinstatement. The company on its part has undertaken to take back the strikers into its employ. It is stated that with one or two exceptions, good feeling has prevailed during the struggle, which involved the whole of the workshop hands, numbering about 220. The support of the staff and a number of other employes has helped materially in bringing about the successful issue of the dispute. The firm ask us to state that the aid received from a large number of manufacturers has strengthened their hands in the conduct of the matter, and to these manufacturers they express their thanks for such assistance. Messrs. Evershed & Vignoles ask customers to continue to extend to them consideration in the matter of deliveries, as these will necessarily for the present be somewhat delayed, though no effort will be spared to speedily remedy this.

**Trade Announcements.**—With reference to a notice that appeared in our last issue, MESSRS. WARD & GOLDSTONE state that in place of Mr. Stafford Sinclair they have engaged Mr. G. G. Turvey to act as their Glasgow representative. They are giving up their present address at 50, Wellington Street, Glasgow, having taken more commodious premises in West Campbell Street, which will enable a larger stock of their manufactures to be kept, and will also afford greater facilities for showrooms, &c.

Mr. Leo. Eppenheim has taken into partnership Mr. Percy Levy, and the business will be carried on under the style of LEO. EPPENHEIM, LEVY & Co., at 31-5, Duke Street, St. Mary Axe, E.C.

MESSRS. JONES & ATTWOOD, LTD., heating and hydraulic engineers, of Stourbridge, have added an electrical department for the supply and erection of plant and fittings for all kinds of electrical work, with Mr. W. Bannister as manager.

Premises at 60, Hamilton Square, Birkenhead, have been taken by the ECONOMIC ELECTRIC Co., electrical and mechanical engineers.

Mr. H. W. POWER, engineering publicity expert, of 31, Queen Victoria Street, E.C., informs us that his telephone number is now City 8590, instead of 8509, as given in the Universal Electrical Directory.

Mr. F. H. WAY has been appointed Midlands' representative for the Electrical Apparatus Co., Ltd., with headquarters in Birmingham, and Mr. W. ROBERTS (late of the British Westinghouse Co.), has been appointed the firm's South Wales representative, with headquarters in Cardiff.

During the past year, large extensions and improvements have been made in the works of the HOFFMANN MANUFACTURING Co., LTD., at Chelmsford, which are devoted entirely to the manufacture of ball and roller bearings and steel balls. Extensions to the

grinding department, cage department, testing department, and stores have been made, increasing the available floor space by 28,200 sq. ft. Even with the above extensions, the demand has again overtaken the capacity of the plant, and, at the present time additional extensions are being made. A further Diesel engine of 1,000 H.P. is on order, making the total available horse power over 2,000.

MESSRS. W. WHITE & Co. have taken larger premises at 25, Budge Row, Cannon Street, London, E.C. the premises recently occupied by Messrs. Krupka & Jacoly.

**Bankruptcy Proceedings.**—CHARLES SPENCER NORTH-COTE, electrical engineer, 67, Stanthorpe Road, Streatham, London.—The public examination of the above named debtor was held at the Court House, Wandsworth, last week, before Mr. Registrar Willoughby. The statement of affairs showed liabilities amounting to £1,713 and assets estimated to produce £61. Questioned by the Official Receiver, debtor stated that in 1906 he left a company with which he had been connected, selling his shares for £4,000, and starting on his own account at Queen Anne's Gate, Westminster, under the style of "Wholesale Electric Traders." In 1908 he was concerned with an electrical exhibition, over which he lost £2,000. He gave up his office three years ago, and since then had been living on his capital, having no paying business. His capital became exhausted at the beginning of last year, and he gave instructions to Messrs. Debenham, Storr & Sons, auctioneers, to sell the greater part of his furniture. Debtor was dissatisfied with the amount handed to him, and as a result of statements made in letters sent by his solicitors to Messrs. Debenham, they commenced an action for libel. Judgment was given against him, and subsequently the damages were assessed at £400. Debtor calculated that he had lost £1,000 over the sale of a house at Forest Hill. The examination was adjourned.

W. H. MICKLETHWAIT, electrician, Ilrargate.—First meeting, March 13th; public examination, April 4th; both at York.

**Liquidation.**—ROSSENDALE BELTING Co., LTD.—A petition (presented by Messrs. A. E. Bennett & Co., Liverpool) for winding-up this company, is to be heard on March 17th at Liverpool.

## LIGHTING and POWER NOTES.

**Accrington.**—Negotiations respecting the supply of electrical energy to the paper works of Messrs. Peebles & Sons have been in progress, and application is to be made to the L.G.B. for power to borrow the amount required to carry out the requisite extension.

A report in regard to the new gas engine plant has been issued by the electrical engineer. A three months' trial on one engine and electrical generator started on February 4th, running 164 hours per week, as near to full load as circumstances permitted. The gas making plant started a three months' trial on March 1st.

**Barking.**—It has been decided to withdraw the Council's opposition to the Romford and District Electric Lighting Order, conditionally upon the words "by agreement, but not otherwise" being inserted after the word "may" in line 10 of Clause 20 (Bulk Supply) of the Order. At the last meeting of the Council a report from the clerk was considered, showing the position of affairs with regard to (1) the suggested transfer of the electric lighting undertaking; (2) the taking of a bulk supply of energy from the West Ham Corporation; (3) the taking of a supply of electricity for traction purposes from the East Ham Corporation; and (4) the proposed leasing of the light railways from East Ham boundary to Loxford Bridge, to the East Ham Corporation. It was decided (a) to take no further regard to item (1) at the moment; (b) that the consideration of item (2) remain in abeyance; (c) that the clerk negotiate further with the East Ham Corporation with regard to item (3); (d) that with regard to item (4), the East Ham Corporation be informed that the terms suggested are such as cannot be accepted; (e) that the engineer prepare a report upon the question of extensions to the electricity plant, to which item (2) be also referred.

**Barrow-in-Furness.**—The T.C. has approved of the Electricity Committee extending the mains on Walney Island in order to supply current to 102 houses which are to be erected by Messrs. Rainey Bros. The electrical engineer reported that at the next meeting of his committee, he hoped to put forward some definite proposition in regard to fixing electric cooking apparatus in each of the houses. It was agreed to support a demonstration of the uses of electricity by the British Electric Transformer Co., Ltd.

**Beckenham.**—The U.D.C. has applied to the L.G.B. for sanction to borrow £2,500 for services and £1,000 for meters in connection with its electricity undertaking.

**Birmingham.**—The proposed new power station scheme at Nechells, to provide an additional 100,000 kw. of generating plant, is still held up. The committee's indecision is explained by the nearness of the end of the financial year, the trading result of which should be available shortly.

**Bispham (near Blackpool).**—An inquiry has been held by Mr. T. C. Ekin, L.G.B. Inspector, relative to the Council's application for sanction to borrow £8,178, for extensions to the electricity undertaking. Although the station has only been in

operation a little over 12 months, the demand for electric lighting has far exceeded the anticipations of the Council, which has found it necessary to increase the plant to something like two and a half times its present capacity. There was no opposition to the application.

**Bolton.**—The Electricity Committee has approved of the plans of the proposed generating station, completed with the amendments decided upon by the engineers.

The chairman and vice-chairman have been deputed to open and tabulate the tenders for the supply of switchgear.

**Continental Notes.**—**LUXEMBURG.**—It is reported from Luxemburg that, after protracted negotiations, an agreement has been reached between the Government of the Grand Duchy and an English power association, whereby the latter undertakes shortly to begin the erection of the proposed Sauer Valley dam in the upper Oesling, in connection with the hydro-electric scheme for the supply of the whole of the Duchy. The expenditure on the work is estimated at £640,000, and the approval of the agreement by the Chamber appears to be assured. Associated with the scheme is a rumour of the projected establishment of a large new steel works near Erpdringen, above Ettelbruck, which would obtain its supply of power from the hydro-electric works in question.

**FRANCE.**—A company has just been formed at Aulne (Parthe), with a capital of £10,000 and the title La Société Sarthoise d'Electricité et de Force, to establish a small electricity generating station in the town.

**SWEDEN.**—The Stora-Kopparbergs Aktiebolag, the second largest mining company in Sweden, and the owner of a large area of timberland, is going to erect a large electrical power station at Forshuford, to utilise the falls of the Wal River. The same company may be said to be the financial pioneer of the development of electrical smelting of iron-ore in Sweden and elsewhere, and has, in addition to the electrical furnace at the Donnarhuford Iron Works, another electrical furnace of different construction in operation, the latter having a capacity of 12,000 H.P.

**NORWAY.**—The largest power station in Europe, says the *Génie Civil*, is being constructed on the Norefal, near Nore, in the Numedal, to supply electricity to Christiania and Eastern Norway. The buildings, 160 m. in length, are at the foot of a mountain, upon which will be a penstock fed from a reservoir 6 km. away, and the available head will be 420 m. There will be 11 turbines of 20,000 H.P. each and two of 10,000 H.P., making a total of 216,000 H.P.

**Dartford.**—The U.D.C. has applied to the B. of T. for consent to supply current in the rural area to the premises of Vickers, Ltd., the S.E. and C. Railway Co., at Slades Green, Messrs. Richard & Brignall, Messrs. Murgatroyd Bros., Messrs. G. P. and J. Baker, and Messrs. D. and C. Rutter, Ltd., all in the parish of Crayford. It is proposed to give the supply by means of overhead cables, carried as far as possible alongside the railway.

The Electric Lighting Committee has had under consideration the question of the scale of charges for current. It states that the falling off in the demand for power purposes is adversely influencing the finances of the undertaking, and recommends a fixed charge of 25s. per kw. (approximately £1 per H.P.) of demand per quarter, and in addition charges based on consumption varying from 1½d. to 3d. per kw.-hour. The Committee states that Messrs. Vickers, Ltd., who have already arranged to take current at their Crayford Works, will be requiring before long 200 kw. The capital expenditure is put at £4,300, of which £1,800 would be spent on two 250-kw. rotaries, with transformers to raise pressure to 6,600 volts, and £600 on two 200-kw. transformers at Vickers' premises, and the necessary switchgear. The total demand would run to some 450 kw., and the capital expenditure be raised to £11,000, with annual receipts on the new scale of £1,705, as against an expenditure on coal, wages, interest and repairs of £3,375.

**Dorset.**—The County of Dorset Electric Supply Co. has been successfully floated, and is putting in hand the scheme for supplying electricity to the various towns in Dorsetshire, particulars regarding which have already appeared in these columns. The works in Swanage, Dorchester, and Blandford are being started this spring, and it is hoped that the supply will be available in the course of a few months. It is intended to start the works in the other towns in Dorset—Sherborne, Wimbourne, &c., directly circumstances permit.

**Dundee.**—The Dock Street sub-station is now completed and capable of relieving Dudhope Crescent Road Station of 1,500 kw.

Specifications have been issued for the steelwork and chimney for the extensions at Carolina Port. Tenders are due on the 10th inst.

**Edinburgh.**—The T.C. has agreed to raise the maximum salary of the station engineer at McDonald Road station from £270 to £330 per annum, by such increments as may be recommended by the resident engineer with the approval of the Committee. The convener of the Committee justified the increase on the ground that the salary of £270 was fixed 10 years ago.

**Faringdon.**—Works for electric lighting for this town have been constructed at the old brewery in Southampton Street. Consent of the public authorities to the erection of the poles having been given, most of the poles are now in place, but a numerous signed protest against these erections has been sent to the District Council, complaining of their unsightliness. The Council, however, has refused to move in the matter.

**Fleetwood.**—A L.G.B. inquiry was held on February 25th into the application of the D.C. to borrow £7,176 for the purpose of the electricity undertaking.

**Galashiels.**—The Tenants' Association has unanimously petitioned the T.C. to make the supply of electricity a Corporation concern. The question engaging public attention at present is whether the scheme should be undertaken by the Council or by a private company. Before coming to a decision the Council sent a deputation to Glasgow to consult an expert, and the members reported to a private meeting the result of their visit. On Thursday, last week, Mr. Parsons, the expert consulted, visited Galashiels for the purpose of getting information to enable him to prepare his report.

**Halifax.**—It is proposed to extend the H.T. supply to the works of Messrs. Asquith, Ltd., at a cost of £352 (subject to a guarantee that the income will not be less than £200 per annum for five years), to West Croft Mills, and to New Brunswick Mills, at an estimated cost of £398, and to Horley Green Mill, at an estimated cost of £767.

**Haslingden.**—The L.G.B. has sanctioned the loan of £3,750 for a period of 25 years for electricity cables, and the sum of £1,500 for a period of 15 years, for electric services.

**Hastings.**—A L.G.B. inquiry has been held concerning the application of the Corporation to borrow £8,133 for electric lighting. In one item of £4,000, the engineer (Mr. Ferguson) said he might include the cost of a high-tension main to the borough boundary. The Inspector said the amount was not ear-marked, and it would be left to the Council to act as it pleased. At the close of the inquiry, there being no opposition, the Inspector said the improved position of the undertaking was quite encouraging. There was rather a long list of what they might call "moral obligations" when they got to the right side. He noticed that the number of consumers had gone considerably. "Don't spend your money on buildings; spend it on wheels," added the Inspector.

**Hebden Bridge.**—The D.C. has decided to apply to the L.G.B. for sanction to borrow £3,250 for the purpose of extensions at the electricity works.

It is anticipated that, for the first time since the electricity works were started, there will be a profit on the working of the undertaking.

**Heston and Isleworth.**—The electrical engineer, Mr. P. Rycroft, reported to the last meeting of the U.D.C. that the engine for the new plant would not be ready until the middle of March owing to the difficulty that had been experienced by the makers in obtaining castings and fittings.

**Keighley.**—The Electricity Committee has made a recommendation that an agreement be entered into with the Bingley U.D.C. for the supply to the latter of electrical energy, in bulk, on the three-phase extra-high-tension system at 6,600 volts, 50 periods per second, on the following terms:—The U.D.C. to pay a fixed annual charge according to the following scale.—If the consumption does not exceed 300,000 units per annum, £400; if the consumption exceeds 300,000, but is not more than 400,000 units per annum, £500; if the consumption exceeds 400,000 units per annum, £600. And in addition to such fixed charge, 3½d. per kw.-hour registered by a meter to be fixed at the Bingley end of the H.T. cable; accounts to be subject to 5 per cent. discount, and to be paid quarterly. The agreement to be for a definite term of 10 years, with options to the Bingley Council to extend the term for two further periods of five years each. Application will be made to the B. of T. for an order to give effect to the proposed agreement.

**Plymouth.**—The T.C. is making application to the L.G.B. to borrow the sum of £5,500 for the purpose of extending the plant at the electricity works. The Electricity Committee reports that it is estimated that the sum required for interest and sinking fund will amount to £488 per annum, and that the saving in working expenses that will result from the operation of the proposed plant will equal the above capital charges at the time it is put into operation. The increase in total plant capacity will enable additional and profitable revenue to be earned. Cables are to be laid to Laira, subject to the intending consumers entering into an agreement.

**Portsmouth.**—At a meeting of the Council the Lighting Committee recommended (the matter arising out of the agreement between the Council and the new Electric Lighting Co.) that, as the streets and highways were to be illuminated by electricity, the number of lamps should be increased by 61, making a total of 174, with the 113 existing lamps. The cost of the 113 gas lamps was £285, and the increase of more than 50 per cent. in the number of electric lamps, would mean an additional expenditure of only £39. The report was unanimously adopted.

**Radstock (Somerset).**—At the last meeting of the U.D.C., a special committee appointed by the Council presented an extensive report upon the question of the public lighting of the town. The gas projects having practically failed, the Committee stated it turned its attention to the question of electric lighting, and secured the services of a well-qualified engineer from London, who visited Radstock and forwarded the surveyor a lengthy report.

With regard to public lighting, the scheme provides for 150 lamps of 50 and 100 c.p., lighted for 1,500 hours per annum. It was proposed that a charge of 6d. per unit be made for private lighting. The capital expenditure was estimated as follows:—Buildings and foundations, £200; plant, including moving the engines, new dynamos, battery, switchboard, &c., £1,130; motors for sewage pumps, £135; street lighting, £285; overhead mains on wooden poles, £1,700; services and meters, £150; cost of prov. order, £200; legal and other expenses, £200; total, £4,000. The revenue was estimated as follows:—Public lighting, 150 lamps, £210; private lighting, 1,600 25-c.p. lamps with current at 6d. per unit, £480; power, £25; sewage pumping, £25; meter rents and sundry receipts, £25; total estimated gross revenue, £765. The corresponding expenditure will total £575. With reference to the total amount which would probably be required to extend the undertaking, if Radstock only were served, it was considered a further £1,500 might be required for additional plant and mains in two years after the undertaking has been started; if Peasedown were included another £2,000 would probably be required. After some discussion, the matter was deferred until the May meeting of the Council.

**Reading.**—The Electric Supply Co., Ltd., has applied to the T.C. for consent to the alteration of the frequency of the supply of current in certain parts of the borough where the supply is given by alternating current, to 50 periods per second.

**Shipley.**—The U.D.C. last week decided to carry out extensions to the electricity works, at a cost estimated at £14,000. The electrical engineer (Mr. Redman) reported that at present the load was just equal to the full safe capacity of the plant, and that it would be overloaded next winter. If the Council were to undertake the supply of power to manufacturers, it would be absolutely necessary to install new plant. This would entail the purchase of an additional turbo-alternator, boiler, motor-generator, condenser, and a new building and switchboard, with which outlay the Council would be provided with a modern 1,000-kw. set.

**Slough.**—By installing electricity at the workhouse, the Guardians for that town have effected an enormous saving. For the year just ended, the actual cost for current was £47, against £200 for gas in the previous year. Taken altogether, it is estimated that a saving of £300 a year has followed the introduction of electricity for lighting, pumping, and laundry purposes.

**Southampton.**—Additional land is required to meet next winter's load, and, upon sanction being received from the L.G.B. to the proposal, tenders are to be invited. The estimated cost is put at £8,200.

**Stalybridge.**—At a meeting of the Joint Tramways and Electricity Board on February 27th, it was reported that the Extensions Sub-Committee had recommended a boiler house extension plan for acceptance, and had expressed the view that it would be unwise to further extend on the present site. Mr. Noel (chairman of the Generating Station Committee) said the extensions were now going on. They had written to the L.G.B. pointing out that they were so handicapped that they were obliged to go on with the work. The demand for electricity continued to increase.

**Tottenham.**—The North Metropolitan Electric Power Co. having been invited by the Council to submit terms for lighting the parish, has replied that it is not prepared to carry out the whole of the street lighting, but only in those streets where its mains are laid. The Tottenham and Edmonton Gas Co. sent a letter to the same meeting of the Council, stating that it would have no possible objection to competition with the Electric Power Co. so long as it was for the whole of the district, and not for the best selected parts; also, conditionally that actual candle-power is taken into consideration as the basis for comparison. The company proceeded to quote prices. Both letters were referred to a Committee.

**Tutbury (Staffs.).**—The R.D.C. has given its consent to the erection of an overhead H.T. main from the borough boundary to the pumping station at Stratton, in order to supply electricity to the Clay Mills pumping station and the works of the English Grains Co., Ltd.

**Walthamstow.**—An additional feeder is to be laid to the corner of Church Hill and Hoe Street, at an estimated cost of £828; and a second cooling tower is to be installed at the electricity works. The cost of this latter work is put at £1,800. Current is to be supplied to the factory recently opened in Billet Lane by the Fuller Electrical Engineering Co., at an approximate cost of £1,128. In view of certain observations by the district auditor, the consumption of current at the various Council schools is, in future, to be grouped together for the purpose of fixing the charge to be made.

**Warrington.**—The electrical engineer has been directed to report upon the capacity of the plant and the supply of power in anticipation of the demand during next winter; also to purchase 25 domestic electric irons, and sell or hire them out. Tenders are invited for an annual supply of motors.

**Whitstable.**—A memorial with the signatures of 266 residents at Tankerton has been presented to the U.D.C. urging that body to favourably consider the electricity scheme submitted by a private company, as "in our opinion this should prove a most attractive addition to our town, and besides bringing about healthy competition with the existing lighting supply, will no doubt bring more residents to this district, as there will be the inducement of a cheaper light for domestic use."

**Workshop.**—The T.C. has arranged to give a temporary supply of current to the works of Messrs. Oates, Ltd., and arrangements are to be made for a permanent supply for a fixed number of years.

**Wrexham.**—Having established a rate of ½d. per unit for shopkeepers, thus enabling them to adopt heating at a competitive price, Mr. Pickvance, the borough electrical engineer, recently suggested a modification of the present assessment tariff to the extent of giving householders an alternative to the present charge. The new rate is 15 per cent. on the net assessment of the house, and ½d. per unit for all current used. Taking an ordinary assessment and ordinary consumption for lighting, 15 per cent. and ½d. per unit for the current is, he states, very little different in its net result to the existing charge, which is 12½ per cent. and a certain number of free units, with 1d. per unit for current used in excess. The advantage, however, of 15 per cent. and ½d. per unit is that cooking and heating may be adopted without any fear whatever as to large bills, and as the department is securing a fixed sum per annum which pays all standing charges comfortably, the scale will be a very beneficial one to the undertaking. The engineer's recommendation was unanimously adopted by the Council.

The borough electrical engineer submitted, at the meeting of the T.C. on February 25th, a letter from the secretary of the Wrexham Co-Partnership Tenants, Ltd., inquiring whether the Corporation would be prepared to supply electricity to the houses and other property proposed to be erected on land between Gresford and Wrexham, where they intended to place a "garden city" close to the new Gresford Colliery. The Council instructed the engineer to present a detailed report.

## TRAMWAY and RAILWAY NOTES.

**Accrington.**—The Electricity Committee recommends that a sum of £1,568, equal to a rate of 2d. in the £, be appropriated from the tramways to rate funds for the year 1913-14.

**Bacup.**—The capital cost of the Bacup Light Railway (tramway between Bacup and Rochdale) has been agreed with the Rochdale Corporation as follows:—Cost of the order and agreement, £462; permanent way, £12,123; overhead equipment, £2,611; cars, £4,950; car-shed, £1,118; land, £76; total, £21,342. It was resolved that the Rochdale Corporation be approached with a view to ascertaining whether it would be prepared to work an extension of the Bacup Light Railway along Burnley Road.

**Bradford.**—A scheme is in progress of negotiation for the establishment of a through tramway service between Bradford and Dewsbury, by way of Batley and Birstall. The only through service between Bradford and any other town running tramways is at present that to Leeds, and, as in that case, the gauge of the Bradford lines differs from that of the lines of the Heavy Woollen District Tramways Co.'s lines, with which the junction will have to be made in the service to Dewsbury. It is proposed to use special cars fitted with the patent extensible axle invented by Mr. C. J. Spencer, manager of the Bradford City Tramways, and which is in use on the Leeds-Bradford system. The establishment of a through service with Dewsbury would reduce the journey between the two places from 50 minutes to 35.

The long-deferred linking-up of the Bradford and Brighouse tramways by way of Wyke and Bailiffe Bridge is expected to come to fruition within the next few weeks, when a stretch of 7½ miles of hilly road will be traversed. This will be the third point at which the Bradford tramways will meet those of Halifax, the others being at Shelf and Queensbury. The new line will, it is expected, bring down the exorbitant railway charges of the locality.

**Burnley.**—The Tramways Committee has decided to gradually remove all the centre pillars, which carry the trolley wires. It has been recognised that, in view of the constantly growing fast vehicular traffic, these poles are a source of danger.

**Continental Notes.**—GERMANY.—By a majority of a single vote, a Special Committee of the Prussian Diet has decided to allocate £1,250,000 towards the electrification of Berlin's city railway and circular system. The proposal to proceed at the same time with the electrification of the suburban lines was defeated by a large majority.

**Croydon.**—At the B.C. meeting on Monday, 20 new fare stages were adopted, of which 13 were 1½d. distances. The chairman of the Committee (Councillor Denning) explained that this was not a cutting of fares, the new stages being uniform with the existing ones. A resolution for the adoption of ½d. fares was lost by a substantial majority.

**Dublin.**—At the half-yearly meeting of the Dublin and Blessington Steam Tramway Co., the chairman stated his conviction that the electrification of the line would immediately turn it into a paying concern.

**Glasgow.**—This week the Tramways Committee formally took over the new 5,000-kw. turbo-alternator which has been installed in the Pinkston power station by Messrs. Richardson's, Westgarth. The Corporation installed a turbine of 3,000 kw. at Pinkston, and it, together with the original engines, has hitherto carried the whole load. The two turbines will now do the work, the original engines being only used in cases of emergency. The

change has been brought about partly owing to the increased demands for tramway power, but it will also add to the efficiency of the station, and will effect a saving in the consumption of coal estimated to amount to between £2,500 and £3,000 per annum. The new turbine and generator have cost £10,200, bringing up the cost of the two turbines and the electrical apparatus to £20,400, compared with £102,000, which was the cost of the original plant.

The officials of the T.C. Tramways Department are looking forward with hopeful expectation to topping the million pounds sterling in revenue for this financial year, which ends on May 31st. Confidence is lent the outlook as the result of the last quarter's trading, which ended on February 28th; the number of passengers carried from June 1st to March 1st shows an increase of no less than 28,142,688 over the corresponding total of last year, the figures being: 1911-12, 200,859,408; and 1912-13, 229,302,096. This large augmentation is largely due to the doubling of the  $\frac{3}{4}$ d. stages early in the course of the present financial year—a course which was expected to bring down considerably the aggregate earnings. That this anticipation was not justified is apparent from the revenue to date, although it was not until about Christmas week that a deficiency was overcome and finances began to mount. The earnings on cars to February 28th for the nine months totalled £743,744 17s. 8d., against £738,558 8s. in the corresponding period a year ago, an increase of over £5,000. As the weekly drawings now average over £19,000, the million of income is, as stated, looked upon as sure, there being still 13 weeks to go.

As reported recently in the REVIEW, Glasgow T.C. is exercised over the question of providing better facilities of access between the north and the south banks of the Clyde, and the Tramways Department of the Corporation, recognising that the cars contribute to the congestion in the main traffic arteries, have verbally offered to share in the cost of erection of a new and suitable bridge. The matter was remitted to the various Committees whose interests were involved, and this week the Tramways Committee appointed members to represent it in negotiations.

**Huddersfield.**—Great keenness is shown by the townships of Elland and Greetland for the carrying out by the Corporation of the proposed electric tramway along Long Wall. The Huddersfield authorities, however, appear to be having some difficulty with the County Council, which has submitted long clauses to Huddersfield, including one for the widening of the way known as Long Wall, an undertaking which would cost £3,000, quite apart from certain points of land ownership which might arise. The Greetland Council has written urging the county authorities to be as lenient as possible, and it appears likely that Greetland and Elland will combine in support of Huddersfield.

**India.**—In connection with the electrification schemes which the Indian railway authorities are understood to have placed before Mr. C. H. Merz, the following projects have been under consideration:—

1. The electrification of the Bombay suburban lines of the Great Indian Peninsula and Bombay, Baroda and Central India Railways. The network here involved is anything from 50 to 100 miles of track.

2. The electrification of the Calcutta suburban lines of the Eastern Bengal State Railway; the conversion of from 20 to 40 miles of track is contemplated in the first instance.

3. The conversion of the Ghazt (main line) section of the Great Indian Peninsula Railway, involving some 30 miles of track. This scheme would be of special engineering interest, as the nature of the Ghazt inclines has always provided locomotive and traffic working problems of great difficulty.

4. The electrification of the Karachi Port Trust Railways.

5. Mr. Merz was also consulted by the authorities of the Ceylon Government Railways, but no details are so far available in this matter. It may, however, be pointed out in this connection that by means of a big engineering scheme, involving extensive bridge-work, the railways of Ceylon are now being linked up with those of India, so that a decision to electrify the lines in the south of the mainland would not be without a bearing on the future of the Sinhalese Railways.

**Lancaster.**—In proposing at the T.C. the adoption of the minutes of the Tramways Committee, Mr. J. Wilkinson referred to the gratifying increase in the traffic returns, and stated that, if they had more top-decked cars, the Committee believed the increase would be still greater.

**Leeds.**—The City Council at its meeting on Wednesday was asked to approve a resolution of the Tramways and Electricity Committee to adopt a plan for buildings for a tramway depot and offices, and a club for the men, upon land in Sovereign Street, at an estimated cost of £22,000.

**Leyton.**—The purchase of an electric watering van is under the consideration of the Council. The cost of the vehicle, with a 1,800-gallon capacity, is put at £770.

**Liverpool.**—Sanction has been received from the B. of T. to the borrowing of £8,000 for the provision of additional tramway cars.

**Llandudno.**—The receipts of the Great Orme tramways for the half-year amounted to £1,747—the highest on record; the net profit was £983, and the number of passengers carried was 61,829.

**Newcastle-on-Tyne.**—A collision of a rather serious character—over 30 passengers being more or less injured—occurred on the North-Eastern Co.'s electrical lines at Manor Station on Saturday morning. The accident was due to a following steam train, and of no account electrically, except as regards the reported short-circuiting of the live rail, which apparently did not lead to fire. A second accident occurred later about a mile away, when an electric train jumped the points without apparent damage to itself, and blocked three tracks for some time.

**Quinton.**—The Light Railway Commissioners on February 26th held an inquiry into the application of the Birmingham T.C. for powers to construct a light railway at Quinton, which will unite the systems between the city boundary and Halesowen. There was no opposition.

**Salford.**—Ten combination tramcars are to be dismantled, and tenders invited for the supply of car bodies and trucks, to be fitted with the electrical equipment taken from the combination cars. Application is to be made to the L.G.B. for sanction to borrow £700 to cover the cost of the installation of filtration plant at the electricity station.

**South Africa.**—Although a somewhat belated move has now been made to carry out the ratepayers' mandate in regard to the railless traction scheme for Bloemfontein, some considerable time must necessarily elapse still before the city possesses a fully equipped system. It is, of course, impossible to specify a given time in which the system will be completed, but it is hoped that the work will be practically completed at the expiration of a period of six months from the time when operations are commenced in earnest. To facilitate the work, much depends, of course, on the condition of the city's thoroughfares through which the tramways will pass. At present the majority of the streets are in a deplorable condition, and it is urged that matters could be facilitated very considerably by this question being taken in hand at once, and a substantial vote being given now towards a thorough and much-needed overhauling of the city's streets.

**South Shields.**—Mr. W. T. Robson, the manager of the Corporation tramways, has submitted a report to the Committee recommending that a 1d. fare be adopted generally on the system. It is pointed out that in the receipts for 1912 1d. fares represented 84·68 per cent. of the whole total, and 1½d. fares 4·08 per cent., the balance being made up of children's, workmen's and return tickets. As the percentage of 1½d. fares was so low, and taking into consideration the probable increase of passengers if the reduction were made, he does not think the receipts would suffer. The Tramways Committee, after consideration of the report, decided to recommend the Council to adopt a universal system of 1d. fares, with the following scale of fares:—1d. single ticket, ½d. single ticket for children, 1d. return ticket for workmen if issued before 8·45 a.m., 2d. double return ticket for workmen if issued before 8·45 a.m., the first return half and the second outward half being available between 11 a.m. and 2 p.m. In each case the single journey to be limited to the present 1½d. distances.

**Tasmania.**—The Hobart ratepayers recently cast 3,439 votes in favour and 905 against purchasing the business of the Hobart Electric Tramway Co., for £210,000. The company is a British one, and owns 9 miles of tramways.

**Todmorden.**—At the T.C. meeting on February 27th there was a lively discussion on the motor-bus undertaking and the proposal of the Motor-Buses Committee to issue workmen's fares at 25 per cent. below ordinary prices. Alderman Dawson said that during the six years the 'buses had been on the roads there had been a total loss of £8,000, in spite of help from the profits on the gas undertaking. Yet it was now proposed to increase the plant and reduce the fares. Councillor Holgate contended that the 'buses should be run more for public convenience than profit. Councillor Wordsworth said the proposal for workmen's cheap fares had been on the carpet for two years, and it was time the Corporation did something. The minutes embodying the proposal and the Committee's recommendation to purchase two more 'bus bodies were adopted.

**U.S.A.**—A definite plan has at last been formulated with a view to consolidating all the surface and elevated traction companies in Chicago. The bodies financially interested have laid a proposition before the city authorities which will probably be subjected to a referendum vote in April next. The total surface and elevated traction mileage in Chicago is about 1,070, all of which is electrically operated. The elevated railway companies are already consolidated, and have a total property value of £15,000,000; the total capital account of the surface companies is about £28,000,000. It is proposed to issue free transfers between any of the lines in return for a 5-cent fare between any two points within the city limits. Subways are ultimately to be provided for rapid transit to all parts of the city, and the elevated railways are to be given access to a subway system, the union elevated loop being then removed.

The financial sections of the scheme provide that 6 per cent. interest shall be paid on the capital account of the properties after paying operating expenses. When the subway for the elevated trains is complete, 7 per cent. interest is to be paid on the gross total capital account. After this 7 per cent. has been deducted, the remaining profit is to be divided between the city and the consolidated company in the proportion 7 : 3. The greater part of the interest allowances will go to the 5 per cent. bonds outstanding and yet to be issued. The remainder and the company's share of the surplus profits will go towards the payment of dividends and retire

the stocks of the company. The city's share will be used to wipe out the companies' bonds now issued, and yet to be issued for extensions and improvements, so that after 10 or 50 years the whole system of consolidated surface and elevated railways and subways will come into the city's possession free of encumbrance. The city authorities are to have the right of assuming ownership at any time by paying off the capital account plus 10 per cent. It is suggested that a Joint Board of Control be appointed to regulate the operation and extension of the system.—*Electrical Review and Western Electrician.*

## TELEGRAPH and TELEPHONE NOTES.

**Canada.**—An American Consul, in Prince Edward Island, reports that important improvements are being made in the telegraph service there. A new multiple cable is to be laid across Northumberland Strait to supplement the present cable connecting Prince Edward Island with the mainland, and will cost approximately £9,000. In addition to two telegraph wires, the new cable will provide permanent telephonic communication across the strait. There are 28 telegraph offices upon the island.

**China.**—The Chinese Department of Communications is reported to have decided to establish a wireless telegraph station at Woosung. The apparatus will be capable of communicating in the daytime within a radius of 1,200 miles.

**Imperial Wireless System.**—Mr. George Balfour, prospective Unionist candidate for Govan, in the course of an address, referred to the Marconi inquiry. He said he was not entitled to say a word about the grave rumours that were in circulation regarding certain of H.M. Ministers, but he was entitled to say something regarding the manner in which His Majesty's Ministers were dealing with these accusations. The Government had appointed a Select Committee of the House of Commons. That Select Committee was necessarily a partisan Committee. That meant that the majority of its members were supporters of these very Cabinet Ministers who were involved in the accusations, while the minority was composed of their opponents. It was not good that there should be partisanship at all. The way to deal with the matter was not to appoint a Select Committee, but a Select Commission, and because of the judicial minds of the men composing it they would, as upright men, give their verdict free from bias. He asserted emphatically that the Government had failed absolutely in its duty in this respect.

**International Radiotelegraphic Convention.**—The United States Senate has passed a resolution approving of the Convention signed in London in July last year.

**London-Berlin Telephony.**—Successful experiments have been carried out in communication by telephone between London and Berlin, *via* St. Margaret's Bay and La Panne in Belgium. The length of submarine cable in circuit was 60 miles, and the total length of line nearly 700 miles. It is hoped that a regular service will be provided before long.

**New Wireless Stations.**—Amongst other new stations ordered from the Marconi Co. is one of 30 kw. for the Italian Government, to be erected in Eritrea. The Portuguese Government has ordered five land stations, for Lisbon, St. Miguel, Funchal, St. Vincent, and Oporto; the Brazilian Government, four land stations of 25 and 15 kw., for naval purposes; the British Government, a station for Valentia, in Ireland; and numerous orders have been placed for smaller sets, as well as for the customary 1½-kw. set and emergency set, for use on board ship.

**Peru.**—A proposal is before Congress to devote £17,750 to the construction of two wireless telegraph stations on the north and south coasts of the country respectively.—*The Marconigraph.*

**Telephony in Mines.**—A Bochum engineer, named Joseph Reineke, has devised a wireless telephone system for use in mines, on original lines. The system has been at work for the past four months with success in the "Carolinenglück" colliery at Bochum-Hamm, and the "Minster-Stein" mine is now being fitted with a similar equipment.—*Zeit. für Schwachstromtechnik.*

**Wireless Time Service.**—According to *The Marconigraph*, the German Imperial Post Office is about to attempt to carry out a scheme for controlling public clocks throughout the whole country by means of wireless signals sent out from the big station in Fulda, once every minute.

**The "Wireless World."**—This is to be the new title of the journal hitherto known as the *Marconigraph*, the organ of the multifarious interests which have grown up on the foundation laid by Mr. Marconi. The new magazine will be larger than its predecessor, and it will deal with everything of interest in the world of wireless telegraphy. The first issue, in April, 1911, consisted of 16 pages; 12 months later it comprised 52 pages, and the *Wireless World* will contain 96 pages. It will appear once a month, and will be "never at any time abstrusely technical," but will aim always to interest the general public. We wish it all success.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberaman.**—March 10th. Electrical goods, for the directors of the Powell Duffryn Steam Coal Co., Ltd. Stores Manager, Aberaman, near Aberdare.

**Australia.**—April 14th. H.M. Trade Commissioner for Australia reports that tenders are invited for plant required to generate three-phase current for the high-power radio-telegraph station at Darwin, Northern Territory, and for lighting and power purposes in the neighbourhood. For further particulars see this column and "Official Notices" last week.

**Belfast.**—March 12th. The Harbour Commissioners are inviting tenders for four 5-ton electric gantry cranes for the Queen's Quay and Abercrom Basin Quay. Specifications, &c., from the Harbour engineer, Mr. W. Redfern Kelly, Belfast.

**Birmingham.**—March 11th. Additional rolling stock (electric tramway cars) for the Tramways Department. Mr. A. Baker, general manager, Tramway Offices, Council House, Congreve Street. (Deposit £2.)

**Bridgend.**—March 21st. One 400-K.V.A. steam alternator and accessories, for the U.D.C. See "Official Notices" Feb. 28th.

**Brighton.**—March 10th. Storage battery (800 amp.-hours) for the T.C. See "Official Notices" February 28th.

**Burnley.**—March 10th. Electrical work for the B. of G. for six months. Mr. J. S. Horn, clerk, Union Offices.

**Chile.**—September 10th. The Harbour Works authorities at Valparaiso are inviting tenders for the establishment of a central generating station for the supply of electricity for lighting and power purposes at the port.

**Colchester.**—March 10th. Sundry stores for the Corporation Electricity Department. Mr. W. Friby, electrical engineer, Osborne Street.

**Croydon.**—March 31st. Stores for a year, for the Corporation Electricity Department. See "Official Notices" Feb. 21st.

**Dover.**—March 12th. Electrical sundries and cables, for a year, for the Harbour Board. Mr. Martyn Mowll, registrar, Castle Street.

**Dundalk.**—March 24th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" to-day.

**Dundee.**—The Corporation invites tenders for the construction of a brick chimney, and for the supply, delivery and erection, complete, of structural steel work for extensions to Carolina Port generating station. Mr. H. Richardson, general manager and engineer.

**Eastbourne.**—March 10th. Combined coal elevator and conveyor for the Corporation Electricity Department. See "Official Notices" February 28th.

**Germany.**—MÜNSTER.—March 15th. Tenders are invited for the supply, erection and setting at work of five electric travelling cranes of 8,000 kg. lifting capacity for the new locomotive workshops at Osnabrück. Particulars, enclosing postage (1.50 marks), from the Königliche Eisenbahndirektion, Münster, Westphalia.

POSEN.—March 17th. Supply of 22,100 metres of paper-insulated cable. Particulars, enclosing postage, from the Königliche Eisenbahndirektion, Posen.

**Heckmondwike.**—Maintenance and repair of electric fire alarms, for the U.D.C. The Surveyor.

**Heston and Isleworth.**—March 8th. Stores and materials for a year, for the U.D.C. electricity department. See "Official Notices" February 21st.

**India.**—March 14th. Motors, transformers and motor-generator, for the B.B. and C.I. Railway. See "Official Notices" February 21st.

**Liverpool.**—March 10th. Electrical fittings for a year, for the Select Vestry. Mr. C. W. Coster, clerk, Brownlow Hill.

**London.**—L.C.C.—March 19th. Electrical installation at the Victory Place elementary school, Walworth, S.E. See "Official Notices" to-day.

It is proposed that during the recess, the Highways Committee shall have authority to open any tenders that may be received for the construction of the authorised conduit tramways from Catford to Southend *via* Bromley Road, and the reconstruction of the existing horse tramways from Chapel Street to Nile Street, Woolwich.

**MILE END.**—March 20th. Re-wiring wards, &c., at the Infirmary, for the Guardians. See "Official Notices" to-day.

According to an announcement in a daily paper, estimate, plan and drawings are invited for the following for the Anglo-German Exhibition, Crystal Palace, 1913:—A light electric railway, connecting from the Low Level entrance to the Crystal Palace Terrace. Two escalators from the Terrace to the main building of the Crystal Palace. Offices of the Anglo-German Exhibition, Empire House, Piccadilly, W.

**Macclesfield.**—March 11th. Electrical goods for the Cheshire County Asylum, Parkside. Mr. Wm. Tingay, clerk of the Asylum.

**Manchester.**—March 12th. High-pressure steam and feed pipes for the Electricity Committee. Mr. F. E. Hughes, secretary, Electricity Department, Town Hall. Deposit £1 ls. returnable.

**Norway.**—March 15th. Town Council of Narvik. 10 tons of electrolytic copper wire. Tenders for delivery c.i.f. Narvik received at "Narvik formandskab," Narvik, North Norway. Further particulars from Hr. Per Larsen, engineer, Hamar, Norway. No special form of tender is required.

**Portsmouth.**—March 18th. Stores and materials for a year for the Corporation Tramways Department. See "Official Notices" to-day.

**Pontypridd.**—March 17th. Tramway-men's uniforms for the U.D.C. See "Official Notices" February 28th.

**Southampton.**—March 10th. Cable for the Corporation Electricity Department. See "Official Notices" to-day.

**South Shields.**—March 10th. Stores for a year for the Corporation Electricity Supply Department. Mr. H. S. Ellis, electrical engineer, Mill Dam.

**Spain.**—The municipal authorities of Banolas (province of Gerona) have just invited tenders for the concession for the electric lighting of the town during a period of three years.

**Swindon.**—March 8th. General stores and materials for a year for the Corporation electricity and tramways departments. See "Official Notices" February 14th.

March 10th.—One 500-KW. mixed-pressure turbine and condensing plant, boiler feed pump and pipework, and one switchboard panel and cables, for the Corporation. See "Official Notices" February 14th.

March 20th.—The Standing Joint Committee of the Wilts County Council invite tenders for work in connection with the installation of electric light at the Old County Police Station, Swindon. Plans and specification and form of tender from County Surveyor's Office, Swindon.

**Swinton and Pendlebury.**—March 10th. One 25-KW. transformer and switchboard, main along Chatsworth Road, and annual supply of materials, for the U.D.C. Electricity Department. See "Official Notices" February 21st.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C. I. Department in London.

**Wallasey.**—March 15th. Fuel oil (400 tons) for a year, for the Corporation electricity department. Mr. J. A. Crowther, electrical engineer, Seaview Road, Liscard.

**War Office.**—Cables, electrical stores, iron telegraph poles, &c. See "Official Notices" February 28th.

**York.**—March 10th. One 3,000-KW. turbo-alternator, with condensing plant, pipework and switchboard, water-tube boilers with chain-grate stokers, &c., storage battery and H.T. cables, for the Corporation. See "Official Notices" February 21st.

### CLOSED.

**Accrington.**—The Tramways Department has accepted the tender of Messrs. Briggs, Jones & Gibson, for the supply of uniform clothing, and that of Messrs. Leffet & Co. for caps.

**Australia.**—The following contracts have been placed:—

**VICTORIA.**—P.M.G.

Three combined Gardner oil engines and generators (a) one for Thursday Island and (b) two for Port Moresby (Papua) wireless telegraph stations, (a) £283, (b) £242 each.—Noyes Bros.

**SYDNEY.**—P.M.G.

Glazed earthenware conduit, 4,000 ft.—Brunswick Brick, Tile and Pottery Works, Ltd. Ditto (about 22,000 ft.)—Mills & Co.

One X absorber, £150.—Maritime Wireless Co. (Shaw System), Ltd.

**VICTORIAN RAILWAYS.**—

Telephone cable.—Automatic Telephones (Australia), Ltd.

—*Australian Mining Standard.*

**SYDNEY.**—The City Council Finance Committee recommended the acceptance of the tender of the Australian Metal Co., Ltd., for the supply of motors for refrigerating plant at the Fruit Markets,

at £2,742. The tenders of the Vacuum Oil Co., the British Imperial Oil Co. and the Pacific Oil Co. for oils were recommended. The Electric Light Committee recommended the following:—Time limit relays, Noyes Bros., £306; arc lamp contact, &c., gear, Laurence & Hanson Co., £214.—*Tenders.*

**Belgium.**—La Société des Ateliers de Construction Electriques de Charleroi submitted the lowest tender last week for the establishment of an electric lighting installation in the Royal Palace at Laeken, near Brussels.

**Birkenhead.**—Messrs. Chamberlain & Hookham's tender for D.C. meters has been accepted by the Council.

**Birmingham.**—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract for the supply of tantalum traction lamps for the lighting equipment of the whole of the cars on the Corporation tramways system for the ensuing 12 months. During this period, it is anticipated that a quantity of some 20,000 lamps will be required.

**Bolton.**—The Electricity Committee has accepted the following tenders in connection with the new Back-o'-the-Bank generating station:—

John Musgrave & Sons, Ltd.—Two turbo-alternators of 4,000 kw. each. Babcock & Wilcox, Ltd.—Four water-tube boilers including superheaters and stokers.

Green & Son.—Four sets of economisers.

**China.**—It is reported that a German company at Shanghai has contracted with a Chinese syndicate for the supply of electricity for lighting purposes at Wuchang.

**Dartford.**—The tender of the Premier Accumulator Co., Ltd., has been accepted by the U.D.C. at £723, for the supply of a battery, and for the maintenance of same for 10 years, at £65 per annum.

**Derby.**—The T.C. has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., for a turbo-alternator, at £7,292.

**Dewsbury.**—The Corporation has accepted the tender of Messrs. Ferranti, Ltd., for a switch panel for the turbine generator at the electricity works, at £266, and that of the Union Cable Co., for fire-proof cable, at £114.

**Eccles.**—The Corporation Public Lighting and Electricity Committee has accepted the tender of Mr. J. F. Heys for trench-cutting and cable-laying for 12 months.

The T.C. has accepted the quotation of the London Electric Firm for the supply of 13 sets of hoists and lowering-gear for the four-light clusters to be fixed on the tramway centre poles in Church Street and Liverpool Road, at £2 19s. 5d. per set.

**Glasgow.**—The T.C.'s Committee on Tramways has recommended the acceptance of the following:—

Steel step treads.—H. & F. Bonten, Ltd.  
Armature coils.—British Westinghouse Electric, &c., Co., Ltd.  
Scrap—(a) copper and lead.—P. & W. MacLellan, Ltd.  
(b) brass, and (c) copper and mica turnings and zinc.—Pegler Bros. and Co.  
(d) brass dust.—R. M. Esdale & Co.  
(e) rubber.—City Waste Rubber Co.  
(f) cable.—Ballardie, Holden & Co.

**Kidderminster.**—The B.G. has accepted the tender of the Birmingham Telephone Co. for the installation and maintenance of telephones in the Workhouse.

**Kingston-on-Thames.**—The T.C. has accepted the tender of the Craigpark Electric Cable Co. for 110 yd. of 2 sq. in. high-tension concentric lead-sheathed and armoured cable, at £52, this being the lowest of seven tenders; and that of the British Thomson-Houston Co., Ltd., for a Tirrill regulator complete, at £150. The Council has also accepted the tender of the Anglo-American Oil Co., Ltd., for up to 20 tons of fuel oil for the electricity works, at £4 3s. 6d. per ton.

**Leyton.**—The U.D.C. has accepted the following tenders for annual supplies:—

Oliver Arc Lamp Co., Ltd.—Carbons for lamps of own make, £2 14s. 6d. per 1,000 pairs.  
Johnson & Phillips.—Second grade carbons, £3 6s. 6d. per 1,000 pairs.  
Wakenfield & Co.—Oil.  
R. Todd.—Service line cable.

**Liverpool.**—The T.C. has accepted the tender of the Worthington Pump Co., Ltd., for the supply and erection of four cooling towers at the Liester Drive power station. The following tenders have also been accepted for annual supplies:—

Insulated cables and wires.—Liverpool Electric Cable Co., Ltd.; Anchor Cable Co., Ltd.  
Metal-filament lamps.—The Gabriel Lamp Co.  
Carbon-filament lamps.—Electrical Co., Ltd.  
Carbons for arc lamps.—Wm. Geipel & Co.  
Cables and accessories for mains (three years' contract).—Callender's Cable and Construction Co., Ltd.

**London.**—L.C.C.—The Asylums Committee has accepted the following tenders for stores:—

Electrical sundries.—General Electric Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.; Veritex, Ltd.; McLellan & Co.; Cox-Walkers, Ltd.; Edison & Swan United E.L. Co., Ltd.; Falk, Stadelmann & Co.  
Electric lamps.—Siemens Bros. Dynamo Works, Ltd.; B.T.H. Co.; and G.E. Co., Ltd.

The Stores and Contracts Committee have placed contracts for electric carbons with Messrs. W. Geipel & Co. and Messrs. H. G. Mayer & Co.

After three months' satisfactory trial, which has shown that a saving in labour amounting to £100 a year will be effected thereby, an adding machine is to be purchased from the Burroughs Adding Machine Co., Ltd., for £153, for use in the tramways department.

The tenders received for three 1,500-KW. rotary converters for the Shoreditch tramway sub-station were:

Dick, Kerr & Co., Ltd. . . . .	(accepted) £8,422
British Westinghouse Co., Ltd. . . . .	8,713
General Electric Co., Ltd. . . . .	9,145
Estimate of Chief Officer . . . . .	7,300

The Committee says that the tenders are "subject to general conditions laid down by the B.E. and A.M.A.," but it sees "no objection thereto, provided the conditions in question are not materially at variance with the general conditions in the Council's form of contract."

For the wiring of the Camberwell and Cressy Road car-sheds the tenders were as follows:—

Williams & Bach . . . . .	(recommended) £2,140
Electrical Installations, Ltd. . . . .	2,146
G. E. Taylor & Co. . . . .	2,315
G. Weston & Sons, Ltd. . . . .	2,572
Lund Bros. & Co. . . . .	2,623
L. G. Tate & Co. . . . .	2,683
Tilley Bros. . . . .	2,697
W. C. Tackley & Co., Ltd. . . . .	3,075
Estimate of Chief Officer . . . . .	2,080

An agreement is to be entered into with Messrs. Thermit, Ltd., for the supply of welded rail joints, at 19s. 6d. each, during the year.

Tenders received for four towers for fitting to existing motor wagons were:—

Watlington & Co., Ltd. . . . .	(recommended) £292
Peter Boswell & Sons . . . . .	379
Bayley's, Ltd. . . . .	604

Four hydraulic pit jacks for Camberwell car-shed were tendered for thus:—

National Rail and Tramway Appliances Co., Ltd. . . . .	(recommended) £25 10 each
Buck & Hickman, Ltd. . . . .	89 0 "

For smiths' hearths and exhaust and blower fans for the Leven Road, Poplar, and Battersea Wharf permanent way depôts the tenders were:—

Alldays & Onions Pneumatic Engineering Co., Ltd. . . . .	(recommended) £109
Standard Engineering Co., Ltd. . . . .	167
G. o. Hatch, Ltd. . . . .	177
Davidson & Co., Ltd. (fans only) . . . . .	50
" " " (alternatively) . . . . .	48

The following tendered for 125,000 drawn-wire metallic-filament lamps:—

Siemens Bros. Dynamo Works, Ltd. . . . .	(recommended) £7,800
A. C. Schove, Exley (works Société Anonyme d'Angrève-Marihaie, Belgium) . . . . .	(alternative) 10,237
General Electric Co., Ltd. . . . .	10,237
British Thomson-Houston Co., Ltd. . . . .	10,237

Tenders for 380 yd. of H.T. cable were received as follows:—

Siemens Bros. & Co., Ltd. . . . .	(recommended) £248
W. T. Henley's Telegraph Works Co., Ltd. . . . .	252
Western Electric Co., Ltd. . . . .	252
B. I. and Helsby Cables, Ltd. . . . .	253
W. T. Glover & Co., Ltd. . . . .	254

For special section rolled-steel bar for magnetic brake shoes the contract is to be given to the Lilleshall Co., Ltd., at £8 2s. 6d. per ton (total £4,745). The tenders were:—

	Prices a ton, both sections.
	£ s. d.
Lilleshall Co., Ltd. . . . .	(accepted) 8 2 6
Earl of Dudley's Round Oak Works, Ltd. . . . .	8 2 6
A. C. Schove, Exley (works Société Anonyme d'Angrève-Marihaie, Belgium) . . . . .	8 2 9
Frodinger Iron and Steel Co., Ltd. . . . .	8 5 6
P. & W. McLellan, Ltd. . . . .	8 7 3
Andrew Brown & Co. (agents for Société Anonyme des Acieries d'Angleur) . . . . .	9 5 0
Henry Bessemer & Co., Ltd. . . . .	9 10 0
Cammell, Laird & Co., Ltd. . . . .	9 10 0
Patent Shaft and Axletree Co., Ltd. . . . .	9 12 6
Bayliss, Jones & Bayliss, Ltd. . . . .	10 7 6

ISLINGTON.—The B.C. has accepted the following tenders for annual supplies to the Electricity Department:—

- Arc lamp carbons.—Sloan Electrical Co.; Geipel & Co.
- Arc lamp globes.—City Glass Co. Ltd.
- Electricity supply meters.—British Westinghouse Electric and Manufacturing Co., Ltd.
- Cables.—British Insulated and Helsby Cables, Ltd.
- Electrical sundries, lamps, brushes, arc lamp parts, &c.—Maxim Lamp Co., Ltd.; Pope's Electric Lamp Co.; Gene at Electric Co., Ltd.; Heap and Johnson; Messrs. Round.
- Cable terminal, service and network boxes, tape, and iron castings.—B. I. and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Lucey & Co., Ltd.; Sykes & Sugden, Ltd.; J. Gibbs & Co.; British Insulated and Helsby Cables, Ltd.; Dusek Bitumen Co.; India Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

SHOREDITCH.—The B.C. has received the following tenders for the supply of economisers for the boiler plant at the Whiston Street Power Station, which is invariably worked at an overload capacity:—

Economisers, Ltd. . . . .	(accepted) £1,600
E. Green & S. n . . . . .	1,875
E. Lowcock, Ltd. . . . .	2,097
Clay Cross Co. . . . .	2,350
E. Goodbrand & Co. . . . .	2,370
J. Thompson . . . . .	2,500

Staffordshire.—The County Education Committee has accepted the tender of the Electric Construction Co., Ltd., at £365, for the installation of electric plant and machinery, &c., for the Burntwood, Chase Town, New County Mining Institute.

Rochdale.—The Corporation Gas and Electricity Committee on Friday decided to recommend the acceptance of the following tenders in connection with the extensions at the electricity works

- Building.—R. & T. Howarth.
- Turbine-alternator.—W. H. Allen & Co.
- Steam turbine.—J. Howden & Co.
- Motor alternator.—The General Electric Co., Ltd.

The contract for boiler and hoppers was left over for further consideration.

Warrington.—The T.C. has accepted the tender of Messrs. T. Speak for wiring the new baths.

Wigan.—The T.C. has accepted the tender of Messrs. Dorman & Smith for a new switchboard for the Market Hall

FORTHCOMING EVENTS.

Royal Institution.—Friday, March 7th. At 9 p.m. Discourse on "Photography of the Paths of Particles Ejected from Atoms," by Mr. C. T. R. Wilson.

Saturday, March 8th. At 8 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture V.)

Saturday, March 15th. At 8 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture VI.)

Charing Cross, West End and City Electricity Supply Co., Ltd. Friday, March 7th. At 8 p.m. Staff Smoking Concert. The Pillar Hall, Victoria Station (S.E. and C. Railway).

Association of Electrical Station Engineers.—Friday, March 7th. At 8 p.m. At Exeter Café, Deansgate, Manchester. Meeting to form Manchester branch.

Wednesday, March 12th.—At 7.45 p.m. At the Y.M.C.A., Bothwell Street, Glasgow. Meeting to form Glasgow branch.

Junior Institution of Engineers.—Friday, March 7th. At 39, Victoria Street, S.W. Paper on "The Training of a Colonial Engineer," by Mr. A. C. Herapath.

Wednesday, March 12th. At 8 p.m. At the I.E.E. Paper on "Water-Heat-team: the Effects of Heat upon Water, and a Consideration of Water Movements in Steam Boilers," by Mr. A. Ross.

Friday, March 14th. At 39, Victoria Street. Continuation of discussion on paper on "Water-Heat-Team."

Institution of Post Office Electrical Engineers (Metropolitan Section).—Monday, March 10th. Meeting at 6 p.m. At the I.E.E.

Faraday Society.—Wednesday, March 12th. At 4.30 p.m. At the Chemical Society rooms, Piccadilly, W. General discussion on "Colloids and their Viscosity."

Association of Engineers-in-Charge.—Wednesday, March 12th. At 7.30 p.m. At St. Bride's Institute, E.C. Paper on "The Province of the Engineer-in-Charge," by Mr. A. E. Penn.

Institution of Electrical Engineers (London).—Thursday, March 13th. At 8 p.m. Paper on "Lower Supply on the Road," by Mr. A. E. Hadley.

(Newcastle Section).—Monday, March 10th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Condensing Plant," by Mr. W. A. Dexter.

(Manchester Section).—Tuesday, March 11th. At 7.30 p.m. At the University, Manchester. Paper on "Power Supply on the Road," by Mr. A. E. Hadley.

(Scottish Section).—The meeting set down for Tuesday, March 11th, has been postponed to March 18th, and the annual general meeting from April 8th to April 15th.

(Yorkshire Section).—Wednesday, March 12th. Meeting at 7 p.m. At the University, Leeds.

(Birmingham Section).—Wednesday, March 12th. At 7.30 p.m. Meeting at the University, Birmingham.

(Dublin Section).—Thursday, March 13th. Meeting at 8 p.m. At the Royal College of Science, Dublin. Paper on "Recent Developments in the Application of Electricity to the Textile Trades," by Mr. S. F. Crowley.

Physical Society.—Friday, March 14th. At 5 p.m. At the University College, Gower Street, W.C. Paper on "Some Oscillograms of Condenser Discharges and a Simple Theory of Coupled Circuits," and "An Exhibition of Braun Cathode-Ray Tubes and an Electrostatic Machine for Working them, used as a High-Frequency Oscillograph," by Prof. J. A. Fleming; and other papers. Demonstration of Spark Photographs, by Mr. W. B. Haines, before the meeting.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, March 10th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, March 11th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, March 13th.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Friday, March 14th.—"D" Company. Company training, 7 to 10 p.m.

Saturday, March 15th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt. For Officer commanding L.E.E.

## NOTES.

**The Easter Holidays.**—Owing to Friday, March 21st, being Good Friday, the ELECTRICAL REVIEW for that date will be published two days earlier, appearing on the morning of Wednesday, March 19th. Our advertisement department asks that new advertisement copy and alterations to existing advertisements for that issue should be received not later than Saturday morning, March 15th. An announcement on the matter will be found in our advertisement pages to-day.

**Cost of Operating Electric Wagons.**—The Commonwealth Edison Co. has published interesting schedules showing the cost of operating two 700-lb.; four 15,000-lb.; four 2,000-lb.; and 20 3,000-lb. electric wagons during the three years, January, 1909, to December, 1911. Nineteen of the vehicles have Edison, and the remainder lead batteries. From these returns (published in the *Electrical Review* and *Western Electrician*), we extract the following average data:—

Item.	Average cost.		Item.	Average cost.	
	Per car.	Per car.		Per car.	Per car.
	per mth.	per mth.		per mth.	per mth.
	s. d.	d.		s. d.	d.
Fixed charges	126	6	20	0	0
Fixed charges on land, buildings and garage.	24	0	0	4	
Operating expenses	582	0	9	15	
Total general expenses	67	10	1	0	5
Grand total	800	8	12	6	
Miles travelled per car per mth.	775				
Miles per day per wagon in service	= 80.5				
Days per month in service (per wagon)	= 23.6				
Average kw.-hr. per car-mile.	= 0.495				

Interest at 6 per cent.; taxes, 1.5 per cent.; insurance, 2 per cent.; depreciation, 10 per cent. Including driver's salary, washing, oiling and minor repairs and operating garage expenses. Including supervision, wheel tax, licence and insurance.

It is said that the 1912 operating costs were lower than the above, but no precise figures for last year have yet been published. It should be noted that the figures apply to American conditions, and probably lower figures would be obtained in this country.

### A Powerful Sterilising Mercury-Vapour Lamp.

In the types of mercury-vapour lamps hitherto in use, the electrodes have been at opposite ends of a straight tube, the enlargements, condensing chamber or radiating vanes of which have prevented close approach of the luminous part of the lamp to objects that are to be illuminated. With a view to removing this limitation and securing a much higher percentage of ultra-violet light than is provided by ordinary 110–220-volt mercury lamps, Messrs. Henri, Helbrunner & Recklinghausen have constructed a lamp in which the luminous vapour is contained by a quartz-U-tube. The internal diameter of the tube is 0.55 in., each limb is 6.3 in. in length, and the two limbs and the electrodes are very close together. The lamp operates on 500 volts, the P.D. between the electrodes being 375–390 volts and the current flowing 3 amperes. The net power consumption of the lamp is thus 1,150 watts, and the candle-power, in a plane through the centre of the arc perpendicular to the axis of the lamp, exceeds 8,000 c.p.

The absolute value of the ultra-violet radiations has not yet been determined, but their chemical and bacteriological effects have been compared with those radiations from 110 and 220-volt lamps. It is reported that the new 500-volt lamp produces the same effect on amidon in six hours and on glycerine in four hours, as is produced by a 110-volt lamp in 260 hours and 240 hours respectively. The sterilising effect of the new lamp on a bacteria culture (*coli*) is 60 times as rapid as that of a 110-volt lamp placed at the same distance from the culture. Considerable photo-combustion and photo-polymerisation of carbides of hydrogen have been effected by the new lamp, whereas such action is very limited if 110-volt lamps be used.

The new lamp provides ultra-violet radiations from 50 to 60 times as intense as those from a 110-volt lamp (though its wattage is only 4.6 times as great). When applying the lamp to the economical sterilisation of large quantities of water, the luminous portion of the tube is enclosed by a cylinder of transparent quartz fixed at the centre of a circular tank, through which flows the water treated. Baffle plates are provided to guide the water round and against the central cylinder.—*Technique Moderne*.

**"New Light Marvel."**—Under this title the *Standard* recently put before its readers an account of a "discovery" made by a French engineer, M. Dussaud. The description ran as follows:—

The invention is based on the principle of matter having need of rest, or molecular equilibrium. For example, two springs working alternately wear out more slowly than if each is worked continuously. "Cold light" is the application of this principle to incandescent electric lamps. Light is concentrated in a single point by all the filaments working successively, and projected through a lens multiplying a thousandfold. By this process M. Dussaud has succeeded in concentrating 2,000 c.p. in a single point and passing 32 volts into an 8-volt lamp, which otherwise would burst.

The advantages claimed are, first, the elimination of danger, since a lamp, though producing so dazzling a light that it is impossible to look at it with the naked eye, can be held in the hand without

the slightest heat being felt. Second, such a lamp requires a hundred times less current than the ordinary lamp, and in the absence of a sector it can be produced by a tiny battery. The motive power can be given by an ordinary water tap, a squirrel in a cage or the operator's foot. Third, it contains ultra-violet rays, thus requiring a hundred times less electricity than usual.

These facts were all demonstrated on the screen. A beautiful coloured landscape, 3 yards square, to project which with ordinary lamps would require 40 volts, or 2,000 watts, only needed 20 watts with the "cold light," costing one centime instead of a franc, or a hundredth of the cost. All the views shown were produced with very small and inexpensive apparatus, and henceforth similar illustrations can be given in schools by professors without danger, the only appliance being a cheap little apparatus that can be slipped into the pocket.

We need not follow the enthusiastic correspondent of the *Standard* further. Those of our readers who remember our exposure of the analogous "Poleforcia" fallacy will not be surprised to know that we regarded this report with the coldest scepticism, and we did not publish anything about it. In the meantime, we have communicated with a distinguished French scientist, who informs us that there is no foundation for M. Dussaud's extravagant claims—backed though they were said to be by no less eminent a physicist than Prof. Branly—except the statements of the inventor himself, who has produced no evidence in support of them.

**Electrical Trades Union.**—Under the auspices of the Plymouth Branch of the Electrical Trades Union, a smoking concert was held at the Clarence Hotel, Morice Town, Devonport, on Friday evening. There was a good attendance, and the general organiser (Mr. J. Hinniburgh) attended and addressed the members on the importance of organisation. He pointed out that it was impossible to get the old men employed in the Dockyard to see the benefits of Trade Unionism. The reason was that they were all right themselves and did not care twopenny for any of the other workers. He therefore made an appeal to the young men, those hands who had come around from Scotland, the North of England and London, to join the organisation, and then band themselves together with the hope of making the electrical trade better in the future than it had been in the past. Organisation or combination was absolutely essential for the self-preservation of the individual. The speaker observed that the members of the House of Commons fixed £400 a year as the minimum rate of wages on which they could exist. Supposing those 700 gentlemen suddenly dropped dead, no one would be put about much except their near relatives. For any real necessity they would not be missed at all. But take the working classes. Supposing 700 bakers in the Three Towns were suddenly to drop dead. They could easily understand what a serious position would be caused thereby. The 700 bakers were far more necessary than the 700 gentlemen who legislated for their country at Westminster. The speaker reminded his hearers of the campaign to be initiated shortly for an 8-hour day. That matter might not interest those engaged in the Dockyard, but those working outside the Dockyard would recognise that an 8-hour day was a big proposition.

Subsequently Mr. T. Parr, who has held the office of secretary of the Plymouth branch for the past five years, was the recipient of a fountain pen in recognition of services rendered.

**Gas Fires and Evil Odours.**—In a leaderette on "The Education of the Gas Consumer," our contemporary, the *Gas World*—for which, by the way, we have sincere respect—courageously publishes some plain truths about the gas fire; as our contemporary occasionally does us the honour to quote from our columns, we return the compliment:—

"The truth of the gas fire situation, as it is capable of being realised to-day, is precisely as Mr. Wilson put it:—No gas fire ought to announce its existence through the sense of smell. Unfortunately, very many gas fires do so betray their defective construction or fitting. It is high time that this deplorable misbehaviour of gas fires were corrected."

"Mr. Wilson speaks of tracing our complaints; but the right rule is not to wait for complaints. All experience shows that absence of complaints is no proof of want of cause for them."

"Many gas consumers are quite resigned to the evil odour of a badly-adjusted boiling ring, or a smothering gas fire. So they will go on, until a case of sickness requires the doctor's visit; and the first thing he does is to condemn the stove or the fire. The degree of toleration of a bad gas smell varies considerably in different people, and an inspector with a keen nose for it is worth money to a gas undertaking."

We agree with every word of these extracts, except, perhaps, the last line or two. If there is real value in a keen perception of a bad gas smell, we ought to be worth a mint of money if we were inspectors.

**Electrical Progress in Russia.**—With a view to ascertaining the position of municipal supply in Russia, the town of Ivano-Vosnesensk (says the *Financier*) has instituted inquiries as to the working of central stations in nine towns: Pensa, Wilna, Viatka, Nerechta, Tula, Kischinev, Stavropol, Minsk, and Astrakan. Presumably information was gathered from towns more or less resembling Vosnesensk in conditions or population, or from the sources where it was most readily available, as this list does not, of course, include the largest towns in Russia, which are lighted by electricity. (If this is Vosnesensk on R. Bug, the population at the last census was 107,000; that of Pensa, 79,000; Wilna, 184,580; Tula, 130,800; Kischinev, 118,807; Stavropol, 54,800; Minsk, 97,990;

and Astrakan, 149,600.) In eight of the nine towns mentioned, the stations were working successfully, and contributing to public revenue. The net profits were as follows: Wilna, 85,000 roubles (say £8,000); Minsk, £5,800; Astrakan, £4,100; Tula and Pensa, £3,800; Viatka, £2,900; Kischinev, £2,500; and Stavropol £1,400. In manufacturing, Germany has all the most important electrical concerns, as the Russian General Electric, the Russian Siemens & Halske, and the Russian Schuckert Co. There are two other large houses—the Russian Tudor Accumulator Co. and the Volta. These concerns have a combined capital of 16,800,000 roubles (£1,600,000), which is about 85 per cent. of the capital of the 10 existing electrical concerns in Russia. The Schuckert now proposes an extension of capital of 12,000,000 roubles and the General Electric is extending its capital 4,000,000 roubles. In 1912, the branches of the Siemens & Halske firm in Poland were transformed into an independent establishment.

**Electricity from Cinders.**—The cinders deposited in locomotive smoke boxes are a fuel of considerable value, since its calorific power is equal to 4,500 to 6,000 calories per kg. Till lately its utilisation has defied every attempt of the many experimenters with it. Recently, however, the firm of J. Pintsch, of Berlin, has succeeded in overcoming the difficulties attending its gasification, by means of a specially devised producer. Several of these have been acquired by the Prussian State Railways, for the production of electric current, which is used to light railway stations and workshops. In practice it is found that 1.5 to 1.6 kg. of cinders is needed to produce a kilowatt-hour. First cost charges are from 1,097 fr. to 1,305 fr. per kw. Working costs range from 0.0325 to 0.055 fr. per kw.-hour, exclusive of charges for sinking fund and interest.—*Revue Electrique.*

**Fatalities.**—A correspondent states that at the Helsby Cable Works, Charles Antrobus was working in the cable testing department, on Friday morning, when he came in contact with a live wire. He was killed instantly.

A Sheffield paper says that while following his employment as a coal-cutting machine driver at Houghton Main Colliery, on Saturday, Joseph Bains (26), of Middlecliffe Cottages, Houghton Parva, was killed by an electric shock.

The *Cape Times*, just to hand, reports that on February 3rd, at Johannesburg, Winter Hart (34), who held the position of assistant distributing engineer in the electrical department of the municipality, was killed while on duty. Hart was inspecting work under his supervision. The Parktown high-tension side of a transformer kiosk was open, and, in the execution of his duty, Mr. Hart, in some inexplicable manner, came into contact with the high-tension terminals at a pressure of 3,300 volts alternating at 50 cycles periodicity, and he was killed instantaneously. He was very badly burnt about the chest. The usual methods of artificial respiration were kept up for over half an hour, with no beneficial result. He leaves a young widow and a baby six weeks old. Verdict, "Death from misadventure."

**Annual Socials and Dinners.**—LONDON.—On Saturday, February 22nd, the members of the Kensington and Knightsbridge Electric Lighting Co.'s Cricket Club held their eighth annual concert at the Constitutional Club, Hammersmith. The chair was taken by Mr. H. W. Miller, supported by Messrs. C. L. Lichtenberg, R. W. Roberts, G. C. Weston and A. France. The whole of the arrangements were carried out under the management of Mr. A. C. Adams, the M.C. for the evening, assisted by Messrs. G. Gilbert, Gammage, Ashpool and R. Mitchell and other members of the Club. The concert was preceded by a whist drive. The winners of the whist drive prizes were as follows: Ladies—Mrs. Enderwick, Bishop, Godfrey and Stebbings; Gentlemen—Messrs. Biddlecombe, Stenning, Featherstone and Shea. There was a half-an-hour's interval between the drive and concert for refreshments, which were supplied by the steward, Mr. Goodchild, Mr. Frank Mitchell and Mr. Spriggs entertained with humorous songs; Mr. G. Gilbert, with mandoline solos; Miss Gillies, Miss Hammond and Mr. E. Driver sang, and Mr. Carter gave siffleur performances. Mr. F. C. Mitchell presided at the piano. The Cricket Club prizes were presented by the president, Mr. H. W. Miller. The winners were as follows: Mr. A. France and L. S. Fosbrooke shared the "A" XI batting prize; Mr. A. Waters, "A" XI bowling; Mr. O. A. Bartlett, "A" XI fielding; Mr. A. Cox, "B" XI batting; Mr. A. Jolly, "B" XI fielding prize. No member qualified for the "B" XI bowling prize. A vote of thanks was proposed by Mr. Gammage to the president of the Club for presiding; this was received with hearty applause, and the chairman responded. A vote of thanks was then proposed to Mr. A. C. Adams for so excellently carrying out the arrangements; Mr. Adams replied, and in turn thanked the artistes and the stewards.

LONDON.—The annual dinner of the staff and other employés of the Westminster Engineering Co., Ltd., of Willesden Junction, was held on Saturday, March 1st, at the Bush Hotel, Shepherd's Bush. A capital musical programme, provided mainly by the employés of the company, followed. The chair was occupied by Mr. J. O. Girdlestone. Mr. W. Meacher proposed the health of the staff.

EDINBURGH.—The annual staff ball of Bruce Peebles & Co., Ltd., was held last Friday evening at the North British Station Hotel, Edinburgh, and, as usual, a large gathering was present. Sandwiched between the two halves of the dancing programme was the supper, to which about 150 individuals sat down, these including guests and members of the staff and works. The usual toasts were proposed, the chairman (Mr. Lee Murray) proposing "The King," Mr. R. Graham proposing "The Firm of Bruce Peebles & Co., Ltd.," Mr. Alex. Mackenzie (director) replying,

Mr. J. H. Bunting proposed 'Our Guests,' and on behalf of the guests Mr. Alex. Robertson-Durham replied, but the toast of the evening was that of "The Chairman" (Mr. Lee Murray), proposed by Mr. S. E. Bastow, who, in the course of his remarks, took the opportunity of making a presentation to Mr. Murray, who has just retired from the position of general manager, having been appointed to a seat on the board of directors. The presentation took the form of an album handsomely bound in full morocco and containing, in addition to an illuminated address, the signatures of between six and seven hundred members of the staff and works. Mr. Murray suitably replied, and emphasised the importance of giving to the new joint general managers, Mr. S. E. Bastow and Mr. J. H. Bunting, the same support which had been loyally given to him during his whole tenure of office. There was an optimistic tone about all the speeches, and it was pointed out that not only were orders being received from new customers at home and abroad, but repeat orders from all old customers were being continually received. Dancing was continued until the small hours of the morning.

The annual smoking concert of the Great Eastern Railway Electrical Engineers Department will be held at the Great Hall, Cannon Street Hotel, on Saturday, April 19th, at 7.30 o'clock p.m. Mr. H. W. Firth, M.Inst.C.E., will preside.

The staff smoking concert of the Charing Cross, West End and City Electricity Supply Co., Ltd., will be held to-night at 8 o'clock, at the Pillar Hall, Victoria Station.

**Change of Name.**—With its April issue our United States monthly contemporary, *Southern Electrician*, will change its name to *Electrical Engineering*, representing the consolidation of the *Southern Electrician* and the *Electrical Age*.

**Institution and Lecture Notes.**—ROYAL INSTITUTION.—The following are included in the lecture arrangements after Easter:—Prof. W. J. Pope, three lectures on Recent Chemical Advances: (1) Molecular Architecture; (2) Chemistry in Space; (3) The Structure of Crystals. Mr. H. A. Humphrey, two lectures on Humphrey Internal Combustion Pump. Prof. E. Rutherford, three lectures on Radioactivity: (1) The Alpha Rays and their connection with the Transformations; (2) The Origin of the Beta and Gamma Rays and the connection between them; (3) The Radio-Active State of the Earth and Atmosphere. The Friday evening meetings will be resumed on April 4th, when Mr. James J. Bobbie will deliver a discourse on the Spectroscope in Organic Chemistry.

JUNIOR INSTITUTION OF ENGINEERS.—On Wednesday, March 12th, at 8 p.m., at the Institution of Electrical Engineers, a paper will be read on "Water-Heat-Steam: The Effects of Heat upon Water and a consideration of Water Movements in Steam Boilers," by Mr. Arthur Ross, F.I.C., F.C.S. The paper will treat of the behaviour of water (1) when heated at atmospheric pressure:—Convection; conduction; steam; spheroidal water. (2) In a boiler working at high pressure:—When lighting up boiler; when steaming lightly; when steaming hard; the effects of hindering free discharge of steam; priming. These points will help in the explanation of:—Grooving; pitting and corrosion; the effect of zinc plates.

ELECTRO-TECHNICAL ASSOCIATION, BRADFORD.—On Monday evening, February 24th, at the Royal Hotel, Bradford, an interesting lecture was given by Dr. Robert Pohl, chief engineer to the Phoenix Dynamo Manufacturing Co., Ltd., entitled: "What are the Output Limits of Electrical Machines?" The lecture was well attended by members of the Association, and after a discussion on various points a hearty vote of thanks was accorded to the lecturer.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.—This Association will hold its annual gathering in Blackpool, on June 12th and 13th next. It is expected that from 150 to 200 delegates will attend. The Blackpool and Fleetwood Tramroad Co. will entertain the members, who will also have a trip on the St. Anne's and Lytham line. The Finance Committee decided, on February 27th, to entertain the members at dinner, and the expense will be provided for in the salary of the Mayor. Voted to him in connection with the King's visit.

INSTITUTION OF CIVIL ENGINEERS.—A paper was read at the meeting on Tuesday last, entitled "Notes on City Passenger-Transportation in the United States," by Mr. G. D. Snyder.

SOCIETY OF ENGINEERS (INC.).—In the inaugural address of the president, Mr. Arthur Valon, A.M.Inst.C.E., delivered on Monday last, the author said that the development of engineering during the past 20 years had wrought a great change in the personnel of the profession. When engineering was almost entirely a matter of practical experience, professional qualification was independent of general education; but now that rational methods of calculation and design had superseded those of empiricism, a complete knowledge of these principles was necessary to every engineer, so that the system of apprenticeship no longer completely met educational requirements. The requirements for modern engineering training were contrasted with those of 20 years ago, and it was shown that a great increase had taken place in the number of engineers occupying more or less subordinate positions, for which technical competence was a greater recommendation than personal initiative.

THE CONCRETE INSTITUTE.—A paper by Mr. John A. Davenport, entitled "Economy in Reinforced Concrete Design," was read at the meeting on February 27th. The next meeting of the Institute will take place on March 13th, when a paper will be read by Mr. H. C. Johnson on the subject of "The Strength of Cement." The total membership of the Institute is now 968. When the membership reaches 1,000 an entrance fee, which at present is not required, will be imposed.

INSTITUTION OF ELECTRICAL ENGINEERS (NEWCASTLE LOCAL SECTION).—Arrangements are being made for a visit to works in the Middlesbrough district on Wednesday, April 9th, to be followed, at 7 p.m., by a meeting, at which Mr. A. E. Hadley will read a paper on "Power Supply on the Rand."

Mr. S. L. Pearce, electrical engineer to the Manchester Corporation, will deliver a lecture at the Municipal Evening School of Commerce, Manchester, on Monday next on the work of the electricity department.

On Wednesday last a paper was read by Mr. E. L. Pope before the L.C.C. Tramways Engineering Society on "The Equipment of Electric Tramway Conduit."

**Copper.**—It is gratifying to note an increase in the production of any European country, and the figures relating to Russian output during 1912 given in the *Financier* of February 24th show remarkable progress. The production for the first 10 months of 1912 is given as 1,698,000 poods (say 27,300 tons) over the corresponding period of 1911; this shows an increase of 34.4 per cent. The district with the highest production is the Ural range, with 14,700 tons; the Caucasus contributes 7,800 tons, Siberia 3,800, and 1,080 tons come from the chemical works and refineries. The increase in the Urals is 42.5 per cent. (for the period taken, compared with the same period in 1911). The leading company is the Kyshtim Corporation (Urals). Sisserts factories also show a large increase. In the Caucasus the Caucasian Copper Co. and the Ssynika factory have largely increased their output. In Siberia, the Spassky Co., with an output of 3,500 tons, shows an increase of 33 per cent. over that of 1911. The Yenissei Co. shows a drop in its small production—436 tons to 226 tons.

The hardening in the price of copper is ascribed to better prospects of peace in the Balkans, and should be confirmed by the removal of the strike depression at home. The decrease in visible supplies during February (England, France, and afloat thereto from Chile and Australia) was 2,052 tons, the greater part of which is from English ports; French stocks were only 191 tons less, and the quantities afloat amounted to 375 tons less than on January 31st. Rotterdam has increased stocks by 2,700 tons, and Hamburg by 924 tons, the total European visible supply being thus 1,572 tons better than on January 31st.

In detailed supplies (quoting, as usual, from Messrs. H. R. Merton and Co.'s circular) arrivals from North America were up to average, Spain and Portugal very low, Chile shipments below average, and Australian just on. Total deliveries at 38,599 tons are (allowing for the short month) up to the average of the past 12 months, which, however, is 1,500 tons below that of the 12 months preceding them (i.e., the greater part of 1911, and two months of 1912). American stocks (American Producers' Association figures) were 7,986 tons better on January 30th than at the end of December, the world's supply standing (January 30th) at 93,198 tons, or 5,825 tons above the preceding month.

**The British Fire Prevention Committee's Testing Station.**—Owing to the greater demands made upon the Committee for testing facilities, it has been decided to enlarge the testing station and to add to the Committee's plant. The main building is also being rearranged in such a form that the principal rooms will be available for the Committee's interesting technical and historical collections. It is anticipated that the alterations will be completed early in April, when the testing operations of the new session will be commenced. Apart from the usual applications for fire tests emanating from Great Britain and the Colonies, there is a marked increase in the requests for tests from Germany and from the United States, where the Committee's reports also enjoy the recognition of the public authorities.

**The Expert and the Witness.**—Mr. John Emanuel Mackey, M.L.A. (Vic.), who was chairman of the Select Committee which was appointed to inquire into Mr. Merz's electrification scheme for the Melbourne metropolitan railways, is feeling somewhat sore concerning an incident of the inquiry which is vastly amusing to everybody else. Mr. Mackey, who was a very strenuous worker in his University days, and carried off many honours and scholarships, determined to get right to the bottom of this electrification business before he entered upon his responsible duties as chairman of the Committee, and with that end in view, it is said that he spent much midnight oil in mastering the contents of an elaborate article on electrification, which forms part of an important scientific encyclopaedia.

Crammed with new and half-digested scientific knowledge, Mr. Mackey adopted a very stern attitude towards Mr. Merz when the latter appeared before him as a witness. Mr. Mackey cross-examined Mr. Merz on every detail, turning him inside out, and determined to catch him tripping if it were possible. Finally, it is said, Mr. Mackey quoted the authority which he had been consulting, and asked Mr. Merz if he agreed with the conclusions of the writer of the article. "Yes," said Mr. Merz demurely, "I quite agree with him. In fact, I wrote the article on which you have been examining me, myself." A broad smile illumined the faces of all Mr. Mackey's fellow committeemen, but since that time the chairman himself has looked upon electrification with a jaundiced eye.—*British Australasian*.

**The Dynamicables.**—The Dynamicables anniversary dinner will take place on Wednesday, April 2nd, at the Trocadero Restaurant, at 7.30 p.m. Mr. J. E. Kingsbury will be in the chair.

**Ten Years in the Norwegian Nitrate Industry.**—February 13th, 1903, was a noteworthy date in the history of the nitrate industry, because it was on that day that Prof. Birkeland

and Engineer S. Eyde met together and came to a final decision with regard to the problem of extracting nitrogen from the air. There is no industry which can show a similar development in the course of such a short period as 10 years. The start was made with a couple of men, and the total amount of power employed was no more than 5 h.p. On February 13th, 1913, there were employed about 400 engineers and officials and more than 2,000 workmen, while the amount of electrical power used had risen to 200,000 h.p. As a result of this activity, there has grown up a new town of the name of Notodden, which has a population of between 4,000 and 5,000 and which recently obtained all the rights of a town. Another community which has grown up in the same neighbourhood, viz., Rjukan, also will shortly obtain official recognition as a town.

**Manufacturing in Russia.**—The question of the utilisation of the power of the small Imatra Falls in Finland, to which reference has been made on former occasions, now appears likely to form a matter of dispute. A concession for the right of use of the falls was secured some time ago by the St. Petersburg (1886) Electric Lighting Co., which proposes to erect large hydro-electric works for the transmission of energy to St. Petersburg for its own services, and for those of the other two supply companies in the capital. But the Government of Finland now wishes to retain possession of the Imatra Falls, and also to utilise the Rouhiala Falls in connection with the suggested conversion of the Finnish railways to electric traction. German financial interests who are concerned with the three supply companies in St. Petersburg contend that if the Government of Finland intends to prevent the use of the Imatra Falls, it will be necessary for it to pay full compensation to the lighting company of 1886 on account of expropriation. The point in dispute is so delicate that future developments cannot fail to be of interest, especially as German firms expect large orders to result from the Finnish hydro-electric undertaking for the additional requirements of St. Petersburg.

**An Electric Dinner.**—An informal all-electric dinner at "Tricity House," 48, Oxford Street, W., on March 14th, is the latest venture on the part of the Students' Section of the Institution of Electrical Engineers. The dinner is open to all Students and their friends, and tickets (price 2s. 6d. each) are to be obtained from the hon. secretary of the Students' Section, Mr. E. T. Driver, 24, Bradgate Road, Catford, S.E.

**Inquiries.**—Makers of "Rosalin" soldering paste, and makers of chains, 14 and 16 gauge, are asked for.

**Appointments Vacant.**—Electrician for the Cornwall County Asylum (24s.); sub-station foreman, for the Shanghai Municipal Council; Meter tester, for the Birmingham Corporation (30s.). See our advertisement pages in this issue.

**The Electrical Iron Industry in Norway in 1912.**—There are now three electrical ironworks in operation in Norway. The new industry has met with difficulties, and, as compared with the electrical iron industry of Sweden, it has made slower progress. The first works set in operation were the Hardanger Electrical Iron Works. The process employed at these works is that of the Swedish Co. "Electrometal," which was demonstrated at the Trollhättan Works. The total production of electrical pig-iron in 1912 amounted to 2,200 tons, and the number of men employed to 55. At the Ulfes Iron Works there is also a small electrical plant in operation. The production of electrical pig-iron in 1912 was 300 tons, which was used in the foundry belonging to the ironworks. The Tinfos Electrical Iron Works have now at last been able to make a start, after the completion of the plant, which was delayed for a whole year on account of late deliveries of machinery and materials, while they also were kept waiting a long time for the necessary permission from the Government to erect the cable for the transmission of energy. At the end of the year there were two out of three furnaces in operation. The production of each has averaged about 10 tons of pig-iron per 24 hours, which, roughly, would give an annual production of 3,000 tons per furnace, or 9,000 tons for the whole plant. The process employed at these works is the invention of a Norwegian engineer, B. Lorentzen, and the products obtained have proved to be of excellent quality. The total production of electrical pig-iron in 1912 was thus rather more than 3,000 tons.

The Stavanger Electro-Steel Works at Jörpeland, in the neighbourhood of Stavanger, have also experienced some delay, but have now been completed and started. The necessary power is derived from the Ryfylke Waterfalls, and 1,500 h.p. are, in the first instance, going to be employed. The annual production will, according to the estimate, be about 6,000 tons of steel, which will be produced from scrap iron, chiefly from old ships, which is first melted in a Martin furnace, and afterwards refined in an electric furnace. The electric furnace has already been tested. A forge is also going to be built in connection with the steel works.

**Electric Smelting of Iron Ore.**—According to the *Revue Electrique* there are only six existing electric furnaces for the production of iron by the direct treatment of the ore, viz.:—Four in Sweden: Trollhattan (2,500 h.p.), Domnarfvet (3,500 h.p.), Hagfors (two of 3,000 h.p. each); one in Norway (Hardanger, 3,500 h.p.) and one in California (Heroult City, 3,000 h.p.). Five other furnaces are nearly completed—one of 3,500 h.p. at Hardanger (Norway), three of 3,000 h.p. at Arendal (Norway), and one of 2,500 h.p. in Switzerland. The total power engaged in iron smelting with the electric furnace is at present about 32,500 h.p.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—Our note of last week with reference to Mr. "J. Phillip" contained inaccuracies. Mr. A. D. PHILLIPS, assistant manager of the Fife Electric Power Co., who has just secured the appointment of engineer and manager to the Derbyshire and Nottinghamshire Electric Power Co., has occupied his position at Dunfermline for the past seven and a half years. He went there from the Glasgow Corporation Electricity Department, not from Dundee as stated by us.

The staff of the Cardiff Corporation Electric Light and Tramways Department has presented a solid silver salver to the engineer and manager, Mr. ARTHUR ELLIS, as a token of esteem and respect.

MESSRS. A. SADLER, of Messrs. Chapman & Hall, engineers, and H. STEAD, of Linkfield Road, Isleworth, have been appointed to positions on the works and office staffs respectively of the Heston-Isleworth Council's electricity undertaking.

Among a number of increases of salary granted to Corporation officials by the Wrexham Town Council, was that of the electrical engineer, from £250 to £275 per annum.

At a special meeting of the Electricity and Tramways Committee of the Heywood Corporation on Monday, a letter was received from Mr. JAMES STOTT, resigning his position as electrical engineer and manager, on account of ill-health. The resignation was accepted. Mr. Stott has held the appointment for a number of years.

**Tramway Officials.**—The Bury Corporation Salaries Committee recommends the T.C. to advance the salary of the tramways manager, Mr. WM. CLOUGH, from £400 to £450, with a further advance to £500 at the end of another year.

MR. L. C. F. BELLAMY, of Liverpool, has been appointed tramways engineer to the Ilkeston Corporation. Mr. Bellamy has for three years been assistant manager to the tramways at St. Helens.

MR. CHARLES MITTELHAUSEN, who has recently resigned his position as engineer and manager to the Bexley Council Tramways and Electricity Undertaking, was entertained to dinner on February 28th, at Whitehall Court, by the tramways managers of the greater metropolitan area. The chair was occupied by Mr. H. E. Blain, West Ham, other present including Messrs. A. Coveney (Erith), S. Dudman (Dartford), W. E. Hammond (Metropolitan Electric), L. E. Harvey (Hford), A. V. Mason (South Metropolitan), F. Schofield (Leyton), H. P. Stokes (Bexley), and W. C. Ullman (West Ham). Messrs. Goodyer, Holmes, Murray, and Pott were unavoidably prevented from attendance. All present expressed, in very warm terms, their appreciation of Mr. Mettelhausen's official and personal qualities, and their good wishes for his health and success in his new sphere.

**General.**—A correspondent writes: "It will interest your athletic readers to know that MR. PERCY MITCHELL, who acts as business manager for Mr. Cleave (Messrs. Drake & Gorham's Bristol agent), was selected to play centre forward for Gloucestershire in the Association football match, Dorset v. Gloucestershire on the Bristol City ground on February 26th. In one of the reports of the match Mr. Mitchell is referred to as follows: 'The score was equalised after clever work initiated by Mitchell, of St. Andrew's. He ran with the ball for 20 yards, and when he was tackled by Brown, Shervy got possession and passed to Powell, who succeeded in finding the net.' Unfortunately for Gloucestershire, their opponents scored another goal in the second half, and, undoubtedly, Dorset was the better team. Bristol City have been angling for Mr. Mitchell for some time past, but he prefers to face the future with the light of the Conference lamps still shining brightly on his path."

DR. A. R. FORSYTH, F.R.S., has been appointed chief professor of mathematics at the Imperial College of Science and Technology. Dr. Forsyth is of world-wide reputation, and will carry into effect the new policy framed by the governing body of the college in connection with the revision of the whole of the mathematical teaching.

We learn that MR. WILL C. MERCER, the Heckmondwike manager for Messrs. H. Hainsworth, Ltd., has been appointed chief electrical engineer at the Holbrook Colliery, Halfway, Sheffield. There were over 150 applicants.

MR. A. J. FIPPARD, of the Hankow Waterworks and Electric Light Co., Ltd., expects to arrive in England about April 21st, on a short visit.

**Obituary.**—SIR WM. ARROL and SIR WM. WHITE.—Within the past few days the country has lost two prominent and justly-honoured engineers, Sir Wm. Arrol and Sir Wm. White, K.C.B. Sir Wm. Arrol, the builder of the Forth Bridge, was no less an engineer for being a contractor. Without his experience and resource in overcoming the difficulties of what was then a novel method of bridge building, applied to one of the most formidable undertakings ever attempted, the work would not have been carried through so rapidly, or constructed so soundly. The sinking of the great caissons on to unequal foundations, through an unprecedented depth of water, was the first stage; and the last was the lifting from the water-level, and erection of the connecting girders—in themselves great bridges—without scaffolding, with the

sole support of the vast cantilevers that had grown out boldly over the Forth, unsupported in any way, and carrying, as they grew all the heavy tackle required in their own construction. The "vialon splendit" originated in the brains of Sir John Fowler and Sir Benjamin Baker. For its materialisation, Sir Wm. Arrol was indispensable. His works live after him, and will endure so long as good material and honest workmanship can survive the attacks of nature. He was a good employer and a generous public-minded citizen. To Sir Wm. White, the eminent naval architect, must be attributed the beginning of the extraordinary progress in the size and power of battleships during the past 25 years. From the age of 14 till the year 1902, with an interval of 2 years at Messrs. Armstrong's, Sir Wm. White was in the service of the Navy. Gradually working his way to the top, he was for the last 16 years of that period chief contractor. He witnessed and encouraged an immense extension of the use of electricity on war vessels, for internal lighting, for searchlights, for fire control, and for communication from ship to ship and from ship to shore by "wireless." For power purposes, such as gun-laying, ammunition hoisting, closing bulkheads, working capstans and cranes and other auxiliary machinery, a warship now calls for the highest electrotechnical skill. It is not many months since Sir Wm. White was discussing at Dundee the problem of electrical transmission for ship propulsion. He was a strenuous supporter of the leading Engineering Institutions, and engineers were looking forward keenly to his Presidency of the British Association at Birmingham this year, and to the prominence which might be expected to be given to engineering science on that occasion. After he retired from the service of the Admiralty, Sir Wm. White took a leading part in the design of the *Mauretania*. He was a great supporter of technical education, and, having carved his own way to eminence and success, was ever ready to lend a helping hand to others. His sudden seizure in his office, and subsequent death in the Westminster Hospital, have given a painful shock to his many friends and to the engineering profession generally.

MR. W. MUSGRAVE, J.P.—The death occurred on February 27th, after a brief illness, of Mr. Walter Martin Musgrave, J.P., managing director of Messrs. John Musgrave & Sons, Ltd., of Bolton, and grandson of the late Mr. John Musgrave, founder of the concern in 1839. The deceased, who was 68 years of age, had spent the whole of his life in the business, and in 1891 he succeeded his father, the late Mr. Joseph Musgrave, as head of the firm. The late Mr. Musgrave had served on the Bolton Town Council, and was a borough and county magistrate.

MR. J. G. WILSON-DICKSON.—The death is announced from Biggar, Scotland, of Mr. John Gordon Wilson-Dickson, member of the firm of Merz & McLellan, of Newcastle-on-Tyne.

## NEW COMPANIES REGISTERED.

**Woodbridge and District Electric Light Co., Ltd.** (127,895).—This company was registered on February 25th, with a capital of £4,000 in £1 shares, to carry on the business indicated by the title, and to adopt an agreement with the Rural Districts Electric Undertakings, Ltd. The subscribers (with one share each) are:—H. T. Harrison, 11, Victoria Street, S.W., engineer; J. H. P. Berthon, 91, York Street, Westminster, engineer; S. G. Leech, 91, York Street, Westminster, engineer; G. Cornish, 51, Cloveley Road, Ealing, W., clerk; J. P. Powell, 91, York Street, Westminster, secretary; W. G. C. Masham, 54, New Broad Street, E.C., incorporated accountant; L. E. Jones, Allendale, Woodstock Avenue, Hendon, N.W., merchant. Minimum cash subscription, 500 shares. The number of directors is not to be less than two or more than seven: the first are H. T. Harrison, S. G. Leech, O. H. Valpy and W. Riggs; qualification, £100. Registered by Jones, Son and Andrews, Capel House, New Broad Street, E.C.

**Mea Magneto, Ltd.** (127,390).—This company was registered on February 25th, with a capital of £5,000 in 4,950 preference shares of £1 each, and 1,300 founders' shares of 1s. each, to carry on the business of manufacturers of, and dealers in, magnets, magneto parts, and accessories, motors, motor-cars, cycles, &c. The subscribers (with one share each) are:—B. Metz, 3, Great Winchester Street, E.C., merchant; H. W. Cook, Iverdal, Billerica, confidential clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. No qualification required. Registered by Goldberg, Barrett & Newall, 28, West Street, Finsbury Circus, E.C.

**Research Laboratory, Ltd.** (127,422).—This company was registered on February 26th, with a capital of £1,000 in £1 shares, to carry on the business of chemists, druggists, dyers, electricians, engineers, suppliers of electricity for light, heat or power, &c. The subscribers (with one share each) are:—G. T. W. Oliver, Foston, Datchet, telegraph engineer; A. Williams, 75, Rodenhurst Road, Clapham Park, S.W., engineer. Private company. The first directors are not named. J. Abernethy is the first secretary. Registered office, 20, Bucklersbury, E.C.

**Rubelite, Ltd.** (127,478).—This company was registered on February 28th, with a capital of £500 in 1s. shares, to adopt an agreement with W. Rubel and L. W. Holmes, and to carry on the business therein referred to (under the name of "Rubelite"). The subscribers (with one share each) are:—W. Rubel, Berlin Charlottenburg Reichstr. 103, butenchemiker and metallurge; L. W. Holmes, 48, Great Russell Street, W.C., electrical engineer. Private company. The first directors are W. Rubel, J. Waldhausen, A. G. Temple, L. W. Holmes and H. M. Harris. Registered by Hicks, Arnold & Mozley, 35, King Street, Covent Garden, W.C.

**Rebels, Ltd.** (127,391).—This company was registered on February 25th, with a capital of £1,000 in £1 shares, to purchase an option relating to type-printing telegraph systems, and to adopt an agreement with E. J. Reid and Reid Brothers, engineers, Ltd. The subscribers (with one share each) are:—E. J. Reid, 12, Wharf Road, N., engineer; M. R. Roberts, 197, Victoria Street, S.W., civil engineer. Private company. The number of directors is not to be less than two or more than six; the first are E. J. Reid, M. Roberts, W. B. Good and W. E. Reid; qualification £50; remuneration as fixed by the company; secretary, W. E. Reid. Registered office, 12, Wharf Road, City Road, N.

**OFFICIAL RETURNS OF ELECTRICAL COMPANIES.**

**Fife Tramway, Light and Power Co., Ltd.**

**Midland Ignition Co., Ltd.**—Debenture dated February 14th, 1913, to secure £100, charged on the company's undertaking and property, present and future, including uncalled capital. Holders Capital and Counties Bank, Ltd., 23, Corporation Street, Birmingham.

**South London Electric Supply Corporation, Ltd.**—Issue on February 14th, of £200, and on February 19th, 1913, of £1,000 debentures, parts of a series of which particulars have already been filed.

**Works Control, Ltd.**—Particulars of £500 debentures, created February 6th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's property, present and future, including uncalled capital. No trustees.

**Indian Electric Supply and Traction Co., Ltd.**—A memorandum of satisfaction is full on February 5th, 1913, of mortgage dated November 18th, 1910, securing £50,000, has been filed.

**Rawlings Bros., Ltd.**—Trust deed dated February 20th, 1913 (supplemental to trust deed of December 27th, 1910, securing £10,000 debenture stock, of which £5,000 is now outstanding), charged on various properties in Kensington, Chiswick, and Westminster. Trustees: J. W. Reacher, 4, Queen Victoria Street, E.C.; and W. R. Rawlings, Lakeside, Wimbledon Park, S.W.

**Alumic' m Stamping Co., Ltd.**—Particulars of £1,500 debentures, created February 17th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**CITY NOTES.**

**County of London Electric Supply Co., Ltd.**

THE directors' report for the year ended December 31st, 1912, states that the capital expended on account of the company's London districts amounted to £71,902, and the net total expenditure in respect of those districts now amounted to £1,885,648. The balance from revenue account No. II, after deducting generation and distribution costs, rents, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries, was £134,082 plus £3,132 brought forward, making £137,214 available, less interest on the first and second debenture stock and interest on temporary loans to December 31st, 1912 (less income-tax), £44,039, and amount carried to reserve for depreciation, repairs, renewals, &c., £27,500, leaving for distribution for the year £65,675. Interim dividends on 55,000 6 per cent. preference shares, on 40,000 ordinary shares, and on 19,000 new ordinary shares from the due dates of calls, for the half-year ended June 30th, 1912, at the rate of 4 per cent. per annum, less income-tax, had been paid and now required confirmation. These interim dividends absorbed £23,663, and left for further distribution £42,012. The directors now recommend a further dividend on the 6 per cent. fully-paid preference shares for the last half-year, and a further dividend on ordinary shares and new ordinary shares for the half-year ended December at the rate of 8 per cent. per annum, less income-tax. These payments will absorb £36,796, and leave £5,215 to be carried forward.

The applications received during the past year amounted to the equivalent of 4,023 kw., making the total at December 31st last 45,362 kw. The total units sold were 22,512,478, as against 20,450,787 for the previous year, being an increase of 2,061,691 units. The number of consumers has increased from 18,459 to 20,246. The funds required to meet the capital expenditure incidental to the rapidly-growing business of the company have been provided by an issue in March last of 19,000 ordinary shares at par. In spite of the dislocation of business resulting from the trouble with the transport workers and the coal strike, the company maintained a full supply to all consumers. The increased costs involved have been partially met by increased economies in generation. The directors of the Bournemouth and Poole Electricity Supply Co., Ltd., have declared a final dividend on the ordinary shares of that company at the rate of 7 per cent. per annum, making 6 per cent. for the year. The business of the Coatbridge and Airdrie Electric Supply Co., Ltd., continues to show substantial improvement. The units sold during the year amounted to 4,445,035, being an increase of over 25 per cent.

Units generated	29,636,258
Units sold—Public lamps	57,524
Private consumers by meter	22,454,954
Total	22,512,478
Used on works	2,435,577
Total accounted for	24,948,045
Not accounted for	4,688,213
Public lamps	363
Total maximum supply demanded, kw.	12,800

The meeting is called for March 10th at the offices.

**London United Tramways, Ltd.**—The directors report a net revenue of £109,793 for 1912. After paying interest on debenture stock and loans, £41,228 remains—a decrease of £15,203, as compared with 1911. £16,000 is to be placed to general reserve, £25,000 to reserve for renewals and contingencies, and £1,224 carried forward. The meeting is called for March 12th.

MR. WM. LOW, of Blebo, presided at the fourth annual general meeting, held in Edinburgh on Friday last. For the benefit of new shareholders, the chairman explained that the earnings of this company were wholly derived from dividends and fees received from the Dunfermline and District Tramways Co., the Fife Electric Power Co., and this year, to a small extent, from the earnings derived from the electric lighting companies taking power from the Fife Electric Power Co. The company owns the whole of the issued capital of the companies referred to. A sum of approximately £60,000 had been expended during the year in new capital works, against which shares were issued to this company by the two statutory companies. The earnings derived from the Tramways Co. during the year, paid over to this company as dividends and management fees, amounted to £12,200, compared with £12,600 for the year 1911. This slight fall off could be accounted for by the want of circulation of money during the coal strike last spring. The lines operated during the year were the same as during 1911, with the exception that the Lochore extension was opened on December 6th. The benefit of this extension would be felt during the current year. The Fife Electric Power Co. had made substantial progress during the year. The consumers connected in 1910 were 176; in 1911, 263; and in 1912, 381. The receipts in 1910 were £6,700; in 1911, £8,700; and in 1912, £12,200. The receipts for January were £1,880, compared with £1,260 in January, 1912. During the year transmission lines were opened northward to Frenchie, and from Wemyss towards Leven. Cables were also laid from the power station to the west and south of the Burgh of Dunfermline and from Dunfermline to Inverkeithing. During the current year, the directors proposed to largely increase the plant at the generating station to deal with the rapidly increasing demand, and to extend the transmission lines and cables to further duplicate the supply to certain areas. He moved the adoption of the report, and the declaration of a dividend on the preference shares for the half-year to December 31st, 1912, at the rate of 6 per cent. per annum, and a dividend on the ordinary shares for the year at the rate of 3 per cent. per annum.

MR. GEORGE BALFOUR, in seconding the resolution, made special reference to the recommendation by the directors that a dividend of 3 per cent. should be declared on the ordinary shares. With regard to this, he pointed out that the capital expenditure during the year referred to by the chairman would be productive of a substantial increase in the revenue in the current year, and that the directors had this rapid increase in view in making the recommendation. The report was adopted.

**Capital Expansion in Germany.**

THE capital requirements of the German Transmarine Electricity Co. (Deutsch-Ueberseeische Elektrizitäts Ges.), notwithstanding the various large issues in recent years, have not yet been brought to a conclusion, a fresh emission of £1,250,000 in the form of 5 per cent. bonds being now in contemplation. As is known, the company possesses an extensive supply undertaking in Buenos Ayres, and is also interested in other enterprises at Santiago, Valparaiso and Monte Video. The share capital already amounts to £6,000,000, and the loans to £4,250,000, whilst the further issue of £1,250,000 will raise the total to £11,500,000. The new emission is prompted by the increase in the sale of current and the extension of the circles of consumers, particularly in Buenos Ayres, where cables are being laid in the most distant parts of the city in view of prospective competition on the part of the Lacroze Co. and the Italo-Argentine Co.

The Schuckert Electricity Co., of Nuremberg, proposes to raise fresh capital by the issue of a new 4½ per cent. loan of £750,000, and application has already been made for the admission of the loan to the Berlin Stock Exchange. Since the dividends paid on the ordinary share capital again began to assume an upward direction in 1909, the increase in the company's capital has been rapid. The ordinary shares now amount to £3,500,000, and the loan capital to £1,800,000, whilst the further emission in contemplation will raise the latter to about £2,500,000. Out of the total capital already issued the company's interests in the Siemens-Schuckert works, of which it is joint proprietor with the Siemens & Halske Co., reached the sum of £3,497,000 at the end of the financial year 1911-12. The Schuckert Co. now explains that the continued great activity of the Siemens-Schuckert works has been attended with fresh capital requirements, and the two proprietary companies intend to advance a further loan of £1,000,000 for this purpose. This transaction will raise the amount of the non-terminable loans to £3,500,000, so that with the ordinary capital of £4,500,000, and the bond capital of £4,000,000, the grand total of the capital of the Siemens-Schuckert Works will be brought up to £12,000,000. It is proposed to provide the Schuckert Co.'s share of £500,000 in the new loan to the S.S. Works out of the issue of 4½ per cent. bonds for £750,000 as already mentioned, whilst the balance will be devoted, among other matters, to the expansion of the company's Russian undertaking in conjunction with the heavy electrical engineering works of the Russian Siemens & Halske Co. It is not yet known what method will be adopted by the Berlin Siemens and Halske Co. for the provision of its half share of £500,000 in the new fixed loan of £1,000,000 to the S.S. Works.

### Bruce Peebles & Co., Ltd.

IN the course of his speech at the fourth annual general meeting of this company, held at Edinburgh last Friday, 28th ult., Mr. F. E. ANDREWS, the chairman, expressed the deep regret of the directors that the report and accounts were not of a more satisfactory nature. A year ago, they all looked forward to a successful year and anticipated with some confidence that the considerable progress that had already been achieved would not only be maintained, but would be appreciably improved upon during 1912. This had not been the case. The outstanding feature of the year had been the extraordinary number of strikes which had taken place, the evil effects of which, unfortunately for all concerned, were reflected in their trading results. The extremely difficult labour conditions which had prevailed during the whole period had sadly hampered manufacturers, and whilst gravely affecting employers, had been seriously detrimental to the best interests of the workmen themselves. In the early part of the year, whilst they were still feeling the effects of the railway strike, the strike of the coal miners took place, causing serious disorganisation of the works, for, although they had naturally provided as far as possible against the contingency by laying in a large and adequate stock of fuel, this did not help them much, as they were quite unable to obtain supplies of raw materials from other works, and even now it was impossible to get them in anything like a reasonable time. The strike also cost the company a considerable amount owing to the increase in the price of fuel, not only during the strike, but afterwards, because fuel prices were now on a much higher level than previously. Following the coal strike there was the dockers' strike in Glasgow, London, and Leith, and then in August there was a serious strike of apprentices in Scotland. They demanded an increase of wages in order to make up for the amounts which the companies were obliged to deduct in compliance with the National Insurance Act. This Act was another burden on industry, and it was difficult to see what recompense, either direct or indirect, manufacturers could possibly derive therefrom, unless it proved true, as he thought it would, that the passing of the National Insurance Act was the tolling of the knell of Trade Unions. Shortly after the apprentices' strike they had two strikes of the carters at Leith, which again impeded them by still further delaying delivery of raw materials, and finally towards the end of the year a strike of electrical winders took place, and this had only recently been settled. All these strikes had the effect not only of increasing the expenses of the year, but they seriously interfered with the output of the works, which might have been much greater but for these troubles. Thus 1912 had been a distinctly worrying and trying period, during the whole of which they had been anxiously contending with seriously adverse labour conditions—conditions largely brought about by present-day politicians, whose chief aim seemed to be to pass pernicious and ill-considered legislation, which only hampered the masters and irritated the men, and was therefore bound, sooner or later, to cause disagreement. Then, when disputes arose, the Government stepped in and patched up a so-called peace, which was unsatisfactory to all concerned. In his opinion, the ultimate effect of Government interference in industrial disputes was disastrous. All these strikes naturally caused a steady rise in the item of labour on all contracts they had in hand; but, apart from this, there had been a considerable increase in the cost of all raw materials, so that when one considered the very low prices it had been possible to obtain for electrical machinery, it was not difficult to account, to a large extent, for the poor results of the year's working. But although these results were disappointing to all, especially to those on his side of the table, representing as they did such a large proportion of the total capital of the company, they would be glad to hear that in some directions they had continued to make a steady and substantial progress. The total value of orders obtained had been greater than at any time during the existence of the present company, and they were now approaching the maximum capacity of their existing workshops. The volume of work given out in the home markets had undoubtedly been greater than for a long time past, and they had been successful in obtaining a fair share, but it was unfortunately the fact that prices had not until quite recently improved to any appreciable extent, and they showed an inadequate margin over the bare cost of materials and wages. Orders also were still often placed under conditions which entailed giving unreasonably long credit for a considerable portion of the contract sum and on terms which were unfair to the manufacturer. In this connection, however, some improvement had been brought about by the British Electrical Manufacturers' Association—their efforts, under the able chairmanship of Mr. Bruce Anderson, were already bearing fruit, and he could only express the hope that their admirable work in the interests of the industry would be vigorously continued. They themselves had, in a slight degree, as the works got full, been able to discriminate to some extent in the contracts they had accepted, but on account of unreasonable terms and conditions they had had to allow some business to go past them, and had had also to decline more than one substantial order, because they felt it was impossible to obtain the raw materials in time to enable them to deliver by the date required, and they were not disposed to jeopardise their reputation for good deliveries and run the risk of incurring penalties for being late. However, they had not very much ground of complaint regarding the amount of work which had been entrusted to them, and he was not without hope that the present tendency of prices to harden slightly would continue and the general position be thereby somewhat improved. With regard to foreign business, they had continued their active campaign abroad, and in pursuance of this policy sent one of their engineers on a five months' tour in South America, during which time he visited their

agencies in Brazil, Argentine and Chile. The results of his journey were quite satisfactory, and he had no doubt, as time went on, they would be recompensed by increased business from those countries, in the same way as they had reaped improving results from other parts of the world which had been similarly visited by their engineers on previous occasions. Electrical engineering was a science that progressed at a great rate, and machinery that was judged splendid three or four years ago, was only considered very passable to-day. Hence it was essential for manufacturers who intended to keep in the front rank to be continually overhauling and improving their designs. The machinery that they turned out continued to give every satisfaction, and it was an eminently gratifying feature that the number of customers on the books was constantly and steadily increasing. In the accounts buildings machinery and plant stood at the same figure as before. Of course it would be very desirable to write off a certain amount for depreciation, but this was obviously not feasible until the profits were sufficient. All additions to loose plant and tools were debited against the results of each year, and everything was kept in a very high state of efficiency, a considerable sum being spent each year in so doing—this year no less than £4,138. This amount was, of course, appropriated from the revenue before arriving at the figures in the profit and loss account. Fuel cost £1,601 more than in the previous year, and the Workmen's Compensation Act tended to become an ever-increasing burden, for whereas when the Bill was under discussion it was stated that the cost to the employer would not be more than 1s. 6d. on each £100 of wages paid, the average was now something like 25s. per £100, and very possibly it might go still higher. Stock, stores and work in progress stood at £52,282 this year, as against £36,481 before, which was an indication of the increased volume of work in hand at the end of the year. The orders in hand at the present time were sufficient to keep the works going at their full capacity for some time. Debts due to the company stood at £48,856, whilst the debts owing by them amounted to £30,517, showing a balance in the company's favour of over £18,000, whilst the actual cash in hand was over £10,000, so that their position in this respect was quite satisfactory. The profit of £3,865 from the manufacturing and trading account was, unfortunately, smaller this year than last, so that after paying the interest, amounting to £3,452, on the mortgage debentures, and allowing for the interest of £3,987 accrued on the unsecured debentures, there was an adverse balance on the year's working. This shortage, however, was more apparent than real, and did not affect their cash position to any appreciable extent. The net result of the year was that, after paying all expenses and spending £4,138 on the efficient maintenance of their plant, they had a surplus nearly sufficient to cover their mortgage debenture interest. Since the formation of the company, each year up to the present had shown substantial progress. What was now wanted was a period of immunity from these incessant labour troubles, so that employers and employed could proceed steadily with their legitimate work. Though disappointed, he, personally, was neither discouraged nor disheartened; the outlook was distinctly brighter, and he had reason to think that when they met next year they would be able to look back on 1913 with much more pleasurable feelings than they did on 1912.

The report was adopted.

**Aberdeen Suburban Tramways Co.**—At the half-yearly meeting Mr. A. Wilkie, managing director, in moving the adoption of the report, said that the directors had been considering the extension of the tramway system both on Deeside and Donside, and had had under consideration various systems, both trackless trolley-cars and motor-buses. The leading factor which the directors had to keep in view was the cost of power. They would have to get their electrical supply at a more reasonable price. Motor-buses had greatly improved lately, but if they could get their electricity at a slightly reduced cost they might favour the trackless trolley system. They were just now waiting for a reply from the Corporation with regard to the price they were going to charge for the electricity. No doubt that would have a great deal to do with the decision which the directors might submit to the shareholders at a future meeting. The reports were adopted.

**Metropolitan Electric Supply Co., Ltd.**—The directors announce a dividend for the last half-year of 1912 at the rate of  $\frac{1}{2}$  per cent. per annum, making  $\frac{3}{2}$  per cent. for the year, as against 4 per cent. in 1911, placing £20,000 to reserve, as against £17,000.

**Brompton and Kensington Electricity Supply Co., Ltd.**—The *Times* states that, after appropriating to depreciation and sundry reserve accounts £14,200, the directors recommend the payment of a final dividend on the ordinary shares for the half-year ended December 31st at the rate of 11 per cent. per annum, making 10 per cent. for the year, carrying forward £7,001.

**Willans & Robinson, Ltd.**—A petition for confirming the reduction of the capital from £483,336 to £141,665 is to be heard in London on April 4th. An announcement on the matter appears in our advertisement pages to-day.

**California Railway and Power Co.**—The directors have declared an initial dividend of  $\frac{1}{2}$  per cent., or at the rate of 7 per cent. per annum, on the prior preference stock.

**Ottawa Electric Railway Co.**—A dividend of 12 per cent., with a bonus of 3 per cent. for the past year, is announced in a financial daily.

## Metalite. Ltd.

The adjourned second annual general meeting was held on Friday, at 20.22, Christopher Street, Finsbury, E.C., Mr. W. Stewart, the chairman, presiding.

The CHAIRMAN, in proposing a resolution for the further adjournment of the meeting until April 29th, when the audit of the accounts would be completed, said that the bank, on the 6th inst., appointed a Receiver of the company's property to secure an advance which they had made. In the meantime, the directors were not letting the grass grow under their feet, and arrangements were practically complete for placing at the company's disposal a minimum of £12,500 within a period of two months. Under the contemplated arrangement, the board would be strengthened by the appointment of additional directors, which, he thought, could only be for the benefit of the company and the shareholders. He would give them full details at the next meeting, and, in the meantime, he was glad to be able to tell them that the series of debenture-holders, in order to assist the company, had agreed to postpone their security, so that there did not appear to be any likelihood of the matter falling through. The £25,000 series of debentures were held almost exclusively by the directors and their friends. He was satisfied that under the proposed arrangement, the company would have an excellent opportunity afforded it of doing a profitable business. The whole details would be placed before the shareholders at the adjourned meeting.

A shareholder said he would like to ask whether the directors and the secretary had retired.

The CHAIRMAN: Neither the directors nor the secretary have retired.

The shareholder said he would like to know whether the new lamp was being manufactured, and whether it belonged to the company. Further, he wished to know whether there was any litigation pending against the company or the directors. He remembered that at the meeting at Derby there were threats of litigation, and he would like to know whether they were still pending, or if they had been settled, in what manner. He further inquired whether the works at Derby were still open, and whether the new lamp was to be had anywhere.

Another shareholder asked whether the adjourned meeting would be held in Derby or London.

The CHAIRMAN, in reply, said that the next meeting would be held in London. The directors were still in office. Mr. Metcalfe was unwell and unable to be present, but Mr. Bentley was present. Mr. Alderton had retired. The new lamp did belong to the company. So far as he knew no litigation of any sort was at present in existence against the company or the directors.

The SHAREHOLDER: That does not answer my question about the litigation that was threatened at Derby.

The CHAIRMAN: You refer to the petition; a petition was presented, and it was dismissed.

The SHAREHOLDER: I am not referring to the winding-up of the company. There were threats at Derby about action being taken against the company or the directors.

The CHAIRMAN: We know nothing of them. A Receiver was put in on the 6th of this month. There are a few lamps in stock, but there are none being manufactured at the present moment.

In reply to another shareholder, the CHAIRMAN said they were paying £400 a year for the rent of the premises in which they were meeting, and it was the intention of the board to sublet some portion of it.

The resolution was then carried, and the meeting stood adjourned until April 29th.

## North Metropolitan Electrical Power Distribution Co., Ltd.

THE report submitted to the meeting held at Kingsway, W.C., on March 4th, stated that the revenue amounted to £17,816, an increase of £2,010 compared with the previous year. The balances from the local revenue accounts amount to £6,859. After adding sundry receipts and £214 brought forward, and deducting administration expenses, legal charges and debenture interest, there remains £5,291. The directors propose that £1,000 be put to renewals, £1,000 to reserve, and that 6 per cent. be paid on the ordinary shares, requiring £3,000, leaving £291 to be carried forward. The expenditure upon capital account during the year amounted to £2,973, of which £2,373 was in respect of extensions of mains and installations upon consumers' premises.

*Barnet Electric Supply.*—The revenue amounted to £5,639, compared with £5,637 during 1911. Installations connected to mains approximately equivalent to 22,100 30-watt lamps.

*Enfield Electric Supply.*—The revenue for the year amounted to £3,821, compared with £3,056 during 1911. Installations connected to mains approximately equivalent to 18,950 30-watt lamps.

*Hertford Electric Supply.*—The revenue amounted to £3,820, compared with £3,787 during 1911. Installations connected to mains approximately equivalent to 19,950 30-watt lamps.

*St. Albans Electric Supply.*—The revenue amounted to £4,334, compared with £3,118 during 1911. Installations connected to mains approximately equivalent to 29,450 30-watt lamps.

The additional connections made during the year to the mains in the four districts represented the equivalent of 12,150 30-watt lamps, making a total connection at the end of the year of approximately 90,450 30-watt lamps. The number of units sold during the year was 1,337,157 which, compared with the previous year's figure of 1,159,323, was an increase of approximately 15 per cent.

Application is being made for an electric lighting provisional order for the Urban District of Wood Green, and for an extension of the Barnet order, to include the parish of Arkley. The Wembley Electric Lighting Order, 1906, which was granted to the Wembley Urban District Council and transferred to the company, has been re-transferred back to the Council under Sec. 67 (b) of the Electric Lighting (Clauses) Act, 1899, for a nominal consideration.

	Barnet.	Enfield.	Hertford.	St. Albans.	Total.
Units purchased	577,390	264,400	261,635	371,980	1,475,345
Units sold—Public lamps	50,124	—	7,262	—	57,386
By contract	319,414	56,614	71,777	179,932	627,737
Private consumers by meter	136,466	187,411	158,045	169,192	652,094
Total sold	506,024	244,025	237,591	349,124	1,337,167
Not accounted for	71,306	20,375	23,651	22,856	138,188
Public lamps	201	—	81	—	282
Max supply demanded	310 kW.	188 kW.	158 kW.	257 kW.	—

## Bournemouth and Poole Electricity Supply Co., Ltd.

THE directors' report for the year ended December, 1912, says that capital expended during the year amounted to £9,371, making the total £469,577. The balance from revenue account, after deducting generation and distribution costs, rent, rates, taxes, wages, directors' fees, general establishment and other charges, and proportion of salaries is £37,606 plus £1,209 brought forward, making £38,816. From this there are deducted interest on debenture stock and interest on temporary loans, less income-tax, £9,145; leasehold and special redemption funds and interest, £1,762; amount written off suspense accounts, £637; amount carried to reserve for depreciation, &c., £5,000; leaving available for distribution, £22,272. Interim dividends on the 7,500  $\frac{1}{2}$  per cent. preference shares, on the 15,000 6 per cent. second preference shares, and on the 15,000 ordinary shares at the rate of  $\frac{1}{2}$  per cent. per annum for the half-year ended June 30th, 1912, less income-tax, amounting to £9,358, have been paid, leaving for further distribution £12,914. Final dividends on the  $\frac{1}{2}$  per cent. preference and on the 6 per cent. second preference shares for the half-year ended December, less income-tax, have also been paid.

The directors recommend a final dividend on the 15,000 ordinary shares, at the rate of 7 per cent. per annum, for the half-year ended December, 1912, less income-tax. The above final dividends absorb £10,770, leaving £2,144 to be carried forward.

The total applications received at December 31st last amounted to the equivalent of 8,245 kW., being an increase of 613 kW. for the year. The total units sold for all purposes was 3,338,425. The directors of the Richmond (Surrey) Electric Light and Power Co., Ltd., have declared a dividend of 6 per cent. on the ordinary shares for 1912. Mr. H. B. Renwick, previously secretary, has been elected to the board, and appointed managing director. Mr. W. D. Brightman, previously local secretary, has been appointed secretary to the company; and Mr. F. C. McQuown has been appointed London secretary.

Units generated	4,022,129
Units sold—Public lamps	22,795
Private consumers by meter	3,315,630
Total	3,338,425
Used on works	363,014
Total accounted for	3,701,439
Not accounted for	320,690
Public lamps	130
Maximum supply demanded, kW.	2,347

The annual meeting will be held in London on March 13th.

**Stock Exchange Notices.**—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Consolidated Cities Light, Power and Traction Co.—\$1,000,000 first lien 5 per cent. gold bonds, in lieu of the scrip.

La Plata Electric Tramways Co., Ltd.—£100,000 5 per cent. first mortgage debenture stock (special application).

Western Canada Power Co., Ltd.—£205,400 5 per cent. 40-year first mortgage bonds of £100 each (Nos. B1 to 2,054) (renewed application).

**Davis & Timmins, Ltd.**—The directors report that the net profit for the year ended December, 1912, including £10,452 brought forward, after allowing for depreciation and commission to manager, was £29,270. After paying interim dividend on the 6 per cent. preference shares and interim dividend at the rate of 6 per cent. on the ordinary, there was placed to general reserve account £2,000, leaving £24,060. The remaining dividend on the preference shares requires £1,800, and a balance dividend at the rate of 10 per cent. per annum on the ordinary shares for the last half-year is proposed, making 8 per cent. per annum for the year (requiring £2,350), also a bonus of 10 per cent. out of profits (£4,700), leaving to be carried forward £15,210. The annual meeting is called for March 14th.

**British Insulated and Helsby Cables, Ltd.**—The directors recommend a final dividend of 6s. per share, making, with the interim dividend already paid, 10 per cent. for the year. £90,000 is to be placed to reserve and depreciation, leaving about £74,000 to carry forward.

**Continental.**—SWITZERLAND.—La Société Suisse pour l'Industrie Electrique, of Ba-le, is declaring a dividend of 7 per cent. for the last financial year, the same as for the preceding 12 months.

### South Metropolitan Electric Light and Power Co., Ltd.

Mr. H. St. JOHN WINKWORTH presided on February 26th at Winchester House, E.C., over the annual general meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, p. 311), the CHAIRMAN said that it was the most favourable report for some years past. The number of consumers increased during the year by 566, which compared with 392 for the previous year, and constituted a record. In addition, 552 extension orders were received from existing consumers, an increase of 30 per cent., making a total of 1,202 new and extension orders for the year. The 35-watt lamp equivalents also showed a record increase of 28,681. The total units sold were 5,481,316, as compared with 4,855,580—an increase of 12·8 per cent. The sales of electricity produced £52,489, as compared with £47,636—an increase of £4,853, or 10·2 per cent. The revenue for 1911 included about £2,000 for electricity supplied to the Festival of Empire at the Crystal Palace, and as there was no such item in 1912, the growth of the general business was in reality larger by that sum. Coal cost £1,560 more, about £1,000 of which was extra cost caused by the colliers' and lightermen's strike in the spring and summer, as the directors felt it necessary to increase the stock of coal and to take all steps possible to ensure a continuous and unrestricted supply of electricity for all classes of consumers. The stock was reduced during the strikes, but had since been built up again, and they now had stored on vacant land about three months' supply of coal. The development expenses were a little less, notwithstanding a large increase in the outdoor staff, owing to the continuous increase in the business done at the showrooms, the number of transactions having increased from 2,750 for 1911 to 4,080 for last year, and the sales exceeded £10,000. The company's offices and showrooms in High Street, Lewisham, had proved most useful as a supplement to the work of the outdoor representatives. The total expenditure he had dealt with amounted to £22,670, or £2,129 greater than last year and represented 40 per cent. of the gross receipts, as against 39·8 per cent. The cost per unit sold amounted to '99d. as compared with 1'01d. They had a net revenue of £33,933, an increase of £2,561, which represented a return of 5·8 per cent. on the average capital expenditure as compared with 5·49 per cent. for 1911 and 4·91 per cent. for 1910. In the course of his references to the capital account, the chairman said that about £5,000 was in respect of the new 1,500-kw. turbine, which was expected to be brought into service shortly, and in addition to enabling the company to cope with a large increase of business, considerable economies in working should be effected. The business of the West Kent Electric Co. was developing, and the accounts for the past year showed a small profit after providing for all expenses. During the year agreements had been entered into with the Woolwich Corporation and the Urban District Council of Bexley for bulk supply, and arrangements were being made for affording a supply in other districts. Looking to the future, their prospects were distinctly favourable. The large increase in the connections last year would benefit the revenue for the present year. The new orders received this year were greater, and the connections made compared favourably with the corresponding period of 1912, while as regarded power, the factories, more particularly in the industrial area, were busy with contracts, and extension orders were being negotiated. The output of units sold showed a satisfactory increase, so that their gross receipts for the current year were likely to show a marked increase. On the other hand, they had to face a higher price for coal, but they expected to be able to effect economies by a greater use of the most economical plant, so that he hoped when they met again next year they would be able to present accounts which would show further and substantial progress.

Mr. H. BOWDEN (managing director and engineer), in seconding the motion, said that last year he referred to the important developments taking place in the Lewisham area. The demand had still further increased and was being largely dealt with by the extra high-tension system, which continued to work efficiently and satisfactorily. The area was now practically covered by the high-tension network (except Brockley, where further extensions were anticipated). Having regard to the extensive area covered by their network of cables, they had for the year under review, been remarkably free from faults or interruptions of any kind, and this might perhaps be attributed to the systematic testing and frequent inspection which was pursued of all cables and apparatus, thus permitting the removal of incipient faults before they became troublesome. As a result, the cost of repairs was extremely small. The maximum load had increased from 3,600 to 4,000, or 11 per cent. The output on feeders at the power-house had increased from 6·3 millions to 7·06 millions units, or 12 per cent. The units sold advanced from 4·85 millions to 5·48 millions, or 12½ per cent. From these figures it could be seen that the efficiency of distribution had increased from 77 per cent. to 77·6 per cent. At the power house they had laid down one 1,500-kw. turbine and two boilers, which were practically finished and ready for steaming. He had hoped to be in a position to tell them the new set had been started, but, owing to the delay in the delivery of material, this had not been possible. The plant should, however, be available within a fortnight. The total cost per unit had been reduced from 1'01d. to '99d., but a still further saving would have been shown had it not been for the coal, which had increased from '36d. to '37d. This increase was largely accounted for by difficulties experienced during the strike (although he was glad to say they were able to give an uninterrupted supply without exhausting their coal stock), and by the inferior quality of the coal delivered about this time, and partly owing to the late delivery of new plant, which they

had hoped would have been in time to assist the winter load, and thus largely dispense with the almost constant running of the reciprocating plant in the West House. He thought they might look to see considerable economies effected in this direction, except for any increase they might be obliged to pay on entering into a new coal contract. It was satisfactory to note that their total cost per unit had been reduced, and he thought he was correct in saying that they still held the second lowest total cost for all the London companies.

Mr. POWELL said it seemed to him the position of the ordinary shareholders was hopeless, and it did not seem that the expenditure incurred had been justified by the results. The West Kent shares were put in the balance-sheet at par, and he did not know how far the directors were justified in doing that. Instead of carrying forward £5,000, they ought to wipe out the preliminary expenses.

Mr. HUGHES also expressed disappointment, and said he had been requested by Liverpool shareholders to ask what fees the managing director got, and what time he devoted to the company.

Mr. HINBERT thought the board might have paid 2½ per cent. this year, as that would have helped them to place debentures and preference shares.

The CHAIRMAN said that the board, who were large shareholders, regretted the non-payment of a dividend, but they felt it was in the true interests of the undertaking to conserve their resources at the present time, and build up a strong financial position. As he had previously explained, by the terms of the debenture trust deed they were prohibited from paying a dividend until they put away to reserve and depreciation a sum equivalent to 2½ per cent. of the capital expenditure during the year, and therefore the profits were not sufficient for the payment of a dividend. He certainly thought the shareholders were within sight of a dividend. The managing director received the same fees as a director as the other directors did, and he received £600 a year as managing director and engineer-in-chief, and he spent a great deal of time in the service of the company.

The report was then adopted, and a vote of thanks was accorded to the staff.

### Bath Electric Tramways, Ltd.

The annual meeting was held on Thursday last week at Winchester House, E.C., the Hon. Sir James Sivewright, K.C.M.G., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., p. 357), said that although they had undoubtedly earned, they did not find themselves in a position to pay a dividend on the preferred ordinary shares. The cause of that was the same as he dwelt on at considerable length last year. Naturally there was a feeling of irritation on the part of the preferred ordinary shareholders, and on nobody's part was that irritation more felt than on his own, because he was far and away the largest preferred ordinary shareholder. He had held 10,000 of those shares since the inception of the company, which he subscribed for at par, and he had not parted with a single one. It would, therefore be understood that they had done everything in their power to meet the situation, and be in a position to pay the dividend which they had earned. One or two shareholders had written complaining of the report, including the secretary of the River Plate Electricity Co., which company held 2,700 preferred ordinary shares. In the course of his letter he said that the report was most unsatisfactory, and he said that the phrase which the directors used as to the pending completion of arrangements which were being made for meeting the loan standing in the balance-sheet at £21,150, had been used over and over again. That was not quite the fact, but he could say that to-day they were at all events nearer the completion of the necessary finance to enable them to attain the end in view. Having referred to the history of the negotiations and their present position, he said that if they succeeded, they would have a sufficient sum of money to repay the loan to the bank, and it would also give them money for improvements which would bring in a fair return. The secretary of the River Plate Co. went on to criticise the action of the directors in putting aside £8,000 to the contingencies and renewals account, which he regarded as altogether unnecessary and unjustifiable. In view of the fact, to which the auditors drew attention, that no special provision had been made for depreciation, the directors were rather in the position of being between the devil and the deep sea in that respect. All he could say was that they believed the policy which they were carrying out was a conservative one. They had maintained the system in all its branches—tramways, motors and foundry—in a manner second to no similar undertaking in the kingdom. They had paid off £5,000 of their debentures; they were carrying forward £3,200, and they had put to the renewal and contingencies account £10,000, making in all about £18,000, which was available. Not only had they done that, but they had just ordered, and partly paid for, four new torpedo motor-omnibuses. The traffic receipts showed an increase of £2,163 over those of the previous year—in fact it was the best year that the company had ever had. He was sorry to say, however, that the net profits were considerably less, owing to a variety of causes. They had to pay a very largely increased price for coal, but although the price had gone up since the strike, their coal bill for 1913 would be considerably less than it was last year. That was due to the introduction, also paid for out of revenue, of mechanical stokers which would enable them to burn a much inferior class of coal. The motor-omnibus traffic was very satisfactory and was full of promise. They had gone very carefully into the cost of running the system, and he thought they could hold their heads up against any tramways either company-owned or belonging to municipalities.

Their working expenses per mile last year were 5'005d., which was considerably more than in 1911, owing to the causes he had referred to. In the case of 17 companies whose records were accessible their average cost of working in 1911 was 5'980d. per mile, and in the case of 79 local bodies possessing tramways the average cost per mile was 6'56d. He thought, therefore, they might fairly claim that in their staff they had an efficient, vigilant and economical body of men. As to the future, it was very dangerous to prophesy, but the first eight weeks of the present year had shown an increase in gross receipts of £300, and an increased net profit of a little over £100. Given a fairly average summer and a fair autumn, they would see a very considerable increase both in the gross takings and in the net profits. Should that be so, and should they succeed in carrying out the financial arrangements to pay off the bank loan, then he thought he could positively promise that the long-deferred goal of paying a dividend on the preferred ordinary shares would be reached.

MR. HUGH CLUTTERBUCK seconded the motion, which was adopted after a short discussion.

### Kensington and Knightsbridge Electric Lighting Co., Ltd.

COL. R. E. CROMPTON, C.B., presided on February 27th, at the offices, 148, Brompton Road, S.W., over the meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 313), the CHAIRMAN first referred to the absence of Mr. Erskine, their secretary, who had been with them during the whole of the life of the company and was away for the first time, but he was glad to say that after a prolonged illness he was now in a fair way of recovery. It was proposed to pay the same dividend as last year, and the carry forward was increased from £1,680 to £1,780. The total amount now standing to the credit of the renewal and reserve fund, £115,361, was very substantial and satisfactory. There were two chief causes for the diminution of the profits earned during the year, the first being a falling off in revenue due to the reduced sales of current from £76,918 to £75,847, a decrease of £1,071, or about 1'4 per cent. The other cause was the increased price of coal, which was likely to be intensified in the future. They had not had to pay an increased price for coal itself, which was a direct result of the coal strike, but in addition they had had to deal with an indirect result of the strike, as they had to draw very largely on their reserved stock which had accumulated at Wood Lane, and which had, to some extent, deteriorated by exposure, so that an extra quantity of this reserve coal had to be used to generate a given quantity of electricity. During last year the price of coal per ton increased by about 10 per cent. The combined effect of this increase in price, and the increased quantity used from the reserved stock, had increased the total working cost per unit supplied from the Wood Lane works to Kensington customers by about 11½ per cent., and it seemed from the still higher price they had to pay for coal for the coming year, averaging the existing contracts, and the new contracts they had yet to make, they must be prepared for a future increase in the cost per unit delivered, of about 15 per cent., and this would affect the total supplied to their customers by about 5 per cent. Under these altered conditions of cost of production, the directors had under anxious consideration the best method of meeting it. The falling off in the units sold was not large, and the fall which actually showed was due partly to the Early Closing Act, which affected the units sold to shops and other trade customers, and the board found it would be necessary to adjust the price to those customers to meet the altered conditions. As the shareholders were aware, the price per unit realised by them for the sale of electricity was especially low for the district, and they compared favourably in point of cheapness with any other company or district. They could not expect any considerable increase in the output otherwise than by the rebuilding going on in certain neighbourhoods where small houses were being pulled down and replaced by larger ones, and there was no doubt whatever that the increased cost of manufacture must be met by some adjustment of their price. In view of the liberal discounts they had been giving in the past, they thought this could be done without any of their customers feeling it. Apart from the increased cost of coal, the general cost of distribution and administration including that of maintaining their plant and mains and meters in as perfect a condition as possible, had not increased, in spite of the fact that they had had to make good during the current year the result of the short-circuit of mains, which occurred shortly before he addressed them at the last meeting, and when he put before them the possibility that they would have to pay heavily for that trouble. He thought the shareholders were to be congratulated that they had practically paid for that short-circuit without any notable increase in their maintenance cost.

MR. R. WALLACE, K.C., seconded the motion.

MR. KILLINGWORTH HEDGES said that it was with a little feeling of disappointment that he heard the chairman foreshadow that the output of electricity would not be increasing, but that it might from certain circumstances tend to decrease, and it behoved this company, as well as other companies, to do all they could to popularise electricity. The speaker referred to efforts which were being made to establish electric cooking, and personally spoke highly of such cookery, but said he found electric lighting companies gave away plenty of literature about cookers and heaters, but did not give the public facilities for seeing how these things were done. He thought they ought to follow more on the lines of the gas companies when they introduced gas cookers.

The CHAIRMAN said they had co-operated with other companies and with the local authorities, and had done a good deal to popularise electric cooking and heating. No one was a greater believer in the future of these two methods of utilising electric energy in residential districts than himself, but it was a slow process to overcome the conservatism of the English kitchen. He thought it highly probable that in six or seven years' time they would have made considerable progress in electric cooking, but he hardly thought it wise, at a shareholders' meeting, to put before them that there was likely to be any substantial increase in the output of electricity during the next year from this cause, although they were doing all they reasonably could to further what Mr. Hedges asked. Owing to the care observed by the staff the cost of the short-circuit they experienced was not one-twentieth of what they anticipated it would be at first.

The report was then adopted, and a hearty vote of thanks was accorded the board, Mr. Miller, the engineer, and the staff for their services, on the motion of MR. HEDGES, seconded by MR. SCHWANN.

### Telegraph Construction and Maintenance Co., Ltd.

The meeting of this company was held on Thursday last week at the offices, 38, Old Broad Street, E.C., under the presidency of Lord Selborne.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 311), said that the net profits for the year had amounted to £109,000, as compared with £87,000 in the previous 12 months. Adding £106,000 brought forward, they had a total of £216,000, as against £195,000 last year. From that had to be deducted the interim dividend already paid of £22,000, which left £193,000 available for distribution, as against £172,000 a year ago. The directors proposed that the reserve fund should be increased by the addition of £20,000, as against £10,000 last year. They proposed a dividend at the rate of 10 per cent. and a bonus of 12s. per share, which would leave practically the same amount to be carried forward as was brought into the account—£106,000. The freehold and leasehold premises, machinery, plant, stocks of stores and materials, stood at nearly £619,000, a considerable increase over last year, the reason being that they had larger stocks of materials on hand, and a larger amount of manufactured cable in connection with contracts in progress. On the other side, the debts owing by the company, and reserves for insurance and contingencies (£1,407,416) had increased. The conservative policy which the board had always adopted in dealing with the company's finances had hitherto met with the approval of the shareholders, and he could give them an illustration to show how necessary that policy was for the success of the company. The amount of material used in the business in the course of a year was very large indeed—partly raw material and partly manufactured material, which they further manufactured, such as gutta-percha, jute, copper, iron, and, of course, a very large amount of coal. As they dealt in such large quantities, it was of the greatest importance that they should buy their materials at the most favourable moments, and one of the secrets of their success was that they were able to do that by reason of the financial strength of the company. At the moment, they had important contracts in connection with work in the Far East. Last year was a period of comparatively small jobs, largely on behalf of foreign Governments, and those Governments, he was glad to say, had always testified their great satisfaction as to the way in which work had been done for them. As he had said they had undertaken an important and anxious work in the Far East. It was in the interests of the company that they should be able to take such contracts, although the responsibility connected with them involved great anxiety, but they could not undertake such work unless they had large stores of materials. Then, again, last year had been a period of great unrest with the railway strike, the coal strike, and the dock strike. Each one of these strikes might have affected their business very seriously, although the relations between the management and the workmen had always been of the most harmonious and sympathetic kind. Their work was not impeded for a moment in spite of those troubles, because they had large stocks of material on hand, and he might say that when the coal strike ended they had enough coal in stock to carry on the works for two months longer.

SIR JAMES PENDER, Bart., seconded the motion.

Replying to a shareholder, the CHAIRMAN said his opinion was that wireless telegraphy would always have a market of its own, and he did not think it would seriously interfere with work which could only be done by the cable.

The report was adopted.

### Chelsea Electricity Supply Co., Ltd.

The directors' report for the year ended December 31st, 1912, states that the profit for the year amounted to £37,460, which, with £3,241 brought forward, and £1,937 for interest, makes a total of £42,638. After deducting interest on debenture stock, £7,875, interim dividend on the preference shares at the rate of 6 per cent. per annum, £900; interim dividend on the ordinary shares at the rate of 4 per cent. per annum, £4,914; there remains a balance of £28,919, which the directors recommend shall be appropriated as follows: to credit of reserve for renewals, depreciation and contingencies, £13,626; to credit of debenture stock premium redemption fund, £704; to amount written off cost of extinction of founders' shares, £1,089; to amount written off cost of purchase of Cadogan Electric Light Co., £1,000; to amount written off cost of invest-

ments, £1,352; to final dividend on the preference shares at the rate of 6 per cent. per annum, making 6 per cent. for the year, £900; to final dividend on the ordinary shares at the rate of 6 per cent. per annum, making 5 per cent. for the year, £7,415, leaving to be carried forward £2,833. The number of 8 C.P. lamp equivalents connected on December 31st, 1912, was 293,973, an addition of 11,597 during the year, and the total number of units sold was 1,184,072, being 167,594 more than for the previous year. The directors record the death of their late colleague and chairman, Sir Irving Courtenay. The vacancy on the board has been filled by Mr. Stanley Becton. Mr. W. R. Davies has been appointed chairman.

The meeting is called for March 12th.

### British Electric Transformer Co., Ltd.

The annual meeting was held on February 28th at Salisbury House, E.C., when, in the absence of Mr. J. P. Albright (the chairman), through illness, Mr. A. F. Berry presided.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 359), first dealt with the variation of the figures in the balance-sheet, due to the increase in the capital owing to the acquisition of the whole of the Berry Construction Co. in accordance with the agreement of April 1st, 1912. Sundry creditors were more by about £1,767, due to increased business and its extending nature. They did not propose to add anything to depreciation reserve, as their advisers did not consider it necessary. On the other side of the balance-sheet, the item for patents and goodwill had been increased by £26,632, due principally to the absorption of the Berry Construction Co., as owners of the "Tricity" cookers and heaters. They had the general reserve account of £21,745, which could be set against this asset or for any contingency. The goodwill alone of a business such as theirs, which was the result of something over 15 years' continuous specialisation, and one which earned them profits of about £20,000 a year, if valued in one or other of the many different ways of arriving at a fair valuation, would give them a sum of about £60,000, but in addition to this, there was the value of the patents. It was, of course, on these patents that the business and the goodwill had been built up. Some of their foreign patents had been sold, and for others licences had been granted, and they were now earning a revenue. The cost of all lapsed patents or those sold had been written off, and the patents left, numbering well over 100, and being regularly added to, were the only ones included in the balance-sheet. Having dealt with the items of freehold land and buildings, &c., and of office furniture, the chairman said the increase of £10,600 in the stock was incidental to a business such as theirs, where with increased orders they had to carry increased stocks of raw material. The manager's valuation of the stock had been verified as far as possible by the auditors, who were of opinion that the valuation was on the conservative side. Work in progress accounted for a large part of the item of stock and materials, and was taken from their cost books, which were very carefully kept, and were also verified by the auditors. Investments were increased owing to the investment of some of their spare cash. All the business of the year had been done on a strictly cash basis, and there were no shares taken in part payment, or anything of that sort. With regard to the profit and loss account, general charges were increased by about £3,786 in consequence of the largely-increased amount of work they had done in both the transformer manufacture and the "Tricity" cooker manufacture. The gross profit was about £4,874 more than last year and discounts, &c., were £892 in excess. Turning to the year generally, 1912 had been quite eventful for the company in several ways. About this time last year, they had to face the consequences of the coal strike, difficulties in getting raw materials, and in delivering their finished goods. But in spite of all the difficulties they had in common with most other manufacturers of electrical apparatus throughout the country, shared in what was clearly a trade boom, in the electrical world at any rate, and the volume of work turned out was considerably in excess of that of 1911. Their shipping work increased appreciably, and in nearly every case where they had obtained an order from abroad they had got repeat orders, which was perhaps the best testimony they could ever hope for. They commenced the year 1913 with some 25 per cent. more work than they started 1912, which, as they were told last year was a record and far in excess of anything they had previously done. It was not safe to prophesy, but they did not see any reason why there should be any falling off in the orders, judging by the number of inquiries they received. This year they started with practically the same loyal staff, and there seemed no reason why the operations of the company should not proceed just as smoothly as in the past. With regard to the manufacture of transformers, in the past they had been used more particularly by authorities supplying electric light and power and dealing only with alternating current. But owing to the increase in the demand for electrical energy, and the greater distance over which it had to be distributed, the direct-current stations and the railway companies had found it necessary in a number of instances to put down alternating-current plant for the generation and transmission of electric energy, and by means of transformers and rotary converters to convert the direct current just where the energy was required. The principal purchasers of transformers to-day were Corporations, Government departments, railway, tramway, colliery, mining, electric light and power companies—all of which they would agree were a first-rate class of customers to get on their books. The "Tricity" business was progressive, and the users of their cooker expressed themselves well satisfied with its behaviour.

They had equipped their works at Hayes with a complete apparatus that they were not alone in looking for a greatly extended use of electricity for cooking was shown by the fact that some 25 manufacturers were contemplating starting the making of electrical cooking apparatus. They believed their system was the best, and this was borne out by the fact that some 28 supply authorities were now hiring their cookers. Their experience in manufacturing both transformers and cookers led them to think they would continue to hold the position they held that day. In conclusion, the chairman again referred to the work of the staff, and expressed the belief that the company owed much of its success to the fact that so large a portion of its shares were held by the directors and their friends and by the staff.

Mr. T. ROWE seconded the motion.

In the subsequent discussion questions were asked as to circulars coming addressed from Copthall House offering large blocks of shares of the company for sale, and as to the attacks made on the company by a financial print. It was also asked what connection there was between the company and "Modern Kitchens, Ltd."

The CHAIRMAN said the board had no control over any circulars outside brokers might issue. The company running the Tricity House restaurant, which was equipped exclusively with their cookers, were, he was glad to say, doing an extraordinarily good business. As a company they had a small interest in it, but they had a great interest in it from the point of view that it was teaching the public to appreciate their cookers, and already it had done a good deal of good to them. With regard to the competition of other makers, if they produced good cookers it would all help to make such apparatus popular.

The report was then adopted.

### Lancashire United Tramways, Ltd.

THE HON. ARTHUR STANLEY, M.P. (chairman), presided on February 27th, at Winchester House, E.C., over the annual meeting.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 357), the CHAIRMAN said that there was a profit of £19,465, which showed an increase of £281. The profits were the highest figure they had yet reached, and were obtained in spite of the coal strike, which, of course, was a heavy loss to them. The receipts per car-mile were 8'21d., which was also the highest figure they had yet reached. The units sold to outside consumers were 1,025,000, as against 660,000 last year, showing a very satisfactory increase of 364,000 units. They might hope that that would be very considerably increased this year, because under the arrangement with the Lancashire Power Co., who had certain rights in the district, they had arranged to supply the urban district of Tyldesley. The load they were at present carrying, and this new load, had necessitated a new battery and a turbine. The new battery was already erected, and they had made arrangements for erecting the turbine at once. When they had got the new turbine they would be in a position to cope with any load that they might expect to get for some time to come, and there was not likely to be much more capital outlay under these heads. They proposed to construct a short bit of new line. They had been able to make very satisfactory arrangements with the local authorities for the necessary powers, and also for the maintenance of the road, and he hoped, therefore, they would be able to run that section at a profitable rate. It was a continuation of one of their lines, and would join up to their main system a rather important district which had been very anxious to see the tramways there. It also would enable them to make effective use of about half a mile of line which was laid, but which hitherto they had not been able to work. As regarded finance, they had left with the companies they controlled after paying dividends £6,900, and the depreciation and renewal funds they had built up in these companies, now amounted to £16,400. It was quite certain, now that their lines had been running some years, that they would have a good deal to spend within a little time on renewals, and they would all agree that it was wise that they should build up the fund in anticipation of the work they would have to do. In a company like that, which had to be very carefully worked, and where the increase each year was not very large, it was important that it should be progressive. It was only by taking a series of years that they could really see the increases which were made. He had taken 1909, not because it was a particularly good year, but because it was a convenient year, and there was no better year before it. In 1909 they carried 13,450,000 passengers, whilst in 1912 they carried 14,500,000, or an increase of over 1,000,000. The traffic receipts in 1909 were £68,900, and in 1912 £72,400. The sale of electricity was rather a remarkable figure, for while in 1909 it was only £690, in 1912 it was £2,500. The total revenue in 1909 was £71,500, and in 1912 £77,600. Perhaps the most gratifying feature was that the increase had been secured at a cost of under £1,900 increase in the expenditure on the lines, and therefore he thought they might say with absolute confidence that the position in 1912 was materially better than in 1909. He thought that great credit was reflected on the secretary and other officials who managed the lines. He could assure them that it was a very complicated business to work if they controlled various lines which worked under different conditions. It wanted very careful watching, and the proof that vigilance was being exercised was shown in the increasing returns, and the fact that expenditure did not increase to a corresponding extent.

SIR J. BEECHAM seconded the motion.

MR. NEWGASS, whilst sympathising with the directors, remarked that friends of his at Liverpool had told him that if there were certain outlays the returns could be materially improved. They

had motors running over their lines and damaging the road, and could the company not carry goods traffic itself?

MR. TAYLOR complained that the accounts did not enable them to form an intelligent opinion of what was actually being done on the tramways, and it would help them if more statistics were given of what was actually being done. He thought the working expenses were high, and compared unfavourably with other companies.

The CHAIRMAN, replying to the criticisms, pointed out that if they could not raise money at a good rate it was certain they could not use it in the district in a remunerative way. If Mr. Newgrass had known the difficulty they had over the prior lien bonds he would realise that the chance of raising capital at a remunerative rate was very remote. They did once have a great idea of the possibilities of goods traffic, but, after going most exhaustively into the whole matter, they could not see how they could fit such a service in practically with the passenger service. With regard to the prospectus they issued for the prior lien bonds, they had the advice of Mr. Salter and Mr. Sellon, and that the results had not come up to anticipations was due to many circumstances it was impossible for him to go into at the moment. He would not venture to make any prophecy as to when they were likely to get a dividend.

The report was then adopted.

### W. T. Henley's Telegraph Works Co., Ltd.

THE annual meeting was held on Friday last at the offices, 13 and 14, Blomfield Street, E.C., Mr. Sydney Gedge, M.A., presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 358), said that when a company could show such a good balance-sheet as they were able to show this year, succeeding, as it did, similar balance-sheets for a good many years past, it would be strange, indeed, if they had to find any fault with the directors. During the year they had made a profit of £92,068. They had spent £32,483 upon additions to their buildings. Out of the balance of £12,164 they proposed to put £13,790 to depreciation for buildings and machinery. It was quite right to do that, but it did not mean that the money had gone out of their pockets, it was still in the business. They had also written a further £4,219 off their trustee securities. He could not say how long that depreciation was going to continue. Personally, he thought that until there was a change in the Government of the country that depreciation was likely to continue, and he might say that since December 31st their securities had depreciated a further £3,000. He hoped that something would happen in the course of the next year or two to cause consols and other gilt-edged securities to go up again. They had put £15,000 to the reserve account, bringing it up to £200,000, and they carried forward £8,155. He thought they would agree that that was a very strong position for an industrial company to be placed in. During the year they had considerably increased their office accommodation, and also their warehouse accommodation in the basement. They had also made considerable additions to the works. The directors had, in accordance with their usual custom, held board meetings at Gravesend and Woolwich, and been over the works, and he thought they were all very pleased with them. Everything was in very excellent order. The whole of the business had worked very smoothly during the year; there had been no strikes; the health of the workpeople had been good, and there had been no accident of any moment whatever.

MR. GEORGE SUTTON, the managing director, in seconding the motion, said the report was as good as shareholders could possibly expect. It represented a year of intense work and of full employment at both factories. It represented the largest turnover that the business had ever done, and that with prices not above the normal. The satisfactory feature of this increased turnover was that it was not due to any one or two abnormal contracts, but, almost without exception, the business had increased in every part of the world. He wanted them to understand that the improved profit was not due to a larger profit upon their goods, but to a larger turnout of material. There were two factors which had contributed to the excellent results of the past year, namely, labour and raw material. In the case of labour, they had had a year of peace; they had had no trouble at either of their factories. There was no bitterness left in the minds of either employers or employed as a result of the strike of 1911. The improvement of the conditions of their workpeople as well as of the staff was always in the minds of the managers; they did not want to be pressed by Trade Unions or other people to do justice to their workpeople. Perhaps there was one echo of the strike during the past year, and that was, that efforts had been made to induce certain of their municipal customers to refrain from renewing their contracts with them. Of course, those efforts were not made by their workpeople. He knew the source from which they emanated, but he had the satisfaction of telling them that in no single instance had they succeeded, and three of their largest customers who were approached had renewed their contracts with the company. As to raw material, as the shareholders were aware, the principal materials in which the company dealt were copper, lead and india-rubber. They had had no boom in any of those materials during the past year. Booms were no doubt very exciting and enjoyable to a large section of the public, but they were very embarrassing to manufacturers who had to use the boomed articles. The fairly level prices which they had had throughout the year, had kept a continuous stream of orders coming in to the works, whereas when prices were unreasonably high, as they were two or three years ago in the case of india-rubber,

buyers were apt to wait and wait until the pendulum swung to lower prices before they sent in orders, and so the equilibrium of trade was upset. As to the future, he could speak with a pretty sure prophetic voice; they were going to be all right this year, because their order sheet at the present time was the largest they had ever had. With regard to the future beyond 1913, the directors were looking with a considerable amount of hope to the electrification of railways, which business ought to bring a great deal of profit to the company. They had no reason to suppose that they would not get a fair share of orders for cables which would be needed in that direction. They had one order on their books for £100,000 for the construction and laying of cables for the electrification of a portion of the Central Argentine Railway—the largest order of the kind which had ever been placed. He might say that at the new works, which they were putting up at Gravesend, it was intended to manufacture pneumatic motor tires.

After some complimentary observations by shareholders, the report was adopted.

### London Electric Supply Corporation, Ltd.

MR. R. H. BENSON presided, on February 27th, at Winchester House, E.C., over the annual meeting.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 358), first referred in sympathetic terms to the late Lord Crawford, one of the original directors and the late chairman. To fill the vacancy they had elected Lord Duncannon who, probably, before long, would again be in Parliament, when he would be in a position to render them valuable service. Further, his close connection with the chairman of the Brighton Railway, with which they already had large dealings and expected larger to come, should tend to the best mutual understanding, and they welcomed any occasion for cementing still more closely the already pleasant relations which had always existed between the Brighton Railway Co. and themselves. Those who had studied the accounts could not fail to have noticed that in three respects the year under review constituted a record:—First, in the actual number of units sold, 28,409,755, an increase of 8,000,000 over the best preceding year; secondly, in the gross receipts for sale of current, the figures being £138,000, as against £125,000, the next highest total, in 1905; and lastly, in the cost of generation per unit sold, namely, '66d., as against '82d., a decrease of 20 per cent. They might fairly claim this as a most satisfactory showing, and one which was full of promise for the future. It was true that the net revenue had not risen sufficiently to enable them to increase their dividends, but it did show an increase of over £7,000, and but for the necessity now imposed on them of creating a sinking fund for the repayment of their debentures in 1931, which required £12,000 a year, they would have had a larger surplus to divide. They proposed payment on the ordinary shares of the same dividend as last year, viz., 2½ per cent, carrying forward £4,706; £1,000 had been placed to contingencies' account, and owing to the provision of the sinking fund, to which he had referred, it had not been thought necessary to increase the reserve, which remained at £77,500. He should like to anticipate a question which some shareholders might be inclined—and very legitimately inclined—to put to them: "You tell us year after year," it might be said, "of the progress which the company is making, of the increase in the number of the units sold, and of the decrease in the cost; and yet our dividend remains the same. What is the advantage of all this to us? You are continually issuing fresh capital, but this capital does not appear to do more than earn its own interest, and the ordinary shareholder is not benefited." This was a natural, and, as he said, a legitimate objection, and he would endeavour to meet it. He had a comparative table showing gross and net revenue, debenture interest, dividends, and surplus placed to reserve, for the last 12 years, beginning 1901, which provided the answer to the question they were considering. It showed that in the year 1906, the year which followed those two exceptional years in which they were supplying current to the L.C.C. for their tramways pending the completion of their own supply station, there was a fall in the gross revenue from £130,591 (this included all other sources of revenue as well as current) to £112,039, and in the net from £78,721 to £56,522. In the following year, 1907, there was a further drop to £105,539 in the gross and £46,320 in the net. That was the low-water mark, viz., the year 1906. During those years they were supplying very little current for power purposes. But directly they began—towards the end of 1910—to supply current to the Brighton Railway for traction purposes, and to manufacturers and industries, as well as for light, their revenue, both gross and net, began to expand. The secret of cheap power was to supply it for all purposes and for the greatest number of hours out of the 24, so as to keep the machinery steadily running. The year just past was the first year in which their two new turbine plants were running—and even then not for the whole period; and the result, as they saw, was an expansion in gross receipts of £15,000, and in net of £7,000, or nearly 12 per cent, while the units sold had increased from 20,000,000 to 28,000,000. What was the conclusion to be drawn from all this? Was it not that the work they had been carrying on during these past years had been work of preparation—arduous but necessary for the harvest which, he thought, was in sight? During the past nine years they had increased their preference share capital by £200,000 and the debentures by more than £100,000; but even in these comparatively lean years of preparation they had earned interest on this money, and a small dividend besides and had

strengthened their position so much that they were producing current considerably cheaper per B.T.U. than any other company in the London area. The board long since came to the conclusion, and it had been often stated from that place, that it was in the generation of current for industrial and traction purposes, combined with lighting, that the prosperity of the company lay. In the lighting field they were out-distanced by more fortunate competitors who had benefited by their pioneering experience, and whom they could not hope to displace. It was for this reason that they turned their attention to obtaining large power contracts, and that they concluded with the Westminster and St. James' companies agreements which were intended to eliminate waste competition for lighting, and give the most efficient service in the area which they served along with those companies. They were entitled to claim that the event had amply justified their action. Any attempt to develop their lighting field further could only have resulted in a cut-throat competition, which, while it might have damaged their rivals, would probably have brought them very little increase of revenue, and he had no hesitation in saying that without the load for traction and industrial power, and relying only on their lighting units, it would have been impossible to get any fair return for the service rendered to the public. Their contract with the Brighton Railway Co. had now been in full operation for not much more than two years. In February, 1910, he said that in the (then) coming year they expected to sell them over 5,000,000 units, and hoped for much more. Well, last year that 5,000,000 was increased to nearly 15,000,000; and that was nothing to the demand which they expect shortly to be called upon to meet. The board of the Brighton Railway, had now decided to complete the electrification of their entire suburban system; and they had good reason to expect that they would come for their supply of current to the company with whose co-operation during the existing contract they had more than once publicly expressed their satisfaction. Their demand might amount to anything, from a minimum of 80,000,000 units up to as much as 150,000,000. Now, as a general principle, and leaving out of account exceptional factors such as a sudden rise in the price of coal, as the number of units generated increased, and the load factor rose, so did the costs of generation tend to fall. Therefore, without his labouring the point further, they would see that in a contract for the supply of power on such a scale as this, when combined with a supply to other customers for industrial purposes, there should be room for profits sufficient to place their ordinary shareholders at last on the footing which they certainly had a right to expect, and for which they had so long and patiently waited. And this brought him to another point—the question of capital. It was obvious that they could not meet so big a demand upon them without a large extension of plant; and that would involve the finding of fresh money. For this purpose they were submitting that day a resolution for increasing the capital of the company by £250,000, to be "divided into shares of such denomination, either preference or ordinary, as the board may determine." That would also increase their borrowing powers, which were now exhausted. They did not anticipate that any of this fresh capital would be needed during the current year, but they wished to be prepared for any emergency. As the length of their tenure diminished, the difficulty of finding fresh capital, of course, increased, for they had to provide for its repayment if they were taken over by the purchasing authority in 1931; and as they had seen in the case of the recent issue of debentures, this had necessitated the provision of a very heavy sinking fund. But their financial advisers were confident that for the purposes of undertaking so important a contract as that on which they hoped shortly to be called upon to enter, there would be no difficulty in finding the necessary capital. In conclusion, he would like once more to bear testimony to the spirit of zeal in which everyone in the company's employment, from highest to lowest, worked for the furtherance of its interests. In a few months their managing director, Mr. Bain, and the chief engineer, Mr. Partridge, would have completed 25 years in the service of the company. They entered upon their duties together soon after the company came into being, and they had worked together, with unflagging keenness for its interests from that day to this. They had so far identified themselves with the company that it was not too much to say that its success was their life's work; and it was a work of which they had a right to be proud, for they had seen the company through many dark days, and it was only by untiring watchfulness, patience and persistence that they, working with the late Lord Wantage as chairman, piloted it to the position that it now occupied. He should like, therefore, in conclusion, to invite them to pass a special vote of thanks to Mr. Bain and Mr. Partridge on the occasion of the completion of their twenty-fifth year of service with the company, which they would hope might also coincide with the signature of a new and profitable contract with the Brighton Railway.

MR. STEWART BAIN (managing director), in seconding the motion, first thanked the chairman for his references to the approaching semi-jubilee of himself and Mr. Partridge, and said he would like to take the opportunity of testifying to the great assistance he had always received from Mr. Partridge. He also endorsed what had been said by the chairman regarding the late Earl Crawford. The capital expenditure for the year was £46,631, as compared with £73,000 last year. This was less than was anticipated, and nearly the whole of it was in connection with the Brighton Co.'s contract. They laid about 6½ miles of new mains during the year, bringing the total number of mains laid up to 196½ miles. They did not anticipate a very large expenditure this year, but when the new contract with the Brighton Railway Co. in connection with their extension came along, very considerable extensions to their plant and machinery and mains would have to be met. Some idea of what it might be might be obtained if he

read an extract from a recent article in the *Times*, viz. "The supply of electricity taken from the London Electric Supply Corporation has proved so satisfactory, that it is intended to purchase all the current required for operating the suburban system from the same source. In consequence that company will have to install additional plant amounting to some 40,000 or 50,000 KW and their power station at Deptford will become one of the largest, if not the largest, in the country." With regard to the revenue account, the total expenditure was about £8,000 more than in the previous year, but as the generating expenses alone were about £9,000 more, the expenditure under the other heads of the account was about £1,000 less. The average price paid for coal during the year was 10d. per ton more, but owing to the precautions they took in building up a large stock of coal they had no difficulty in meeting every demand upon them. The gross revenue showed an increase of £15,000 over last year. The average price received for every unit was about 1½d., as compared with 1½d. for the previous year—a reduction of about 20 per cent., and it spoke well for the efficiency and zeal of the staff that the total cost had fallen from 8½ to 6½ per unit. This latter figure was one which their engineering staff had every reason to be proud of. They were paying special attention to the supply of power for industrial purposes, and manufacturers were gradually realising the economy, efficiency and facility of electric driving, as compared with steam driving. Generally, the year had been one of progress, and the future was not only hopeful but bright.

MR. MAKINS suggested that with regard to the debenture redemption fund, it would be well if the company purchased its own stock. He also urged the board to take care in negotiating the Brighton Railway contract, as it might be that a few years hence the railway company might think it better to generate their own electricity.

MR. HANKEY said he was glad they had heard the chairman give them some hope for the future. They seemed so far to have been a philanthropic company to provide electricity first for the London County Council and then to the Brighton Railway Co.

The CHAIRMAN, in reply, said that they were acquiring their own debenture stock, and last year for £12,000 they purchased £13,353 worth of stock. The present contract with the Brighton Co. had 15 years to run, and it went without saying that they must have a sufficiently long contract to make it pay.

The report was then adopted.

The necessary resolutions for increasing the capital as explained in the chairman's speech were carried.

On the motion of MR. INCE, seconded by MR. HANKEY, a special vote of thanks was passed to Mr. Bain and Mr. Partridge; and the latter gentleman, in acknowledging it, said the progress being made by the company was due to the wonderful engineering staff they now had. He had visited many stations on the Continent, and nearly all the stations in this country, and had never seen a more competent staff than they had at Deptford.

### Waste Heat and Gas Electrical Generating Stations, Ltd.

THE annual meeting was held on February 28th at the offices in Newcastle-on-Tyne. Dr. J. B. Simpson, chairman of directors, presided.

The CHAIRMAN said the issued capital was the same as last year, but it had been fully paid up during the whole year, and consequently the amount required for the same dividend was considerably more than it was in the previous year, when only a small part of the new capital was dividend earning. The reserve and depreciation account had been increased by the transfer of £9,000 out of the year's profits, and amounted to £33,350. Their capital expenditure had been increased by £43,000, which represented further payments made in connection with Grangetown, Port Clarence and Ayresome generating stations. These stations had been completed during the year, and had produced a considerable increase in the revenue of the company. Their investments had been increased by £17,000 by the payment of the balance on the new shares taken up in the Bankfoot Power Co., Ltd. The profits of the Waste Heat Co. showed an increase of £10,939 on the previous year, which was owing principally to the starting up of new generating stations. All the company's stations were running very satisfactorily, and had it not been for the miners' strike in the early part of last year, the profits would have shown a still further increase. As it was, however, the coke ovens and ironworks, from which they obtained the waste heat and gas, were shut down during the period of the strike, and in consequence the generating stations had to be closed down also. The revenue from the production of electricity was reduced to nothing during the period of the strike, but at the same time, of course, they had no payments to make for waste heat or gas. Advantage was taken during that period to thoroughly overhaul all the plant in their stations, which was consequently in a thoroughly efficient state of repair. The directors had not yet concluded any further agreements for the erection of new generating stations, but proposals were still under consideration, and they hoped that during the current year agreements would be finally concluded whereby one or more additional generating stations would be erected by them. The character of their business was, he thought, so far as this country was concerned at least, unique. They purchased waste heat from the people who had it, converted it in their stations into electric power, and sold the electricity in bulk to power companies, by whom it was distributed throughout the district. Their contracts with the power companies were very simple. As that company could supply

them with power from the waste heat stations more cheaply than the companies could produce it in their coal-burning stations, the power companies were glad to take from them as much power as the stations could generate. In addition the former companies bore the cost of operating the stations, and kept them in repair and paid that company a rental for the use of them. The expense of obtaining a sale for and distributing their product, which was such a large and growing item in the expenses of most companies who manufactured and sold, was borne by the power companies, which placed them in a specially favourable position. On the other hand, the supply of cheap power was of the greatest possible benefit to the power companies, and ultimately to the consumers. But the Waste Heat Co.'s operations were more than this—they were of great advantage to the ironmasters and coalowners in that district. Not only did they earn a substantial revenue from energy which was formerly wasted, but that company also supplied them with electric power for their own use at a price and with a reliability which they could not obtain by themselves. The fact that all their stations were linked together and with those of the power companies enabled a continuous supply to be given throughout the year.

The report was unanimously adopted.

### Para Electric Tramways and Lighting Co., Ltd.

SIR WILLIAM EVANS GORDON (chairman) presided on February 28th, at the Cannon Street Hotel, E.C., over the annual meeting.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 378), said it was the most satisfactory they had ever had. The hope he expressed at the last meeting regarding a reduction of operating expenses had been fulfilled. The results of the improvements in the plant, and the cessation of interference with their operations, which was caused by the construction of the Port Works, had come up to their expectations, and they were able to show the substantial decrease in total operating expenses of £17,317. He would remind them, however, that this decrease was not fully apparent by a comparison of the figures in the respective reports. This was due to the fact that a different rate of exchange was used in their accounts in the two years. For the past year the rate had been altered from 15d. to 16d. per milreis. This rate of 16d. had now been fixed as the legal rate by the Brazilian Government. For the purpose of a true comparison, therefore, the 1911 figures must be converted at the rate of exchange of 16d., and this had been done, as closely as was now possible without reanalysing every item in last year's accounts. The number of passengers carried increased by 766,546, and the operating expenses fell from £132,200 to £124,304—a decrease of 6 per cent. The result in net gains over last year's figures was £8,147. As regarded the lighting branch of the business, the gross receipts decreased from £95,510 to £94,610, but the operating expenses fell from £52,468 to £44,047, or a decrease of 18 per cent. The net result on the lighting was, therefore, a gain over last year of £8,521. To sum up, the percentage of operation to gross receipts over the whole year was 54 per cent., against 59 per cent. for the previous year. It was satisfactory to know that the number of their lighting customers during the year increased by 14 per cent., and, as regarded the slight decrease in gross receipts, he might say that this was accounted for by the extended use of metallic-filament lamps, and also by some reduction in the public or street lighting. Turning to the capital expenditure, they spent on capital account £24,637. The principal items for which this expenditure was made were a new 600-kw. traction set, a new boiler already in service, and material for two further boilers not yet completely erected. They had also to provide for extensions in their lighting system, and a considerable increase in the number of consumers' meters. This expenditure was required for meeting the growth and progress of the undertaking. The sum of £4,654 had been written off capital expenditure and charged to the reserve for renewals account. This sum represented the value of an old unit of 240-kw. capacity replaced by the 600-kw. set, and an old boiler replaced by the new one. In this way they followed the usual practice of writing off new expenditure, which did not increase their actual earning capacity. They had to face the fact that the rubber position, upon which the prosperity of Para largely depended, was at present not very satisfactory, and that a period of depression was being experienced, and might continue. It was, indeed, most encouraging that during this depression their business had continued to do so well, and no signs of bad times were noticeable in their results. But they considered it wise to be amply provided against any trouble that might occur, and felt that their financial arrangements this year placed them in a very secure position. In the spring of 1912 their manager in Para, Mr. P. C. Barley, was taken seriously ill, and was compelled to return to England, and, they regretted to say, had been unable to resume his work in Para. Mr. C. H. Julius, of Messrs. J. G. White & Co., Ltd., their engineering managers, at once proceeded to Para, where he remained for several months. The directors fully appreciated his efforts and ability in the operation of the property and in reducing operating expenses. The retirement of Mr. Barley had led to several changes in the operating staff. Mr. Walter Binns, formerly of the Reading tramways, had been appointed general manager. He took up his duties in December last, and they looked forward to continued and increasing prosperity with him in charge. They had also been fortunate in obtaining Mr. J. P. Kemp, who was in charge of the Birmingham electric supply station, as the chief station engineer, and with these two additions to their existing well-tried and loyal staff, they felt that their property was in the safest possible hands.

As to the future, he did not believe he could give a better indication than to tell them that for the first two months of the current financial year the gross receipts of the undertaking had increased by £3,575, and the surplus, after providing for all charges, including preference dividend, was increased by £2,451 over the corresponding period of 1912. The weekly gross tramway takings to date showed the continued maintenance of satisfactory increases. Every effort was being made by the board and by the engineers to still further reduce expenses and improve operating results. The new governor and new Mayor had just taken their seats, and strong efforts were being put forward by them and the Federal Government to foster the great resources of the Amazon country.

MU. E. C. CHESTON seconded the motion, and the report was adopted without discussion.

MR. W. J. FISHER proposed a vote of thanks to the board, and this was carried.

### City of London Electric Lighting Co., Ltd.

THE directors report that capital expenditure on additions, extensions and replacements during the year 1912 cost £46,509, and there has been written off in respect of buildings, plant and other works dismantled £191,150, leaving a net expenditure under capital account at £2,000,324, a net deduction of £145,642. £176,841 of the amount written off represents the cost of engines and generators erected in succession to the original pioneer plant. The bulk of this plant was retained as a measure of precaution until last year when the completion of the erection of turbine generators of the most modern type permitted its removal. It is the intention of the directors to continue their policy of replacing any further plant which from time to time may become obsolete or uneconomical in operation, as they consider that this policy is in the best interests of the shareholders both as regards the earning of profits in future years, and the maintenance of the plant in the highest state of efficiency in view of ultimate purchase by the L.C.C. upon the terms of the Electric Lighting Act, 1888.

The directors have credited the first debenture stock premium redemption account with £1,476 from revenue for interest, raising the amount at the credit of the redemption account to £62,961. They have also transferred £50,000 from net revenue account to reserve account. The balances at credit of the reserve funds total £240,164, including dividend equalisation account balance, £7,352. Amount to be carried forward to 1913, £24,333.

The total revenue for the year, including interest on investments and discounts (£2,710) was £300,619, from which must be deducted the following items—Expenses of generation and distribution, £70,131; repairs and maintenance of buildings, machinery, plant, mains and other works, £10,960; rent, rates, taxes, management expenses and special charges, £55,847; leaving £163,681, plus £25,943 brought forward, making a total available revenue of £189,625. Of this sum the following amounts have been distributed or provided for:—Interest on loan from bankers, consumers' deposits, &c., £2,787; interest on first and second debenture stock for year ended December, 1912, £31,546; interest transferred to debenture stock premium redemption account, £1,476; leasehold redemption account, interest and appropriation, £269; contributions to employees' provident funds and under National Insurance Act, £1,804; stores, written down, £1,628; transfer to reserve account, £50,000; leaving available for dividends on preference and ordinary shares and for "carry forward" to 1913, £100,115. The directors now recommend the following dividends for the year ended December 31st, 1912, subject to deduction of income-tax:—Preference shares, 12s. per share (6 per cent. per annum); ordinary shares, 16s. per share (8 per cent. per annum), as against 8 per cent. for the previous year. These absorb £75,782, leaving £24,333 to be carried forward. The directors also propose to distribute a bonus of 2s. per ordinary share, less income-tax, out of the amount standing at the credit of the dividend equalisation account. This fund was set aside out of profits in past years in order to ensure the maintenance of a 7 per cent. dividend upon the ordinary shares, it being then impossible to foresee to what extent the company's revenue might be reduced by the introduction of the metallic-filament lamp. The directors, however, are glad to say that the loss so caused has been almost counterbalanced by the progressive consumption of electricity for other purposes than lighting, and, as the metallic-filament lamp has now been adopted by practically all lighting consumers, they consider it is no longer necessary to retain the full amount of this fund, but they propose to leave the balance of £7,352 for the present. The following comparative tables show the position of the company:—

	REVENUE.	Dec., 1910.	Dec., 1911.	Dec., 1912.	+ over 1911.
Gross revenue .. ..	£232,129	£291,584	£300,619	£9,035	
Net revenue .. ..	£166,766	£161,866	£163,681	£1,815	
Div. on ordinary shares ..	7%	8%	8%	—	

Private supply for all purposes: average prices per unit obtained,

	1909.	1910.	1911.	1912.
	2.49d.	2.45d.	2.69d.	2.87.

The following show total number of customers and connections, after allowing for disconnections (private supply) on account of removals, substitutions of metallic-filament lamps, &c.:—

	1910.	1911.	1912.	+ over 1911.
Number of customers .. ..	18,876	14,246	14,729	488
kw. connected (including power and heating) ..	87,127	89,122	41,151	2,029

On February 19th, 1913, there were 42,311 kw. applied for, out of which 41,290 were connected, and the customers numbered 14,789. The following are the total units generated, sold, utilised on works, &c. (including public street lighting):—

	1911.	1912.
Generated .. . . . . .	30,527,716	32,220,808
Sold .. . . . . .	26,040,759	27,488,860
Metered and used by company .. . . . . .	1,189,635	1,429,794
Expended in distribution, &c. .. . . . . .	2,710,391	3,901,694
Maximum supply demanded, A.W. .. . . . . .	17,762	18,610

The total units sold during 1912 show an increase of 855,101 over 1911.

Power and heating supplies continue to show a steady increase, the total units sold for these purposes in 1912 being as follows:— Power, 9,280,870 units; heating, 1,670,275 units, = 10,951,145 units, or equal to 41·6 per cent. of the total units sold for private supply. It is hoped that during the present year active progress will be made with the reorganisation of the public street lighting in accordance with the tender already accepted by the Corporation. Wayleaves for attachments to buildings are being obtained by the Corporation, but these necessarily take some time to negotiate.

At the ordinary general meeting of the company, held on March 4th, 1903, a resolution was passed constituting the company a contributing company of the British Electrical Superannuation Fund, and authorising the directors to make annual contributions to that fund on behalf of members of the company's staff. Owing to an adverse actuarial report necessitating the reorganisation of that fund, the directors and those of the company's staff who were members of the fund decided to withdraw therefrom. After very careful inquiries and consideration the directors decided that it would be more advantageous to the company and its staff to form a Staff Provident Fund, taking as a nucleus the amount of £8,954, which was received by the company as the share of the assets belonging to these members of its staff who were members of the British Electrical Superannuation Fund.

The directors have also decided that contingent provision should be made by the company for making appropriate grants where circumstances call for such assistance, with due consideration to long service and good conduct on the part of the employes concerned. The shareholders will be asked to approve and confirm by resolution the action of the directors in making annual contributions for this purpose and to aid the staff in providing systematically for the eventualities of the future.

The directors' report contains the following references to the question of purchase of the undertaking:—

"Your directors desire to call attention to the fact that the company is approaching the date, August 18th, 1914, at which (or within six months of which) the Corporation may give notice of its desire to purchase the company's undertaking in respect of the City of London and, in view of the interest which has already been aroused upon this subject, the following extracts from the company's provisional orders relating thereto, are quoted for the information of the shareholders. It will be noticed that, so far as public lighting is concerned, the terms of purchase are to be those contained in Sec. 2 of the Electric Lighting Act, 1888, but as regards the remainder of the undertaking, by agreement, or as, in default of agreement, may be determined by arbitration."

#### EXTRACTS FROM PROVISIONAL ORDERS.

**EASTERN DISTRICT (LAINO WHARTON & DOWNS).** Royal Assent, August 18th, 1890.

Sec. 61.—The local authority may within six months after the expiration of 24 years from the commencement of this order, by notice in writing require the undertakers to sell, and thereupon the undertakers shall sell to them so much of the undertaking as relates to public purposes, and also, if the local authority so require, so much of the undertaking as relates to private purposes.

So far as relates to public purposes, the said purchase shall be on the terms specified in Sec. 2 of the Electric Lighting Act, 1888.

So far as relates to private purposes, the said purchase shall be upon such terms as may be agreed upon between the undertakers and the local authority, or as, in default of agreement, may be determined by arbitration.

**CENTRAL DISTRICT (BRUSH).** Royal Assent, August 18th, 1890.

Sec. 19b.—The local authority may within six months after the expiration of 24 years from the commencement of this order, by notice in writing require the undertakers to sell, and thereupon the undertakers shall sell to them so much of the undertaking as relates to public purposes, and also, if the local authority so require, so much of the undertaking as relates to private purposes.

So far as relates to public purposes the said purchase shall be on the terms specified in Sec. 2 of the Electric Lighting Act, 1888.

So far as relates to private purposes the said purchase shall be upon such terms as may be agreed upon between the undertakers and the local authority, or as, in default of agreement, may be determined by arbitration.

**WESTERN DISTRICT (BRUSH).** Royal Assent, August 5th, 1891.

Sec. 2.—The City of London Electric Lighting (Brush) Order, 1890, hereinafter called the principal order, and this order shall be read and construed together as one order, and may be cited as the City of London Electric Lighting (Brush) Order, 1890 and 1911.

Sec. 10.—The period of 42 years mentioned in Sec. 2 of the Electric Lighting Act, 1888, shall for the purposes of the principal order and this order be reckoned from the commencement of the principal order.

[\* Commencement = Date of Royal Assent.]

The annual meeting is called for March 12th, at Salisbury House, E.C.

### Charing Cross, West End and City Electricity Supply Co.

MR. W. F. FLADGATE (chairman) presided on Tuesday at the office, St. Martin's Lane, W.C., over the annual general meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 357), the CHAIRMAN said he was glad they were not this year in the unhappy position they were last year, viz. in the middle of the coal strike, although labour troubles did not seem to have ended, and they might have something to meet in the course of the current year. At the last annual meeting the coal strike was absolutely at its height, and the board were filled with very great anxiety as to what might be the effect upon the company's affairs. He was happy to say that the strike was dealt with, and they emerged from it without any very great loss. Of course, expenses were increased consequent upon it, but the effect of the care and economy with which their engineer ran their stations had been that he was able to put before them a statement of accounts which he considered exceedingly satisfac-

factory. No alterations in the share or debenture stock had been made during the year. They only spent £30,000 on capital account, and part of this was in the purchase of freeholds, and part in the erection of an oil fuel tank at the Bow station in order to provide against emergencies in case of further coal strike or future difficulties in maintaining their fuel. There was no need to trouble them with the details of the revenue account because the corresponding figures of last year were set out in the accounts, and further the figures showed little variation. The only real difference was that in the West End stations they had generated rather more electricity, and the results as a whole were satisfactory. From the West End undertaking in 1911 for an expenditure of £69,000, they brought in on account of sales £135,862. For the year 1912, with an expenditure of £66,000, they brought in sales to the extent of £111,989, or between £2,000 and £7,000 more, and this showed the result of the economies. To get the gross figures they had to bring in the meter rentals and other small receipts, which brought their total receipts for 1912 up to £146,675, as against £140,900 for 1911. These figures gave them the sum of £79,889 to deal with, or with the £15,949 brought forward, a sum of £97,833. Out of this they had paid the debenture interest, amounting to £17,829, and provided £15,000 for depreciation, which was somewhat in excess of what they had been accustomed to. They had also placed £9,054 to the general income reserve account. They had opened this account because they did not think it right to carry forward a very large figure, and because it would be well to set up an intermediate account on which they could draw for different purposes, and they proposed to add to that from year to year. This left £56,000 for division, out of which they had paid the preference dividend, amounting to £18,000, and recommended a dividend of 5 per cent. on the ordinary shares, which would absorb £20,000, and leave £18,000 to be carried forward. Some might think with such a satisfactory state of affairs they might have been tempted to declare a higher dividend, but after careful consideration, the board felt it would be better to increase the reserve funds. It would be remembered that last year they had to make a very large inroad into those funds, and had to write off practically the whole of the value of the Lambeth station, and the effect was to decrease their depreciation funds until they did not stand at a very high figure. Consequently they thought it wiser to have respect to the depreciation fund first and consider the dividend afterwards. The business had increased, but not by a very large extent. In the West End undertaking the increase had only been 5·7 per cent., or 686,000 lamps in 1912, against 649,000 lamps in 1911. They could not expect in these West End districts to increase with the same rapid strides as at first, but in the current year they did hope for a somewhat larger increase consequent upon the fact that the property in and around Kingsway, which had been lying unoccupied for so many years, was now apparently beginning to be dealt with. The demand for energy for heating and power was increasing in the West End, and no less than 34 per cent. of their whole load was used for these purposes, which necessarily brought down the average price for the units sold. Last year they sold 61 per cent. more current than in the previous year. He was glad to say that in the present year the loss on transmission was smaller than for some time past. In 1910 it was 28 per cent., in 1911 26 per cent., and in 1912 23·9 per cent, which was a benefit of 2 per cent. With regard to the City undertaking, they had not made a high rate of progress, but it was satisfactory. They had spent £21,000 on capital account, principally in the purchase of turbines for the Bow station. For 1911 the total expenditure was £84,356 and in 1912 £84,958, an increase of only £600; but the expenditure in 1912 produced £147,198, as against £144,299 in 1911. Therefore, with a slight increase of £600 in the expenditure they had earned some £3,000 more. Bringing in meter rentals, &c., the total was £148,513, against £145,671, and bringing in the carry forward from the previous year, they had £99,712 to deal with. They had paid the debenture and loan interest, amounting to £30,891, which left £68,820. The preference dividend took £18,000, and they had opened a general reserve fund on the City undertaking, to which they had put £32,820 17s. 10d., leaving to carry forward to revenue account £18,000, which was the amount of the preference dividend for the coming year. This result was exceedingly satisfactory in view of the fact that they were working against the coal strike for a considerable part of the year. The coal cost per unit in 1911 was 270d., and in 1912 it increased to 273d., being an increase of 1 per cent. on the whole cost to them of the coal they bought. But the price of coal during that period had increased by 13 per cent. Fortunately, owing to the economies practised by their engineer, the coal burnt per kilowatt, which in 1911 amounted to 4·7 lb., in 1912 only amounted to 4·2 lb., or a decrease of 11 per cent. As usual, the auditors pointed out that there was no depreciation fund for the City, but, as he had before pointed out, the form of their provisional order was such that they did not consider it right or advisable to absolutely set up such a fund, but they had set up a reserve fund to which he had referred, and they proposed to add to that fund in the future. The demand in the City had increased by 4·2 per cent., but the load in the City was now over 50 per cent. for heating and power, and under 50 per cent. for lighting which brought down the price. The losses on distribution were not so satisfactory in the City as last year, but the engineer pointed out that the reason was that last year, when their losses were only 26·2, there was an abnormal figure as regarded losses through their meters. That figure last year the engineer admitted he did not understand. It was 2 per cent. less than he expected it to be. This year the losses on distribution were 28·7 per cent. instead of 26·2 per cent. He looked on the whole position of the company as being exceedingly satisfactory. The whole of their plant was now modern, and was, he believed, to-day worth every shilling they had

expended on it. So far as they could see, there would not be any large capital expenditure in the future, and they hoped to be able to meet such expenditure out of the reserves they were creating each year. Happily, they had not now to spend large sums as in years past in fighting rivals. The London County Council had appointed a Committee, which sat last year, with a view to considering what course they would take with regard to the electric lighting undertakings, and he had reason to believe that the Committee would be reconstituted. Whether the Committee would take any steps which would imperil their position he did not know, but, speaking for himself, he looked forward without the slightest fear to the future so far as that company was concerned. They were actually supplying 20,000 H.P. for machinery, which showed that whatever might be said as to the want of cheap electricity, it was not a charge which could be sustained against them. In conclusion, the chairman invited the shareholders to assist the company by pushing the merits of electrical appliances, and said he could not sit down without expressing the appreciation of the board to their officers and staff for the zealous help they had given in the past year.

Mr. J. M. GATTI seconded the motion, and the report was adopted without discussion.

The retiring directors were re-elected, and a hearty vote of thanks was accorded to the board and staff.

STOCKS AND SHARES.

Tuesday Evening.

The expectation that Turkey would make peace through the mediation of the Great Powers was a useful factor in strengthening markets throughout the Stock Exchange. The chief reason for the relief felt at this prospect lies less in the anticipation of hostilities ceasing than in that of money becoming easier immediately the war has spent itself. The money which has been hoarded up during the Balkans affair will, it is supposed, be released, and on the hope of this there was a general recovery throughout the House.

The Home Railway market, however, provided the damper for the spirits of the bulls. This week's meetings of railway-men were not encouraging to the confidence of those who had looked forward to a strike being averted, and up to the time of writing on Tuesday evening, the possibility of a struggle is certainly present. This has had a depressing effect upon prices, which just before had started to recover, on the theory that the March figures would look bumper ones in comparison with those of the corresponding period last year, during which the coal strike was in full blast. It looks now as though strike figures might compare with strike figures, although, so far, it must be admitted that hopes of a possible solution of the difficulties are far from dead.

Metropolitans have been up to 53½, but dropped to 51½, leaving off with a net fall of ½ on the week. Districts, in which there has been a sharp rise, reacted to 38½, at which they still show an improvement, while the Underground Electric Railways group is firm. The speech of Sir Edgar Speyer at the meeting of the Underground Company last week infused fresh courage into the minds of holders, who had been rather disappointed with the character of the company's report, for Sir Edgar hinted at the prospect of a dividend being nearer than might have been supposed from the report itself. The 6 per cent. Income bonds at 94, ex £3 coupon, show a rise of 2—in their case the coupon is paid without deduction of income-tax. The £10 shares rose ½, but lost it again, and the "A" are somewhat weaker than might appear from the official quotation.

Central London Ordinary and Deferred have come into some prominence on the consideration that the stocks are cheap at the present yields. The dividend is guaranteed at 4 per cent. in the case of the Central London trio, and, accordingly, is so worked out in our lists overleaf. City and South London Preferences have again fallen sharply, the 1903 issue being down to 96½, at which the yield is £5 2s. per cent. on the money, this being about the highest return obtainable from sound stock in the railway preference division. London United Trams have not recovered from their last week's fall, and the British Electric Traction sextet remains dull.

The list of English Electricity Supply shares is once more a colourless one. Dividends have been deducted from Westminster Ordinary, St. James's Ordinary and Preference, and South Metropolitan Preference, the markings being reflected in the prices. City Lights fell ½ on the issue of the report, good though it is. The County of London report makes a very favourable showing, while that from the Chelsea Company is very like its predecessor of a year ago, the net result being almost the same in each case. The reports which have been published so far make a satisfactory appearance on the whole, but they are not sufficiently exciting to prove of themselves strong enough magnets to arrest the attention of the ordinary investor, who retains a lively recollection of the fact that within some vague number of years the companies will be taken over. He is not aware that it is to 1931 that most of the concessions run, but the mere fact of their having a term at all is his ground for letting the market alone.

The recovery in Mexican issues has made further progress this week. The main change is a rise of 4 points in Mexico Trams Common, but Mexican Light and Power Common gained 3, and the First Gold bonds advanced 2. Montereya provided the exception, with a fall of a point to 83½. The news from the country is read as showing that there is a strong man in power, who, if he can

avoid assassination and similar little excursions inseparable from the life of a president in Mexico, may be able to restore order with a firm hand.

Other stocks and shares in this department are steady. Montreals shed 3 points, but Shawinigans rose this amount, the bonds putting on ½. Brazilian Traction Ordinary, at 101, are 3 points higher, and one or two of the British Columbia emissions has made small rise to their credit. La Platas are a little easier, and Victoria Falls Preference, at 4½, have gone back another ½ per share. The Anglo-Argentine group is steady, and City of Buenos Ayres Trams recovered part of their dividend deduction.

The Telegraph market shows a series of small rises, which has included the pre-ordinary stocks as well as the junior securities. The improvements are noticeable in the Anglo-American group and in the Eastern section. West India and Panamas are a little better on relaxation of the monetary tension, the price regaining 2s. 6d. of its fall. Globe shares, both Ordinary and Preference, are ½ up; but Mackay Common fell back to 84½. It may be noticed that Reuter's new shares have been added to our list of Telegraph and Telephone prices. The market now is largely in these new shares, which stand a trifle under their seniors, the discrepancy being accounted for by the fact that up to June 30th they carry a little less dividend than the others.

Business in National Telephone Deferred stock has come to something like a stop, now that the Company's books are finally closed. Nobody can tell how long it will be before the final settlement of the transfer will take place. Some fix it as six months, but the estimates are little better than guesswork. Marconi's fell back to 4½, and the subsidiary companies' shares are mostly a trifle lower, the market, for some reason or other, being a bad one at present. It is said that a new issue may be made by the Cuban Telephone Company.

In the Manufacturing division, General Electric Preference are nominally a little better, while Edison & Swan partly-paid shares have moved up to 5s. middle, following their last week's rise of ½ with another of equal amount. British Westinghouse Preference are somewhat easier. The Rubber share market is weak, with the price of the raw material gradually dwindling. Its decline to 3s. 10½d. per lb. has given rise to uneasy sentiments in the minds of some of the rubber share holders, although there is no pressure to sell good shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of wks.	Total to date.		Route miles open.
		£	£*		£	£*	
Bath	Feb. 26	2,669	+ 27	9	6,229	+ 290	..
Blackpool-Electw'd	Mar. 1	1,124	+ 65	9	2,900	— 5	8
Bristol	Feb. 28	26,490	+ 2,456	9	76,702	+ 4,523	30-5
Brit. Elec. Trac. Co.	" 21	18,807	+ 5,358	8	154,068	+ 9,408	..
Chatham and Dist.	" 20	3,175	+ 259	7	7,884	+ 268	14-98
Cork	" 27	1,078	+ 7	8	3,556	— 30	6-89
Dublin	" 28	21,165	+ 630	8	45,765	+ 1,069	54-25
Hastings	" 27	2,748	— 18	—	—	—	58 19-3
Lancashire United	" 26	5,262	+ 404	8	10,768	+ 756	39
Llandudno-Col. Bay	" 28	612	+ 88	13	1,334	+ 170	6-5
London United	Mar. 1	20,661	— 785	9	47,812	— 81	..
Tyneside	Feb. 26	1,898	+ 243	9	3,607	+ 118	11
Anglo-Argentine	" 25	218,565	+ 15,614	8	437,715	+ 35,310	..
Auckland	Jan. 17	21,658	+ 1,833	29	119,412	+ 20,113	24-1
Bombay (B.E.T.)	" 30	12,643	+ 198	5	18,551	+ 192	..
Brisbane	Dec.	25,890	+ 1,660	62	254,911	+ 2,211	..
Brit. Columbia Ry.	Mar. 1	16,717	+ 87	..	..	+ 449	..
Calcutta	..	..	..	..	..	..	..
Cape Electric T. Co.	Jan.	2,734	..	4	2,724	..	20-5
Kalgoorlie, W.A.	..	..	..	..	..	..	..
Lisbon	..	..	..	..	..	..	..
Madras	Feb. 28	3,163	+ 188	8	6,706	+ 5,451	14-7
Montevideo	Jan.	38,561	+ 9,010	13	162,167	+ 11,355	..
Can. London Ry.	Mar. 1	2,515	+ 1,421	9	49,515	+ 3,660	6-78
Cen. & S. Lon. Ry.	" 1	12,058	+ 1,397	9	27,610	+ 3,067	7-26
Dublin-Lucan Ry.	Feb. 28	329	+ 27	9	941	+ 16	7
G.N. and City Ry.	Mar. 1	6,174	+ 769	9	14,008	+ 1,722	8-5
L'pool Overh'd Ry.	" 2	6,285	+ 362	9	14,323	+ 1,061	6-6
London Elec. Ry. Co.	" 1	67,866	+ 1,175	9	133,100	+ 15,0	21-75
Mersey Railway	" 1	9,076	+ 428	9	20,489	+ 1,084	-4-5
Metropolitan Ry.	" 2	64,653	+ 387	9	148,767	+ 1,916	25-75
Mct. District Ry.	" 1	52,398	+ 1,198	9	119,312	+ 4,498	25

\* Compared with the corresponding period of 1912.  
 † Three weeks only.  
 ‡ Includes horse, steam and other receipts.

The Bradford Strike.—A Bradford correspondent writes:—"The strike of Bradford electricians still continues, although this is the end of the twentieth week of the strike, and there is no immediate prospect of a settlement. Most of the contractors in the city have got staffs of non-union men working, and a lot of the strikers have been driven to take up other jobs, so that there is little likelihood of any further negotiations between the masters and men. There is an impression that the men were very ill advised by their leaders at the commencement of the trouble, and the Trade Union organiser left the district some time ago."

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Mar. 1th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Mar. 1th.	Rise or Fall	Present Yield p.c.		
Bournemouth & Poole, Ord. ..	10	1911. 5 1/2	61	9 1/2-10 1/2	..	5 4 1/2	Kensington & Knightsbridge, Ord	5	1911. 8 1/2	7 1/2-8 1/2	..	8 1/2	
Do. 4 1/2 % Prof. ....	10	4 1/2	6 1/2	8 1/2-9 1/2	..	4 14 0	Do. 4 % Deb. ....	Stock	4	4	90-93	..	4 6 0
Do. Second 6 % Prof. ....	10	5	6	10 1/2	..	5 17 1	Kent Elec. Power, 4 1/2 % Deb. ..	Stock	4 1/2	4 1/2	76-80	..	5 12 6
Do. 4 1/2 % Deb. Stock ..	Stock	4 1/2	4 1/2	9 1/2-9 1/2	..	4 11 10	London Electric, Ord. ....	8	2 1/2	1 1/2-2	..	3 15 0	
Brompton & Kensington, Ord. ....	5	10 9 1/2	9 1/2	8 1/2-9 1/2	..	6 6 8	Do. 6 % Prof. ....	5	6	4 1/2-5 1/2	..	5 14 8	
Do. 7 % Cum. Prof. ....	5	7 7	7	9 1/2-9	..	5 17 9	Do. 4 % First Mort. Deb. ....	Stock	4	4	90-93	+1	4 6 0
Central Electric Supply, 4 % (Gen. Deb.)	100	4	4	9 1/2-9 1/2	..	4 1 8	Metropolitan .....	5	4	3 1/2-4	..	5 0 0	
Charling Cross, West End & City	5	5	5 1/2	4 1/2-5	..	5 0 0	Do. 4 1/2 % Cum. Prof. ....	5	4 1/2	4 1/2-4 1/2	..	4 17 4	
Do. 4 1/2 % Cum. Prof. ....	5	4 1/2	4 1/2	4 1/2-4 1/2	..	4 14 9	Do. 4 1/2 % First Mort. Deb. ....	Stock	4 1/2	4 1/2	67-100	..	4 10 0
Do. "City Undertaking"	5	4 1/2	4 1/2	4 1/2-4 1/2	..	5 2 10	Do. 3 1/2 % Mort. Deb. ....	Stock	3 1/2	3 1/2	84-86	..	4 1 5
Do. 4 1/2 % Deb. ....	100	4	4	9 1/2-9 1/2	- 1/2	4 5 7	Midland Electric Corporation	100	4 1/2	4 1/2	98-101	..	4 9 1
Do. Do. 4 % Deb. ....	5	5	4 1/2	4 1/2-5 1/2	..	4 15 3	Do. 4 1/2 % First Mort. Deb. ....	5	5	5	4 1/2-4 1/2	..	5 2 7
Chelsea, Ord. ....	Stock	4 1/2	4 1/2	9 1/2-9 1/2	..	4 10 11	Newcastle-on-Tyne 5 % Prof. ....	5	5	5	97-102 1/2	..	4 17 7
Do. 4 1/2 % Deb. ....	10	8	8	10 1/2-11	- 1/2	5 0 0	North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 1/2-102 1/2	..	4 17 7
City of London, Ord. ....	10	6	6	11 1/2-12	..	4 9 0	Notting Hill, 5 % Non-Cum. Prof.	10	5	5	97-102	..	5 11 7
Do. 6 % Cum. Prof. ....	10	6	6	11 1/2-12	..	4 8 4	Oxford .....	5	7 1/2	6 1/2-6 1/2	..	5 9 6	
Do. 6 % Deb. ....	100	4 1/2	4 1/2	100-102	..	4 8 8	St. James' and Pall Mall, Ord.	5	10	10 1/2	8 1/2-9 1/2 xd	..	5 8 1
County of London, Ord. ....	10	6	6	11 1/2-12	..	5 0 0	Do. 7 % Prof. ....	5	7	7	8 1/2-7 1/2 xd	..	4 15 0
Do. 6 % Prof. ....	10	6	6	11 1/2-12	..	4 13 9	Do. 8 1/2 % Deb. ....	100	8 1/2	8 1/2	84-87	..	4 0 6
Do. 4 1/2 % Deb. ....	Stock	4 1/2	4 1/2	106-106	..	4 4 11	Smithfield Markets, Ord. ....	5	2	2	8-1 1/2	..	6 3 1
Edmundson's, Ord. ....	Stock	5	5	9 1/2-10 1/2	..	4 8 8	South London, Ord. ....	4	4	4	2 1/2-2 1/2	..	5 0 0
Do. 6 % Cum. Prof. ....	5	Nil	3	4 1/2-4 1/2	..	5 7 2	Do. 5 % First Mort. Deb. ....	100	6	5	97-100	..	5 0 0
Do. 6 % Non-Cum. Prof. ....	5	Nil	3	1 1/2-1 1/2	..	5 7 2	South Metropolitan, 7 % Prof. ....	1	7	7	1 1/2-1 1/2 xd	..	5 14 10
Do. 4 1/2 % First Mort. Deb. ....	100	4 1/2	4 1/2	8 1/2-8 1/2	-1	5 17 1	Do. 4 1/2 % First Deb. Stock ..	100	4 1/2	4 1/2	96-99	..	4 11 3
Folkestone .....	5	5	5	4 1/2-5 1/2	..	4 17 7	Urban, Ord. ....	£3	Nil	Nil	3	..	..
Do. 5 % Cum. Prof. ....	5	5	5	4 1/2-5 1/2	..	4 17 10	Do. 5 % Cum. Prof. ....	5	5	2	2 1/2-2 1/2	..	5 2 10
Do. 4 1/2 % First Deb. ....	100	4 1/2	4 1/2	9 1/2-9 1/2	..	5 12 6	Do. 4 1/2 % First Mort. Deb. ....	100	4 1/2	4 1/2	8 1/2-8 1/2	..	5 11 1
Hove .....	5	9	8 1/2	7 1/2-8	..	5 12 6	Westminster, Ord. ....	5	10	10	8 1/2-9 1/2 xd	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Prof. ....	5	5	8	5-5 1/2 xd	..	5 14 3	Monterey Ry. Light & Power, 5 % 1st Mort. Deb. ....	100	5	5	82-85	-1	5 17 8
Calcutta, Ord. ....	5	5 1/2	7 1/2	6 1/2-7 1/2	..	5 19 4	Montreal, Lt., El., and Power ..	\$100	8	9 1/2	230-235	-3	6 16 7
Do. 5 % Prof. ....	5	5	5	4 1/2-5 1/2 xd	+ 1/2	5 6 5	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$500	5	5 1/2	10-20	..	..
Calgary Power, 1st Mort. Bds.	\$100	6	5	9 1/2-9 1/2	..	5 17 8	River Plate, Ord. ....	Stock	10	..	217-227	..	4 8
Canadian Gen. El. Com. ....	\$100	7	7	115-119	..	5 6 8	Do. 6 % Non-Cum. Prof. ....	Do.	6	6	104-109	..	5 10 1
Do. 7 % Prof. ....	\$100	7	7	120-124	..	5 10 0	Do. 5 % Deb. Stock .....	Do.	5	5	100-102	..	4 18 0
Corduba Lt., Power and T., Ord.	1	8	5	1 1/2-1 1/2	..	5 6 8	Roy. Elec. Co., Montreal, 4 1/2 %	100	4 1/2	4 1/2	100-102	..	4 8 3
Do. 5 % Deb. ....	100	5	5	96-99	..	5 1 0	Shawinigan Water, Capital	\$100	5	5	141-145	+3	3 9 0
Eleo, Lt. and P. of Cochinabamba, 3 % Bonds	100	6	6	93-95	..	8 6 4	Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	106 1/2-106 1/2	+ 1/2	4 12 2
Eleo, Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90-93	..	5 7 6	Do. 4 1/2 % Per. Deb. ....	Stock	4 1/2	4 1/2	101-103	+ 1/2	4 7 5
Eleo, Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5	5	93-95 xd	..	5 6 3	Toronto Power, 4 1/2 % Deb. ....	Do.	4 1/2	4 1/2	98 1/2-100 1/2	..	4 9 7
Kajoorie Eleo. P. and L., Ord.	10/-	Nil	6	1 1/2-1 1/2	..	Nil	Vera Cruz Lt., El. and T., 5 %	100	5	5	91-94	..	5 6 5
Do. 8 % Prof. ....	5	6	6	1 1/2-1 1/2	..	9 15 2	Victoria Falls Power, Prof. ....	1	1 1/2	1 1/2	1 1/2-1 1/2	- 1/2	..
Kaministiquia Power, 5 % G. B.	\$500	5	5	101 1/2-103 1/2	..	4 16 7	West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	5	105-107 xd	+2	5 12 2
Madrax, Ord. ....	5	Nil	5	12-1 1/2	..	4 16 2							
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101-104	..	4 16 2							
Mexican El. Lt., 5 % 1st M. Bds.	\$100	4	4	83-86	+ 1/2	5 16 3							
Mexican Lt. & Power, Common	\$100	4	4	81-83	+ 1/2	4 16 5							
Do. 7 % Cum. Prof. ....	\$100	7	7	101-105	+ 1/2	6 13 4							
Do. 5 % 1st Mort. Gold Bds.	..	6	5	94 1/2-96 1/2	+2	6 8 8							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph .....	10	4	4 1/2	7-7 1/2	..	6 0 0	Monte Video Telephone, Ord. ....	1	8	6 1/2	1 1/2-1 1/2	..	5 13 0
Do. 5 % Deb. Red. ....	Stock	5	5	97-99	- 1/2	5 1 0	Do. 5 % Prof. ....	1	5	5	3-5	..	5 14 9
American Teleg. & Teleg. Cap.	\$100	4	4	135 1/2-137 1/2	+1	5 16 5	New York Teleg., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	98-99	..	4 10 11
Do. Collat. Trust .....	\$100	8	8	91-93	..	4 8 0	Oriental Teleg. and Elec. ....	1	8	6 1/2	1 1/2-1 1/2	+ 1/2	4 9 10
Anglo-American Telegraph .....	Stock	8	8	65 1/2-67 1/2	+ 1/2	4 9 0	Do. 6 % Cum. Prof. ....	1	5	5	1 1/2-1 1/2	..	4 18 5
Do. 8 % Prof. ....	Do.	8	8	111-112	+ 1/2	5 7 2	Do. 4 % Red. Deb. ....	Stock	4	4	88-90	..	4 8 11
Do. Def. ....	Do.	80/-	80/-	24 1/2-24 1/2	+ 1/2	6 1 7	Pacific and European Tel. 4 % (Gen. Deb.)	Do.	4	4	97 1/2-99 1/2	..	4 0 5
Anglo-Portuguese Tel. 5 % (Mort. Deb.)	100	5	5	99 1/2-101 1/2 xd	..	4 18 6	Reuter's .....	10	10	10 1/2	11 1/2-11 1/2	..	8 10 2
Chili Telephone .....	5	7	8	7 1/2-7 1/2	..	4 1 7	Do. New Shares .....	10	..	..	10 1/2-11 1/2	..	..
Commercial Cable, 5 1/2 % Deb.	Stock	4	4	79-81	..	5 12 9	Submarine Cables Trust	Cert.	6	6	127-180	..	4 12 4
Cuba Telegraph .....	10	6	6 1/2	84-8 1/2	..	6 9 9	Telephone Co. of Egypt, 4 1/2 %	Stock	4 1/2	4 1/2	95-97	..	4 12 9
Do. 10 % Prof. ....	10	10	10	16-17	..	5 17 8	United River Plate Telephone	5	8	8	7 1/2-7 1/2	+ 1/2	5 4 11
Direct Spanish Telegraph, Ord.	5	4	4	84-8 1/2	..	5 6 8	Do. 5 % Cum. Prof. ....	5	5	5	5 1/2-5 1/2	..	4 8 11
Do. 10 % Cum. Prof. ....	10	10	10	6 1/2-6 1/2	..	7 8 2	West Coast of America .....	2 1/2	2 1/2	2 1/2	1 1/2-1 1/2	..	4 3 4
Direct United States Cable	10	5	4	6 1/2-7 1/2	..	6 15 7	Do. 4 % Deb. 1 to 1,600	100	4	4	95-98	..	4 1 8
Direct W. India Cable, 4 1/2 % (Reg. Deb.)	100	4 1/2	4 1/2	99-101	..	4 9 0	West India and Panama Teleg.	10	2 1/2	1 1/2	1 1/2-1 1/2	+ 1/2	..
Eastern Telegraph, Ord. Stock	Stock	7	7 1/2	134-137	+1	5 2 2	Do. 5 % Cum. 1st Prof. ....	10	5	8	10-10 1/2	..	6 14 3
Do. 8 1/2 % Prof. Stock ..	Do.	8 1/2	8 1/2	7 1/2-8 1/2	+ 1/2	4 6 11	Do. 8 % Cum. 2nd Prof. ....	10	6	6	8 1/2-10	..	6 0 0
Do. 4 % Mort. Deb. ....	Do.	4	4	96-98	..	4 1 8	Do. 5 % Deb. ....	100	5	5	101-103	..	4 17 1
Eastern Extension .....	10	7	7 1/2	18-13 1/2	+ 1/2	5 3 8	Western Telegraph, Ltd. ....	100	7	7	13 1/2-13 1/2	..	5 2 9
Do. 4 % Deb. ....	Stock	4	4	95-97	- 1/2	4 2 6	Do. 4 % Deb. ....	Stock	4	4	95-97	..	4 2 6
East and S. Africa Tel. 4 % (M. B. Mauritius Sub.)	25	4	4	98-101	..	3 19 6	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	4 1/2	97 1/2-100 1/2	..	4 10 0
Globe Telegraph and Trust ..	10	6	6 1/2	10 1/2-11 1/2	+ 1/2	5 7 10							
Do. 5 % Prof. ....	10	6	6	12 1/2-13	+ 1/2	4 12 4							
Great Northern Telegraph ..	10	18	18	29-31	..	5 14 3							
Indo-European Telegraph ..	26	13	13 1/2	57 1/2-59 1/2	+ 1/2	5 9 8							
Mackay Companies Common ..	100	5	5	83-86	-1	5 16 3							
Do. 4 % Cum. Prof. ....	\$100	4	4	67-70	..	5 14 4							
Marconi's Wireless Telegraph	1	20	..	4 1/2-4 1/2	- 1/2	4 12 10							
Do. 7 % Cum. Prof. ....	1	17	..	8 1/2-8 1/2	- 1/2	4 10 8							

\* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ Ss. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations Mar. 4th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Mar. 4th.	Rise + or Fall	Present Yield p.c.	
Bath Trams, Pref. Ord. . . . .	1	1911. Nil	111	..	£ s. d.	Metropolitan Railway Consol. . . . .	100	1911. 12	12	61½-52	— ½	£ s. d.
Do. 6% Pref. . . . .	1	6	5	..	6 8 1	Do. Surplus Lands . . . . .	100	2½	2½	61-63	..	4 6 0
Do. 4½ Deb. . . . .	100	4½	4½	..	6 11 1	Do. 8½ Deb. . . . .	100	8½	8½	84-86	..	4 1 5
Brit. Elec. Trac., 6% Pref. . . . .	100	6	6	..	..	Do. 8½ Pref. . . . .	100	8½	8½	82-84	..	4 8 4
Do. Do. Deferred . . . . .	100	..	..	..	..	Do. 8½ Con. Pref. . . . .	100	8½	8½	81-83	..	4 4 4
Do. Do. 8% Cum. Pr't. . . . .	100	6	6	..	6 15 7	Metropolitan District Ord. . . . .	100	Nil	Nil	88½-93	..	5 12 6
Do. Do. 7% Non-Cum. Pr't. . . . .	100	..	..	..	..	Do. 6% Deb. . . . .	100	6	6	185-137	..	4 7 7
Do. Do. 5½ Perp. Deb. . . . .	100	5	5	..	5 5 3	Do. 4% Deb. . . . .	100	4	4	90-95	..	4 2 6
Do. Do. 4½ 2nd Deb. . . . .	100	4½	4½	..	5 7 2	Do. 4% Prior Lien . . . . .	100	4	4	98-100	..	3 13 8
Central London Railway, Ord. . . . .	100	8	8	..	4 18 9	Do. 4% First Pref. . . . .	100	4	4	85-87	..	5 1 2
Do. Pref. . . . .	100	4	4	..	4 14 2	Do. 3½ Ord. . . . .	100	8½	8½	75-77	..	4 10 11
Do. Def. . . . .	100	2	2	..	4 18 9	Metropolitan Elec. Trams, Ord. . . . .	100	6	6	82-84	..	5 14 3
Do. 4% Deb. . . . .	100	4	4	..	4 0 0	Do. 6% Pref. . . . .	100	1	5	6	..	4 17 10
City & S. London, 5% Pref., 1891	100	6	6	..	4 18 0	Do. 4½ Deb. . . . .	100	4½	4½	93-92	..	4 17 10
Do. Do. 1896 . . . . .	100	6	6	..	4 18 0	Do. 5% Deb. . . . .	100	5	5	94-97	..	5 3 1
Do. Do. 1901 . . . . .	100	5	5	..	5 0 0	Potteries, Ord. . . . .	1	8½	..	..	..	6 19 0
Do. Do. 1908 . . . . .	100	5	5	..	5 2 0	Do. 5% Pref. . . . .	1	5	..	..	..	4 17 8
Do. 4% Deb. . . . .	100	4	4	..	4 0 10	Do. 4½ Deb. . . . .	100	4½	4½	85-88	..	5 2 8
Dublin United Trams, 6% Pref. . . . .	10	6	6	..	4 18 0	South Metro. Trams, 6% Pref. . . . .	1	8	..	..	..	7 7 9
Great Northern & City, Pr't. Ord	10	Nil	Nil	..	Nil	Do. 4% Deb. . . . .	100	4	4	65-70	..	5 14 4
Hastings Trams, 6% Pref. . . . .	1	6	6	..	7 7 8	Underground Elec. Railways	10	..	..	..	..	Nil
Do. 4½ Deb. . . . .	100	4½	4½	..	6 1 7	Do. "A" . . . . .	17	..	..	..	..	5 7 2
Isle of Thanet Trams, 5% Pref. . . . .	100	5	5	..	4 15 3	Do. 6% First Cum. Inc. Deb. . . . .	100	6	6	110-112½	+½	5 7 2
Do. 4% Deb. . . . .	100	4	4	..	5 0 0	Do. 4% Bonds . . . . .	100	4	4	98-101	+½	4 10 0
Lancashire United, 5% Deb. . . . .	100	4	4	..	6 5 0	Do. 6% Income . . . . .	100	1½	6	94-94½	+½	6 7 8
London Elec. Railways, 4% Deb. . . . .	100	4	4	..	4 3 4	Yorkshire (West Riding), Ord. . . . .	6	Nil	..	..	..	4 12 4
London United Trams, 6% Pref. . . . .	10	Nil	Nil	..	5 12 8	Do. 6% Pref. . . . .	5	8	3½	24-23	..	Nil
Do. 4% Deb. . . . .	100	4	4	..	..	Do. 4½ Deb. . . . .	100	4½	4½	80-84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . . . .	5	5½	5½	4½-5½	5 7 4	La Plata Elec. Trms, Ord. . . . .	1	Nil	..	..	..	..
Do. 2nd Pref. . . . .	5	5½	5½	4½-4½	5 14 8	Do. Pref. . . . .	1	8	..	..	..	6 0 0
Do. 4% Deb. . . . .	100	4	4	92-94	4 5 1	Lisbon Elec. Trams, Ord. . . . .	1	6	6	14-13	..	4 7 8
Do. 4½ Deb. . . . .	100	4½	4½	88½-100	4 9 7	Do. 6% Pref. . . . .	1	6	6	1-1	..	4 16 0
Do. 5% Deb. . . . .	100	5	5	93-100	4 19 6	Do. 5% Deb. . . . .	100	5	5	82-97	..	5 3 1
Auckland Trams, 5% Deb. . . . .	100	5	5	101-103	4 17 1	Madras Elec. Tr. (1904), Deb. . . . .	100	5	5	101-102	..	4 17 1
Bombay Elec. B. & Trams, Pref. . . . .	10	6	6	11-12	5 0 0	Manaos Trams & Lt., 1st Deb. . . . .	100	5	5	87-90	..	6 11 1
Do. 4½ Deb. . . . .	100	4½	4½	96-98	4 11 10	Manila Elec. R. and Lig., Bonds	\$1000	5	6	98-100	..	5 0 0
Do. 5% 2nd Deb. . . . .	100	5	5	97-99	5 1 0	Mexico Trams Com. . . . .	\$1000	7	7	110-113	+½	6 4 0
Brazilian Traction Light and Power	\$100	..	6	100-102	+3	Do. Gen. Con. 6% Bonds . . . . .	..	5	6	91-95½	+½	5 5 8
Brisbane Trams Invt., Ord. . . . .	5	8	8	74-72	5 5 0	Do. 6% Bonds . . . . .	100	6	6	97½-100	..	5 19 6
Do. 5% Pref. . . . .	5	5	5	44-53	4 15 8	Para Elec. Rlys. & Lt., Ord. . . . .	5	10	10	72-75	..	6 7 0
Do. 4% Deb. . . . .	100	4	4	100-103	4 7 5	Do. 6% Pref. . . . .	6	8	8	42-63	..	11 7
B. Columbia Elec. Rly., Def. . . . .	100	8	8	139-143	5 12 0	Do. 5% 1st Deb. . . . .	100	5	5	93-101	..	4 19 0
Do. Pref. Ord. . . . .	100	8	8	119-123	4 17 7	Perth (W.A.) Elec. Tr., Ord. . . . .	1	5	5	143-144	..	3 14 5
Do. 5% Pref. . . . .	100	6	6	106-109	+1	Do. 6% 1st Deb. . . . .	100	5	5	105-108	..	4 12 7
Do. 4½ 1st Mort. Deb. . . . .	40	4½	4½	100-103	4 7 5	Rangoon El. Tr. & Sup., Pref. . . . .	5	6	6	58-64	..	5 0 0
Do. 4½ Vancouver Deb. . . . .	100	4½	4½	101-103	4 7 5	Do. 4½ 1st Deb. . . . .	100	4½	4½	97-99	..	4 10 11
Do. 4½ Con. Deb. . . . .	100	4½	4½	97-99	+½	Rio de Janeiro Trams, 1st Mort. 6% Bonds	..	5	5	101-103	..	4 17 1
Calcutta Trams, Ord. . . . .	5	7	7	67-62	5 12 0	Do. 5% Mort. Bonds . . . . .	100	5	5	90-98	..	5 2 0
Do. 6% Pref. . . . .	5	6	6	41-56½	4 17 7	Sao Paulo Tram, Lt. and P. . . . .	\$500	5	5	103-105	-½	4 15 3
Do. 4% Deb. . . . .	100	4	4	97-100	4 10 0	Singapore Trams, 5% 1st Deb. . . . .	100	5	5	80-90	..	5 11 1
Cape Electric Trams . . . . .	1	2½	2½	5-5	4 8 2	Southern El. Tr. B.A., 5% Deb. . . . .	100	5	5	97-99	..	5 1 0
City Buenos Aires Trams (1904)	5	5	5	51-51½	5 0 0	Un. Elec. Trams Monte Video . . . . .	5	7	7	51-53	..	6 1 9
Do. 4% Deb. . . . .	100	6	6	97-100	6 2 1	Do. 6% Pref. . . . .	5	6	6	44-53	..	5 11 7
Colombo Elec. Tr. & Lt., 5% Deb. . . . .	100	5	5	93-97	4 17 1	Do. 5% 1st Deb. . . . .	100	5	5	98-101	-1	4 19 0
Havana Elec. Rly., 5% Bonds	\$1000	6	6	89-103	..	Winnipeg Elec. Rly., 4½ Deb. . . . .	100	4½	4½	100½-103	..	4 7 0
Kalgoorlie Elec. Trams . . . . .	Nil	..	..	87-88	..							
Do. 5% A Deb. . . . .	100	6	6	87-88	..							
Do. 6% B Deb. . . . .	100	6	6	25-35	..							

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	6	..	..	6 0 0	Crompton & Co. . . . .	8	Nil	..	..	..	ND
Do. 6% Pref. . . . .	1	6	6	22-22	7 2 2	Do. Deb. . . . .	100	5	5	55-57	..	9 15 6
Babcock & Wilcox . . . . .	1	28	14	..	4 0 0	Dick, Kerr . . . . .	1	5	Nil	..	..	..
Do. Pref. . . . .	1	6	6	14-14	4 0 0	Do. Pref. . . . .	1	6	6	..	..	6 17 2
British Aluminium, Ord. . . . .	1	Nil	..	..	..	Do. Deb. . . . .	100	4	4	95-98	..	4 11 10
Do. 5% Prior Lien Deb. . . . .	100	5	5	95-96	5 6 5	Edison & Swan, A., £8 paid	5	6	Nil	..	..	..
Do. Deb. Siks. . . . .	100	5	5	87-90	5 11 1	Do. Italy paid . . . . .	5	6	Nil	..	..	..
B.I. & Helsby Cables . . . . .	5	10	8	84-88	5 15 11	Do. 4% Deb. . . . .	100	4	4	61-65	..	6 8 1
Do. Pref. . . . .	5	6	6	62-62	4 16 6	Do. 6% Second Deb. . . . .	100	5	6	72-75	..	6 18 4
Do. Deb. . . . .	100	4	4	102-104	4 6 7	Electric Construction . . . . .	2	2½	2½	11-11½	..	5 14 4
British Thomson-Houston, Deb. . . . .	100	4	4	94-102	4 13 6	Do. Pref. . . . .	2	7	7	12-2	..	7 0 8
Do. Deb. . . . .	100	4	4	91-94	4 10 9	Greenwood & Basley, Pref. . . . .	10	7	7	73-8	..	5 6 8
Do. 8% Prior Lien . . . . .	100	6	6	100-103	6 11 2	Do. Deb. . . . .	100	5	5	92-94	..	6 4 2
Brown, Linsley, Ord. . . . .	1	..	..	27-37	..	General Electric, Pref. . . . .	10	5	6	10-103	+½	4 13 0
Do. Pref. . . . .	1	..	..	47-67	..	Do. Deb. . . . .	100	4	4	90-95	..	4 4 8
Brush, 7% Pref. . . . .	2	Nil	Nil	0-1	..	Henley's, Ord. . . . .	5	17	5	13-133	..	6 8 8
Do. 6% Prior Lien Deb. . . . .	100	5	5	78-78	..	Do. Pref. . . . .	5	4	4	44-66	..	4 7 10
Do. 4½ Deb. . . . .	100	4½	4½	88-43½	10 9 4	India-Rubber, G. & T. . . . .	10	..	..	..	..	4 7 6
Do. 4½ 2nd Deb. . . . .	100	4½	4½	28-82	14 1 4	Do. Pref. . . . .	10	5	5	92-101	..	4 17 4
Callender's Cable . . . . .	5	15	10	11-112	6 7 8	Telegraph Construction . . . . .	12	17½	6	86-88	..	5 16 8
Do. Pref. . . . .	5	6	6	44-64	4 17 7	Do. Deb. . . . .	100	4	4	95½-98½	..	4 1 8
Do. Deb. . . . .	100	4	4	97-100	4 10 0	Williams & Robinson . . . . .	1	Nil	..	..	..	Nil
Casner-Kellner . . . . .	1	20	20	84-84	5 6 0	Do. Pref. . . . .	5	Nil	..	..	..	Nil
Do. Deb. . . . .	100	4	4	103-106	4 4 11	Do. Deb. . . . .	100	4	4	67-69	..	6 15 7

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING JANUARY, 1913.

THE returns of electrical business during January, which we publish herewith, show a considerable advance over the figures for the last month of 1912.

The exports reached a total value of £576,526, as compared with £510,700 in December last, and included very large amounts due to machinery and cables, the former reaching over £212,000 in value, and the latter nearly £111,000.

The imports totalled £252,167, as compared with £231,551 in the preceding month, while the re-exports amounted to £28,494, as compared with £24,867 in December.

The exports from this country showed a general improvement over those of the preceding month, and although they included £81,713 worth of telegraphic material—an amount rather above the average—the remaining business, totalling £491,813, was only once exceeded in value during 1912. Brazil, India, New South Wales and Argentina were our best customers during the month, the former owing its unusually prominent position to a telegraphic purchase valued at £15,000. Machinery and cable imports were both at a considerably higher level than in December—the imports total of £252,167 comparing with an average of about £217,000 per month during 1912.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable, and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	1,743	400	70	184	...	534	8,090	658	127	24	506	7,315	19,651
Germany ...	2,572	78	63	43	573	...	3,483	...	48	...	84	157	7,101
Netherlands, Java & Dutch Indies ...	833	2,254	191	...	31	...	1,541	11	11	8	89	488	5,457
Belgium ...	733	252	409	117	137	207	1,907	2,673	11	54	1,338	306	8,111
France ...	1,194	...	3,881	73	13	23	11,569	796	40	13	104	385	18,091
Portugal ...	282	141	16	61	...	...	782	...	...	...	130	237	1,649
Spain, Canary Isles and Spanish N. Africa...	2,065	3,221	382	...	...	329	7,289	572	22	...	561	762	15,203
Switzerland, Italy and Austria-Hungary ...	616	32	55	...	...	23	3,521	15	60	871	215	3,699	9,137
Greece, Roumania and Turkey ...	87	399	68	200	22	...	134	...	...	...	1,869	38	2,817
Channel Isles, Gibraltar, Malta and Cyprus...	62	341	24	44	...	26	459	...	11	...	...	3,820	4,787
U.S.A., Philippines and Cuba ...	194	46	...	...	...	347	442	...	233	...	...	...	1,262
Canada and Newfoundland ...	535	3,158	708	914	...	1,080	23,305	...	6,181	...	221	828	36,930
British West Indies and British Guiana ...	118	...	126	26	...	...	106	...	11	10	130	50	577
Mexico and Central America ...	31	22	66	...	...	...	207	...	18	...	...	...	344
Peru and Uruguay ...	481	132	9	15	106	5	479	...	68	...	4	608	1,907
Chile ...	387	434	331	129	...	75	3,159	31	228	...	179	350	5,303
Brazil ...	1,367	903	854	321	42	43	8,747	1,454	359	56	7,954	45,021	67,121
Argentina ...	3,316	14,578	1,863	1,077	219	358	14,062	2,872	995	227	5,124	547	45,238
Colombia, Venezuela, Ecuador and Bolivia...	177	...	74	273	...	...	1,832	...	105	...	70	...	2,531
Egypt, Tunis and Morocco ...	473	236	429	73	14	...	1,644	...	278	...	152	567	3,866
British West Africa ...	255	822	142	37	11	58	807	...	15	...	63	44	2,650
Rhodesia, O.R.C. and Transvaal ...	2,372	5,183	177	612	...	36	6,021	17	80	3	48	208	14,755
Cape of Good Hope ...	2,042	5,099	584	928	13	505	11,625	36	4,854	21	7,784	1,118	34,609
Natal ...	1,348	6,255	550	478	...	313	1,224	...	35	3	448	117	10,771
Zanzibar, Brit. E. Africa, Mauritius & Aden	70	...	34	108	...	36	679	...	14	...	61	215	1,217
Azores, Madeira and Portuguese Africa ...	246	465	197	44	...	36	2,596	21	19	...	...	255	3,879
China and Siam ...	2,575	736	860	1,716	28	1,984	2,762	...	1,064	...	90	4	11,819
Japan and Korea ...	875	3,685	308	16	115	1,059	22,582	1,273	546	150	333	...	30,942
India ...	3,727	12,277	2,540	2,213	326	1,044	16,848	2,700	5,550	233	1,917	1,239	50,614
Ceylon ...	372	2,613	36	202	...	126	518	860	64	...	715	37	5,543
Straits Settlements, Federated Malay States and Sarawak ...	462	1,534	166	9	...	500	1,778	207	31	147	1,241	63	6,138
Hong Kong ...	786	440	579	183	...	176	993	29	289	...	...	24	3,499
West Australia ...	551	579	213	228	...	563	3,007	112	1,200	...	1,589	1,254	9,296
South Australia ...	758	6,144	147	470	...	733	1,250	66	36	...	3,526	9,880	23,010
Victoria ...	2,818	17,005	1,896	844	...	284	5,269	260	1,153	...	3,291	218	33,038
New South Wales ...	3,354	18,999	1,310	1,270	...	735	9,439	2,023	79	5	7,406	800	45,420
Queensland ...	469	2,567	38	261	...	130	2,170	...	86	46	4,997	106	10,364
Tasmania ...	59	...	6	...	...	11	320	62	23	...	249	...	730
New Zealand and Fiji Islands ...	772	2,680	578	262	528	54	13,350	...	219	25	1,583	565	20,616
<b>Total, £</b>	<b>41,177</b>	<b>113,710</b>	<b>19,980</b>	<b>13,431</b>	<b>2,189</b>	<b>11,742</b>	<b>195,738</b>	<b>16,686</b>	<b>24,163</b>	<b>1,896</b>	<b>54,101</b>	<b>81,713</b>	<b>576,526</b>

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark ...	49	...	7	118	...	36	7,047	308	409	...	5,732	...	13,706
Germany ...	10,089	28,129	1,359	15,286	8,555	3,096	63,431	1,427	3,703	7,526	11,971	...	154,572
Holland ...	150	...	...	2,235	735	...	109	...	10	...	...	...	3,239
Belgium ...	712	2,738	344	407	135	24	2,560	21	281	93	6,902	...	14,217
France ...	97	6	1,125	958	227	2,014	2,372	...	598	3,766	1,488	...	12,651
Switzerland ...	312	824	93	119	18	337	1,207	...	17	323	4	...	3,254
Italy ...	326	4,735	60	...	...	...	170	...	...	...	29	...	5,320
Austria-Hungary ...	...	1,305	...	1,135	283	...	225	...	12	981	10	...	3,951
United States ...	3,453	995	992	43	708	15	9,422	21,739	317	256	146	...	38,086
<b>Total, £</b>	<b>15,188</b>	<b>38,732</b>	<b>3,980</b>	<b>20,301</b>	<b>10,661</b>	<b>6,522</b>	<b>86,513</b>	<b>23,495</b>	<b>5,347</b>	<b>12,945</b>	<b>26,282</b>	<b>...</b>	<b>248,996</b>

Additional imports: Spain, carbons, £197; Greece, machinery, £90; Canada, telegraphic goods, £2,884.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	10,891	1,032	...	3,234	1,747	...	9,185	...	459	788	1,158	...	28,194
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TOTAL EXPORTS: £576,526.

TOTAL RE-EXPORTS: £28,494.

TOTAL IMPORTS: £252,167.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

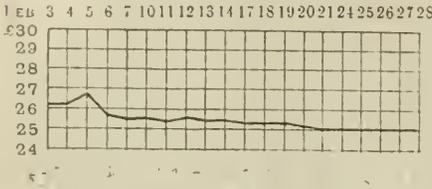
METAL MARKET.

A PLEA FOR THE DOMESTIC LOAD.

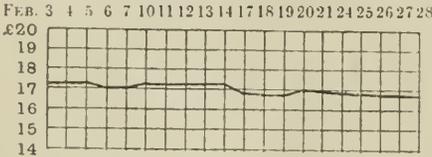
Fluctuations in February.

By "WHISTLEFIELD."

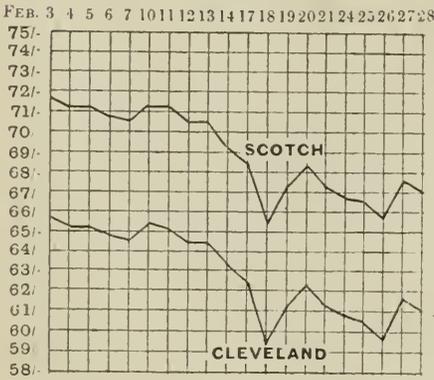
SPELTER (G.O.B's.).



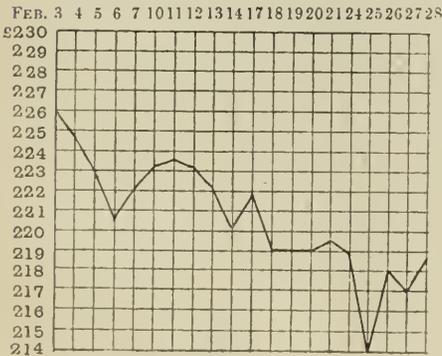
LEAD (ENGLISH).



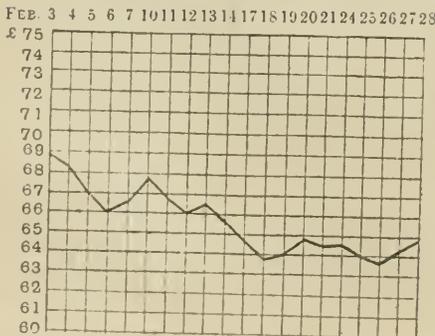
IRON.



TIN.



COPPER (G.M.B's.).



ELECTRICITY undertakings have lately wakened up to the need of pushing for business and trusting less to Providence to send along new consumers. The convenience and utility of the electric motor, even in inexperienced hands, have led to a great increase in the output of electricity for power purposes of undertakings situated in industrial areas, and the result of this day load has been an improvement in the load factor, with a consequent reduction in the cost of generation, to the mutual advantage of the undertaking and the consumer. Recently, however, engineers have begun to realise that a day load does not necessarily mean a motor load only, because electrically heated and operated appliances are being put on the market which can be relied on to do useful work without continually breaking down, and which can also be purchased at a reasonable cost.

The operation of these appliances will be found to increase the much-desired day load, since most housework is done in the forenoon, and, in any case, only a small proportion of houses are wired for plugs so that connection can be obtained only by removing a lamp and using an adaptor. Even in the case of radiators, kettles, toasters, &c., which are used during the hours of heavy lighting load, the fact that their use is intermittent and for short periods only, prevents the peak load from being appreciably affected, for the chances of a large number of, say, kettles or hot plates being "on" at identically the same time are very remote.

Engineers who are striving for a better load factor do not, however, appear to realise the importance of encouraging the use of the smaller domestic appliances, quite overlooking the fact that although they may be used for a short period only each day they nevertheless take a fairly high current compared with lamps, and so can be relied on to appreciably increase the units used from any service without increasing the capital expenditure in distribution.

To put a new service in a small shop, whose average load will probably not exceed six 55-watt metal-filament lamps, will cost approximately £5, including meter and other charges. Such an installation, as the examination of ledgers clearly proves, uses between 250 units and 500 units per annum, depending on the nature of the business, while the average for small dwelling houses comes to about 250 units per annum. A large proportion of the units used on such installations are taken at times of heavy lighting load, so that each installation connected means not only an increase in the capital expenditure on mains but also on plant.

The use of small domestic appliances, however, like irons, kettles, &c., requires no extra expenditure to install them, as far as the supply authority is concerned, and increases the units used from existing services by as much as 10 per cent. to 30 per cent. Even undertakings which have a good power load could profitably develop a domestic load, for power loads usually overlap the lighting load in winter, and plant must be provided for this overlapping, so that the domestic load helps to utilise the surplus plant not required during the day for power purposes.

Some undertakings, realising the advantage of a domestic load, have commenced to hire out electric cookers, but, so far, it is uphill work; people are not quite convinced yet that cookers are reliable, and they are not prepared to put in a special circuit for the cooker, or to run the risk of being left without food through a blown fuse or a defect in the apparatus, though they may be quite convinced of the advantages of electric cooking. This method also involves heavy capital expenditure to the undertaking for comparatively small returns.

The following method tried by some other undertakings seems to promise more success, since the capital expenditure involved is small and the returns are fairly large. A number of 6-lb. flat irons fitted with 3 yards of flexible, and terminating in an adapter, are loaned to consumers on the distinct understanding that no liability of any kind is incurred by their use. Since there is no preliminary expense for alteration to wiring, or liability for damage to apparatus, the consumer will have every inducement to give the iron a trial, and if there are

any babies or grown-up daughters in the house, that iron will be in use on an average at least half an hour per day. The convenience of merely turning on the switch to heat the iron makes people put it on for doing the smallest article, and as it takes about five minutes to heat up, and may be in actual use only five or ten minutes more, the number of times the iron is heated up accounts for quite an appreciable number of units.

At the end of five or six weeks, when the iron is taken away to be loaned elsewhere, the contrast between the old method and the new will be so great that the household will find that it cannot get on without an electric iron. If the supply authority has powers to supply apparatus on hire, or hire-purchase, a good business can now be done, not only in irons, but also in other current-consuming devices due to the favourable impression made by the iron. If the undertaking cannot hire apparatus, arrangements should be made with a good local firm to stock a quantity of irons identical with those sent out on loan. A good iron, complete with flexible and adapter, can be bought wholesale for about 7s. 6d., so that for the same expenditure as on a new service 15 irons can be put out on loan. Assuming that each iron is switched on only for three hours a week, a very moderate estimate, each iron will account for 63 units in the year, and the whole 15 will increase the annual output by nearly 1,000 units, units which are used during the day, and, therefore, at times of light load, and most of which will have been paid for at lighting rates while the irons were on loan.

A good electrical cooking outfit will cost complete about £15; this sum spent on smaller apparatus, such as irons, would be able to purchase 45, which, on the above basis, would cause a consumption of about 3,000 units per annum, a return far greater than that which a single cooker would cause, besides which the irons will have done six weeks of canvassing work in 360 households, and probably caused another 200 irons, involving an annual consumption of 12,000 units, to be connected to the mains.

When lending out irons, small shops should not be neglected, for in many of these the proprietress or her daughters will bring down their work and do it in the back shop during slack times.

After the possibilities of an ironing load have been exhausted, the same procedure can be adopted with electric kettles. Even if a kettle is used only twice a day for ten minutes each time, at breakfast and tea, for keeping a supply of hot water available, it will consume two units a week or 100 units per annum, so that a household with a 2-pint kettle and iron will use at least 150 units more per annum than before; this is not a great quantity, but it very often represents a 50 per cent. increase in the units supplied through the service without any appreciable increase in the maximum demand at times of peak load from that service.

These are only two of the many small, and, therefore, comparatively cheap domestic appliances which can be judiciously pushed amongst electricity consumers, and the figures quoted give some indication of the percentage by which the output from any undertaking could be increased. Great care, however, must be exercised in choosing the apparatus which is circulated, as bad design, resulting in continuous breakdown, will do a great deal of harm, which will take a long time to neutralise. To make the use of electrically operated domestic appliances popular, the prices charged for the energy used must be made reasonable; there are several methods of doing this. One is to make a special charge for all units used for domestic purposes other than for lighting or power; this is almost out of the question if it means a separate meter, and, therefore, a separate circuit throughout the house; the additional expense in fitting up the installation would probably kill the movement at once.

The only method of charge which seems to meet the case is the "telephone" or "annual charge" system, by which a fixed sum is paid each quarter, and all units used on the premises are charged at a low rate, ranging from 1d. to ½d. per unit.

The methods adopted by different undertakings for arriving at this fixed charge vary a great deal; some make the charge a percentage of the rateable value, others

base the charge on the maximum demand, while others, again, base their charge on the floor space. Since the ideal arrangement would be to charge for all units used for lighting at the lighting rate, and all units used for domestic purposes at the special low rate, without, however, the drawbacks and expense of two separate circuits, the annual charge must be fixed at such a figure that, if electricity were used for lighting only, the bill would come to the same amount on either the flat rate or the annual charge rate; then every extra unit used, presumably for domestic purposes, would actually be obtained at the low rate.

For example, if, in a certain case, the lighting bill per annum averaged £3 with energy at 3d. per unit, it follows that the units used per annum must have averaged 240. If the annual charge in this case were fixed at £2, and all units used were charged at 1d. per unit, then the annual consumption of 240 units on this system would work out at £3, the same as on the flat rate; but if, in addition to using the 240 units for lighting, 150 units had been used for heating purposes also, the bill would work out as follows:—

Annual charge ... ..	£2 0 0
390 units at 1d. per unit ... ..	1 12 6
Total ... ..	£3 12 6

which is exactly the figure which would have been arrived at if the units had been registered on separate circuits, that is, 240 units at 3d. = £3, and 150 units at 1d. = 12s. 6d., total £3 12s. 6d. Of course it is not advisable to base the annual charge for any installation on the units actually used on that installation, because there may have been abnormal conditions prevailing; also, it would lead to such anomalies as two identical houses being charged annual sums of different values. The correct and only safe way is to collect the data relating to houses of the same size and strike an average; all the figures obtained can be compared, and, where necessary, graded so as to obtain an equitable scale.

Such a scale can be easily explained to consumers, and as it is perfectly straightforward without any electrical terms by which he may be trapped later, there is no difficulty in inducing a consumer to go on to this system of charging when domestic appliances are installed.

Undertakings with a good motor load can afford to neglect this kind of day load, but undertakings situated in residential districts will find, if they go into the matter carefully, that in the development of the domestic load they have the means whereby they can appreciably increase their load factor, and thus considerably reduce the cost of production.

## THE USE OF ELECTRICITY AND ELECTRICAL ACCIDENTS IN MINES.

(Concluded from page 333.)

IN the Manchester and Ireland district there was only one non-fatal accident, which occurred on the surface at Hulton Colliery to a turbine generator attendant. In attempting to replace blown-out fuses, not having switched off pressure, he was slightly burned on the face and eyes. He had passed the switch on his way to the fuses. The arrangement of the switch did not meet with the approval of Mr. Nelson, the fuses being on the "live" side of the switch; the position should be reversed.

In the Liverpool and North Wales district the inspector says: "I am pleased to be able to report that another year has passed without any fatal accident due to electricity. There were, however, four non-fatal accidents, one to an electrician while trying to locate a fault in a fan motor with the pressure on, with the result that the armature shorted and his eyes were thereby slightly injured. In another case a shaft sinker, preparatory to testing, made contact with bare wires at the end of a shot-firing cable. The third accident was due to the bursting of a trailing cable connected to a coal-cutting machine. In the remaining case a motor attendant at St. Helen's Colliery received a shock

while lowering a set of tubs down an incline, at the time when the motor of the haulage engine was at rest."

One can scarcely credit that anyone termed an "electrician" would attempt to locate a fault in a motor with "current" on, and in regard to the shaft sinker we must assume that the shots were being fired from a power or lighting cable, a foolish practice, as it would scarcely be possible for him to receive an injury from a shot-firing battery, which ought to be used in every case for shot-firing purposes. But whatever is meant by a cable "bursting"—we presume it fused owing to its not being of sufficient capacity to carry the current. Was this the result of economy or of sheer ignorance?

"At the St. Helen's Colliery, current in the pit is got from a power house on the surface. The system of distribution is three-phase, 2,200 volts pressure, with insulated neutral. Current is taken down the shaft by a double-armoured three-core cable to a distributing station near the pit bottom. From that point it is taken by single-armoured cable along the main roads to sub-stations, and after being transformed down to 440 is conducted by unarmoured cables to the various motors in the pit. Current at 440 volts was also taken through a small double-pole switch to eight lights arranged four in series. This lighting switch fused and caused a short between two phases, the overload coils in the power station tripped, and so cut off the entire current; but, strangely, the overload cut-outs in the sub-station did not act." There must have been a heavy leak to earth through the cover when the lighting-switch fused, and the shock accident to the attendant was apparently caused through the earth return to the surface being unable to take the discharge sufficiently rapidly. Mr. Nelson, H.M. Electrical Inspector of Mines, subsequently inspected the plant, and his opinion was that one of the earth connections might have been disconnected at the time of the accident, but made good before the responsible electrician made his investigations.

The italics are ours, but the last statement is amazing, if true. Whoever would break and connect up again the earth connections if not the responsible electrician?

There were two non-fatal underground accidents in the South-Wales district, and three non-fatal accidents on the surface, but of the latter no particulars whatever are given. As regards the two former, in one a "haulier," while harnessing a horse on a double parting, received an electric shock by his head coming into contact with an unarmoured cable carrying 500 volts D.C., the insulation of which was defective. The place was wet, and the water had seriously deteriorated the insulation of the cable. On receiving the shock the haulier fell, and his head struck a tram, causing concussion of the brain. He was unconscious for 45 minutes.

In the other case, a motorman at a hauling engine received an electric shock causing burns to his hand and arm by treading on a wire, the insulation of which was abraded through having been trodden on, while his hand was on a resistance grid. The wire was one of a number between the controller and the resistance grid, which were not properly protected. Pressure 500 volts, three-phase.

One fatal and one non-fatal accident were reported to the inspector by the Midland and Southern district. In the fatal accident, deceased was in charge of a haulage motor. He also had under his control a switch from which cables extended through a ropeway to a  $7\frac{1}{2}$ -H.P. pump motor, 200 yd. distant. These cables had been in use over 12 years. Originally, they were armoured throughout, but owing to leakages from time to time the armour had been removed in numerous places in varying lengths, from 2 ft. to 10 or 12 yd. apart. The armoring was not earthed, except at two junction boxes which, together with the armoring where they entered the boxes, were earthed in connection with a line of waterpipes. The voltage was 425 D.C. Three days prior to the accident the electrician had tested all sections of the armoring for leakage of current, but said he had found none. The deceased was found lying dead in the ropeway in contact with a strand of wire rope, which was hanging over the electric cables, by a man who attempted to remove him; but he himself received a shock, and therefore went to the motor house and opened the switch, thus shutting off the current. The haulage

rope had been respiced on the previous day, and it appeared that someone had carelessly thrown the strand of wire upon the cables in the ropeway to get rid of it. Deceased had authority to travel along the ropeway after shutting off the electric current from the pump motor, but this he neglected to do. Subsequent examination revealed a leakage of current from the cables at the point where deceased met his death. The faulty cables have now been replaced by new ones.

The Inspector goes on to say—and we quite agree with him—that "the accident was very clearly due to inefficient earthing of cable in which the armoring had been cut in a number of places without being bridged over or otherwise rendered electrically continuous." The manager was of opinion that "it is not reasonably practicable to keep the armoring of cables earthed in a haulage road subject to heavy squeeze necessitating heavy repairs over a long period." The answer to this appears to be that if a road is of such a nature that electrical cables cannot be maintained in such a condition as to ensure as far as possible the safety of the workmen, the cables ought not to be there.

Mr. Nelson, H.M. Electrical Inspector of Mines, subsequently visited the colliery, and was of opinion that the supervision and maintenance of the plant had been very inefficient. In his report upon it he stated: ". . . I think it is impossible to come to any other conclusion than that the person in charge of the electrical plant at the mine has either been grossly ignorant of the risk he was allowing the workmen working on the cable level to run, or gravely negligent as regards his responsibility. If the risk in question was also unknown to the management, then it ought not to have been, but, in any event, the conditions which admittedly existed before the accident constitute, in my view, a serious reflection upon those responsible."

The non-fatal accident occurred to a pump-motor attendant at Whitefield Colliery, North Staffordshire, on September 19th. It appeared that the pump had lost its water, and the attendant switched off the current and then switched it on again without placing the controller in the "off" position. The resistance being cut out, there was a flash from the contact, which slightly burned the back of his hand.

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## SUPPLY TO PREMISES SITUATE OUTSIDE THE "AREA OF SUPPLY."

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WHEN the 1909 Act became law, many supply authorities considered that they would benefit themselves and the public by giving a supply to the many premises situate just outside their boundaries. Clause 6 of the 1909 Act reads as follows:—

1. Where it is proved to the satisfaction of the Board of Trade that the occupier of any premises is desirous of obtaining a supply of electricity from any undertakers within whose area of supply those premises are not situate, the Board of Trade may, if the local authority within whose district the premises are situate, and the undertakers (if any) authorised to supply electricity to such premises, consent, by order permit the first-mentioned undertakers to give a supply to those premises on such terms and subject to such conditions as the Board think fit; provided that, if in the opinion of the Board of Trade any consent required by this sub-section is unreasonably withheld, the Board of Trade may proceed as if such consent had been given.

2. An order given by the Board of Trade under this section may, for the purpose of enabling a supply to be given thereunder, confer any such powers and impose any such duties on the undertakers as would have been conferred or imposed by the Electric Lighting Acts and as might have been conferred or imposed by provisional order if the premises and the route along which lines are to be laid for the purpose of giving the supply were within the area of the supply of the undertakers, anything in the special Act or order relating to the undertaking to the contrary notwithstanding.

3. If the undertakers on whom powers are conferred by an order under this section are not a local authority, the works and lines erected and laid under the powers so conferred shall, so long as the order remains in force, be deemed, for the purposes of the provisions as to purchase applicable to the undertaking, to form part of the undertaking within the district of the local authority which comprises the area of supply of the undertakers, or, if that area is comprised within the districts of more than one local authority,

within such of those districts as the Board of Trade may determine.

4. Nothing in this section shall enable the Board of Trade, without the consent of the undertakers within whose area of supply the premises are situate, to give such permission as aforesaid to any undertakers where the last-mentioned undertakers are by any Act of Parliament specifically prohibited from supplying electricity within the area of the first-mentioned undertakers.

For the information of those who have not yet taken advantage of the clause, I will quote the procedure of the Board of Trade in answer to an application lately made.

Having obtained the consent of the local authority, and also the authorised undertakers (a power company), sanction was applied for from the Board of Trade. The Board wrote enclosing a memorandum of procedure, Part "E" of same, reading as follows:—

"E"—Application by undertakers for order of Board of Trade under Sec. 6 of the Electric Lighting Act, 1909, permitting them to give a supply of electricity to premises situate outside their area of supply:—

1. The application must be made in respect of specific premises, and not in respect of an addition to the area of supply of the applicants.

2. The application must be accompanied by:—

(a) A map or plan on a scale of not less than 6 in. to the mile, having marked thereon, in some distinctive colour, the route of the electric lines proposed to be placed for the purpose of giving the supply, the names of any streets in or along which the said electric lines are to be placed, and the situation of the premises proposed to be supplied.

(b) A list of the streets and any railways or tramways proposed to be broken up for the purpose of giving the supply, showing separately those streets (if any) which are not repairable by the local authority, and an affidavit or stamped statutory declaration to the effect that the streets repairable by the local authority are so repairable.

(c) Proof of the consent of the local authority in whose district the premises are situate, and of the undertakers (if any) authorised to supply electricity to the premises forming the subject of the application, or evidence that those consents are unreasonably withheld.

(d) Evidence that the occupier of the premises to which the application relates is desirous of obtaining a supply of electricity from the applicants.

(e) A statement of the terms and conditions on which the supply is proposed to be given; and

(f) An affidavit or stamped statutory declaration to the effect that the applicants are not by any Act of Parliament specifically prohibited from supplying electricity within the area in which the premises are situate.

3. The consent of the local authority, if given, should be given in pursuance of a resolution passed at a meeting of a local authority held after previous notice of the same and of the purpose thereof has been given in the manner in which notices of meetings of the local authority are usually given, and the fact that such a resolution was duly passed should be proved by a certificate signed by the clerk of the local authority reciting a copy of the notice and of the resolution, and declaring that the notice was duly given and the resolution duly passed.

4. The consent of any undertakers being a company authorised to supply electricity to the premises, if given, should be proved by a certificate signed by the manager or secretary to the company.

5. In cases where for the purpose of giving the supply the applicants require to break up any street not repairable by the local authority (including any street repairable by a County Council), or any railway or tramway they must (unless the authority, company, or person by whom that street, railway, or tramway is repairable consent to the breaking up thereof) apply to the Board of Trade under Sec. 13 of the Electric Lighting Act, 1882, for the written consent of the board authorising and empowering the applicants to break up that street, railway or tramway in the manner provided in this memorandum (see page 1).

6. Any costs or charges which may be incurred by the Board of Trade in connection with the application must be paid by the applicants.

The Board also stated that, in the event of their deciding to make an order, it would be necessary to refer the draft order to counsel, requiring a fee of three guineas. Now this, added to the cost of the affidavit mentioned in Clause 2, Sub-Sec. (f), of the Memorandum of Procedure, and the cost of cable, would in many instances preclude the supply from being profitable.

Again, as indicated in Clause 1, one may assume that the procedure must be gone through and the costs borne for each application to the Board.

One can imagine the comments of another Government Dept., namely, the Local Government Board, when a local authority applied for a loan and supplied the L.G.B. with the cost per service in detail, as they now require. Is it all necessary?

Clause 6 of the 1909 Act sets out clearly the procedure, and ties up the undertakers sufficiently. Why, then, should the Board of Trade put undertakers to any expense if the evidence asked for is supplied?

## PROCEEDINGS OF INSTITUTIONS.

### The "Electric Arc."

At a meeting of the INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION), in Edinburgh, on February 11th, Mr. W. B. Hird, of Glasgow, contributed a paper on the *Electric Arc*, an electrically-propelled ship equipped by Messrs. Mavor & Coulson, Ltd., Glasgow. Mr. Hird, who confined himself mainly to the features of electrical interest, said that since the question of electrical transmission had been considered from the point of view of covering the whole field, including power for fairly large ships, it became evident that continuous current was not suitable. The only objection to polyphase plant was that it did not lend itself readily to any change of speed. The best-known way to change the speed was to provide the motor with windings which would enable it to be run either as a six or eight-pole machine. Another plan was to have two motors and run them in cascade. These methods had both a certain amount of complication. Mr. Mavor employed the "spinner motor," in which the outside part of the induction motor was mounted so as to be capable of rotating. This was controlled by a second induction motor built on the outside, and provided with a different number of poles, so that while the first motor would run at 500 R.P.M. they could drive the inside one at 250 R.P.M. in the same or in the opposite direction, giving three different speeds. In ship installations the current could be supplied at two different periodicities, and motors could be provided with two windings, one for 20, and the other for 33½ periods per second, each still giving the same speed. It was considered highly desirable that the rotor should be, if possible, of the squirrel-cage type, and have no windings. The simplicity of this rotor commended itself in that it had no connections outside, no contacts and no windings to give trouble or go wrong. Another point was that the arrangement should always be such as to involve no running in parallel of two or more generators, because synchronising was considered to be too delicate an operation on board ship, where the propellers might suddenly have to be varied in speed in cases of emergency. Taking all these points into consideration, it was finally decided that an experiment on a small scale should be carried out with a system in which three-phase current should be generated at two different periodicities of supply, the motor being provided with two windings on different numbers of poles suitable for receiving the two periodicities, and the result was the *Electric Arc* boat built at Dumbarton by Messrs. MacLellan & Whitson. The boat was 50 ft. long with a 12-ft. beam, and the displacement was about 19 tons. The propeller had a diameter of 3 ft. 6 in. In a small installation of this sort only one engine was provided, although two would be required for a larger installation. Both periodicities were got from one alternator. In the case of a larger installation the different periodicities would be supplied by separate machines. The vessel was put on the Clyde early in 1911, and had given quite good results on the lines expected. It had enabled them to show that the combination of generating motor and switchgear was workable, and would allow a boat to be easily and effectively handled. It was evident, however, that even with the largest type of boats a combined efficiency of 95 or 96 per cent. could scarcely be hoped for, and, therefore, it was necessary to show that by increasing their turbine speed and reducing the propeller speed they gained in propeller efficiency more than the 8 or 9 per cent. which they must lose in electrical gear in order to work profitably.

### DISCUSSION.

PROF. BAILEY (Edinburgh) said the driving of ships seemed to lend itself very well to special speed contrivances, because one did not want to vary the speed of a ship as one varied the speed of a motor-car. But how would they go dead slow? Another question which he did not understand was with relation to reversing. In reversing, the motor was not so satisfactory as the steam engine, as that could run at a low speed with quite as large a torque. They would require a very much improved squirrel-cage motor, but in other respects, when they were going full speed ahead or at half speed, it seemed an ideal system.

MR. STEVENSON suggested that in an experiment of this kind, the spinner motor would have been well adapted to meet the conditions, though he thought the double frequency would have given better results, so far as the mechanical side was concerned. He quite appreciated the squirrel-cage motor for the smaller sizes, but when they came to bigger machines there seemed room for doubt.

MR. ROBERTSON (Greenock) referred to the difficulty of synchronising alternating machines on board ship. Some years ago, he was able to obtain some details of a scheme got up by a large firm of electrical engineers for the electrical propulsion of a cruiser, which had been submitted to the Government. The weight of the vessel was 22,000 tons, and the alternators were to be run at 3,000 volts, with change-over switches operated from the bridge, the captain's room, or the engine room. The scheme seemed very complete and

well thought out, but there was no provision for changing the speed of the motor. It was full speed in each case, which meant that an auxiliary set had to be provided for half speed for cruising. The additional weight would be about 60 per cent. of the whole of the electrical installation, and that put the matter out of court. His opinion was that if the problem was to be solved, its solution lay in the principle Mr. Hird had suggested—double frequencies to drive the motors, or the use of some type of spinner motor.

Mr. SAM MAJOR (Glasgow) said that the very high state of perfection to which the reciprocating steam engine had been brought made it difficult for any new method to gain a footing. Engineers should, however, bear in mind that generators for driving ships effected an enormous saving of weight on even that class of plant. He saw a scheme the other day for driving a yacht of 500 tons, and in comparing the electrical drive with the ordinary steam drive, there was a saving of 10 tons in weight—the steam plant weighing 100 tons and the electrical plant 90 tons. The centre of gravity was very much lower than in the case of a yacht with the usual top-hammer, and further, the increased area for the men in the mid portion of the ship was something like 9 or 10 ft. of her available accommodation.

In the course of his reply, Mr. HIRD stated that the voltage was 310 volts, variable to a small extent either way. Great stress had always been laid upon not having two alternators in parallel in cases of ship propulsion. The scheme they were considering did not prevent a combination of three alternators and three different motors, unless the motors were all of the multiple wound type. If they had a ship with three propellers, a whole range of combinations could be obtained. As to the suitability of the squirrel cage, he thought Prof. Bailey overestimated the power required to reverse the propeller. The experiments showed that in this case it did not take the full torque corresponding to full load to reverse the propeller. They had made experiments which had shown that the ordinary propeller, when asked to act as a turbine, had a bad efficiency, and that accounted for the fact that the propeller would reverse more rapidly than would appear at first sight. The question of size was a different one. It was a squirrel-cage rotor that they had on this boat, and it was well known that if the vessel was small the squirrel cage would do what they wanted. It was only on bigger sizes that it failed. He thought that in the case of ship propulsion there were some considerations which would lead them to hope that they might come to higher sizes of squirrel-cages, chiefly because of the fact that they had there an installation which was at their disposal simply for the purpose of driving a squirrel-cage motor and nothing else. To change speeds in a big ship by simply throwing over a switch, would of course, be impossible. The switch itself would not stand it.

## The Commercial Aspect of Electric Cooking and Heating.

By T. P. WILMSHURST, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Birmingham, February 26th, 1913.)

THE object of the present paper is to consider how far the use of electricity in the home is likely, in the near future, to supersede existing methods of cooking and heating.

The question of lighting may be considered settled. The author's experience for some years past has been that all new houses within reach of the mains, of a rental value as low as 7s. per week, are now wired as a matter of course for electric light, even though the initial cost may be £4 10s. per house, as against 30s. to 40s. for gas, as the owners now realise that houses fitted with electric light have a better letting value. The service cable should not be less than 7/18 s.w.g.

Probably more than half the revenue of a modern gas undertaking is derived from the cooking load, and the greatest cooking load in the smaller houses occurs on Sundays.

In London, in four years the number of gas cookers on the mains of the Gas Light and Coke Co. has increased from 312,865 to 475,853, and on those of the South Metropolitan Co. from 245,165 to 281,880. Manchester shows an increase from 36,214 to 53,730, Birmingham from 34,069 to 40,925, Derby from 11,819 to 17,500, Southampton from 16,834 to 21,473, and Coventry from 11,102 to 17,332. These magnificent results have been obtained by supplying an article which fairly well met the needs of the consumer at a low rental (usually 10 per cent. per annum), or free of all rental; by the innate advantages of availability and cleanliness; and by good business organisation, including intelligent canvassing and frequent popular demonstrations and lectures.

In a gas oven the joint of meat during the whole cooking operation reposes in an atmosphere consisting of the objectionable products of combustion of coal gas; and many consumers have, on taking up electric cooking, at once been struck with the vastly improved flavour of the meat. If it can be proved to the consumer's satisfaction that electric cooking is not more expensive than gas or coal-fire cooking, the battle will be won, as the innate advantages of the former are so considerable that progress is bound to be very rapid.

The author's first experience, about three years ago, was with a "lagged" or "black" oven made by one of the best firms in the country: the design, however, was crude, and the makers exhibited had not studied the housewife's problem at first hand.

At Olympia in September, 1911, several types were exhibited which showed a marked advance in design; but it is, in the author's view, largely due to the business foresight of one man, Mr. A. F. Berry, that substantial progress is now being made. Mr. Berry has for some time past organised a series of lectures and demonstrations in various towns, given by Mr. F. S. Grogan, in co-operation with

the local supply authorities; these practical demonstrations have done more to stimulate public interest than any amount of literature could have effected.

Prior to Mr. Grogan's visit only two cookers were connected to the Derby mains, and they were evidently regarded as luxuries, as the revenue from them was small and fitful. The Derby Corporation offered to lend a complete outfit to *bona fide* lighting consumers for a week's free trial, including temporary wiring, with the result that over 30 satisfied consumers were coupled up within two months; others have come on since, and several new houses are being completed in which cookers are arranged for.

The advantages of electric cooking are at once apparent to those who adopt it, the chief being:—

1. Absolute cleanliness.
2. Absolute certainty of results, owing to the voltage limit restrictions laid down by the Board of Trade. This is in marked contrast with the results obtained with gas cookers, owing to the wide fluctuations of gas pressure in practice, or with the results with coal ovens. With the "Tricity" system absolute evenness of temperature is attained by a simple arrangement of deflectors fixed under the top heater and over the bottom heater. With an electric cooker it is only necessary to weigh the joint and allow 15 to 20 minutes per pound, according to taste, and at the predetermined time the joint is taken out with the certainty that the meat will be cooked perfectly and without the door of the oven having once been opened.
3. A saving owing to the diminished loss of weight as compared with other methods.

This is the best money-saving argument, and although many convincing figures have been given both before the Institution and in the Press, a few further figures may not be out of place.

In the introduction to "Mrs. Beeton's Cookery Book" it is stated that with coal or gas-fired ovens the loss of weight in cooking beef or mutton is 25 per cent. to 33½ per cent., and with pork the loss is nearly 50 per cent. owing to the greater proportion of fat. With an electric cooker this is very much reduced. The following figures, some of which are taken from experience at Derby, relate to results with the "bright" oven, of which the "Tricity" is the best known type.

### FROM THE COAL RANGE.

	Raw.		Cooked.		Percentage loss.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	
Sirloin of beef ... ..	7	4	4	4	41·3
Ribs of beef... ..	5	7	3	12	31·0
Boned sirloin of beef ...	4	0	2	13	29·7
Half-leg of mutton ...	4	0	2	13	29·7
Leg of pork ... ..	10	14	6	9	39·6

Marmalade making:—18 lb. orange pulp and sugar gave 13½ lb. of marmalade, or a loss of 25 per cent.

### FROM THE GAS OVEN.

	Raw.		Cooked.		Percentage loss.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	
Ribs of beef... ..	9	14	7	14	19·0
Sirloin of beef ... ..	3	2	2	6	24·0
Leg of mutton ... ..	8	4	6	0	27·3

### FROM THE "TRICITY" COOKER.

	Raw.		Cooked.		Percentage loss.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.	
Ribs of beef... ..	10	14	9	13	9·8
Sirloin of beef ... ..	6	0	5	6	10·4
Ribs of beef... ..	5	3	4	13	7·2
Shoulder of mutton ...	4	14	4	5	11·5
Leg of mutton ... ..	9	1	7	10	15·8
Leg of pork ... ..	10	8	9	0	14·3
Sirloin of beef ... ..	5	2	4	8	12·2
Ham ... ..	10	0	9	7	5·6

Marmalade making:—17 lb. of orange pulp and sugar gave 14 lb. of marmalade, or a loss of 17 per cent.

A pork butcher in Derby cooks an average of 30 legs of pork per week, as well as pork pies, hocks, &c. For nearly six months this cooking has been done entirely on a "Tricity" double oven measuring 19 in. x 28 in. x 16 in. internally. This consumer assures me that the saving in meat is so great as far to outweigh the cost of current at 1d. per unit. And whereas the loss on his coal range was formerly 40 per cent., this is now reduced to an average of 20 to 25 per cent. The following table gives a few typical figures obtained from this consumer.

	Raw.		Cooked.		Percentage loss.	Cost of current in pence.
	lb. oz.	lb. oz.	lb. oz.	lb. oz.		
Legs of pork ... ..	12	12	9	12	23	13
	12	8	9	10		
	13	12	10	10		
Pork and hocks ... ..	11	0	8	4	25	10½
	12	12	8	8		
Legs of pork ... ..	10	8	8	3	21½	11
	10	8	8	3		

Taking the first and last results, which represent the output of the double oven, the saving in weight over the coal range amounts to 18 per cent., or 4½ lb. The cooked meat is sold at 1s. 2d. per lb.; therefore the net money saving on each two joints, after deducting the cost of current, is 3s. 10½d. and 4s. 0½d. This consumer also assures me that there is no comparison as regards the regularity of the results and the improved taste of the meat.

If the domestic consumer would take the trouble to keep a balance-sheet, setting the diminished but her's bills against the

cost of current, it could be proved every time to his own satisfaction that he was money in pocket at the end of the year.

A further obvious economy is the diminished consumption of coal in the kitchen. The annual consumption of coal in a house of, say, £50 rental is about 15 tons, of which at least 10 tons are used in the kitchen. In providing for warming the kitchen and providing hot water for baths, &c., probably not more than 4 tons are required, thus showing a saving of 6 tons, representing (at prices in the Midlands) £1 10s. per annum.

Users of electric cookers have soon discovered one grave defect, the absence of a quick-boiling kettle for small quantities of water. The ordinary consumer will not wait 10 minutes while the hotplate is warming up, and a further 7-10 minutes for the water to boil, when a kettle on a gas-ring can be boiled up in 10 minutes. To meet this difficulty a neat arrangement has recently been devised by Mr. Berry. A specially shaped kettle is used, into which can be inserted a cartridge element (fig. 1). The resistance strip is wound on a copper tube covered with a layer of pure mica. The connecting leads consisting of four strands of the element laid along the tubes in longitudinal grooves so as to prevent lumps. Over this strip is wound two layers of thin copper tape insulated from the winding by pure mica. A brass cap, fitting tightly on the tube and then opened out to slip over the tape, finishes one end; and at the other end is a brass terminal box, which carries the contact pins. When all the parts are assembled the whole apparatus is soldered up solid and watertight. A smaller tube is fixed down the centre of the main one into the plug closing the end carrying the terminal box, and has holes at the bottom end; the other end carries a small "umbrella." This arrangement allows the water to circulate inside, the "umbrella" preventing the overflowing stream from interfering with the cold water entering. The loading is 1,200 watts, and this can be assisted by standing the kettle on the hot-plate. With an initial temperature of 40° F. three pints of water can be boiled in six minutes with 2,000 watts, at an efficiency of over 98 per cent.

The author would suggest from his own experience the following points for the promotion of economy in the kitchen and for the satisfaction of the consumer:—

When cookers are first installed, fix for a few weeks an additional meter alongside of the cooker, and provide a card to show both the daily consumption and also the money saving on each joint of meat cooked. Provide a small red lamp or other indication that current is being used. For small houses use a 1s. or 6d. slot-meter, fixed near the cooker, and provided with an indicator which will show when the value has been expended. Follow up the first installation of the cooker by a visit from a lady expert to give advice and instruction.

The author's experience is that the consumers very soon find out how to get the best results from the cooker, so simple is it in operation.

The usual practice with gas undertakings is to let apparatus out on hire at 10 per cent. of the net cost of the outfit. This course has been adopted in Derby with electric cookers. The rentals charged are:—

For outfit, including "duplex" cooker, extension heater and oven ...	4s. 0d. per quarter.
Including grill and grease pan ...	4s. 3d. " "
Additional extension heater ...	1s. 4d. " "

The small utensils used with the hot plates are sold outright at prices approximately 10 per cent. above the net cost.

The consumption of energy, at any rate with the "bright" oven, usually amounts to 1 to 1½ units per person per day; the lower figure may be obtained by strict economy, and at 1d. per unit the author believes this will compete with gas at 2s. 6d. per thousand cubic feet.

With electricity at ½d. or ¼d. per unit, as is now charged in some towns, there is no question of the economy of electric cooking.

To some engineers, the warming of rooms offers an even more attractive problem than electric cooking, on the ground of the much lower selling and hiring prices of radiators; on the other hand, it must not be forgotten that they are very little required in summer, whereas the cooker is an all-the-year-round load, and is even more used in summer than in winter.

It is difficult to lay down definite rules for the amount of electrical energy required for warming rooms, as it depends on so many factors, such as the window area and the user's idea of fresh air. For proper ventilation it is necessary to change the air of a room three times an hour.

A good rule, based on hot water practice is —

$$\text{Kilowatt capacity} = \frac{(30A + 8B + 7C) 20 \cdot 4 \times l}{60 \times 60 \times 1,000}$$

Where A = number of square feet of window surface, B = number of square feet of wall surface, C = number of cubic feet of air in room; n = number of times air is changed per hour l = number of degrees F. the air has to be raised in temperature.

Thus in a room 30 ft. x 16 ft. x 10 ft., with three windows 3 ft. 6 in. x 6 ft., would require 2.5 kw. to raise the temperature 20°; and a room 16 ft. x 11 ft. x 10 ft. high with one window 5 ft. x 3 ft. 9 in. would require 1.3 kw. to raise the temperature 20°.

The electric radiator contains all the elements of success. It is clean, portable, cheerful and instantaneous. The present difficulties are the innate conservatism of the householder, the necessity for two sets of wiring where ordinary flat rates of charging are in force, and the running cost where the radiators are used for long hours at the ruling price of 1d. per unit.

It is unnecessary to point out the absurdly low efficiencies of coal and gas fires owing to the necessity of providing for the disposal of the products of combustion. In the aggregate, the smoke nuisance from domestic chimneys is far more serious than from factory chimneys, and if more attention were paid by the municipal authorities, as it should be, to the prevention of smoke from private houses, an enormous impetus would be given to electric heating.

Water heating is, financially, by far the most difficult problem to deal with. Comparing coal, gas and electricity on a calorific basis, the case for electricity appears to be hopeless, and its only salvation lies in the exceedingly high efficiency of the electric heater. Taking coal at 17s. per ton, and 13,000 B.T.H.U. per lb., gas at 2s. 6d. per 1,000 cb. ft. and 600 B.T.H.U. per cb. ft., and electricity at 1d. per unit and 3,455 B.T.H.U. per unit, a comparative statement is somewhat as follows:—

	B.T.H.U. obtainable for 1d., assuming 100% efficiency.	Efficiency in practice (say)	Useful B.T.H.U. obtained for 1d.
Coal ... ..	142,750	10%	14,275
Gas ... ..	20,000	50%	10,000
		(with geyser)	
Electricity ... ..	3,455	90%	3,109

The author has seen tests made by an independent and reliable authority in which an efficiency of over 97 per cent. has been gained with a Belling electric geyser.

The three most notable attempts to solve this problem are the Therol heater, the Belenus boiler and the Belling geyser.

In the first mentioned, the heating coil is embedded in a block of cast-iron, providing a large degree of thermal storage. The capacity of the coil varies from 50 watts to 900 watts in the large sizes, and the hot water at 110° F. varies from 5 gallons to 135 gallons per day. The apparatus is the essence of simplicity, and provides a demand of 100 per cent. load factor, obviously forming a most desirable load, even at an exceedingly low price for electrical energy.

An interesting installation of Therol heating in a private house in London may be mentioned. The household consists of seven persons, including two children. A 300-watt heater is installed with an auxiliary 1,000-watt unit, also a small 200-watt heater for the kitchen and scullery; there are three baths required per day, and of course, hot water continually for other purposes. This installation has replaced a gas circulation heater. After one year the consumer found a saving of 7½ per cent. in actual payments, as well as a saving in deterioration of decorations. The price paid for current, based on £4 per kilowatt installed plus ½d. per unit, came to about 0.65d. per unit.

The Belenus boiler consists of a column of cast-iron provided with deep corrugations along the bore in order that the surface in contact with the water may be as great as possible, and with a number of deep slots on the outer surface in which the elements are embedded. These elements are plain strips of inert material, wound with heavy gauge wire run at a low current density, and are insulated by pure mica from the column. There is at least ½ in. of cast-iron between the elements and the water. The boiler, when arranged as a circulation heater, is always full of water, and the elements can never attain a high temperature or burn out.

The boiler is installed in exactly the same manner as the old-fashioned saddle-back kitchen boilers, iron pipes being run from the top and bottom to the top and bottom respectively of the household hot-water tank. In old houses the electric boiler can be fitted in the riser to the tank, and employed to reinforce the kitchen boiler and to take its place in the summer. The boiler is provided with a steel case and air lagging around the column. A high efficiency is attained when sheet lagging is fitted over this and the pipes are lagged in the usual manner. The Belenus boiler can be installed in the kitchen, scullery, or any convenient out-of-the-way position; it can be fixed in series with the kitchen boiler and simply switched on when the fire is not in use.

The Belling geyser is somewhat similar in operation to the Belenus boiler, but it has in addition a control gear by which the electric switch and water supply handles are interlocked so that it is impossible to switch on the current before the water, or to turn off the water without first switching off the current. Independent tests show an efficiency as high as 98 per cent. The heavy loading of 10 kw. is, however, an objection.

Undoubtedly the cheapest solution of the problem, at the present time, would be to discard the kitchen fire altogether; to fix a coke stove of the "Ideal," or other type, for hot water purposes, and to

cook by electricity. A small "Ideal" boiler will supply 50 gallons of hot water per hour at, say, 120° F. for 30,000 B.T.H.U. per hour, or, say, 1d., a result not yet approached by any other method.

Supply engineers are now realising that the application of the Hopkinson system of charging in one form or another is a necessity for domestic supply, if heating and cooking by electricity are to make rapid headway.

The two best known modifications are the "Norwich" system and the "Telephone" system. In the former the initial charge is a percentage of the rateable value, plus a low charge for current. At Norwich the rate is 12½ per cent. of the rateable value, plus 1d. per unit for all current consumed. At Bradford the rate is 15 per cent., plus 1d. per unit, and at Sunderland 10-15 per cent., according to the size of house, plus 1d. per unit.

In the "Telephone" system the initial charge is based on the connected lighting load. In Marylebone the charge is based on 70 per cent. of the connected lighting load at £14 per kW., plus 1d. per unit.

A house on the Derby mains is rented at £18, and the rateable value is £40. The consumer, during 1912, paid for—

250 lighting units at 4½d., or	...	...	£4 13 9
2,100 heating units at 1d., or	...	...	8 15 0

Total ... .. £13 8 9

Average price, 1'37d. per unit.

Under the Norwich system at 15 per cent., plus 1d. per unit, he would pay:—

Initial charge...	...	...	£6 0 0
2,350 units at 1½d.	...	...	4 16 8

Total ... .. £10 16 8

and all additional units would be obtained for 1d. per unit, thus giving every encouragement to use more heating units.

From the preponderance of demand over lighting units in the above case it will be seen what enormous developments are possible, especially in towns which depend on lighting rather than power for their revenue. The preponderance may also be emphasised by a comparison of figs. 2 and 3, which are the lighting and the heating recorder charts for the house above mentioned.

FIG. 2.

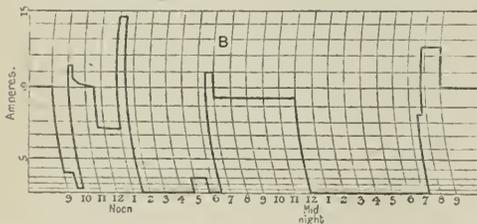
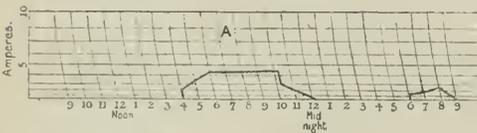


FIG. 3.

At Southampton, Mr. H. F. Street informs me that prior to 1910 only 20 radiators were in use. Since the institution of a flat rate of 1d. per unit, however, about 1,000 radiators have been connected, and more than half of these are of the 2-kw. type. At Luton, Mr. W. H. Cooke has sold about half a million units for heating during the last year at a low price. It is obvious, therefore, that once a satisfactory price can be adopted the load will follow, as a matter of course.

DISCUSSION.

MR. FRED. S. GROGAN (British Electric Transformer Co., Ltd.) said he congratulated Mr. Wilmsburst upon his paper dealing with practical results obtained from the "Tricity" cooker, especially as he had accepted the manufactured article instead of, as was often done in the very smallest supply stations, attempting to design his own cookers, and, with experimental work costing a few pounds, expecting to do what had cost the manufacturer thousands of pounds. He agreed with the author in having heavier service cables, and would go even further and specify 7/16 S.W.G. as a minimum. From the latest returns he found there were almost 3½ million gas cookers in use in the United Kingdom, so that a large field was waiting for the enterprising supply engineer. Undoubtedly excellent results had been obtained where good organisation existed and popular demonstrations were given. Having been the first to introduce these cooking lectures, he said that such a lecture must not consist of a dry cooking lesson, but must teach the audience how to apply their own cooking know-

ledge to the newer methods, and deal with the question of cost of operation in both the new and old methods, at the same time bringing out the advantages of electric cooking. The gas companies started by denying that a saving in shrinkage could be effected, but they were now producing figures showing that they could cook with the same saving in weight as with an electric oven. He had formed the opinion that the saving with the electric method was entirely due to their ability to alter quickly the temperature in the oven. The meat was first seared for a short period at a high temperature, and then cooking was continued at a much lower temperature. Such a saving could be effected in the older methods of cooking, but only with an infinite amount of care on the part of the cook, and continual attention to the oven during the cooking operation. That was why electric cooking would always win, because this saving could be effected without any attention on the part of the cook. The "Tricity" system would obtain such results with the minimum of trouble, because there was not a large mass of iron to be heated up in preparing the oven for cooking. It naturally followed that any oven employing large masses of iron must gradually accumulate a large quantity of heat, and the temperature in the oven could not, therefore, be rapidly lowered on account of the reserve heat in the casting, unless a great amount of care and watching was given in the cooking operation. As a proof of the ease of manipulation, he was visiting many towns during the year, and invariably cooked a joint of meat for the public to see for themselves the great saving. He did not take a number of joints and select a special one to show, but cooked only one joint, and always got the same result—a shrinkage of 10 per cent. With a cooking outfit supplied to a school at Eastbourne by his company, the results averaged over last term gave a consumption of just under ½ a unit per head per day. There were in all 100 people to cater for, and besides the ordinary daily meals for boys and staff, the adults were served with a full course dinner in the evening. Coming to the water heating, about 95,000 useful B.T.H.U. of heat were obtained for 1d. from the "Ideal" coke boiler. He asked them not to rush at doing everything electrically just because they were electrical men. The hot-water-supply-in-bulk problem was one which they should leave alone; both electricity and gas were beaten hopelessly on cost when compared with the coke stove. He preferred to have the independent hot water boiler connected in parallel not in series with the kitchen boiler. Where he had installed electric cooking, he had also put in many independent coke boilers, and they worked perfectly when coupled in parallel. The disadvantage of the series arrangement was that when the kitchen fire was not working the whole of the circulating hot water passed through the old boiler at the back of the kitchen range, and rapidly lost heat by its proximity to heavy masses of iron. He strongly advocated the charging of an annual fixed sum plus a low price per unit, for this would encourage those already connected with the supply mains to use more electricity for domestic purposes, and the supply engineer would rather increase his load on existing services, than extend by new connections. He noticed the excellent progress reported in Southampton, and would like to emphasise the fact that about 70 per cent. of the radiators were hired out by the Corporation; if the number placed in one large installation, where the radiators were bought, was omitted, the percentage of hired radiators was considerably increased, thus driving home again the condition pointed out by the author as being necessary for success, viz., hiring apparatus at a low rental.

MR. W. PENNELL said he was convinced that two things were necessary before it was advisable to push electric cooking. A suitable tariff, and an electric oven at £4. He had at Wednesbury the Norwich system for private consumers—10 per cent. of the annual rateable value plus 1d. per unit in winter and 1d. per unit in summer. Having provided the proper tariff, he was now waiting for the manufacturer to come along with the oven; when he saw the oven, he would push electric cooking. It was useless to offer an oven for hire at £1 per quarter (and that was necessary with the £12 to £15 outfit), while the gas authorities offered the equivalent at 3s. 6d. Water boiling by electricity was uneconomical, and to combine this with the oven was sure to cause the whole apparatus to be rejected, in an industrial district. He had had two years' home experience of electric cooking, with both the types of oven described: both cooked splendidly, and they did not know what good cooking was until they had the electric oven. They would not change back to coal or gas. The hot-plate portions were not used (he could not face the bill), so they conducted all the boiling operations on the top of the old gas range. He was, therefore, speaking from experience when he said, "Push the oven, and leave the boiling for the gas people." Hot water jugs, afternoon tea kettles, toasters, &c., for use on the table were very successful, because large quantities of heat were not required. They added a little to the revenue, and greatly to the reputation of the electricity supply. Regarding the percentage losses in weight (gravely carried to different points), he thought it unwise to make too much of the point, because it was easy for the other side to retort that this much-vaunted saving in "meat" was only a saving in water, which was not worth anything unless they were going to sell again by weight. It would be better, therefore, to keep on safe ground by maintaining that cooking in an electric oven was very simple, and reasonable in cost, and that the result was a cooked article, whether meat or pastry, which was far superior to that produced in coal or gas ovens.

MR. N. B. ROSHER gave some particulars of a proposed electrical cooking installation for the office staff of some works, numbering 20 persons. Relying upon the published figures as to saving in cost with electric cooking due to less shrinkage of meat, it was

estimated that this system would pay handsomely, but an experiment carried out to ascertain the relative cost of cooking by gas and electricity resulted in favour of the former. It was only fair to state that the same cook cooked both joints, but that whereas she was experienced with the gas cooker, she had never before used an electric oven.

MR. W. C. S. PHILLIPS suggested that the difference in results obtained by means of the "Tricity" cooker and the gas oven might be due to the difference in mechanical construction of the two ovens. The electric cooker was practically a closed box.

MR. MORRISON said that the results obtained with "black" or lagged ovens were of the same order as those obtained with "bright" ovens.

#### Institution of Electrical Engineers (Manchester Section).

The annual dinner of the Manchester Section of the I.E.E. was held in the Midland Hotel, Manchester, on Friday last. In the absence of the chairman (Mr. A. A. Day), Prof. E. W. Marchant presided. There were present 181 members and friends, including the Lord Mayor of Manchester, the President of the Institution of Electrical Engineers (Mr. W. Duddell), Profs. Rutherford and Petavel (Manchester University), Dr. Rosenberg, Mr. S. Z. de Ferranti, Messrs. S. L. Pearce, C. D. Taite, J. E. Kingsbury, W. Cramp, W. C. Mountain, J. Frith, hon. sec., and A. L. Green (assist. sec.).

After the loyal toasts had been duly honoured, Mr. S. Z. DE FERRANTI proposed "The Corporations of Manchester and Salford." He said a great change had come over the electrical industry. At one time manufacturers viewed each other with a very great amount of suspicion, but recently this was changed, and there was now a tendency to a certain amount of co-operation between manufacturers which would help both the latter and the public generally. A good deal of preference had been shown to municipal authorities in the Electric Lighting Acts. Some people considered it desirable for public bodies to go in for trading; on the other hand, there was the opinion that only private business firms should trade. He believed that the best method of carrying on the supply of electricity was by a combination of the local authorities and private companies. In the United States, powers were granted to public companies to provide lighting and power supplies over large areas on the basis that when the money subscribed by the shareholders had earned a fair rate of interest, the surplus should be divided between the municipality and the shareholders. In this country we were, generally speaking, suffering from too high prices. An enormous development would take place if only people would take more risk by supplying at a lower rate. Risk, however, was not the sort of thing a public body should undertake to any great extent. He had given a good deal of thought to the subject, and had come to the conclusion that the best way of giving a cheap and efficient supply was by the co-operation of the private company and the municipal authority—a co-operation which would have the stability of the municipality and the business keenness of the private company.

The LORD MAYOR, in replying, said electricity supply was in itself of the nature of a monopoly. They could not have half-a-dozen companies competing in the streets of Manchester. Whether they adopted the American or the German system, it was only a half-way solution. Manchester, it would be admitted, supplied electricity at as cheap a rate as most of the towns in the country, and at a cheaper rate than other towns which had not special advantages in this way. He was not one of those who believed that the trading departments of a Corporation should make handsome profits in aid of rates. After those departments had paid interest and sinking-fund charges, and, say, 1 per cent. or 1½ per cent. for the risk—if there was any risk—the remainder should go to the reduction of prices, and if there was any good in electricity, the low price would stimulate the demand. He was of the opinion that Mr. Ferranti was on the wrong line, and that, in the long run, those things that were in the interests of the people must be worked by municipalities or the State for the benefit of the people.

PROF. RUTHERFORD proposed "The I.E.E.," to which the PRESIDENT and PROF. MARCHANT replied. In the course of his remarks Mr. Duddell said that the Council of the Institution had decided to do some research work in connection with the properties of materials used in electrical engineering. In London there was to be found one of the finest libraries of electrical literature in the world. The Council were also forming a lending library, so that provincial members could consult a book without the expense and inconvenience of visiting London for that purpose. He wished that there should be no misunderstanding on the question of the proposed examinations. They were to be of such a character that any man who knew his work well could pass them without any cramming.

PROF. MARCHANT, in replying to the toast, spoke of the large amount of electrical engineering work done, and power supplied and used in and around Manchester and Liverpool. The Manchester Section possessed great opportunities for discussing all matters relating to electrical engineering, and it would be the aim of the Committee to foster in every possible way the interest of the members in the work of the Section, by providing papers of the widest range, which would give those engaged in the profession in the district the opportunity of supplying practical information on the branches of work on which they might be engaged. He hoped that in the future as in the past, the papers and discussions in Manchester might become known for the breadth of their scope, and for the practical value of their matter.

MR. W. CRAMP gave "The Visitors," to which Mr. E. W. LANGDON responded.

#### A 60,000-VOLT UNDERGROUND CABLE INSTALLATION.

In a paper read before the Elektrotechnischer Verein, Dr. Leon Lichtenstein\* gives some interesting particulars of what is probably the first 60,000-volt a.c. underground cable to be laid. The installation is one for supplying single-phase power to the Dessau-Bitterfeld railway, from the central station at Muldenstein. The transmission distance is at present only 4.3 km. (2.7 miles), but this extra-high pressure was selected partly to meet the requirements of future extensions, and partly for the sake of obtaining experimental data. The cable described was made by the Siemens-Schuckert Co., and forms one of three sets of feeders connecting the same points, another of them being a similar cable supplied by the Felten & Guillaume Co., and the third an ordinary overhead system. The cables came into full operation at 60,000 volts and 16½ cycles per sec. in April, 1911, and have been successfully operated (at comparatively light load) ever since, the two makes of cable being generally used alternately for a week at a time each.

The central station contains a turbo-generator of 4,100 K.V.A., at 3,300 volts, 1,000 r.p.m., and some smaller machines, and eventually four more similar turbo sets are to be added. The energy from each turbo set is transformed to 60,000 volts, in two 2,000-K.V.A. transformers, and at the far end the voltage is reduced in similar transformers to 10,000 volts, which is supplied direct to the overhead line of the railway. The middle point of the 60,000-volt system is earthed at the station through a high resistance, so that the voltage of each cable to earth is limited to 30,000 volts. Every provision against high voltage rises has been made, but no particulars of the arrangement are given.

It was decided to employ two single-core cables in preference to a two-core cable, as the experimental data available for the latter type were less complete. In order to avoid undue losses in the cable sheathing no iron armouring is used.

The cable core is of stranded aluminium, and has a section of 100 sq. mm. (1.57 sq. in.). This is covered with a radial thickness of 13 mm. of impregnated paper, as shown in fig. 1, p. 414. Outside the lead covering there is a layer of jute, and this is coated with asphalt and chalk.

The permissible load of the cable is about 240 amperes for a maximum temperature rise of 25° C., so that the full-load output of the cable is 14,400 K.V.A. At 240 amperes the ohmic drop is about 150 volts per km. run, and the inductance drop about 35 volts per km. run, so that the net voltage difference between the two ends of the transmission works out at about 650 volts, or 1.1 per cent., with a power factor of .9.

If a copper conductor had been used of equivalent carrying capacity, its section would have had to be about 57 sq. mm, with a radius  $r = 4.75$  mm. With the same radial thickness of insulation ( $\delta = 13$  mm.), this would mean a maximum number of volts per mm. near the surface of the wire of—

$$\frac{\text{volts to earth}}{r \log_e (r + \delta/r)} = \frac{30,000}{4.75 \log_e 17.75/4.75} = 4,790.$$

whilst with the actual aluminium cable the maximum volts per mm. work out at—

$$\frac{30,000}{6.5 \log_e 19.5/6.5} = 4,200,$$

or some 14 per cent. less. To give the copper cable the same maximum stress, the paper would have had to be increased to 16.7 mm. radial thickness, making the overall diameter inside the lead 42.9 mm. in place of 39 mm. The use of aluminium in this case was, therefore, considered to be fully justified.

The cable was manufactured in lengths of 750 m., so that, in all, 10 joints were required on the system besides the four special end-connection pieces.

The junctions were insulated with impregnated paper by hand, whilst the cable ends were similarly treated and

\* E.T.Z., January 2nd, 1913.

then encased in special porcelain covers, to exclude the air. No special difficulties were experienced in this direction, as the single-core cable lent itself much more readily to treatment than would a multi-core cable.

The laying of the cable along the railway line commenced in the middle of October, 1910, and was completed in the middle of December. The two cables are laid side by side in split earthenware troughs filled with sand, in a single trench 8 m. deep, as shown in fig. 2. Where the cable had to be laid over the railway bridges, it was placed in wooden troughs. The sections of both troughs are shown in figs. 3 and 4. The laying was carried out under somewhat difficult weather conditions, the mean temperature being only about 5° C., whilst the joints were made with an air temperature of -2° C. to -5° C., and so had to be surrounded by artificially-heated tents during the process.

Measurements made in the factory before laying, and at a temperature of 15° C., showed an insulation resistance of 3,000 megohms per km., a conductor resistance of 275 ohm per km., and a capacity to lead of 169 microfarad per km. The latter figure enables the mean value of the specific

!—Although this cable is normally intended to work at 30,000 volts to earth, it is possible, under certain circumstances, to have one cable working at 60,000 volts to earth if a short-circuit to earth occurs on the other. This increased voltage would, of course, not damage the cable instantly, but in order to prevent its continuing for any length of time, an automatic indicating device is provided at the station to draw attention to any earthing of either pole.

Special earthing rods are also provided both at the central station and at the sub-station, which connect the cable to earth through a resistance when it is disconnected from the bus-bars. In this way, any danger from residual charge on the cable is avoided. The cable has been in regular use, although only at the small current of 10 amperes, for alternate weeks and about 20 hours a day, since April, 1911, and only one serious accident has occurred. On this occasion (in July, 1912) a h.t. transformer in the main station and the cable itself were both found to have broken down. Very careful tests, and examination of the cable since, show that nothing in the shape of ageing can have been the cause of

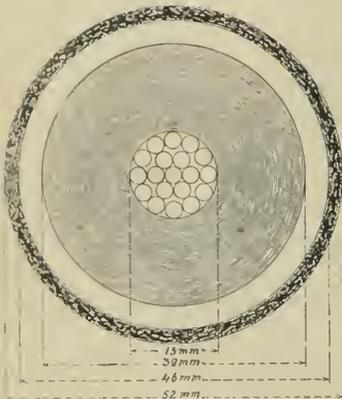


FIG. 1.

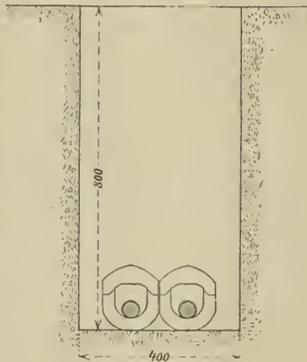
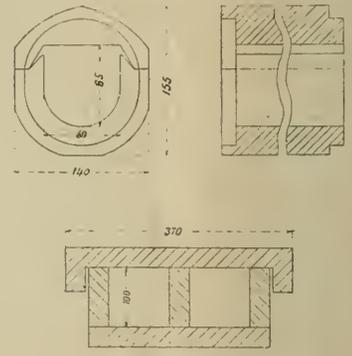


FIG. 2.



FIGS. 3 AND 4.

inductive capacity or dielectric constant  $\kappa$  of the insulation material to be estimated:—

$$\text{Capacity in microfarads per km.} = \frac{\kappa}{2 \log_e (r + \delta) r} \times \frac{1}{9},$$

from which

$$\kappa = 3.35.$$

After laying, the values were again measured, and showed the following results:—8,620 megohms per km., 265 ohm per km., and 1705 microfarad per km. The differences are accounted for by the fact that the temperature was lower (being about 4° C. in place of 15° C.), and serve to indicate that no damage can have been done to the cable during laying, in spite of the fact that it was unarmoured. When these three constants were again measured at the end of 1911, they still showed the same values. The cable was further tested with 50,000 volts to earth (corresponding to a line-to-line voltage of 100,000).

Such a test was only possible in this case, because it was permissible to earth one pole of the transformers temporarily, and because the length of line and the frequency were both moderate. Even so the charging current taken would be about  $2\pi \times 16\frac{2}{3} \times 50,000 \times 17 \times 4.3 \times 10^{-6} = 3.83$  amperes, corresponding to an apparent power of 190 k.v.a.

The writer points out the difficulty that would be met with in testing a longer line, and at a more usual frequency, such as 50 cycles. Even supposing that compensating choking coils are inserted to reduce the k.v.a. taken from the supply, the size of these choking coils would introduce fresh difficulties. He suggests that possibly some such device as the high-tens on rectifying commutator described before the Turin Electrotechnical Congress in 1911, by Herr Delon, might be employed to test such cables after laying, with h.t. direct current, but before this can safely be done further experiments as to the relative effects of a.c. and d.c. high voltages must be carried out.

the trouble, as neither the break-down voltage nor the electrical constants had altered appreciably, whilst the appearance of the paper, &c., was quite unchanged. Since repairing the fault the cable has again been in use for some months without any trouble, so that the accident must be put down to some outside undiscovered cause.

A point of some importance in connection with h.t. cables is the question of dielectric hysteresis loss. Under normal working conditions this should amount to a very small value, and in this case it was, in fact, too small to measure directly with the available apparatus. The loss to be expected can, however, be approximately estimated by reference to Höchstädter's tests made in 1910\* on cables of similar manufacture. The writer has done this, and finds that the loss for the whole line (4.3 km. run) at 30,000 volts to earth, and 16 $\frac{2}{3}$  cycles, should only amount to about 2 kw. This is only about 1.45 per cent. of the full-load C<sup>2</sup>R loss in the line, and should produce about 1.45 per cent. of the temperature rise at full load. The full load temperature rise is estimated to be 25° C., so that a rise of only about 36° C. might be expected, due to the dielectric hysteresis loss alone. A 20-hour no-load temperature test was made on the cable in October, 1911, and the temperature rise was estimated from careful measurement of the copper resistance. This rise proved to be of the same order as that estimated, thus showing that no serious dielectric loss or eddy-current loss in the lead covering could be taking place.

**Truro Electric Lighting.**—The electricity question has this week been the subject of an inquiry at the B. of T. offices in London, when the claims of the T.C. and the Gas Company for a prov. order were considered.

\* E.T.Z., 1910, page 355.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Siemens Radiator Flexible.

The illustration, fig. 1, shows a specially designed wire, which MESSRS. SIEMENS BROS. & CO., LTD., Woolwich, are supplying for use with all kinds of heating apparatus, such as radiators and irons; it is also suitable for portable hand lamps in garages and other places. It contains two rubber-insulated flexible conductors of fine tinned copper wires, and can be provided, when necessary, with an earthing wire to meet the Home Office Regulations for workshops. The wire is supplied with either a polished cotton braid finish or a flexible metallic covering, the latter being recommended where the wire is likely to be subjected to severe mechanical use. In either case, a special feature of the wire is the provision of a wrapping of metallic foil immediately beneath the cotton braid which protects the rubber insulation from grease, oil and other injurious substances. It is desirable that the surface of any metallic protective covering employed for this class of wire should be perfectly smooth, so that it can be handled without any possibility of the slightest injury being caused to the user, such, for instance, as would result from the sharp points of broken wires of a metallic braiding. It will be seen from the illustration that this condition is fulfilled by covering the wire with a spiral wrapping of segmental aluminium or brass, the rounded outer surface of



FIG. 1.—SIEMENS RADIATOR FLEXIBLE.

which gives the finished wire a very neat appearance. The finished product possesses the required degree of flexibility without being springy.

### The "Klipton" Lamp.

MESSRS. ROSE BROS., of 38-39, Beech Street, Barbican, E.C., have recently added to their "Klipton" specialities an improved large size lamp for use with current from the mains—the original "Klipton" being a pocket lamp for use with dry batteries.

The new fitting, shown in fig. 2, is, of course, of more substantial build than the earlier one, and is finished in lacquered brass with a strong clip and hand-made ball-and-socket movement, a reflector, 3 yd. of flexible, and an adapter or plug, as desired, for coupling to the main supply. Like its predecessor, it is a most convenient accessory, which can be clipped on to any ledge and adjusted to give light where wanted, or if clipped on to a ruler or book, will take the place of a standard lamp on a table. It appears to be a particularly useful adjunct for shop window lighting.

### Tailoring Irons.

The introduction of the electric iron into tailoring shops will confer great benefits upon the employés, but the heavy duty required of the iron calls for a device much more highly developed than the ordinary laundry electric iron. To meet this need, the GENERAL ELECTRIC CO., LTD., has produced the "Magnet" tailoring

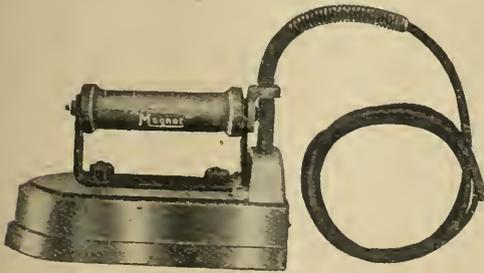


FIG. 3.—MAGNET TAILORING IRON.

iron, which is illustrated herewith; this is made in weights varying from 12 to 25 lb., the former size being adapted for dressmakers' use and the latter for heavy tailoring work. Special attention has been given to the flexible connection, the weak spot of the electric iron; the cord is very strong, and is heavily insulated with rubber covered with a thick layer of asbestos and heavy cotton braiding over all. Connection with the heating element is made in a substantial box, to which a strong spring is attached, supporting and protecting the flexible for a length of about 9 inches. The heating element consists of a narrow metal ribbon of special alloy, and is readily replaceable. Ample heat is provided, and the design provides for reliability and efficient working.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS

AUSTRALIA.—The Commonwealth Customs authorities have issued the following decisions as to the duties to be levied on certain imported goods:—

Etching machine: motor, blower and switchboard	20 % ad val.
Ruberoid or ruberine cement	... (classification to be decided on analysis)
Surgical and dental instruments: "Multostat," including the motor, which is an integral part	... .. free
Electric motor-wagons:	
Body	... .. £36 each
Chassis	... .. free
Vulcanising equipment	... .. 25 % ad val.



FIG. 2.—NEW "KLIPTON" LAMP.

NOTE.—The duties given above are in all cases those levied under the Preferential Tariff applicable to goods of British origin.

BRAZIL.—The Brazilian Budget Law provides that clearance of goods for consumption in Brazil will not be permitted without presentation by the consignee of the original Consular invoice, unless the consignee enters into an engagement to produce the document within a period of 90 days. This period may not be extended, and if the invoice is not forthcoming on its completion, the consignee will be liable to a fine of 50 per cent. of the total amount of duties and other charges leviable in respect of the goods.

The Brazilian Budget Law provides that goods which have undergone transhipment in foreign ports shall not be cleared through Customs Houses of the Republic unless they are accompanied by a transit certificate issued by the Consular agent at the port of transhipment.

BOLIVIA.—A Commission has been appointed to revise the existing tariff of import duties. The Commission is to communicate with all Chambers of Commerce in Bolivia inviting suggestions for the modification of the tariff, and is to submit a new draft tariff in August next. If the new tariff is approved, it will come into force on January 1st next.

MEXICO.—The Board of Trade are informed that the Bill for the revision of the Mexican tariff, referred to in these columns some few weeks ago, has been postponed until the ordinary session of Congress, which opens on April 1st next.

A decree has been issued increasing the rates of duty under the Mexican tariff by 10 per cent. from February 16th. This 10 per cent. includes the 5 per cent. increase imposed on goods imported from September 1st, so that the net effect is to increase the rates by a further 5 per cent. only.

**Eccles Electricity Supply.**—The Public Lighting and Electricity Supply Committee of the Corporation has considered a report of the Manchester Steam Users' Association upon No. 1 boiler. The engineer recommended the provision and fixing of a new boiler, at an estimated cost of £360, allowing for the sale of the present boiler, estimated to last 10 years, at a cost for repair of £165, and the Committee adopted the recommendation and decided to invite tenders.

**NEW PATENTS APPLIED FOR, 1913.**

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 8,976. "Mechanical shutters for operating box in picture halls that can be closed quickly with electricity from one or more places in the hall or box in case of fire." F. BRADSHAW. February 17th.
- 8,987. "Electric lighting switches for automobiles." M. S. CONNER. February 17th.
- 8,988. "Non-conductor connection." T. E. ORANGE. February 17th.
- 4,008. "Electric apparatus for heating or boiling liquids." M. RAILING and C. H. ARCHER. February 17th.
- 4,034. "Process for the manufacture of filaments for electric glow lamps." A. JOST. (Convention date, March 11th, 1912, Germany.) February 17th. (Complete.)
- 4,071. "Telephony." D. S. HULFISH. February 17th. (Complete.)
- 4,090. "Process for manufacturing electric transformers of small power." VEDOVELLI, PRIESTLEY & Co. (Convention date, February 24th, 1912, France.)
- 4,091. "Method of and means for winding coils." (Convention date, January 10th, 1912. Divided application on 91 of January 1, 1913.)
- 4,093. "Electric motor-controlling devices." BRITISH THOMSON-HOUSTON Co., LTD., and H. E. BRITTON. February 17th. (Complete.)
- 4,106. "Ignition lead cases for motor vehicles and wagons." CLAYTON and Co. (Huddersfield), LTD., and A. BROOBS. February 15th.
- 4,117. "Means for attaching shades to electric and other lamp fittings." W. S. ROSS. February 18th.
- 4,131. "Rheostat." T. RHODS. February 18th. (Complete.)
- 4,164. "Order telegraphs." A. H. POLLEN and H. ISHERWOOD. February 18th.
- 4,197. "Electro-magnetically operated diaphragms for producing sound." E. A. GRAHAM. February 18th. (Complete.)
- 4,225. "Device for holding a coil or coils of insulated or other wire which is being used in the installing of electric lighting, bell and telephone, and like systems." H. W. BROTHERTON. February 19th.
- 4,230. "Electric switches." L. RASCH. February 19th.
- 4,239. "Device for assisting in setting or timing the ignition and valves of internal-combustion engines." W. H. LEXER and A. J. K. WILESMIRE. February 19th.
- 4,256. "Electrical signalling apparatus for lifts and the like." G. A. LONDON. February 19th.
- 4,297. "Electric mercury switches." T. GUMER. February 19th. (Complete.)
- 4,344. "Telephone silent-speaking apparatus." F. HODSON. February 20th.
- 4,345. "Insulated rail-joint for track circuit railway signalling." R. C. S. WOODS. February 20th.
- 4,349. "Holders for testing motor sparking plugs." W. T. LORD. February 20th.
- 4,355. "Electric ozone generators." C. W. DENNY. February 20th.
- 4,391. "Spark-plugs." F. R. BLAKE. February 20th. (Complete.)
- 4,383. "Electric contacts." E. M. WILKEY. February 20th.
- 4,386. "Intercommunication telephone systems." STERLING TELEPHONE and ELECTRIC Co., LTD., and F. G. BELL. February 20th.
- 4,397. "Lighting fixtures." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) February 20th.
- 4,398. "Protective devices for electric distribution systems." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) February 20th.
- 4,401. "Dynamo-electric machines." C. SCHLICK. February 20th. (Complete.)
- 4,405. "Electric typewriter." R. IMPE. (Convention date, February 27th, 1912, Austria.) February 20th. (Complete.)
- 4,406. "Electric train lighting." G. W. MACARTNEY. February 21st.
- 4,425. "Signalling apparatus on transcars and the like." R. HEATON. February 21st.
- 4,462. "Incandescent electric lamps." A. A. BARRON. February 21st.
- 4,472. "Electrically prepayment meters." BRITISH INSULATED and HELSBY CABLES, LTD., and L. B. WILSON. February 21st.
- 4,470. "Electrically-heated cooking and like utensils." J. MANN. February 21st. (Complete.)
- 4,490. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING Co., LTD. (Automatic Electric Co., United States.) February 21st. (Complete.)
- 4,502. "Telephone attachments." N. MAXX. February 21st.
- 4,507. "Starting switches and the like for alternating-current induction motors." SIEMENS BROS. DYNAMO WORKS, LTD., and C. RODGERS. February 21st.
- 4,508. "Ignition systems." C. F. KETTERING. (Convention date, March 4th, 1912, United States.) February 21st. (Complete.)
- 4,514. "Aerial conductors for use in wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH Co., LTD., and C. S. FRANKLIN. February 21st.
- 4,528. "Telephonic apparatus." H. W. SULLIVAN and C. E. HAY. February 22nd.
- 4,543. "Electrically-driven secondary clocks." H. HAYCOCK and T. SANDYSON. February 22nd.
- 4,548. "Sparking plugs for internal combustion engines." W. DOUGLAS (trading as Douglas Bros.) February 22nd.
- 4,573. "Electrical instruments." P. W. SCHOLEFIELD and FERRANTI, LTD. February 22nd.
- 4,584. "Selective electric signalling." H. H. HARRISON and C. M. JACOBS. February 22nd.
- 4,591. "Automatic electrical switches." ELECTRIC SIGN Co., LTD., and W. K. L. DICKSON. February 22nd. (Complete.)
- 4,595. "Magnetic separator." F. KAUFF AKT.-GES. GROSSWERE. (Convention date, March 15th, 1912, Germany.) February 22nd. (Complete.)

**PUBLISHED SPECIFICATIONS.**

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

- ELECTROMOTIVE MACHINER FOR THE PRODUCTION OF ALTERNATING CURRENT. W. PETERSEN. 2,442. January 30th.
- ELECTRIC INCANDESCENT LAMPS. British Thomson Houston Co. (General Electric Co.) 2,468. January 30th.
- ELECTRIC AIDING DEVICE FOR MEASURING INSTRUMENTS. S. WORLICZKA and M. BLUZAR. 2,517. January 31st.

- MEANS FOR, AND METHODS OF, CHARGING AND DISCHARGING ELECTRIC ACCUMULATORS OR SECONDARY BATTERIES. A. M. TAYLOR. 2,680. February 1st. (Cognate application, No. 12,834 of 1912.)
- AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE CIRCUITS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 2,671. February 1st.
- AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE CIRCUITS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 2,672. February 1st. (Addition to No. 2,820 of 1912.)
- SELF-EXCITED DIRECT-CURRENT DYNAMO-ELECTRIC MACHINERY. Akt.-Ges. BROWN, BOVERI & Cie. 2,734. February 2nd. (February 24th, 1911.)
- AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE CIRCUITS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 2,743. February 2nd. (Addition to No. 2,820 of 1912.)
- STARTING GEAR FOR INTERNAL-COMBUSTION ENGINES AND OTHER PRIME MOVERS. H. LEITNER. 2,746. February 2nd.
- INCANDESCENT ELECTRIC LAMPS. A. W. BEUTTELL and J. A. MANDERS-SMITH. 3,093. February 7th.
- ELECTRIC ARC LAMP. Crompton & Co. and C. Crompton. 3,397. February 10th.
- ELECTRICITY METERS. S. Z. de FERRANTI. 3,412. February 10th.
- APPARATUS FOR PROVIDING ELECTRIC LIGHT ON MOTOR ROAD VEHICLES. T. CLARKSON and W. J. MORISON. 4,716. February 26th.
- ELECTRIC INCANDESCENT LAMPS. C. F. STILLMAN. 4,783. February 26th.
- COUPLING-UP OF CONDUITS AND FITTINGS FOR ELECTRICAL WIRING PURPOSES. F. L. YATES. 6,146. March 1st.
- SAFETY APPARATUS FOR ELECTRICALLY-PROPELLED TRAINS. Siemens Bros. Dynamo Works, Ltd., and F. LYDALL. 6,222. March 20th.
- ELECTRO-MECHANICAL TRANSMISSION SYSTEMS FOR VEHICLES. H. PIEPER. 7,133. March 23rd. (April 29th, 1911.)
- SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. M. RIESZ. 8,206. April 4th. (April 5th, 1911.)
- MANUFACTURE BY ELECTROLYSIS OF SHEET-IRON. G. TISCHENKO. 8,608. April 12th.
- ELECTRIC COAR-LIGHTERS. L. T. DIXON. 8,677. April 12th.
- MANUFACTURE OF FOOT STEP OR INSULATOR BRACKET FOR TELEGRAPH AND LIKE POLES. H. LENCH. 10,600. May 4th. (Cognate application, No. 17,458 of 1912.)
- PROCESSES OF REPAIRING ELECTRIC INCANDESCENT LAMPS. M. DU MOULIN. 12,784. May 30th.
- ELECTRO-MECHANICAL PROPULSION SYSTEMS FOR TRAINS. H. PIEPER. 13,238. June 5th. (June 27th, 1911.)
- SELF-CONTAINED KEY PANEL FOR SEMI-AUTOMATIC TELEPHONE EXCHANGES. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 13,415. June 7th.
- ELECTRO-MECHANICAL ELECTRODES. Siemens & Halske Akt.-Ges. 13,416. June 7th. (August 29th, 1911.)
- ELECTRODES FOR ARC LAMPS. British Thomson-Houston Co. (General Electric Co.) 13,488. June 15th.
- METHODS OF DRAWING FINE WIRES OF REFRACTORY METALS. K. FARKAS. 14,664. June 2nd. (June 23rd, 1911.)
- COMBINED ELECTRIC SWITCHES AND PLUGS. A. H. RAILING and C. C. GARRARD. 14,785. June 25th.
- PROCESS FOR THE MANUFACTURE OF IRON ALLOYS FOR DYNAMO-ELECTRIC PURPOSES. W. RUBEL. 15,532. July 3rd. (July 11th, 1911. Addition to No. 12,483 of 1911.)
- SWITCHES FOR ELECTRIC WIRING SYSTEMS. L. MILNE. 16,065. July 9th.
- BRACKETS OR PENDANTS FOR GAS, ELECTRIC AND OTHER LIGHTING PURPOSES. H. PERRY. 16,119. July 10th.
- ELECTRICALLY HEATED HOT-AIR DOUCHES. A. SCHAEFFER. 20,191. September 4th. (December 23rd, 1911.)
- ELECTRIC FERRACES FOR PROMOTING GAS REACTIONS. H. PAULING. 21,478. September 20th. (October 24th, 1911.)
- PORTABLE ELECTRICALLY-DRIVEN CENTRIFUGAL FANS. S. C. DAVIDSON. 22,049. September 27th.

**Radiator Lampholders.**—In the course of a very long letter, received too late for use last week, Mr. G. St. John Day, of Oldham, says:—"Experience has proved that a screw lampholder is far from satisfying the requirements of the application. The troubles are not confined to the lampholders, but relate also to the lamps and the design of the radiator. Each individual part has its failings, and when fitted together the whole appliance has faults, and these individual and collective faults vary in degree with makers, contractors and users.

The foregoing remarks are equally applicable to other types of lampholders such as B.C., two-pin and central contact lampholders. The cleaner, larger, and firmer are contacts, joints, &c., the better; the best conditions then prevail and yield the best results. There is a vast field of opportunity for a better state of electrical accessories in many ways. Does the design of electrical accessories compare favourably with the design of steam, water and gas accessories?

Some of the correspondents have mentioned the Mumps lampholder as a solution of the matter. As the designer and patentee of the Mumps lampholder I simply state a few facts:—

A. A current of 10 amperes at 440 volts has been passed through a Mumps holder and plug in connection for 18 hours continuously without heating or breaking down of insulation.

B. The insulation of the Mumps holder is unique and extra strong.

C. The adjustable range of contact is not only new, but most desirable and effective.

D. Life of lamps increased.

E. More light for same watts.

F. Maintenance costs reduced.

G. Hard and spring contact at one and the same time.

H. Complete security and rigidity of both mechanical and electrical joints unaffected by vibration.

**An Everlasting "Auriga" Lamp.**—In a letter recently received by the BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING Co., LTD., the writer says: "You will be interested to know that one of the "Auriga" metal-filament lamps, 50 C.P., 220 volts, which we bought from you in February, 1910, is still burning, and has been in use continually since that date, averaging at least 18 hours per day for the three years, thus burning practically 20,000 hours. The filament is quite intact—not having been 'joined across.'"

This is the highest record that has yet come to our notice.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

MARCH 14, 1913.

No. 1,812.

## ELECTRICAL REVIEW.

## THE PERSONAL FACTOR IN ENGINEERING.

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MODERN engineering, and particularly electrical engineering, has reached such a stage of definite mathematical precision that it is becoming harder and harder to adjust the mind to allow for variations. In the older days, when estimating was being conducted, it was a very common practice to put in a very substantial proportion of the total lump sum for contingencies, but except in the most speculative quotations, based on insufficient data, it is nowadays the exception rather than the rule to find any considerable sums allocated to this heading. The tendency is more and more to render everything included in the price clear and definite, the margins being cut away. This is, of course, the inevitable result of the keen-edged competition to which engineering and electrical industries have been subjected in recent years, as well as of the clearer definition of thought due to the scientific training which nearly everyone in the profession now receives.

Let us examine a little more closely what this really means. The price of a piece of engineering work depends to a certain extent, of course, on that of raw material, and here a certain amount of give and take must be allowed if the prices under which the supply is regulated are not sufficiently stable. The fluctuations in the price of copper are an example of this point. When once, however, the material is delivered into the factory it is then subjected stage by stage to processes, each of which can be accurately costed, and in many cases the cost can be predetermined to a decimal, until finally we obtain the finished article. Added to the works production cost must be the proper allowance for depreciation of plant, selling costs and the margin of profit, often very small, which is allowed, together with establishment charges, and we get the final price delivered from the works. All these charges can be, and in most cases are, very definitely ascertained, and it is manifestly impossible for the variations between price and price of a similar article made by different firms to be unreasonable. What then constitutes the determining factor or factors which sway the balance between one firm and another, and make the one a struggling concern for which orders are hard to get, while the other becomes a prosperous and increasingly important undertaking?

It is sometimes stated that a good deal of this difference is due to special features in a machine protected by patents; but while undoubtedly the foundation of many firms' prosperity lies in their pioneering work, it can hardly be argued that any firm can exist for very long periods, either wholly or in the main part, on patents. For one thing either a patent, as soon as it becomes valuable, becomes hotly contested as to validity, or the ingenuity of competitors rapidly devises something which is sufficiently close to the patent to render the balance of advantage very small. It

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION

Ready.

*H. Alabaster, Gatehouse & Co., 4, Ludgate Hill, London, E.C.*

has generally been found that a firm which makes its name on patented articles utilises the name and does a larger proportion of its business on the general run of engineering work in which there is open competition. A good deal of success, of course, depends on engineering the organisation with a view to economy. This is largely a matter of personality, and with this we wish to deal further in another paragraph. Obsolete and obsolescent plant does much to handicap a firm in the production of work, but over and above these causes we would like to make the assertion that in a great many instances the determining factor in the success or failure of a firm is simply sheer personality, and cannot be expressed in any mathematical equation or determined in £ s. d.

It is this personal factor which we are to-day very largely in danger of forgetting, but it is worth while remembering what this means. Let us, for example, take a supposititious case. Suppose there are two firms, each of which manufactures, or is capable of manufacturing, the same article at the same price to the same specification. Let us further suppose that the specification is rigid enough to indicate clearly in the ordinary way of commerce exactly what is required. Let us, however, suppose that the first firm has a reputation for straightforward dealing and a clean record so far as any attempted evasion of its responsibilities is concerned, while the second firm somehow or other has obtained a reputation not for any overt act placing it outside the line of honourable firms, but for a general meanness and pettifying spirit which quibbles at every point possible in order to make an insignificant addition to its profit. The two articles as produced might or might not be identical, but there is the danger in the second place that the specification might have left some matter vague, and that this would be seized upon by the second firm, while if the work were given to the first firm it would be understood that on a reasonable explanation being given the firm would not quibble, but would do its best for its own name's sake to give the fullest possible satisfaction to the buyer. Is there any doubt as to the direction in which the order would be placed? The difference in the firms is palpable. It cannot be expressed in any accurate terms, but the value of the personality of the firm here means all the difference between losing and getting the order.

Take another case. Two firms may both be absolutely reliable so far as the product is concerned. They may have a reputation for straightforward dealing, and both may be looked upon as competent manufacturers. Suppose, however, that one has, either through taking on more work than the works could turn out conveniently, or from any other cause caused disappointment to its customers in time of delivery while the other has not so disappointed people. The first firm will then have an uncertain character as regards delay, and in many cases even where time is not the essence of a contract, the order, other things being equal, will in all probability go to the firm which has kept up to the mark. Here, again, a very small difference in personal character will make all the difference between success and failure.

Putting it in another way, there is surrounding every firm a more or less nebulous character which everybody in the running knows and which nobody is able to define. It is stated that the limited liability company has neither a soul to be saved nor a body to be kicked, but from a busi-

ness point of view it has a definite personality which determines business. It may seem that we have rather laboured the point, but for the honour of the profession we are anxious that it should be remembered that everyone from the manager to the head of the smallest department is invested with a responsibility as regards the building-up of a corporate individuality for the firm with which he is connected. This individuality is a matter of slow growth and often slow decay. The individual atoms composing the substance of a firm may from time to time change, and with them, to some extent, the personality of the firm, but, as a rule, corporate personality is longer lived than individual personality, and hence its effect on the status of the profession as a whole is the more persistent and marked. We have, from time to time, had occasion to remark on the tendency towards the lowering of the status of the profession induced by the keenness of competition. Rules and regulations have been made and broken, but in the long run it comes back to a point of moral standing. The personality of a firm, which means ultimately its standing in the profession, depends on the cumulative personalities of the individuals composing it, and the standing of the profession in turn ultimately depends upon the personalities of the firms composing it. From this point of view, therefore, we claim that the moral virtues inculcated by the great philosophers of all time are obligatory from a commercial standpoint, and we also claim that they exercise a direct and not very far removed effect on the fortunes of individual firms and of the profession as a whole. These moral qualities cannot be expressed by mathematics. They are apt to be overlooked, but nevertheless they are so important that we cannot refrain from emphasising them.

---

### THE "COMPETENT PERSON."

---

SOME astonishing evidence was given at an inquest in Mansfield on Friday last. A boy of 14, employed underground, was killed by an electric shock obtained by touching the metal guard of a lamp, which had become charged due to a sharp corner of the fitting cutting through the insulation and making metallic contact with the live conductor. The circuit was apparently one of 440 volts A.C., feeding four 110-volt lamps in series. A number of these series were used about the workings. The unfortunate boy, quite casually, while in conversation with two chums, and with no mischievous intent, touched the fitting, which was not earthed; he fell down, exclaimed "Ah!" or "Aye!" when asked if he had got a shock, breathed a few times and lost consciousness; although artificial respiration was persevered with for a long period, he did not revive. The colliery manager, in giving evidence, stated that the electrician was under the impression that the circuit was a 110-volt one. The "electrician" was called, and stated that he had had 10 years' experience, but possessed no certificates. He said that the question whether the circuit was above or below the standard of low pressure laid down by the Home Office rules was a disputed one. The colliery manager stated that they employed the best people they could get.

Pertinent questions were put, and observations made, by the Coroner and the Home Office Inspector on these facts. The jury brought in a verdict of "Accidental death," and added no rider.

It was, of course, obvious that the colliery company, like so many others, had taken no real pains to ensure that the "electrician" was competent. The fatality would certainly

not have occurred if the Home Office rule as to earthing had been complied with.

According to the report of the inquest in the *Nottingham Evening Post*, the manager of the colliery said that the electrician considered this circuit to be one of 110 volts, but he himself had tested the circuit since, and found the voltage to be 440. "Found" is good: we admire the artless simplicity which is almost surprised to "find" that four ones make four—while we deplore the fact that nothing short of the loss of human life sufficed to drive home this simple lesson. But a representative of the colliery company went further, and submitted that there was something to be said for the view which the electrician took, and the colliery manager said it was not a case of neglect on the part of the electrician. It was, in point of fact, pure ignorance, and the whole thing hinges, as usual, on the definition of a "competent person."

In that district, and no doubt others, there are scores of lads who have been taken on by wireman contractors, having picked up the "trade" of running lighting wires in tubes, and posing as "electricians," they get on for quite a long time without the slightest real understanding of the principles of electrical science. Such things always lead to trouble.

without its other exceptional features; the distance from shore to shore is about  $3\frac{1}{2}$  miles.

The respective merits of direct and alternating current were taken into consideration by the experts of the Swedish Government in preparing the estimates, and, not for the first time, high-pressure d.c. was found to offer marked advantages over three-phase transmission. The fact that submarine cable for 90,000 volts d.c. can be obtained is of especial interest, while the highest practicable three-phase pressure for this part of the line is 20,000 volts, so that the former has here a very great advantage; and, apart from this, a d.c. line, for equal maximum voltage, is necessarily far cheaper than any a.c. line can be. Further, experience appears to leave no room for doubt that a given line will in point of fact withstand a much greater dielectric stress when the pressure is continuous than when it is alternating, so that here again the d.c. system has the advantage. The only difficulty appears to reside in the generators and motors; we question whether there is real ground for objection to the system on this account, but it would seem that if a method could be found of generating, say, 20,000 volts in a single machine, a considerable impulse would be given to the system.

**Mañana?** THE statistics published on another page relating to electrical imports into Spain are worthy of study, as showing the rapid advance that is being made in German electrical exports to that country. If any of us were inclined to take Consular comfort from the statement recently issued from Barcelona concerning the poor quality of German electrical manufactures and the willingness of the Spaniard to welcome British goods instead if we would push them there, these figures must fill us with pangs of regret that we were not there first. Several years ago we referred to Spain as being practically virgin soil electrically, but there has been a marked British disinclination to embark upon enterprise on the other side of the Pyrenees. German firms, however, established a complete electrical organisation covering the most important points in the country, and the 1911 returns show with what excellent results their efforts have been attended: and though British quality may tell, in the long run, to some extent, it is no good trusting to that possibility alone in presence of very active competitors, who, as experience is showing, are aggressive and price-cutting in their efforts to discourage competition and secure an early and substantial footing in foreign markets. It is unlikely that British manufactures will to-day sell themselves anywhere on the mere basis of quality. The existence of a poor quality can only be recognised in comparison with the availability on the spot of something better. A Consul may know that British manufactures are superior, and so may we, but how can such knowledge assist us unless the Spanish buyer or user himself has it strongly and persistently impressed upon his mind? Either through indifference, disinclination, or else through being too much occupied with other markets, we appear to have let our rivals have things pretty much their own way.

The figures may be allowed to speak for themselves, but they show that in some classes we have actually lost ground while German totals have leaped forward, and the least that we can hope for as the result of their study and analysis is that they will awaken us to the necessity for ending our apathy and entering upon the aggressive way.

**Submarine Transmission.** THE particulars which we give this week regarding the projected transmission of energy from Sweden to Denmark are of special interest, as this is, we believe, the first instance in which it has been seriously proposed to transmit large quantities of energy at high pressure through long submarine cables. The total distance is over 200 miles, so that in this respect alone the scheme would be unique in Europe,

**Lignite as Station Fuel.** THE use of lignite for the firing of boilers in generating stations is attracting increased attention in Germany, particularly in the left Rhenish district. It is claimed that the erection of stations adjoining the deposits of lignite, which is worked from the surface, dried, or partly dried, in apparatus and pressed into briquettes, permits of the production of electric power at an exceptionally low cost. It was for this reason that the Bergeist supply station was established several years ago near Bruhl, whence a supply of energy is furnished to a considerable distance. The station, which in the meantime has been taken over by the great Rhenish-Westphalian Electricity Works Co., of Essen, which also possesses pit-coal works on the colliery site, delivered 25,800,000 kw.-hours in 1912. Now the Rhenish-Westphalian Co. has started the building of another large station in the vicinity of the Ver. Ville lignite mine belonging to the Rodlergrube. Two steam turbines, each of 15,000 kw., will be installed at first including boilers, the cost is estimated at £175,000, and a lengthy contract has been concluded with the mine owners for the supply of fuel. The station will supply current to the network of cables which the Rhenish-Westphalian Co. possesses in the district of Cologne and beyond, and energy for electrolytic purposes is also to be furnished to a chemical works to be built on the Rhine. A third instance is that of the Rhenish Lignite District Electricity Works Co., which was constituted in 1910, and has contracts for the delivery of energy to Cologne, Mulheim, and other places. The first plant was of 8,000 kw.; a second generating set of 8,000 kw. is now being put into service, and a third will be ready on October 1st, making a total of 24,000 kw. It is expected that the output will amount to 25,000,000 kw.-hours this year, without taking into consideration the annual supply of 16,000,000 kw.-hours which has been contracted for, for a chemical works to be erected in the neighbourhood of the generating station on behalf of the Metal Bank and Metallurgical Co., of Frankfurt-on-Main. A fourth example relates to the decision to establish on the site of the Zukunft lignite mine, near Eschweiler, a station capable of dealing with 30,000,000 kw.-hours per annum, by way of a beginning, and of this quantity agreements have already been made for the disposal of two-thirds at appropriate prices. Apart, however, from these developments, it has to be remembered that the generating station which supplies power for the working of the Dessau-Bitterfeld railway utilises lignite as boiler fuel, and brown coal is also projected for the power stations in connection with the conversion of the Berlin railways to electric traction.

## THE INSTALLATION OF POWER-FACTOR INDICATORS.

By LEONARD MURPHY, M.I.E.E., A.M.I.Mech.E.

It has now become recognised that an instrument for showing the power-factor of any machine or circuit is quite a necessity on systems dealing with large amounts of power, and there is every probability that in the near future the use of power-factor indicators will extend to every circuit in which the power factor is capable of regulation. The advantages of being able to work machines or cables at unity power factor are now well understood, and engineers invest capital in regulating apparatus for the express purpose of obtaining this condition. At other times it may be desirable to obtain a leading current, but in every case the full advantage can only be obtained from the regulating gear when the resulting power factor can be read at a glance from one instrument.

The function of a power-factor indicator is fundamentally to show the angle between the pressure and current in the circuit, and this may be shown by a scale of electrical degrees if desired, but most engineers wish to know chiefly the relation between the actual current which is being employed and the minimum possible current for the corresponding power, *i.e.*, with unity power factor. For this reason the scales are usually marked directly in values of power factor or the cosine of the angle of phase difference, but in a well-designed instrument the angular deflection of the pointer should be approximately a direct measure of the phase angle. This design also leads to an open scale for power factor in the region of the unity point, which is certainly desirable. The type of scale referred to is illustrated by the instrument shown in fig. 1. The scale of electrical degrees is also shown on this instrument, and it will be observed that this is nearly uniformly divided.

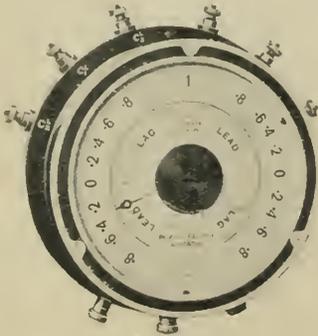


FIG. 1.—THREE-PHASE UNBALANCED-LOAD POWER-FACTOR INDICATOR.

These instruments are obtainable for all single and poly-phase circuits, and in the latter case may either be suitable for measuring the phase relation between one of the line currents only and the corresponding pressure, or for obtaining the average power factor of the whole circuit, having due regard to the magnitude as well as the phase relation of the current in each line. When the load consists entirely of motors, the currents in all the lines will be equal, and a balanced-load type of instrument, which operates only on one line current, is sufficient; but in determining the power factor of a mixed load, one should either employ as many instruments as there are phases, or adopt the type which depends for its reading on all the line currents. Some engineers prefer the former method when dealing with unbalanced loads, as the indications of the instruments give information as to the manner in which the load should be distributed when making further connections to the mains; but the single instrument giving an average result will meet the requirements of the majority of cases.

Fig. 1 is actually an illustration of an instrument of the unbalanced-load type. In designing this particular type, the makers had in mind what may be termed the average effective power factor.

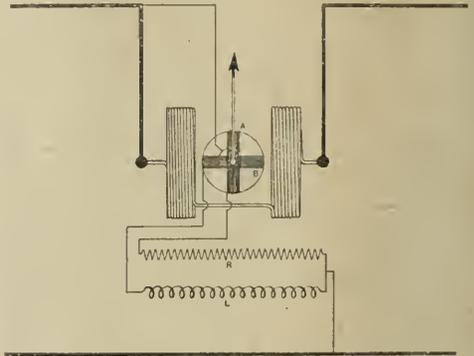
If one considers a three-phase star-connected load in which  $C_1, C_2, C_3$  are the currents and  $\phi_1, \phi_2, \phi_3$  are the angles of phase difference between each of the currents and their respective applied pressures (taken from line to neutral point), the average power factor is—

$$\frac{\cos \phi_1 + \cos \phi_2 + \cos \phi_3}{3}$$

But an indicator which gives the value of this expression is of little practical use, since the power factor is only of importance when considered in conjunction with the current to which it actually refers. The unbalanced-load instrument mentioned above gives a reading whose value is approximately—

$$\frac{C_1 \cos \phi_1 + C_2 \cos \phi_2 + C_3 \cos \phi_3}{C_1 + C_2 + C_3}$$

It will be noticed that the reading of this instrument is not unduly affected by the power factor of a very lightly loaded phase. When using three instruments of the



A and B, potential coils on rotor; R, resistance in series with coil A; L, inductance in series with coil B.

FIG. 2.—DIAGRAM OF SINGLE-PHASE POWER-FACTOR INDICATOR.

balanced type on a three-phase unbalanced load, the mind involuntarily averages out the readings without regard to the relative values of the phase currents, and this is apt to be misleading.

It may also be pointed out that the unbalanced type can readily be provided with a switching arrangement whereby any two phases can be made inoperative on the current side of the instrument. By this means it is possible to obtain readings of the power factor of each phase independently, as well as the average effective value of the whole system, with the advantage that the readings are all given on one instrument, and only one scale is used.

Power-factor indicators are also extremely useful in the test room and laboratory. By their aid, it is possible to test a machine or a meter under definite conditions of power factor, this being practically impossible by any other means. The results obtainable are quite as accurate as those given by the best class of deflectional wattmeters, and form a ready check on the combined readings of voltmeter, ammeter, and wattmeter, when these are also used.

*Action.*—The operation of a power-factor indicator is dependent on the interaction of two magnetic fields, one of which is generated by a set of fixed coils, and the other by a set of coils, which are either carried by the moving system, or are fixed in such a way that they produce the same result as though they were so carried. One of the fields rotates, as in an induction motor, while the other may either be rotating, or simply a fixed-position alternating field.

In single-phase instruments, the windings which carry the current are usually fixed and produce a simple alternating field, while a two-phase rotating field is produced by the moving coils. These are two fine-wire coils, and carry currents obtained by connecting a high resistance in series with one, and a choking coil in series with the other across the potential. A clear idea of the way in which this type of instrument operates may be obtained from fig. 2. It should be noted that the moving portion is entirely free from control by springs or weights, so that until current

and pressure are applied to the respective elements, the pointer takes up no definite position on the scale.

Suppose that, first of all, the connection through the choker to the coil *B* is left broken; the current passing through *A* will generate a magnetic field, and this will turn the movement into the position in which it is shown, since, in this position, its field is in line with that of the current coils. The force tending to hold it in this position will be a maximum when the current in coil *A* is in phase with that in the fixed coils, and the force will diminish to zero, when the current in the fixed coils is 90° out of phase with that in *A*. Similar results will be produced if the coil *B* is connected, and *A* disconnected, except that the movement must turn through 90° in order to bring the axis of the coil *B* into line with that of the fixed coils. Now, it will be evident that if both *A* and *B* are connected, the moving system must take up some intermediate position depending on the relative values of the components of the currents in *A* and *B*, which are in phase with the current in the fixed coils. But it will be noted that since the current in *A* is derived from the potential, through a circuit composed almost entirely of resistance, it may be regarded as being in phase with the potential, while, since the circuit which supplies *B* is very highly inductive, the current in *B* will lag approximately 90 electrical degrees behind the potential. Hence, the position of the pointer will depend on how nearly the current in the fixed coils is in phase with the current in *A* (and with the pressure), and out of phase with the current in *B*. When the power factor of the circuit is unity, the axis of *A* will be in line with the axis of the fixed coils, and the force on *B* will be nothing; when the power factor is zero, coil *B* will come into line, and the force on *A* will be zero.

Now it will be noted that the combined effect of the two coils forming the moving system is really to produce a rotating field, and to some minds it is easier to dispense with any consideration of the action of each coil and simply remember that the axis of the rotating field must coincide with the axis of the alternating field produced by the fixed coils at the instant that the latter is at its maximum. The angular position of the rotating field, with reference to the coils *A* and *B*, is definite in its relation to the instantaneous value of the applied pressure, while the

*Connecting-up Power-Factor Indicators.*—Engineers who have installed these instruments on polyphase circuits have generally found that it is possible to connect up in many ways before hitting on the correct one, and as the process of trying different methods is apt to be a long and tedious one, it is hoped that the following notes may assist in getting the correct connections as quickly as possible. Fig. 3 shows a diagram of connections for a three-phase unbalanced-load power-factor indicator working off current and potential transformers. Two of each kind of transformer are shown in the diagram, as this is the minimum number from which one can obtain a true copy of all the line currents and potentials; but, of course, three of each may be installed if desired. From this diagram one may trace the following possible sources of wrong connections:—

(a) Transformers may be connected wrongly with regard to the instantaneous relative polarity of primary and secondary.

(b) The order in which the phases attain their maximum value may not be the same as that for which the instrument has been constructed. This may occur on either the current side or pressure side, or both.

(c) A terminal or pair of terminals on the instrument, which corresponds to a certain phase either on the pressure or current windings, may be connected to some other phase, although the order of the phases mentioned at (b) may be correct.

To this list one might add such slips as connecting current leads to the pressure terminals, omitting to insert an external resistance box when this forms part of the instrument, &c., but these are obvious mistakes, and would be apparent immediately the connections were checked before switching on the current.

With regard to (a), transformers are usually marked by the makers in such a way that the currents from the secondary are instantaneously the same in direction as would be obtained if no transformers were used and the instrument were directly connected up in place of the primaries. This means that if the primary and secondary windings are similar in geometric direction, the ends of the secondaries must be crossed over each other. The potential transformers may be tested in their relation to each other by checking the voltages on each secondary and across the two outer terminals—*i.e.*,  $S_3 - S_1$ ,  $S_1 - S_2$ , and  $S_3 - S_2$ . If these are all equal, the polarity is correct; if not, one of the transformers must be reversed either on the primary or secondary side. The checking of the current transformers may be carried out by inserting an ammeter in each of the leads connected to the terminals  $C_3$ ,  $C_1$ , and  $C_2$ . These readings should be equal (if the load is balanced), but if one transformer requires reversal, the reading in  $C_1$  will be approximately 75 per cent. greater than the readings in  $C_2$  and  $C_3$ .

On account of the probability that the load will not be balanced, the indications in this test are not so emphatic as those obtained when testing the potential transformers. When a current transformer can be disconnected, one may check the relative polarity by connecting a polarised linesman's detector to the secondary and obtaining deflections by

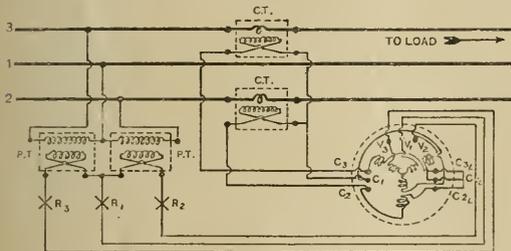


FIG. 3.—CONNECTIONS FOR THREE-PHASE UNBALANCED-LOAD POWER-FACTOR INDICATOR.

instant at which the current attains its maximum value in the fixed coils depends for its relation to the applied pressure on the power factor of the circuit. The acceptance of this form of explanation makes the consideration of polyphase instruments much easier, as in these instruments no phase splitting is used. The rotating field is obtained by connecting a high resistance to each line and to one end of each pressure coil and then forming a star point at the other ends of these coils. The geometric angle between the coils on the moving system is the same as the electrical angle between the phases, *i.e.*, 90° for a two-phase instrument and 120° for a three-phase.

It is not essential that the rotating field should be produced by the moving coils, it being quite common practice, for example, to use three fixed current coils for this purpose on three-phase circuits. When the instrument is intended to work on unbalanced loads, both the current and the pressure coils are arranged so as to produce rotating fields. The movement then takes up a position depending on their relative instantaneous positions.

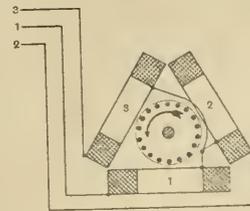


FIG. 4.—DIAGRAMMATIC INDUCTION MOTOR ILLUSTRATING PHASE ROTATION.

touching wires from a small battery, first to the terminals of the secondary, and then to those of the primary. If the deflection is in the same direction in each instance at the moment when the circuit is made, it follows that those terminals of the primary and secondary which have been connected to a certain battery wire should be similarly marked. As, however, one may generally rely on the marking of the relative polarity of the primary and secondary

given by the makers, there is only need to use these tests in cases where a mistake in the marking is suspected.\*

The most prolific source of mistakes when making connections is that mentioned under (b). This is probably because there are few other instruments in which the question of the direction of rotation of the phase is of any importance. As is well known, it is possible to reverse the direction of rotation of a three-phase induction motor by interchanging two of the supply leads on the stator terminals. As one may represent the elements of an induction motor winding by three coils spaced at equal intervals of 120° about a circle, the direction of phase rotation may be defined as the order in which the currents in the windings attain their respective maxima. If, for example, the motor, shown diagrammatically in fig. 4, is connected so that it rotates in a contra-clockwise direction, it may be assumed that the phases attain their maximum values in the order 1, 2, 3, but if it should rotate in a clockwise direction, the assumption is that the phases come up 3, 2, 1. The numbering of the phases need not be expressed in this particular way, as the conditions are continuous. Thus, for forward rotation, the method of connections might also be expressed as 3, 1, 2, or 2, 3, 1, and similar alternatives are available for reversed rotation.

This point is not easily checked by tracing out the connections from the supply, as it eventually depends on the way in which the generator connections are brought out. It is therefore advisable to connect a very small motor to the circuit in order to ascertain the way in which the phases follow each other on the transformer secondaries, and for this purpose one may obtain a very sensitive little induction motor running in jewelled bearings and marked with the direction of mechanical rotation corresponding to certain phase numbering. Such an instrument is known as a phase rotation indicator; fig. 5 is an illustration of one of these with its cover removed. It can be operated off a very wide range of voltages, and takes about the same current as a high-class voltmeter. This instrument may also be

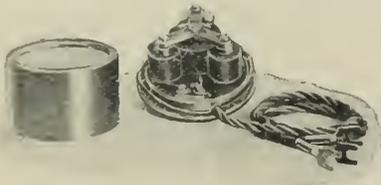


FIG. 5.—PHASE ROTATION INDICATOR.

obtained in a form suitable for connecting in series with the secondaries of the current transformers, but this is not usually required, as one can generally trace the connections sufficiently far to discern which current secondaries correspond with any particular potential connections.

In many power-factor indicators, however, it is possible to obtain information as to the phase rotation directly from indications given by the instrument itself. In the example under consideration, one has two rotating fields available, and if the potential winding be short-circuited on itself,

\* If it should be found necessary to obtain decisive information as to the polarity of any current transformer without removing it from the circuit, the best method is probably to provide oneself with a spare current transformer, whose polarity is known. This should be of the type in which the magnetic circuit can be opened or closed at will for the purpose of enabling any cable or bar to be used as a primary winding without opening the electrical circuit, of which it forms part. Slip this transformer over the conductor which supplies the primary of the transformer whose polarity is in question, and connect the secondary at both ends directly to the secondary of the other transformer, so that the two secondaries form a simple complete series circuit. Connect also a low-reading voltmeter or test lamp across the windings, and note the effect on the voltage obtained when one secondary is reversed with reference to the other. When the two secondaries are connected in that relation which produces the higher voltage, the incoming terminal of the testing transformer is connected to the incoming terminal of the unknown. The transformer used for testing need not, essentially, have any iron circuit. All that is necessary is a coil of wire which can be held near the primary conductor, and this arrangement has the advantage that the reversal can be made by merely turning the coil over. There is also less voltage generated, and this is under more control.

while the current winding is excited, the movement will act as the rotor of an induction motor, and will move round in a definite direction, indicating the phase order of the current coils. Similarly, if the current windings be disconnected and short-circuited, a rotational effect will again be produced, but this time in the opposite direction. If these directions are known for the particular instrument, there will be no difficulty in obtaining the correct connections with regard to phase rotation.

The source of error under (c) should not now give any trouble, as all that is necessary is to ensure that the potential terminals are connected (through the transformers) to the lines from which the current coils of similar marking obtain their excitation. If this should be difficult on account of the transformers themselves being ungetatable, and if the value of the power factor is known approximately, one may deduce the alterations required to the connections from the indications of the instrument.

1. If the pointer should set in a position approximately 120 from the assumed correct value, step all the potential connections on or back by one phase.

2. If the pointer should set in a position 60 from the correct value, reverse all the current coils and proceed as at (1).

In conclusion, the writer would like to add that, although the above information will not be new to most instrument experts, he believes that it may prove of use to many others. The power-factor indicator is one of the most valuable alternating-current instruments, when properly understood, and he trusts that its rapidly increasing popularity will not be checked by any lack of knowledge as to the correct method of using it.

He would also like to express his best thanks to Messrs. Everett, Edgcombe & Co., Ltd., for the photographs with which this article is illustrated and for their kind permission to publish details given of the unbalanced-load type of instrument, of which they make a speciality.

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

### Wireless Telegraph Patents.

I notice in your columns a quotation from the *Australian Mining Standard* giving an account of a patent granted to Mr. Balsillie on October 15th, 1912, with respect to his system of wireless telegraphy. The description speaks of it as an arrangement wherein an exciting circuit is "electrostatically coupled" to a radiating circuit.

On referring to the diagrams this appears not to be the case. The two circuits are coupled by direct metallic connection, with a part common to both, in fig. 1; while in fig. 2 the resonating circuit is connected in the same way to the aerial and through a transformer to the detecting circuit.

I presume, therefore, that the phrase "electrostatic coupling" is a misdescription, especially as I hold a patent for coupling, which is really of that kind, dated April 8th, 1911.

Oliver Lodge.

Edgbaston, March 8th, 1913.

### Supply to Premises outside the "Area of Supply."

With reference to the article in your issue of March 7th on "the operation of Clause 6 of the Act of 1909," the writer is under the impression that the charge made by the Board of Trade for referring draft orders to counsel has either been discontinued, or is about to be discontinued, and that such charges were only made at the commencement of the working of the Act owing to there being certain obscurities in the wording of it.

It is also of interest to bear in mind that orders made under this clause have, up to the present, contained provision

giving the Board power to revoke the order in the future, in the event of any supply authority into whose area the extension contemplated is taken becoming able to give a supply of electricity at the point in question, where, at the time the order was made, they were not in a position to give a supply. In the event of such revoking clause being put into operation, it would presumably be competent for the first supplier to make a bargain with the second supplier, with regard to the cost of mains or other capital works carried out in order to give the supply; but the existence of this clause in the order does, in the writer's opinion, make some difference in the outlook of the supply authority towards business of this class, because, whilst the terms of the order commit the supplier to all the usual responsibilities of an electric lighting provisional order, they do not give that security of tenure in the business which exists within the supplier's own area. Therefore, apparently, supplies of this class should be sufficiently remunerative to cover all special capital expenditure involved within the period during which the supplier may anticipate that he will be allowed to enjoy the business unmolested.

**J. W. Beauchamp,**  
*Engineer and Manager.*

West Ham Electricity Supply,  
March 8th, 1913.

#### Morse Signalling on Submarine Cables.

My keen interest in Mr. P. O'Neil's opportune letter, and specimen of his inverse-current Morse signals, in the ELECTRICAL REVIEW of March 7th, became all the keener when, for the first time, I looked up Mr. O'Neil's patent, No. 16,462, 1907. I then found that his automatic pole-changing switch, which gave him these inverse-current siphon-recorder Morse signals, is practically identical with one of my two devices referred to in the ELECTRICAL REVIEW article of February 28th. It would be interesting if Mr. O'Neil would add to his kindness by telling us whether he ever succeeded in converting his received inverse currents into actual Morse dots and dashes. Mr. P. B. Delany's patent, No. 21,629, of 1893, includes a very clever device for effecting this conversion.

In Mr. John Gott's system—as your contemporary, the *Electrician*, of February 21st, has informed us—this conversion of inverse currents received on a suspended coil or other such relay is brought about by the electrical connecting together of the two contact stops limiting the play of the relay tongue. For readers new to the subject, this point, perhaps, was not sufficiently emphasised in the writer's article of February 28th. These two electrically-connected contact stops, between which the relay tongue oscillates under the alternate + and - currents shown in B, fig. 1, in the ELECTRICAL REVIEW article of February 28th, are in circuit with a local battery and a common Morse or Morse repeater. Whichever way, then, the cable relay tongue happens to be deflected, the effect on the local Morse is the same.

Mr. Gott has successfully co-ordinated apparently known physical principles with his own original and effective transmission devices. Official statements testify to successful direct Morse working between London and New York; truly a *fait accompli* which, apart from other men's clever work in the past, may justifiably regard Mr. John Gott as its true originator.

**E. Raymond-Barker.**

Wimbledon, March 10th, 1913.

#### Weak Hearts and Electric Shocks.

In your article this week on "Electricity in Mines," in an instance of a fatal shock, that at Trimdon Grange Colliery, it is pointed out—that the inspector thought the effect would not have been fatal, but for the fact of the victim having a weak heart. That set me thinking, how many other victims have had weak hearts? Also of an instance that came before me about a year ago, and as I think it points a moral, I give it as briefly as possible, just, for an obvious reason, giving fictitious instead of real names.

Felix Senior, 53, and Ralph Young, 23, were standing on the lead covering of a projecting shop-window trying to

localise a rupture in a cable that had been run eight years before in screwed tubing from a 200-volt a.c. circuit to supply an illuminated sign, when suddenly a tube which both were holding made contact with the live cable, and both received a rather severe shock.

Senior just left go of the tube, but, looking at Young, he saw that his face was becoming red, and then turning to purple, his hands being completely paralysed on the tube. He forcibly opened Young's hands (getting the shock meanwhile), and pulled him off; after a few minutes' rest, both were able to proceed with their work.

Now, why the difference? Both had similar boots on, both were on the lead sheathing, which was wet all over. Young was, besides being younger, much the stronger man physically—that is as regards running, lifting, &c. He, however, was a heavy tobacco smoker; Senior, an abstainer from this habit for some years. Both were abstainers from alcohol.

The veriest tyro in medicine knows that tobacco indulgence almost always, more or less, weakens the heart, especially in excess. Without wishing to dogmatise, least of all to pose as goody, I think that whether my surmise is right might be worth consideration as a word in season to young members of our profession.

**A. W. Bennett.**

Leeds, March 4th, 1913.

[The hands of Senior, the older man, were probably more dry and horny than Young's.—Eds. E.R.]

#### Heavy Service Lampholders and Adapters.

With reference to a letter in a recent issue signed "Sales Superintendent" anent heavy-pattern lampholders to carry 5 amperes without the slightest heating, being myself engaged in issuing approximately 400 electric power, lighting and heating specifications annually, I thoroughly endorse what is said. If some manufacturer would bring out a suitable heavy-pattern lampholder to enable a radiator or other apparatus to be used, it would quickly repay him, as some 10,000 could be sold locally in a very short space of time: it would supply a long-felt want in the West of Scotland and other parts of the country.

**An Engineer.**

Glasgow, March 4th, 1913.

#### Electric Cooking.

One very satisfactory feature of last year's trading, so far as it relates to electrical industries, is the greatly increased sales of electric cookers. Manufacturers have realised the great scope underlying this branch of the business, as evidenced by the cooking demonstrations which some of them have given in various towns throughout the kingdom with, I believe, very satisfactory results.

It is, however, one thing to familiarise the public with an article, and quite another to persuade it to invest in that article, and when it is remembered that nearly every gas concern hire-purchases out gas cookers, it is in some cases an extremely difficult matter to persuade a prospective consumer, who, perhaps, has a very limited income, to write out a £14 cheque for an electric cooker, and that by so doing, he is transacting a business deal which is in every respect not only satisfactory but also convenient to himself.

I am convinced that, if manufacturers were to hire-purchase out electric cookers, I, for one, would be able, in a comparatively short period, to increase my day-load peak by at least 40 per cent.

Another factor which has a predominating influence on the subject is the high cost of a reliable and efficient cooker.

Compare a gas cooker costing about £4 with an electric cooker of the same capacity, priced at about £14. Does £10 represent the actual worth of the difference? It seems almost impossible. Until we have a reliable cooker on the market priced at about £7, with the option of hire-purchase, electricity as a medium for cooking will never be seriously regarded by the middle class.

**Julian G. Thain,**

*Chief Electrical Engineer and Manager.*

Stratford-on-Avon Electricity Supply,  
March 4th, 1913.

## CO-OPERATIVE ELECTRICAL CAMPAIGN IN AMERICA.

A CONFERENCE of the Society for Electrical Development was held in the Engineering Societies' Building in West 39th Street, New York, on March 4th and 5th, which brought together, we are informed, "representatives of more than ten billion dollars in a campaign of education." Every branch of the electrical trade will be represented. Officers of such corporations as the General Electric Co., the Westinghouse Co., the Philadelphia Electric Co., the Union Electric Light and Power Co., of St. Louis, and the Buffalo and Niagara Falls Light and Power Co., to mention but a few, are members of the board of directors.

The Society was organised a few weeks ago for the purpose of educating the public up to a more general use of electricity in all its forms, and the conference was called to make definite plans for carrying on the work through the expenditure of a considerable sum in advertising and publicity work of all kinds. The president of the Society is Mr. Henry L. Doherty, a New York banker, who handles many electrical securities, and is well known in the electrical industry. The general manager of the Society is Mr. J. M. Wakeman, for many years president and general manager of the *Electrical World*, and the secretary-treasurer is Mr. Philip S. Dodd, formerly general manager of the *Electrical Review*, and later director of the Commercial Development Department of the National Electric Lamp Association.

The conference was opened by an address by the President of the Society, Mr. Doherty, and some observations by the general manager, Mr. Wakeman, on "The Aims of the Society." "Electricity has been decreasing in cost to the consumer, while the price of everything else has been advancing," says General Manager Wakeman, in discussing the plans for the Society for Electrical Development, "and it is our aim to show the general public that electricity is no longer a luxury for the few, but has become a necessity for all. It can be stated, as a fact, that 70 per cent. of the people in the United States use electricity in some form every day, if only by sending a telegram, using the telephone, riding on a street car, or ringing a door bell, and approximately 5 per cent. of the population is supported more or less directly by the electrical trade and its ramifications. And this enormous industry practically can be said to have developed itself, as it is only within the past half dozen years that a few of the larger manufacturers and central stations have made any real effort toward educating the public to the use of what is still to the average layman a stupendous mystery. No one manufacturer, central station, contractor, or dealer can carry out single-handed efficient educational work as well as it can be carried out by co-operative effort. The conference constitutes a starting point in electrical development, and it will produce a co-operative result eclipsing any heretofore known, with individual benefit to all engaged in the industry, and to the industry at large. While no active campaign has as yet been inaugurated to obtain additional members for the Society, its membership is open to any individual or person as a representative of any firm, corporation or association which is engaged in the manufacture, production, installation or sale of electrical or other apparatus or supplies necessary in the production, distribution or utilisation of electrical current, or is engaged in the manufacture or sale of electrical current. The funds necessary to carry out the purposes of the Society will be subscribed by the members or the firms, corporations or associations represented. The central stations and manufacturers represented by membership will subscribe to its funds at the rate of not less than  $\frac{1}{100}$ th of 1 per cent. of the gross amount of their respective annual sales, and the contracting, dealing and jobbing interests represented will subscribe on the basis of  $\frac{1}{100}$ th of 1 per cent. of the gross amount of their respective annual sales. The Society has already been financed to the extent of something over \$100,000, and it is intended to immediately inaugurate an active campaign to increase the membership of the Society and to bring the amount subscribed up to a minimum of at least \$200,000. The thought is that active work will not be commenced until the full \$200,000 has been subscribed, but, naturally, the campaign will be continued to a point where the entire electrical industry will be co-operating to win the desired results. An analysis of the by-laws will bring out the truly co-operative extent of the Society. The fact that its membership is open to all the electrical industry, and that control of the Society will for all time be vested in the four different branches of the industry, to wit, central stations, jobbers and dealers, contractors, and manufacturers, and the actions of the Society are to be always controlled by an even distribution of the various interests mentioned, on its board of directors, executive committee, and among its officers, is a guarantee of the truly co-operative nature of the Society."

The object of the meeting was to obtain from as many angles as possible the various ideas of the many branches of the industry on the tentative plans that would be proposed in a most comprehensive programme. Among the plans to be suggested was a broad educational general advertising campaign, together with plans for a comprehensive Press bureau for the dissemination of news matter pertaining to things electrical, and also a field department for co-operative and general educational work throughout the electrical and allied industries, architects, building trades, and various manufacturing fields.

In addition to the items in the Conference programme mentioned above, the following were subjects brought forward:—"Where the National Electric Light Association Comes In," by Mr. T. C. Martin; "The New Value of Electricity," by Mr. F. H. Gale;

"Electricity and the Architect," by Mr. F. E. Wallis; "The Dissemination of News," by Dr. Talcott Williams; "Co-operation in the Electrical Industry," by Mr. J. R. Crouse; "An Electrical Advertising Campaign," by Mr. W. D. McJunkin; "Selling a Commodity," by Mr. E. St. Elmo Lewis; "Merchandising Co-operation," by Mr. W. E. Robertson; "Efficiency in Local Advertising," by Mr. J. C. McQuiston; "Electrical Development and the Electrical Contractors," by Mr. E. Freeman.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### "Economic" Bench Grinders.

THE WILSON-WOLF ENGINEERING CO., LTD., of Thornton Road, Bradford, have just placed on the market a new type of electric bench grinder, which we illustrate in fig. 1. This machine has been designed for hard and constant work; the motor is shunt-wound, rated at 1 H.P., and runs at a speed of about 1,800 R.P.M. It is fitted with Hoffmann ball bearings, and is quite dust-proof. The box base, on which the motor is mounted, is of rigid design, and

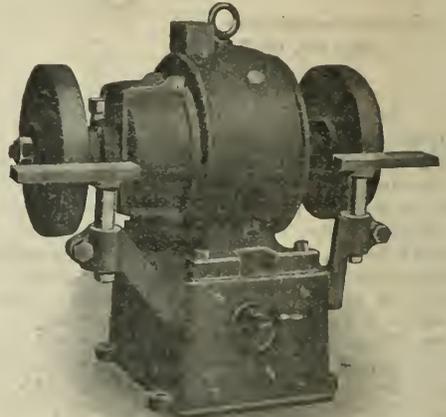


FIG. 1.—ELECTRIC BENCH GRINDER.

carries the tool rests, which, besides being adjustable to the wear of the wheels, are capable of a vertical and angular adjustment to accommodate work of varying thickness and shape. A starter, with no-voltage release attachment, is fitted inside the box, and is actuated by the hand wheel seen in front.

The standard equipment supplied with the grinder consists of two 8 in.  $\times$  1 in. wheels, of any grade to suit the work. The machine can also be supplied as a special heavy duty grinder, equipped with one 10 in.  $\times$  1½ in. wheel.

### Electric Toaster.

A new electric toaster has just been placed on the market by MESSRS. F. A. WILKINSON & PARTNERS, LTD., of Hatfield, Herts., the features of which are simplicity of construction, efficiency and cheapness. The heating element comprises a strip of mica, upon

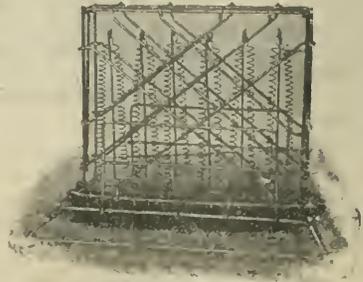


FIG. 2.—A NEW ELECTRIC TOASTER.

which are mounted vertical steel rods, their attachment to the mica being made by a special process. The top portion of the coil is held by means of the steel supports, while the bottom portion is secured to the base by means of detachable rivets. The element is enclosed in a bright metal network, and is readily removed when required. An insulating strip is fitted beneath the element.

### An Ironclad Switch-Fuse.

Fig. 3 shows a 1,000-ampere, 500-volt, double-pole combined switch and fuse, made by the SAFETY CONTROLLING APPLIANCES CO., LTD., of Luton, Bedfordshire. An examination of the illustration will show the remarkable compactness and space-saving properties of this form of circuit control as compared with the older designs which were adopted in connection with high-power traction voltage supplies of this description, and this saving of space has been secured without any detriment to safety. The switch is made up of substantial contacts, so sub-divided that considerable contact surface is given; on each pole there are two sets of contacts, and between these are mounted two indicating cartridge fuses, which are secured to the contact blades by means of screws in such a way that a blown fuse can be replaced in under half a minute. The switches are provided with a positive pull out, and, in addition, the motion of the moving portion is controlled by steel springs giving an extremely long and rapid break. The alignment of the moving portions with the fixed contacts is secured by

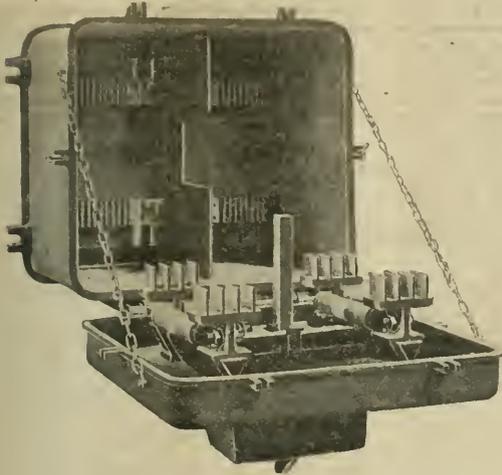


FIG. 3.—1,000-AMP. SWITCH-FUSE.

a squared steel shaft on which the moving part slides, and the mechanism is automatically interlocked with the lid, making it impossible to open or close the case unless the switch is in its off position.

The contact blades and fuses are insulated from the carriers by means of moulded micanite, and mica and metal construction are the features of this gear. The slates are insulated from the case by means of a special insulating material  $1\frac{1}{2}$  mm. thick, the puncture voltage of which is 10,000 volts per mm. The holding-down screws are insulated from the slates and the interior of the case is coated with a special enamel. In a test made by the National Physical Laboratory at Teddington, on a 500-volt 30-amp. switch, measurements were made between all insulated parts of the case and between one insulated part and another, and the insulation resistance was in every case over 200 megohms. The glands are removable, and hence the wiring of the switch is accomplished with ease. These switch fuses are constructed either for double or triple-pole service, and have been combined with other apparatus in panel form in order to produce complete controlling units for all purposes.

### Slow-break Witton Switches.

For many purposes a quick break is not necessary, as in equaliser switches and switches for short-circuiting starters on motor-generators, &c.

THE GENERAL ELECTRIC CO., LTD., provide for such purposes the "Witton" slow-break switches, which are made in sizes from 100 amperes up to 3,000 amperes, and in the single, double and triple-pole patterns. Good grinding over the whole area of faces in contact, coupled with a current density at the contacts of 90 amps. per sq. in., is responsible for a very small power loss, and in the change-over type, off-stops are provided, which prevent the possibility of the switch falling back on the lower contacts, should it by any chance work loose.

### Electric Water Heater.

Some years ago we described a simple form of water heater, in which the resistance consisted of carbon spheres, actually immersed in the current of water to be heated. This device has been greatly improved and developed, and is now about to be put on the market by the BRITISH HEATER CO., LTD., of 105, West George Street, Glasgow. The accompanying illustration, fig. 4, shows the apparatus, which consists of a high-class porcelain tube containing the carbon balls, a switch and stop-valve. It will be noticed that the switch and valve are both controlled by the same handle, that switch cannot be closed without first turning on the water, but after closing the switch the rate of flow of water can be widely varied, thus controlling the temperature of the issuing

water. The electrical connections to the resistance are at some distance from the water connections, so that the circuit is not earthed—as measured on the Glasgow mains, we understand, the resistance between them is no less than two megohms, though the current-carrying balls are actually in the water—and the use of



FIG. 4.—WATER-HEATER WITH IMMERSED RESISTANCE.

the device is permissible on any circuit. To eliminate the risk of shock, the inlet and outlet water pipes are electrically bonded together, and are therefore earthed, if the water supply is from the mains.

The apparatus is made up in forms suitable for domestic use, hotels, &c.; fig. 5 shows a pattern for use on board ship, which is

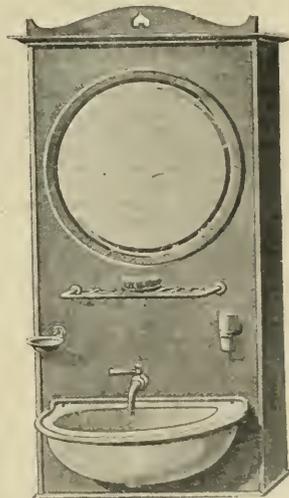


FIG. 5.—SHIP PATTERN, COMBINED WITH WATER-HEATER AND BASIN.

already becoming popular. There is, perhaps, no place where electric geysers are more readily applicable and convenient than on passenger ships.

### The "Regina" Electric Cleaner.

MESSES. MICHAEL K. COOPER & CO., of 27, Oswald Street, Glasgow, are introducing a new type of electric suction cleaner, which possesses some exceptionally good features. The motor, which is made by the G.E. Co., of Schenectady, is of excellent design and workmanship, and is fixed in a compartment which is shut off from the air passages, so that no dust has access to it. The dusty air is drawn in through a canvas bag, which catches all the dust before it reaches the fan, which is thus protected from injury; a metallic casing encloses the dust bag, which is easily withdrawn and emptied. The nozzle is fixed on the front end of the casing, as shown in fig. 7, and the weight of the machine (only 14 lb.) is carried on rubber-tired wheels at the other end. By means of other attachments, a hose can be coupled to the front end,

for cleansing the walls, &c., or to the exhaust of the fan, for blowing dust out of crevices, books, &c. We have tried one of these machines, and find that it does everything that is claimed for it; it is a very practical and well-made pattern of cleaner.

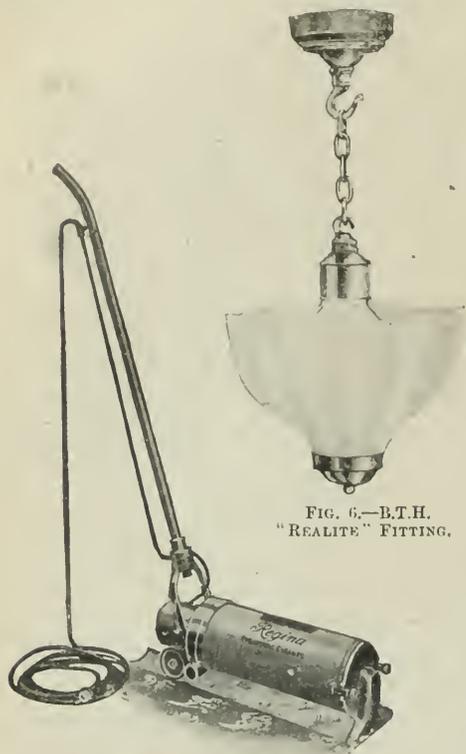


FIG. 6.—B.T.H. "REALITE" FITTING.

FIG. 7.—"REGINA" SUCTION CLEANER.

### B.T.H. "Realite" Semi-Indirect Fitting.

The "Realite" fitting (fig. 6) is the latest development of semi-indirect lighting introduced by the BRITISH THOMSON-HOUSTON CO. LTD. The fitting consists of an inverted standard "Veluria" reflector suspended on a special semi-indirect attachment. The Mazda lamp hangs pendant in the reflector, and is completely hidden thereby.

The "Veluria" reflectors produce charming lighting effects, and when used for semi-indirect lighting, they have the advantage of thoroughly diffusing the light, and consequently reducing the apparent intrinsic brilliancy of the light source.

## LEGAL.

JOHNSON BILLINGTON ELECTRICITY METERS, LTD., v. A. M. BILLINGTON.

MR. JUSTICE COLEBRIDGE, with a special jury, in the King's Bench Division on March 6th and 7th, heard an action in which the plaintiffs sought to recover damages from Mr. Arthur Marston Billington, of Holland Park (formerly one of the directors of the company), for alleged breach of duty. In his defence, Mr. Billington denied the various acts of negligence alleged, and denied that there had been any breach of duty.

Mr. J. R. ATKIN, K.C., and Mr. Theobald Mathew were for the plaintiffs, and Mr. Ernest Pollock, K.C., M.P., with Mr. H. G. Robertson were for the defendant.

Mr. ATKIN, in opening, said that Mr. Billington was one of two directors of the plaintiff company, and in July and August, 1910, he was managing director of a company called the Beck Flame Lamp, Ltd., which was a company formed to manufacture and work certain patent electricity meters. A successful meter (said counsel) was a thing of considerable commercial importance, and the patentee of the particular meter in which the company was interested was a Mr. Johnson. The other director of the plaintiff company was Mr. Harvey Benjamin Spiller, a jobber and a member of the Stock Exchange. Mr. Billington, who had known Mr. Spiller for a considerable time, saw him with reference to the formation of the plaintiff company for the purpose of working the patent, and the company was, in fact, incorporated in July, 1910. The company had a nominal capital of 8,000 £1 shares, and the arrangement was that £1,000 in shares was to go to the vendors of the patents. A cash working capital amounting

altogether to £1,775, was subscribed by Mr. Spiller and his friends. Mr. Billington then suggested the desirability of the meters being manufactured by the Beck Flame Lamp, Ltd., and eventually an agreement was drawn up, the substance of which was that the Beck Co. were appointed the sole licensees and manufacturers of the meters. The plaintiff company were to provide £500 as part payment of the outlay necessary to provide the plant required, and a Mr. Harrison was appointed to have the sole selling rights of the meters. There was a provision enabling the Beck Co. to use the £500 for the ordinary purposes of their business, it being stipulated that if within two years they placed orders for 10,000 meters, the Beck Co. were to repay the money. Counsel proceeded to suggest that at that time the Beck Co. were insolvent, and he alleged that Mr. Billington must have known it. About August 8th, 1910, there was a board meeting of the plaintiff company, at which Mr. Billington and Mr. Spiller were present. As Mr. Spiller was going away for a holiday, a resolution was passed that cheques could be drawn by one director with the counter signature of the secretary. The secretary appointed was a clerk in the employ of the Beck Co. It was alleged (added counsel) that Mr. Billington caused the plaintiff company to pay various sums to the Beck Co. by way of loans. For the £500 paid over previously, the plaintiff company received nothing, and eventually it was found that Mr. Billington had been in the habit of getting money in and out of the plaintiff company's bank by a series of loans upon the security of certain debts which he proposed to pay off. Various advances were made on outstanding debts, and there were certain repayments. Subsequently Mr. Billington was deposed from his office as director of the plaintiff company, and the Beck Co. had gone into liquidation.

Mr. HARRY BENJAMIN SPILLER said that he knew Mr. Billington 20 years ago, but he had not seen him for five years when they met in 1910. In June of that year he knew that Mr. Billington was managing director of the Beck Co., but he did not think anything definite was said in regard to the finances of the company.

Mr. MATHEW: So far as you knew the company was in a sound financial position?—Yes, I knew that years before, I had found money to put it in a sound financial position.

In cross-examination by Mr. POLLOCK, K.C., Witness said that the statement of claim showed that it was sought to recover £500 lost under the agreement with the Beck Co. to manufacture the meters; £46 the difference on certain transactions on the sale and purchase of debts; and something like £40 or £50 expenses relating to a matter with the Dublin Corporation.

Mr. POLLOCK: Do you think Mr. Billington has swindled you?—I am not going to say that.

In further cross-examination, Mr. SPILLER said that he placed debentures for the Beck Co. in 1909. He knew that the Beck Co. wanted money, but inquiries as to the value of the patents were answered satisfactorily. He was satisfied that the Beck Co. had a prosperous future before it. Mr. Billington had, in fact, bought several debts of the Beck Co.

A CLERK formerly in the service of the Beck Flame Lamp Co., Ltd., at the time Mr. Billington was managing director, said that he was appointed secretary *pro tem.* of the plaintiff company by Mr. Billington, who was well acquainted with the financial condition of the Beck Co.

Mr. HAYDN HARRISON, electrical engineer, stated that he entered into an agreement for the sale of the meters, and could have sold them if they had been supplied to him.

His LORDSHIP suggested that the evidence was unnecessary, as they knew that no meters were sold. The witness was the sole agent, and therefore, if there had been anything to be sold, he would have sold it.

Mr. ATKIN: Was it, in your judgment, a sound commercial venture, and do you believe that you would have been able to sell the meters if they had been supplied?—I do believe that it was a sound commercial venture, and I have no doubt I should have been able to make good sales.

Mr. POLLOCK, in opening the case for the defence, said that there was not an atom of evidence, and not even a suggestion, that any of the money had passed into Mr. Billington's pocket, or that he had derived any advantage out of the transactions. The Beck Co. was a company likely to do well, as it had some very good patents; but it wanted capital. It had been suggested that Mr. Billington had been guilty of fraud, but in order to arrive at such a conclusion, they must look for motive. It could not be suggested that a man would descend to fraud without motive, but here there was not even a suggestion that the defendant had derived any advantage. The only advantage had been with the Beck Co., and yet reckless charges had been made against the defendant in order to create prejudice.

Mr. ARTHUR MARSTON BILLINGTON was then called, and said that he was a constructing electrical engineer, carrying on business at Suffolk House, Lawrence Pountney Hill, E.C. In the course of his business he had come across several patents from time to time, and had been interested in companies formed to exploit them. He was for many years engineer to the London Electric Supply Corporation, and he entered into the plaintiff company, and Mr. Spiller was the other director. He had known Mr. Spiller for some 15 years, and in 1908 he came into business contact with him in connection with the Beck Co., whose business related to a patent arc lamp for street lighting. They secured some important contracts with the London County Council for lighting the Strand and other places. Mr. Spiller was to find a certain amount of capital, and witness promised him 300 shares, but he ultimately got 500. When he came to witness's office he saw the meter on the table, and asked what it was. Witness explained it to him, and told him that he had a half share in it, and was arranging with the Beck Co. to manufacture it. He suggested that as witness had a great deal on hand, it would

facilitate matters if witness would allow him to form a company. At first he (witness) rejected the proposal, because he did not wish to make a company of it, as he wished to work it with Mr. Johnson. Ultimately, however, he agreed that the company should be formed. It was formed, and the arrangement was that the Beck Co. should manufacture the meters. It was also agreed that £500 should be paid to the Beck Co. to provide plant, an accumulator house, and put up a testing room. In fact, it was arranged that they should put themselves in a position to carry on the manufacture. The plant was exceptional, and had to be provided. It was not true that he made any representations about the Beck Co. at that time, but he believed it would have been in a position to carry out the manufacture of the meters, or he would have had nothing to do with it. He was supposed to have a salary as managing director of the Beck Co., but he did not always get it.

As a matter of fact, have you ever had any fees as a director of the plaintiff company?—No, not from either company.

Had you any desire to falsify the minutes at all?—No, certainly not.

Or any object in falsifying them as alleged?—None whatever. Examination continued: The meter company had a certain amount of capital lying idle, and the Beck Co. had no money immediately available, and I suggested that it would be to our mutual advantage to assist the Beck Co. financially. At that time we could not have made use of the money for the sale of the meters, as the meter was not then in a sufficiently advanced form.

Have you in any way sought by these transactions which are questioned in this action to secure profit or advantage for yourself?—None whatever. I have suffered in pocket and in health.

Is it true that on any occasion you have made false assertions to Mr. Spiller?—No.

In cross-examination by MR. ATKIN, Witness said that in August, 1910, he thought the Beck Co. was in a satisfactory financial position, and Mr. Spiller knew the exact position of that company.

After some further evidence, the Jury found a verdict in favour of the plaintiff company, and awarded them £486 damages.

Judgment was accordingly entered for the plaintiffs with costs, but a stay was granted with a view to possible appeal.

#### OSRAM LAMP WORKS, LTD., v. FREEMAN.

In the Chancery Division on March 7th, Mr. Justice Sargant had before him this case, on a motion to restrain an alleged infringement of the plaintiffs' patent.

MR. J. HUNTER GRAY (for plaintiffs) explained that the patent had been certified as valid by Mr. Justice Warrington as the result of a trial before him last year, which lasted two or three weeks. Since then there had been a very large number of infringing lamps made abroad, imported into this country, and sold through retailers. The patent was for a metal-filament incandescent lamp, and there was no process except plaintiffs' by which this filament could be made.

SIR ALFRED CRIPPS, K.C. (for the defendant) said his client was not the manufacturer but merely the retailer. Immediately the motion was launched the defendant told plaintiffs this and offered to abide the result of an action which plaintiffs were bringing against the manufacturers—the Gabriel Co. In these circumstances, counsel urged that it was extremely oppressive for the plaintiffs to have continued the proceedings against the retailer, and asked that plaintiffs should be ordered to pay the costs of the motion.

HIS LORDSHIP: Is there a substantial defence on the part of the manufacturer?

SIR ALFRED CRIPPS: Certainly. It is not evidence now, but I may say that, according to an affidavit of Mr. Ballantyne, there is a very substantial defence. We are not using the process upheld before Mr. Justice Warrington, but something quite different. We are not going to tell them now what it is.

HIS LORDSHIP: It would be very oppressive on the manufacturer for the process to be disclosed by the retailer.

MR. GRAY: This sort of thing is very much more oppressive on the patentee.

HIS LORDSHIP (to Sir Alfred): Are you prepared to keep an account of the lamps sold?

SIR ALFRED CRIPPS: Certainly. We have offered that, and to abide by the case against the manufacturer. We say that from the moment that offer was made, no costs should have been incurred.

HIS LORDSHIP made no order on the motion, and reserved the costs.

#### MUNDAY v. SOUTH METROPOLITAN ELECTRIC LIGHT AND POWER CO., LTD., AND THE NEW GUTTA-PERCHA CO., LTD.

On March 6th Mr. Justice Swinfen Eady heard in the Chancery Division an application on behalf of the South Metropolitan Electric Light and Power Co., Ltd., who were defendants with the New Gutta-Percha Co., Ltd., to an action brought against them by Mr. Edgar Lake Munday. Plaintiff asked for an injunction to restrain an alleged nuisance. By this application the Electric Co. asked that the plaintiff should be required to elect against which defendant in the action he was going to proceed, and that so far as related to the defendants against whom he elected not to proceed, the action should be dismissed with costs.

Mr. Tomlin appeared for the applicants; Mr. Frank Russell, K.C., and Mr. J. Edwards for the plaintiff; and Mr. A. E. Hughes for the New Gutta-Percha Co.

MR. TOMLIN said the statement of claim in the action alleged that the defendants carried on, or permitted to carry on, their businesses upon their respective premises at Crooms Hill, Greenwich, and upon the roadway or passage leading thereto,

known as May's Building Mews, so as to cause a nuisance by noise to the plaintiff as the owner and occupier of the dwelling house and premises, 54, Crooms Hill. The noise complained of was caused by the traffic of lorries, trollies, and other vehicles. A nuisance was also caused by numbers of the workmen of the defendant companies gathering in the roadway and in front of the plaintiff's house and shouting and making a noise there. He (counsel) contended that there had been an improper joinder of defendants.

In reply to his LORDSHIP, Counsel said that throughout the claim there was a separate tort against each defendant alleged, and no sort of connection was alleged between the defendants, who carried on separate businesses on separate premises at the end of a lane.

HIS LORDSHIP: Which of the two defendants knocked the plaintiff's wall down?

MR. TOMLIN said he did not know, but the plaintiff seemed to be in the position of the unfortunate man who was squeezed between two omnibuses, and sued the owners of both, because he did not know who was the squizzer. Plaintiff ought to be compelled to elect against which defendant he intended to proceed.

MR. HUGHES, for the New Gutta-Percha Co., supported Mr. Tomlin's argument.

MR. RUSSELL said it was not possible to say whose lorry was passing or whose goods were being carried past the plaintiff's house on any particular occasion. Plaintiff complained that defendants were obstructing his right of way and making life intolerable—at all events, unpleasant, by reason of the noise. He could not, however, tell which defendant's workmen made more noise than the other—it was, however, a combined noise of the workmen which constituted the nuisance.

HIS LORDSHIP said it was not disputed that the defendants respectively had a certain right of way, but the extent of it was disputed by the plaintiff. It appeared manifest that plaintiff alleged a wrong or tort committed by each of the defendants. In each case the defendants claimed a right of way, and in each case it was a question of what the defendants had separately done. He was of opinion that the plaintiff must be put to his election as to which of the defendants he desired to proceed against, and the action must be stayed against the other defendant.

#### OSRAM LAMP WORKS, LTD., v. LOUIS SCHLOSS & CO.

On Friday last Mr. Justice Swinfen Eady, in the Chancery Division, decided a motion by plaintiffs against defendants, of 3, Rangoon Street, Crutched Friars, for an interim injunction to restrain the infringement of the plaintiffs' patent No. 23,899, of 1904, relating to tungsten filaments for lamps.

MR. COLEFAX, K.C., (with him Mr. J. Hunter Gray), instructed by Messrs. Bristows, Cooke & Carpmael, appeared for the plaintiffs, and the defendants were represented by Mr. Frost.

MR. COLEFAX, in opening the plaintiffs' case, said they had purchased a number of "Edna" lamps from the defendants. They had been submitted to Dr. Oberlander, who had sworn an affidavit that they had been manufactured in infringement of one or other of the plaintiffs' patents. The defendants said they purchased the lamps from the Société Anonyme Métal et Lumière, of 63, Rue du Marché, Brussels, and the Belgian company stated that the lamps were made in Italy—by the Società Edison and Cruto Clerici et Cie, of Milan—whose works were at Turin. There was evidence on behalf of the Belgian company showing that a gentleman connected with them had seen the Italian company's works, but he did not give any detail of the manufacture, and, so far as detail was concerned, it was left to a Mr. Maurice Bayet to put it in evidence.

COUNSEL reminded his Lordship that the Osram patents had been upheld by Mr. Justice Warrington, in an action against the "Z" Lamp Manufacturing Co. On the present application, he had an affidavit by Mr. Wm. L. Pakenham, the superintendent of the "Z" Co., who had, in fact, seen the "Edna" lamps manufactured in Italy, and he said that the process was precisely that which was carried on by his own company in this country, and which had been found to be an infringement. After describing the plaintiffs' mode of manufacture, Mr. Colefax said that the patent of 1904 consisted in the use of steam and hydrogen, and the other patent, in the use of nitrogen and hydrogen. The defendants in the action against the "Z" Co., said they did not use steam, but only hydrogen, but it was found, as a fact, that there was still sufficient trace of moisture left.

The affidavit of Dr. Oberlander stated that he had examined the Edna lamps submitted to him, and he was satisfied that the process used in their manufacture was an infringement of the plaintiffs' patents.

MR. FROST read the affidavit of Louis Schloss, which stated that he was a dealer in lamps. The "Edna" lamps were not manufactured by him, but purchased from the Brussels company above referred to.

The affidavit of Michel Bieske, managing director of the Brussels company, stated that all the lamps sold by them to the defendants were manufactured by the Italian company at their works in Turin. The affidavit of Carlo Clerici, son of a director of the Italian company, showed that he had made a study of lamps, and he visited the works of the Italian company and knew that neither steam nor hydrogen was used to prevent oxidation of the filaments.

Commenting on the defendants' evidence, MR. COLEFAX said that Clerici was the responsible person, but he did not go into any details of the manufacture. When the filament had got to its last stage, in order to raise it to a sufficient temperature, the Italians said they passed a current of electricity through it. Precisely the same suggestion was made in the action against the "Z" Co.,

and on that issue being fought out, Mr. Justice Warrington found that, in effect, there was a minute quantity of moisture clinging to the bell-jar, which, in fact, effected the removal of the carbon. He suggested that the defendants were swearing by the card rather than stating what the process really was.

**HIS LORDSHIP:** In the process described by the defendants supposing there is an imperfect vacuum, what is there to prevent the oxidation of the tungsten?

**MR. COLEFAX:** Nothing, unless hydrogen is put in. Our patent gets over the carbon without oxidation.

**MR. FROST:** The carbon is removed in vacuum. The vacuum being sufficiently complete there is not a sufficient quantity of oxygen remaining to destroy the filament.

**MR. COLEFAX:** The only evidence given by the defendants does not put forward any such story, but, on the contrary, says an electrical current is used.

**HIS LORDSHIP:** Are the lamps manufactured by the Italian company sold in Italy as "Z" lamps?—**MR. COLEFAX:** Yes. I submit that in the absence of any affidavit from Clerici telling us exactly what the process is, we are entitled to an injunction. Mr. Justice Warrington has found that there is no direction in the specification to introduce steam.

**MR. FROST,** for the defendants, submitted that as Clerici's affidavit was not contradicted, the motion failed.

**HIS LORDSHIP:** Does he explain anywhere how it is that the tungsten does not get oxidised?—**MR. FROST:** No.

**HIS LORDSHIP:** That is rather important.

**MR. FROST:** These things are very extraordinary. In the previous case against the "Z" Co. it was argued that there was no steam left in the bell jar. That, of course, has now gone. We contended that the carbon was actually distilled off without chemical action.

**HIS LORDSHIP:** The affidavit of Bayet throws over Mr. Swinburne's theory of the physical volatilisation.

**MR. FROST:** That is his opinion. If there is no hydrogen introduced into this vacuum, there is an answer to this case.

**HIS LORDSHIP,** in giving judgment, said he need only deal with the first of the plaintiffs' patents—that of 1904. The plaintiffs had established the validity of that patent in the action before Mr. Justice Warrington, and also that the "Z" Manufacturing Co. had infringed it. It now appeared that the defendants, Louis Schless and Co., imported lamps, which, according to the plaintiffs' allegations, were made in infringement of the patent, and in the same way as the lamps which were the subject of the former action. According to the evidence adduced on behalf of the defendants in the former action, it was said that no steam or hydrogen, or hydrogen with a small quantity of water, was used, and that, therefore, there was no infringement. The plaintiffs' process was to protect the filament, and the defendants said the process used in the manufacture of Edna lamps was to remove the carbonaceous material by electricity, and although that was done in a vacuum, the vacuum was imperfect, and there was a sufficient residuum of air left for the removal of the carbon. Mr. Biske said that he had visited the Italian company's works, but he did not in terms say that he had witnessed the manufacturing process. All he said was that the carbon was removed by placing the filament in a vacuum, and raising it by means of current to a high temperature.

In other words, he attributed the oxidation of the carbon to the small quantities of air remaining in the vacuum. Mr. Clerici did not give any details in his affidavit of the way in which the filaments were manufactured. He denied that certain gases were introduced, but there was no denial of the introduction of hydrogen alone. On the other hand, it seemed clear from the affidavit of Dr. Oberlander that unless some means were adopted to protect the tungsten in the filament from oxidation, the introduction of a high electrical current would result in the destruction of the tungsten filament. "Having regard to that evidence," said his Lordship, "I am of opinion that for the purposes of the present motion it has been shown that these lamps are really manufactured in the same way as the lamps of the "Z" Co. in the previous action." Mr. Pakerham, the superintendent of the "Z" Co., had seen the Italian process, and said it was the same as that of the plaintiffs. There would, therefore, be an interlocutory injunction against the defendants on the plaintiffs' undertaking in damages, and the usual order as to costs.

### Electrical Trade in Switzerland.—The year 1912

was a record year for the Swiss machinery and electrical industry. Factories were so full of work that delivery to date, in many cases, was impossible. Orders were booked for large electrical units for the Augst-Wighlen station, and also for that at Laufenburg. The enlargement of power stations and the extension of distribution networks, both at home and abroad, created a lively demand for generators, transformers and motors. In view of the monopolisation of electric supply by the Cantons and Communes; private capital obtained from putting forth new schemes. The electrification of the Federal railway system, which is to be undertaken at no distant period, involves the establishment of new generating stations to supply the current which will be required. In contrast with the temporary lull in electric circles in Switzerland, orders for water turbines came from abroad, and especially from oversea countries, in ever-increasing numbers. Business in steam turbines was also extremely satisfactory.

### REVIEWS.

*Design of Electrical Machinery.* Vol. III. By W. T. RYAN. London: Chapman & Hall, Ltd. Price 6s. 6d. net.

This is the third volume of a series of books by the author on electrical design, and deals with alternators, synchronous motors, and rotary converters, the two preceding volumes having discussed direct-current machines and alternating-current transformers respectively.

Different types of alternating-current generators and their characteristics are described in the first chapter. A number of extracts from specifications and the A.I.E.E. standardisation rules, together with some miscellaneous information on windings, vector diagrams, &c., are given.

Chapter 2 deals with the design of alternators and synchronous motors, and the treatment is quite modern. A number of tables are given relating to output coefficients, specific loadings, air-gap densities, and so on—all of which are on the safe side. Field and voltage wave forms are treated fairly thoroughly, as is also armature inductance.

Following, we have 11 pages devoted to the design of rotary converters, and the author states that he has only considered the points wherein a rotary is different from either a synchronous motor or a direct-current generator. As a matter of fact, the information given is of the most elementary and discursive character. Some definite data should surely have been given as to the different proportioning of the various parts, conductor sections, number of conductors in series per pole, &c.

The concluding chapter gives a number of reproductions from working drawings of a 180-K.V.A. 2,200-volt alternator.

The book consists of 127 pages of matter, with a seven-page index. Distributed amongst this 127 pages are 55 photographic reproductions of machines and parts of machines, strongly suggestive of manufacturers' catalogues, and it may at once be stated that the great majority are useless from an educational standpoint. The price is altogether unreasonably expensive.—H. G. S.

*The Practical Telephone Handbook.* By J. POOLE, A.M.I.E.E. London: Whitaker & Co. Fifth edition. Price 6s. net.

Dr. Fleming recently remarked, in the course of a series of lectures which he was delivering on wireless telegraphy, that nowadays it was quite impossible for a man to be an all-round telegraph engineer—he must specialise in one of the branches into which the profession is divided, each of which in itself constitutes a life's study. In none of the subdivisions of telegraph engineering are these remarks more true than in connection with telephony. Only a few years ago, telephony formed a part, and only a small part, of the work of the inland telegraph engineer. At present, however, telephony has grown to such an extent as completely to overshadow the older art, and rapid developments and changes are still taking place. The difficulty of keeping abreast of modern practice in the telephone field is only too well known to the engineers and other officials connected with the telephone industry, and by them the appearance of an up-to-date edition of the work under review will be welcomed. The greater number of readers are, in all probability, familiar with this book in earlier editions, and to them we need only say that the old standard of excellence has been well maintained in the present one, which has been considerably revised and enlarged. For the benefit, however, of any readers who may not be acquainted with the work, we give a short sketch of the ground which it covers.

The first chapter gives a brief outline of the elementary electrical phenomena upon which the science of telephony is founded. Then follows a chapter on batteries, and one in which the history of the development of the telephone is rapidly sketched.

The various pieces of apparatus, the different exchange arrangements, including some special exchange systems, and automatic working, are described in considerable detail.

Chapters are given on the apparatus room; power plant; traffic statistics; construction—overhead, underground and submarine; loading, including a brief sketch of Dr. Kennelly's theory of artificial cables; the localisation of faults; electrical measurements; development studies; and wireless telephony. The book concludes with a chapter on the miscellaneous applications of telephony, such as the electrophone service; police and fire alarms; the telautograph; and several others. At the end of the book many useful notes and tables have been collected into an appendix.

The book is well printed, the diagrams are clear, and we can recommend it to all who wish to obtain an up-to-date book on telephony at a reasonable price.

We have only two adverse criticisms to offer.

In dealing with the Leclanché cell, on page 31, the author remarks that in setting up this cell care should be taken to exclude manganese dioxide dust. It has been shown by Mr. J. G. Lucas, in a paper read before the Institution of Post Office Electrical Engineers, that this is a fallacy, and that a Leclanché cell, in which powdered manganese dioxide is used, is much more efficient than one in which the granulated substance is employed.

We notice with regret, on pages 405 and 406, that in dealing with the theory of telephone transmission, the author has used the symbol  $\alpha$  to denote the wave-length constant, and  $\beta$  to denote the attenuation constant. The best English writers on this subject, among whom may be mentioned Dr. J. A. Fleming and Messrs. Cohen and Shepherd, use  $\alpha$  to denote the attenuation constant, and  $\beta$  to denote the wave-length constant. This manner of using the symbols is that which follows naturally, in the theoretical investigation of the subject, from the mathematical conventions ordinarily employed in algebra and geometry.

It seems very undesirable to use the same pair of symbols with reversed meanings, and we hope that in future editions of the work under review this matter will be put right.

*Wireless Telegraphy and Telephony.* By W. J. WHITE. London: Whittaker & Co. Price 2s. 6d. net.

The author's aim has been to provide the general reader with a sufficient acquaintance with the fundamental principles of electricity and magnetism, to enable him to follow intelligently the principles and practice of wireless telegraphy and telephony. The work is neither a scientific treatise nor a "popular" book in the ordinary sense of the word. To treat a highly technical subject in a manner which shall enable the layman to obtain a reasonable insight into its theory and practice, without consulting other works, necessarily involves the devotion of considerable space to introductory matter, and, in our opinion, what is needed (and what is, indeed, already available in various forms) is a popular handbook dealing with the elements of electricity and magnetism in such a manner as to absolve the author of a popular treatise on any electrical subject from descanting on introductory matter, which is, after all, practically the same in every case. As matters stand at present, almost every popular handbook on electrical subjects—and, for that matter, most of the higher-grade text-books as well—is encumbered by preliminary chapters dealing with amber, ἡλεκτρον, magnetic needles, Ampère's "swimming rule," and so forth. The space available for the branch of electrotechnics actually in hand is consequently curtailed. Surely it is not too much to hope that this profitless repetition—wearisome to the reader and involving loss of time and space to the author—will be eliminated from electrical and other technical and scientific handbooks at no distant date. As the result of the space devoted to introductory matter—which is, be it understood, excellent in itself—the subject of wire telegraphy is not reached before page 40 in the present volume, and the subject of wireless telegraphy is broached on page 64; some 20 pages are devoted to wireless telephony.

The introductory pages deal with frictional electricity, voltaic electricity, and the storage of electricity in secondary cells. The section on magnetism affords an excellent introduction to the principle of action of telegraphic instruments. The Morse key, code, sounder, recorder, and relay, &c., are

treated in Chapter III, while Chapter IV is devoted to wire télégraph circuits and working. The latter section is brief (8 pp.), and in itself excellent, but it might easily have been omitted from a treatise on wireless telegraphy and telephony.

Chapter V explains the principle and limitations of wireless telegraphy by induction, and by utilising two more or less remote waterpaths across a river—the latter system simply avoiding the necessity for carrying wires across or through the river, and being largely used at the present day across a number of Indian rivers. Proceeding, the author describes and discusses induction systems, and then turns to the generation and telegraphic application of high-frequency oscillations. The work of Hertz and the application of his results in tuned circuits are discussed briefly, but very clearly, and the present limitations of wireless telegraphy in respect of secrecy are pointed out. Chapter VII, describing the function and construction of spark gaps, Righi's and Chunder Bose's oscillators, and the coherer and tapper, leads the reader to a clear conception of the *modus operandi* of Marconi's system. Chapters IX-XII respectively deal with the Telefunken, Lodge-Muirhead, De Forrest, and Fessenden systems, and clearly explain their characteristic features and advantages.

Recent progress and improvements in apparatus are considered in Chapters XIV and XV; most general readers would appreciate a rather fuller description of results already obtained, distance of transmission, general location of the chief present and proposed stations (preferably illustrated by a map), and a more complete review of miscellaneous present and prospective applications of wireless signalling. The Fessenden high-frequency alternator is illustrated and briefly described, but the author certainly attaches too little importance to the possibilities of high-frequency electro-mechanical generators, and no mention is made of the Goldschmidt machine.

The general production and style of the book are excellent, but the unorthodox spelling "oscilligraph" is repeated a number of times. It is a pity that some of the space devoted to introductory matter could not have been allocated to some of the recent important developments, which receive no mention, but the volume suffers much less than would be expected from being a revised early edition. By an oversight the author has allowed 1905 (page 145) still to be referred to as "last year" in the 1912, as in the 1906 edition. The book is to be recommended as a clear exposition of wireless telegraphy and telephony, sufficiently complete for the needs of the general reader.

*Common-Battery Telephony Simplified.* By WALTER ATKINS (Engineering Department, G.P.O.). London: The Electrician Printing and Publishing Co., Ltd. Price 3s. net.

Probably in no branch of applied electricity are more involved and complex systems met with than in modern common-battery telephony.

The full diagrams of the connections of these systems are so intricate that the student experiences very great difficulty in tracing out the paths of the currents concerned in the various operations of calling, clearing, &c. It is almost absolutely necessary, in order to obtain a clear grasp of the actions which take place, to cut out from the complete diagram everything not concerned in the particular phase of the working being studied, and to draw a simple diagram which enables the attention to be concentrated on the circuits and pieces of apparatus actually involved.

The difficulty is, however, immediately met with that when the working of the circuits represented on the full diagram is not properly understood, it is by no means easy to draw these simple diagrams—the knowledge, which the student wishes to acquire, being necessary to enable him to unravel the complexities which he meets with. The author of the present volume has recognised this difficulty, and has produced a book which should smooth the path of the beginner, and also be acceptable to those who are actually engaged in the telephone field—for, owing to the rapid

developments of the subject, any means by which the work of keeping abreast of modern progress can be facilitated is welcome.

The writer has omitted all padding in the form of descriptions of obsolete methods, discussions on theoretical questions, and photographs of exchanges and apparatus. He has confined himself to describing the principles of the common-battery telephone system, as used to-day by the British Post Office.

The book is divided into sections dealing with the main frame and apparatus room, subscribers' switchboard arrangements, junctions, subscribers' apparatus, testing arrangements, and several miscellaneous circuits, such as supervisor's, observation and interception circuits, electrophone arrangements, and some special types of switchboard.

An appendix is added, in which the colour scheme used for switchboard cables is given, and also one dealing with the voltmeter method of measuring resistances.

The book is well printed on good paper, the diagrams are clear, and it can be recommended to all who are brought into touch in any way with common-battery exchanges; especially to those who are studying the subject without the aid of a teacher.

## BUSINESS NOTES.

**Consular Notes.—India.**—A recent report by the American Consul at Bombay stated that the substitution of electric traction for steam power on the suburban line section of Bombay, which had been under consideration by the Railway Administration for some years, had reached an important stage.

If electric power is substituted for steam traction on the Great Indian Peninsular and Bombay, Baroda and Central India Railways, it is expected that both lines will be disposed to adopt similar systems to facilitate interworking. It is understood, however, that the intention of the Bombay, Baroda and Central India administration is only to carry suburban passenger traffic by electricity, there being no idea at present of using electric traction for either freight work or on the main lines. A number of newspaper articles have discussed the system of electrification most suitable for the project, and it is stated that, if the port authorities acquiesce in the desirability of electrifying their local lines, this will practically eliminate the introduction in Bombay of any but the single-phase alternating-current system, and that everything points to the expert recommending the installation of this system. Local engineers are somewhat at variance with this view, and results obtained on railways in the United States are cited in support of their argument for direct-current operation.

A survey will shortly be carried out by the agency of the Bombay, Baroda and Central India Railway Co., for a line of railway on the 5 ft. 6 in. gauge, from Gangapur, on the Nagda-Muttra section of the Bombay, Baroda and Central India Railway, to Luni, on the Jodhpur, Bikaner Railway, a distance of about 260 miles.

**Russia.**—The American Consul at Moscow reports that negotiations have been going on for some time respecting the sale of the Rauchiall waterfalls on the river Vuoxen, and an agreement has only recently been reached under which the proprietors cede all their rights to a Brussels banking house for a little over £200,000. The average power of the waterfall is 48,469 H.P. It is said that the purchasers contemplate delivering the current to be generated by the fall for power purposes in St. Petersburg. The capital of the proposed exploiting syndicate is £4,000,000. The bank in question, it is stated, is also negotiating for the purchase of the Vallinkoski Falls, the second in importance on the Vuoxen River, which will yield 44,398 effective H.P. The municipal finance committee of Finland is said to be considering a project for a car line between Helsingfors, Haaga and Munkunas. The Moscow Electric Light Co. has given out a statement of its business in 1911, which shows a net profit of nearly 84 per cent. According to the conditions of the contract with the city the surplus above 8 per cent. must be distributed among the consumers of electricity in proportion to the amount consumed by them. The total sum subject to distribution amounts to £3,000, and each subscriber is entitled to receive 1s. 5½d. on every £10 worth of electricity consumed. The company has presented to the city board a report on its development during the past three years, from which it appears that the reduction of the local rate has promoted its general progress. The average cost of energy has been reduced from 7d. to 5½d., while the assets of the company have increased from £1,400,000 to £2,200,000. The number of electric meters installed in private dwellings has risen from 14,000 to 33,000. The length of cable has increased from 325 to 725 miles, and the income of the company from £300,000 to £450,000 per annum.

The American Consul at Moscow also reports that there was a considerable increase in the amount of electrical power used in Russia in 1911, and in connection with this, in the

production of electrical machinery principally for mining and metallurgical purposes. The greatest progress was noted in the production of Diesel engines, while there was also a larger output of cables, tramway and telephone equipment, and machinery used in the production of ozone. The forward movement of Russia's industries, together with the increased agricultural production, caused the continued importation of various systems of electric, gas and other tractors, as well as of separate equipments. For some time to come Russian manufacturers will not be able to satisfy the demand. A considerable amount of improved machinery for working metal was imported, indicating the growth of machinery building in the country.

**Siam.**—The American Consul at Bangkok reports that estimates for three wireless stations and installations were placed in the budget of Siam for the fiscal year 1912-13. An experimental station of the Telefunken system was erected on the island of Kohsichang some years ago, and this system will be used for the new installations. The sites for the land stations will be on the eminence at the exhibition ground at Pratoomawan, at Kohsichang, and the third on the top of the hill at Singora. Three vessels of the fleet are to be equipped. The station at Singora will be easily able to communicate with the Telefunken station at Sabang during the day and during the night will have a much further radius. The Post and Telegraph Department will connect the central station at Sapatum with the Ministry of Marine by ordinary telegraph, and will place a second line between Post Office No. 2 and Sapatum. Commercial messages will be dispatched by wireless, but it is not anticipated that the system will compete with the landlines.

**China.**—A recent report by a German commercial agent attached to the German Consulate at Shanghai refers to the possibilities for the expansion of trade with China in electrical and similar goods. Although it is hardly to be expected that the electrical trade of China will develop as soon, or grow as quickly, as that of Japan, there can be no doubt that considerable expansion will take place in the near future. Apart from English companies already working in the market, American and German companies are displaying considerable interest, and competition is bound to become keener than it has been up to the present. The larger towns, which are more and more beginning to undertake the installation of municipal stations, are probably the most important source of demand. The extension of electric tramways, too, will call for important supplies; projects for such tramways are already in hand for Peking, Hankow, Canton, and several other towns. Electrical firms should also consider the possible demand for their goods on the part of mining and metal works. Not only are new works of this description being undertaken, but existing works are carrying out extensive works for the modernisation of their plant. With such possibilities of extension there will be excellent opportunities for the extension of trade in electrical goods of various kinds, and chiefly in power plant, lighting plant, lamps, &c. Steam power is chiefly used in China for driving generators. There is an active demand for water-tube boilers, which can be easily transported; boilers made by Babcock & Wilcox are specially favoured. English steam engines find a good sale. Turbines are in demand for plants of over 500 H.P., but for smaller plants, petroleum motors are used, as petroleum can be readily obtained all over China.

The Austrian Consul at Tientsin reports that the imports of electrical materials into that port in 1911 were valued at 326,131 Haikwan taels, as against 130,061 Haikwan taels in 1910. The most important items are metal-filament lamps, insulated copper wire, electrical materials for household installations, copper wire for electric tramway work, motors, &c. The imports of telegraph and telephone material fell from 299,190 Haikwan taels in 1910, to 77,853 Haikwan taels in 1911.

The American Consul at Swatow reports that the project of establishing a telephone system in that port, which was much discussed in the spring and summer of 1912, was again actively engaging the attention of local capitalists towards the end of the year, and it was anticipated that in all probability the scheme this time would materialise. It should be remarked that practically the same men who financed the electric light system and the waterworks are backing the telephone venture. The leading man in this group is also the principal shareholder in the Swatow-Chaochow Railway, and has also been asked to serve as a director of the proposed Chaochow-Hinchow line. It is proposed to open with a small exchange of about 100 subscribers, and it is not expected that there will be over 250 subscribers altogether in Swatow later on. Proportionately a great deal of wiring will be necessary, owing to the distances between subscribers. The concession was granted last October, and certain English and German manufacturers sent agents to study local conditions and submit estimates. The contract was to have been let before the end of 1912. No specifications were issued, each firm tendering being expected to draw up its own. Tenders were desired for the complete installation, including exchange, instruments, poles, wiring, &c. Under these conditions it was obvious that a manufacturer wishing to bid would have to send an engineer to Swatow to ascertain the conditions, and it was not believed that any American firm manufacturing telephone supplies, that did not have a Far Eastern agency, would be in a position to send a representative there in time to submit estimates, and that, even if it were, the contract was not large enough to warrant the heavy expenses involved in doing so. The waterworks already own two private telephone installations, one from the intake station at Ampo to Swatow, and another from Swatow to Chenghai. These were put in by the China and Japan Telephone Co., of Hong-Kong, a British concern, which naturally secured advance information of the present project. As indicated above, an agent of this firm has already visited Swatow. The local German firm of Lauts & Haesloop was also very anxious to secure the con-

tract. The Consul concludes with the following remarks, which are extremely interesting:—"The Swatow Consulate is greatly handicapped in efforts toward securing such contracts for American firms by the absence of local American business houses and by the lack of information as to which American manufacturers have agencies in China. The first difficulty is unavoidable, but the second is due to the carelessness of the American manufacturers themselves, who should notify Consular officers when establishing agencies if they wish to secure the assistance of the Consular service."

**Spain.**—The American Consul at Almeria reports that the wireless telegraph station (situated on a high hill behind Almeria and half a mile from the sea), belonging to the Spanish Government, has recently been equipped with new apparatus. The new instruments, manufactured by the Telefunken Co., are of the latest type and of high power. The station is in constant communication with the central office at Madrid and with other Spanish ports.

**Catalogues and Lists.**—THE METALLIC SEAMLESS TUBE CO., LTD., Birmingham.—Postal card relating to their "Metallic" cables and cords.

MESSRS. R. H. PATTERSON & CO., LTD., Forth Street Works, Newcastle-on-Tyne.—March catalogue of new and second-hand electrical, steam and other machinery for sale or hire.

THE ELECTRICAL CO., LTD., 122-124, Charing Cross Road, London, W.C.—18-page pamphlet (No. 14) containing particulars, with illustrations, prices and sketches, of a large number of their standard types of electric measuring instruments.

MESSRS. C. MELIN & CO., 7, India Street, Crutched Friars, London, E.C.—20-page catalogue, fully illustrating and describing their Borkessel burners and blowpipes, some of which are specially designed for use by electric lamp manufacturers, while others are for laboratory and workshop service.

MESSRS. MAGIC APPLIANCES, LTD., 6, Farringdon Avenue, London, E.C.—Illustrated leaflet giving brief particulars and prices of their "Oscillus" vibrator, and "Hotwynd" blower.

MESSRS. PASS & SEYMOUR (INC.), Solvay Station, Syracuse, New York, U.S.A.—Illustrated folder, showing their "P. and S." interchangeable electric lamp sockets "24 sockets made from 15 parts."

THE HOTPOINT ELECTRIC HEATING CO., Canada and U.S.A.—Several illustrated lists (with prices) of Hotpoint electric irons, also heating and cooking apparatus.

MESSRS. H. MILLER, LTD., Hazebrourk, France.—Leaflet showing a number of French electric measuring instruments.

THE STERLING TELEPHONE AND ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—Leaflet No. 207, giving an illustrated description and price particulars of their watertight magneto mining telephone.

**Fire.**—We learn that a somewhat serious fire occurred at the Sphere Engineering Works of ENGINEERING AND ARC LAMPS, LTD., St. Albans, on Saturday night. The fire was first noticed by one of the employes at the North Metropolitan Electric Supply station next door, who promptly gave the alarm, at nine o'clock. Nobody had been on the premises since half-past four. No reason has been discovered for the outbreak. The two fire brigades were promptly on the spot, and succeeded in arresting progress of the flames. Apparently the fire originated at the south-east corner of the building, and three gables were completely burnt out for two-thirds the length of the works, and the coiling department was also completely destroyed. The shafting was very much injured, but damage to the machinery is not extensive, the principal loss being suffered by finished stock and raw material. The damage to the stock, building and contents is about £4,000, which is fully covered by insurance. It is hoped to have all the machines, &c., working within five weeks; and although part manufacture has already been resumed, the incurrence of clients for any delays in delivery is requested.

**Dissolutions and Liquidations.**—ROSSENDALE BELTING CO., LTD.—A meeting of creditors is called for March 14th, at 7, Norfolk Street, Manchester.

EXPRESS CABLE INVENTIONS, LTD.—A meeting is called for April 11th, at 29A, Charing Cross Road, London, W.C., to hear an account of the winding up from the liquidator, Mr. R. H. Gillespie.

MELDRUM BROS., LTD., Timperley, Manchester.—March 25th is the last day for receipt of proofs for dividend by the liquidator, Mr. T. Gregory, 3, York Street, Manchester.

ROAD AND RAIL ENGINEERING CO., LTD., Derby.—First and final dividend of 20s. in the £, payable at Smith's Bank Chambers, Market Place, Derby.

PYBUS & CO., electrical engineers, 29, Brown Street, Manchester, and Chorlton-cum-Hardy. Messrs. J. H. Pybus and T. Pybus have dissolved partnership. Mr. J. H. Pybus attends to debts.

**Bankruptcy Proceedings.**—J. W. LEWISLEY, electrician, 65, Brierley Street, late 103, Mansfield Road, Nottingham.—The first meeting of creditors herein was held at Nottingham last week, when the liabilities were put at £156, and there was a deficiency of £143. It transpired that the debtor started trading in partnership with another in 1910, with a capital of £160, which was contributed equally by the partners. After six months' trading the partnership was terminated, and Lewisley continued to carry on the business on his own account until 1911, when he executed a deed of assignment. Only two creditors, however, appeared to have assented to the deed, and the present liabilities were due to the non-assenting creditors.

MESSRS. J. & F. MITCHELL (Fred. Mitchell & Co.), electrical engineers, 97, Stockport Road, Ardwick, Manchester.—Receiving order made March 6th, on debtor's petition.

BERNARD MURGRAVE, director of a limited company, Howick, near Preston, late of Astley Bridge near Bolton. First and final dividend of 32½d., payable March 15th, at 10, Acresfield, Bolton.

**Sold Out.**—The last issue of the ELECTRICAL REVIEW was sold out early on publishing morning and some of our regular readers were, therefore, unable to secure their usual copies. If any such readers who may still desire to complete their sets will apply to the publisher, he will endeavour to obtain sufficient copies of the last issue for the purpose.

**Trade Announcement.**—THE TORMO MANUFACTURING CO., of Bunhill Row, E.C., have opened a branch depot at 8, Peter Street, Manchester, where they will keep a representative stock of F, and S, ball bearings and Tormo steel balls.

**Book Notices.**—*Manual for the use of Fire Brigades.* Compiled and published by the National Fire Brigades' Union Inc., London. Price 2s. 6d. net.—This work has been issued to fill a want, owing to the great changes which have taken place in the methods of fire-fighting in recent years and the introduction of improved appliances; it is believed that it contains all the details necessary for the education of firemen, so far as this can be derived from a book, to enable them to attain to efficiency in the execution of their dangerous duties. Many well-known experts have contributed to its pages, and the contents may be relied upon in all respects. The Manual will be useful not only to works which maintain their own fire brigades, but also to private householders and all others who are interested in fire prevention. There is a chapter devoted to "Electricity in the Fire Service," in which the fireman is given some general ideas about wiring, the method of control, suitable means of extinguishing electrical fires, &c. This is good on the whole, though somewhat too optimistic regarding the dangers of shocks from 200-500-volt circuits; these are treated lightly, but firemen with wet clothes and boots, standing on wet floors, should be peculiarly susceptible to severe shocks, and the warning might well be more earnestly impressed upon them. No doubt, to save bulk and weight, the book is printed on thin paper, with the result that in many places the printing on both sides of the leaf can be seen, and reading is difficult.

"Journal of the Institution of Electrical Engineers." No. 217, Vol. 50. London: E. & F. N. Spon, Ltd. Price 5s.—The issue for February, 1913, contains the following papers:—Inaugural Address of the President, by W. Duddell; Chairman's Address, Newcastle Local Section, by W. C. Mountain; Manchester Local Section, by A. A. Day; Yorkshire Local Section, by S. D. Schofield; Scottish Local Section, by W. McWhirter; Birmingham Local Section, by A. M. Taylor; Western Local Section, by W. A. Chamen; The Magnetism of Permanent Magnets, by Prof. S. P. Thompson; Earthed & Unearthed Neutrals, by J. S. Peck; The Turbo-Converter, by F. Creedy; The Control of Meters, Public Lamps, and other Apparatus from the Central Station, by W. Duddell, A. H. Dykes and H. W. Handcock; The Testing of Ebonite for Electrical Purposes, by C. C. Paterson, E. H. Rayner and A. Kinnes.

"Psychology and Industrial Efficiency." By Hugo Münsterberg. London: Constable & Co., Ltd. 1913. Price 6s. net.

"Reports of the Committee on Electrical Standards Appointed by the British Association for the Advancement of Science." London: Cambridge University Press. 1913. Price 12s. 6d. net.

"Methods of Measuring Electrical Resistance." By Edwin F. Northrup. "Electrical Machine Design." By Alexander Gray. Price 17s. net each. London: Hill Publishing Co., Ltd.

"Proceedings of the Physical Society of London." Vol. XXV, Part 2, February 15th, 1913. London: Electrician Printing and Publishing Co., Ltd. Price 4s. net.

"Journal of the South African Institution of Engineers." Vol. XI, No. 7, February, 1913. Johannesburg: The Institution. Price 2s.

"Bulletin of the Association des Ingenieurs Electriciens." Vol. XII, No. 11, November, 19th. Liège: The Association. Price 5.50 fr.

"Third and Fourth Annual Reports of the Hydro-Electric Power Commission of the Province of Ontario for year ended October 31st, 1911." Toronto: L. K. Cameron.

"Bulletin of the Armon Institute of Technology." Vol. VI, No. 1, May, 1912. Chicago: The Institute.

"Proceedings of the American Society of Civil Engineers." Vol. XXXIX, No. 2, February, 1913. New York: The Society.

"The Physical Review." Vol. I, No. 2, February, 1913. Lancaster, Pa.: The Physical Society.

"Bulletin Mensuel de la Société Belge d'Electriciens." Vol. XXIX, No. 12, December, 1912. Brussels: E. Bruylant. Price 1 fr. 75.

"Bulletin Scientifique de l'Association des Elèves des Ecoles Speciales." January, 1913. Liège: The Association. Price 75 cents.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 4, February, 1913. Milan: Stucchi, Ceretti & Co. Price L 1.50.

"Boletín de la Sociedad de Fomento Fabril." Vol. XXX, No. 3, January 1st, 1913. Santiago, Chile: The Society.

**Meeting of Creditors.**—FOSTER ENGINEERING CO., LTD., Wimbleton.—A circular letter issued by Messrs. Nicholson and Becroft, 12, Wood Street, Champs, E.C., under date March 8th, reads as follows:—

"A conference of the principal trade creditors, amounting to over £8,000 out of a total trade indebtedness of about £12,000, was called this week by the debenture-holders of the above company, amounting to £9,000, as to the best course to be adopted for the

preservation of this valuable business, which lately has had some special losses in connection with matters now disposed of and which are not likely to occur again. Mr. James Rook, of the Sloan Electrical Co., Ltd., was in the chair, and it was generally felt that every effort should be made to accomplish this object, and that the creditors should be asked to hold their claims in abeyance for the time being, in order to give the Committee, consisting of five of the principal trade creditors which was appointed, and the other parties interested in the company, the opportunity of arranging, if possible, some scheme for the payment of the creditors' claims and placing the business on such a footing as will enable it to regain its former successful position. In order to preserve the *statu quo* of the various parties, to protect the assets and to carry on the business (there being a large number of valuable orders on hand and coming in), Mr. Nicholson, of this firm, has been appointed Receiver, and he will be in constant communication with the Committee, who will from time to time take such measures for the protection of the general interests as they may deem advisable. It is, therefore, hoped that you will see your way clear to sign and return the resolution passed, copy of which we have pleasure in enclosing you herewith.

The resolution was as follows:—

"That this meeting do hereby appoint a Committee as at foot to represent the interests of the trade creditors with power to make such arrangements with the debenture-holders and/or the company as they deem desirable, and that in the meanwhile the creditors should hold their claims in abeyance. The meeting and the Committee appointed very strongly recommend this course to be agreed to by the other creditors.

"Committee:—Mr. Rook, Sloan Electrical Co., Ltd.; Mr. Billington, Beck Engineering Co., Ltd.; Mr. Willey, London Electric Wire Co. and Smiths, Ltd.; Mr. Jenkins, J. Sankey and Sons; Mr. McKechnie, McKechnie Bros.; or, failing him, Mr. Churchill, Chas. Churchill & Co., Ltd."

**Makers to His Majesty.**—The CARRON Co., of Carron, N.B., has been appointed grate makers to H.M. the King. The Carron works have been visited on many occasions by Crown heads of Europe, including Czar Nicholas I of Russia, Prince Leopold Maximilian of Austria, and by King Edward VII, when Prince of Wales.

**The Shops' Act.**—The Leeds Corporation announces that tradesmen who alter their half-day closing arrangements at Easter, must alter the notices in the shops. There was much offending in that respect at Christmas, and the Leeds Chamber of Trade warns tradesmen that similar offending at Easter may bring trouble.

The Nelson T.C. has decided to take steps to ascertain whether the electricians of the district are agreeable to a closing order under the Shops' Act, fixing Tuesday or Saturday, as the half-day holiday.

The Manchester Corporation is proposing to make an order fixing Wednesday as the day of the weekly half-holiday for dealers in electrical fittings, &c.

## LIGHTING and POWER NOTES.

**Aylesbury.**—The U.D.C. has taken a referendum on the electric light question, and the result was as follows: For the scheme, 1,452; against, 439—majority for, 1,013. The number of voting papers issued was 2,538, including 116 sent to out-voters, and 2,090 were returned. Of these, 53 were rejected and 146 were unmarked.

**Birmingham.**—At a meeting of the Council on March 14th, Councillor E. C. R. Marks, a member of the Electric Supply Committee, suggested the amalgamation of the Gas and Electricity Supply Committees. He based his arguments for the consideration of such an amalgamation upon the statement that the two Committees controlled undertakings for the supply of the same commodities, viz., light, heat, and motive power, that they both used coal as their raw material, and as they were to occupy adjacent land at Nechells, it was reasonable that they should be amalgamated. The proposal was supported by Councillor Heath, another member of the Electric Supply Committee. Councillor Ellaway, the Chairman of the Electric Supply Committee, opposing the motion, said, there could be no real amalgamation, as each undertaking must necessarily be controlled by separate Sub-Committees. He also pointed out that both departments were so big, and the work of the Committees engaged in controlling them occupied so much time, that it was doubtful if they could, with efficiency, undertake the very heavy extra work which would be entailed by the amalgamation. With regard to the argument that the future engine was a gas engine, he pointed out that the gas would not be the same gas as was being manufactured by the Gas Department. The Electric Supply Department sold about eighteen million units per annum to the Tramways Department, and there was no suggestion of amalgamation between them, although the likeness between the two was more pronounced. Sir Hallowell Rogers, the Chairman of the Gas Committee, and Sir James Smith, the Chairman of the Public Works Committee, both opposed the proposal, which was negatived by a considerable majority.

**Bognor.**—At a half-yearly meeting of the Gas Co., it was announced that the company hoped to have its electric supply available by July next. The laying of mains will be proceeded with forthwith.

**Bradford.**—The Corporation Gas Committee has decided to install an electric equipment in connection with the coal elevating and conveying machinery at Thornton Road Gasworks, at a cost of £48.

**Braunton.**—The first annual report, presented at a meeting of the Braunton Electric Light and Power Co., was of a satisfactory nature. The net revenue account showed a profit of £80, and the directors recommended payment of a dividend of 5 per cent. (less income-tax) on the cumulative preference shares from October 1st, 1911, which would amount to £29, to write £30 off the formation expenses, and to carry forward the balance of £21. The chairman (Mr. T. Yeo) explained that the capital authorised to be raised was 5,000 £1 shares, divided into 1,000 5 per cent. cumulative preference shares and 4,000 ordinary shares each of £1. The amount of capital issued totalled £3,250 of fully-paid shares. They had good reason to be gratified at the first year's result.

**Bristol.**—The Electrical Committee reports that the loan of £52,919, sanctioned by the L.G.B. in March, 1907, for mains, substations and services has been expended, and recommends that it be authorised to apply to the L.G.B. for sanction to borrow a further sum of £25,000 for similar purposes, to be spent as and when required. This sum is the estimated requirements for the ensuing three years.

**Burnley.**—The Electricity Committee's estimates recently contained a recommendation that if the profits anticipated to be realised during the year ending March 31st, 1914, are sufficient, the sum of £4,550 be paid into the Borough Fund, the question of the disposal of the balance of profits (if any) to be deferred. This was agreed to on March 6th.

**Burton-on-Trent.**—In connection with the scheme for electrifying the brewery of Messrs. Marston, Thompson & Evershed, it is intended that the work of replacing the present machinery with electric motors shall be commenced almost immediately after Easter, and to this end a consulting engineer will be engaged to supervise the extensive operations.

The B. of G. has decided not to take any action at present in the matter of installing the electric light at the Workhouse, but to leave the matter to the new Board to be elected. The scheme submitted will entail an expenditure of £850.

**Bury.**—The L.G.B. has refused to sanction the application for the borrowing of £1,025 for the carrying out of certain works including the provision of electric light and bells at the Aitken Sanatorium, which was made by the Bury and District Joint Hospital Board. The L.G.B. pointed out that, notwithstanding previous warnings, the Bury Joint Board had incurred a large part of the expenditure for which the loan was required, without any sufficient reason for having anticipated the sanction.

**Cheltenham.**—The T.C. has decided to convert 33 gas lamps in various streets into 34 electric lamps. The capital cost will be £338, and the annual cost per lamp will be £2 10s., including a return of 8 per cent. on the capital outlay, which will be met out of the renewals fund.

**China.**—We have received from Mr. Aldridge, electrical engineer to the Shanghai Municipal Council, a copy of a Chinese pamphlet on electric signs and decorations, published by his department. We understand that it is the custom of Chinese store-keepers to have elaborate decorations for the opening of a store or business, and an electrically-illuminated building illustrated in the pamphlet, took, we are informed, about 150 kw. for lighting alone. As it is not unusual to have several such installations on at the same time, the effect on the streets can be well imagined.

**Colchester.**—The T.C. has applied to the L.G.B. for a loan of £7,660 for electricity purposes.

**Conway.**—The Lighting Committee has had under consideration a scheme submitted by the borough engineer for the electric lighting of a part of the town. The Committee came to the conclusion that it would be inadvisable for the Council to entertain such an elaborate scheme at present, and the engineer was instructed to submit an alternative scheme for lighting the embankment.

**Dover.**—The Electricity Committee of the T.C. has decided to purchase, at a cost of £528, 325 time switches for automatically switching on and off the public electric lamps.

**Folkestone.**—Quotations are to be obtained from the Electricity Supply Co. and the Gas Co. for lighting portions of Cheriton Road and Sandgate Road with electric light and high-pressure gas, respectively.

**Grimsby.**—Application is to be made to the L.G.B. for sanction to the borrowing of £8,000, the estimated expenditure for the ensuing three years on mains and services.

**Heckmondwike.**—The U.D.C. has decided to give a supply of current to the works of Messrs. T. F. Firth & Sons, Ltd., and the engineer has been instructed to prepare a detailed estimate of the cost of converting street gas lamps to electric lighting.

**Hull.**—The T.C. has rejected a recommendation from the Education Committee that gas should be used for lighting the new Sauer Street Schools, and intends to have electric lighting installed.

**Japan.**—Large new works for the manufacture of soap have just been completed at Tori-Shinden, near Amagasaki, by Messrs. Lever Bros. (Japan), Ltd. The buildings are lighted throughout by electricity, the machinery being also all electrically operated. The generating plant comprise a horizontal cross-compound condensing engine coupled direct to a 300-kw. dynamo.

**Keighley.**—The Corporation last week referred back to the Electricity Committee the proposed scheme for supplying Bingley with electricity in bulk, the particulars regarding which were given in a recent issue.

**London.**—**SOUTHWARK.**—The Electric Light Committee recommends the adoption of a scheme by the electrical engineer, for extending the plant at the generating station at a cost of £29,464, made up as follows:—Buildings, £2,000; two boilers, including fan, economiser, flues and foundations, £8,220; two 1,500-kw. generators, and four converters, switchboard and foundations, £13,350; condenser, cooling tower and foundations, £5,175; contingencies, £719. Messrs. Preece, Cardew & Snell, to whom the scheme was referred, express the opinion that there can be no doubt that an extension of the station is the correct way to meet the further requirements of the borough. The Committee also recommends that it be empowered to invite tenders for carrying out the works.

**LEWISHAM.**—At a meeting of the Guardians on Monday, the Works Committee recommended that the Board engage the services of the engineer of the South Metropolitan Gas Co. to draw up specifications for the electric lighting of the infirmary and work-house, at a fee of £10 10s., and to invite tenders for the supply of electricity from the electric light companies, and from the South Metropolitan Gas Co., the latter to supply electricity from its own generating plant. The Board agreed to the recommendations.

**MARYLEBONE.**—The B.C. has approved a scheme by Mr. Seabrook for the lighting of the new circus in Marylebone Road. The scheme provides for eight columns with one large and four small, lamps on each be placed in the circus (one at each quadrant and one on each of the refuges to be placed in the roads leading into the circus). The columns will have five lamps on each, and the approximate candle-power will be 4,800. The total cost of lighting and maintenance of the columns is estimated to be £110 per annum.

**HACKNEY.**—Of the £9,176 surplus, estimated on the working of the undertaking for the year ended March 31st next, the Finance Committee has decided to transfer £3,000 to the reserve fund, and £2,000 in aid of the rates. The balance, when ascertained, is also to be given in aid of the rates. Consent has been given to the proposal of the L.C.C. to double the tramway track in part of Lea Bridge Road.

**Plymouth.**—The Electricity and Street Lighting Committee of the T.C. has presented estimates of income and expenditure for the ensuing financial year, and the same were approved as follows:—Electricity revenue account: Income, £29,417; expenditure, £28,480; electricity capital account expenditure, £5,500; electricity reserve account expenditure, £2,000; and street lighting revenue account expenditure, £7,120.

**Port-Glasgow.**—The Corporation has lodged answers in reply to the objections made by the School Board with the B. of T. against the provisions of the local Electric Lighting Draft Provisional Order. The School Board's demand that distributing mains should be laid within a reasonable distance of the schools is described by the Council as wholly unreasonable and inexpedient, and if given effect to will place an undue burden on the undertaking. The Board, in its reply, states that the position taken up by the undertakers is contrary to the intention of the Electric Lighting Acts. The scheme of distribution was devised solely with a view to the earning of profits by Greenock Corporation, and not at all with a view to the provision of electric light for domestic purposes in the residential parts of the burgh of Port-Glasgow. As the object of the order was to confer an exclusive monopoly within the whole burgh, it was improper for the undertakers to give facilities in only one portion, where a large and profitable demand for electricity may be expected, and to deprive the other portions of the town of the benefits of electric lighting, as was proposed.

**Rochdale.**—Speaking at a meeting of the T.C. on March 6th, Councillor Walker drew attention to the fact that a number of contracts in connection with the electricity works extensions had been placed, subject to the sanction of the L.G.B., and remarked that long before they were completed the Committee would have to consider further additions to the works. He had previously informed the Council that the estimated increase in the electrical supply for the present year would be about 500,000 units. That estimate would be exceeded, and the estimated increase at the end of March would probably be in the neighbourhood of 750,000 units. The Committee would have to consider whether any further extensions that were required should be made on the present site or elsewhere.

**St. Helens.**—The T.C. has applied to the L.G.B. for a loan of £2,040 for a 500-kw. rotary-converter with switchgear, and for £1,660 overspent on a loan of £10,800 sanctioned in August, 1911.

**Sheffield.**—It has been decided to make a charge of 1d. per unit net to the promoters of the Fuel, Light and Power Exhibition to be held next autumn under the auspices of the Sheffield Health Association and the Sheffield Smoke Abatement Society. It has also been decided by the L.L. Committee to erect a stall at such exhibition for a comprehensive display of electrical appliances. Tenders are to be obtained for a new condenser and steam pump, together with all the necessary piping.

**South Africa.**—**DURBAN.**—The annual report of the borough electrical engineer (Mr. J. Roberts) shows a very satisfactory year up to July 31st, 1912. Many extensions have been made to the plant and mains during the year particularly on account of the Corporation taking over the supply of current to the Government railways and harbour, which supply was commenced on June 21st last. The principal additions to the plant have been the following:—Two 2,000-kw. three-phase 6,600-volt turbine units and auxiliaries; two Babcock boilers and auxiliaries; a three-phase H.T. switchboard, and one 750-H.P. rotary converter and track booster. In addition, 6,000-volt three-core cables have been laid to the old railway power station, and a three-phase overhead line constructed to Greenwood Park. In street lighting, a great improvement has been brought about by changing the old enclosed type of arc lamps for high C.P. metal lamps. The progress during the year is reflected in the following figures:—

	1912.	1911.
Private consumers of electric light ...	5,223	4,803
Private consumers of electric power ...	308	278
Number of street lamps ...	2,292	2,200
Units sold ...	9,023,699	7,395,621
Total revenue ...	£78,894	£73,283

#### UNITS SOLD.

Private lighting ...	1,725,944	1,468,692
Private motors ...	1,157,321	809,350
Corporation lighting ...	157,673	127,077
Corporation motors ...	1,005,697	1,013,872
Street lighting ...	733,836	728,010
Tramways ...	3,389,712	3,249,623
Government ...	553,513	—

The works costs were 44d. per unit generated, and the total cost, including capital charges, 14d. per unit generated. The net profit was £22,192, of which sum £12,608 goes to the borough fund, leaving a surplus of £9,584.

Mr. John Roberts, the borough electrical engineer, has been called in by the Harris Smith T.C., to report on the suggested hydro-electric scheme, which it is proposed to inaugurate from the water at Plattburg, overlooking the town.

**Stoke-on-Trent.**—The T.C. has decided to apply for a loan of £8,000 for carrying out a scheme of electric supply at Fenton under the Stoke-on-Trent E.L. Extension Order, 1907. A further loan of £6,000 for mains extensions has also been applied for.

**Stroud.**—The U.D.C. is supporting the proposal for an electric light installation for the town. Having obtained favourable terms with the option of purchase in 21 years from the company, it has adopted a resolution consenting to the grant of the prov. order.

**Swindon.**—At the meeting of the T.C., it was stated that the electric lighting showed a profit of £1,681, but there had been a loss on the tramways of £1,728, to which must be added £700 for depreciation.

**Torquay.**—The electricity undertaking continues to make satisfactory progress. The engineer reported that through the installation of the turbine, a saving of 1,200 tons of coal had been effected during the year, which at the lowest figure of 13s. 10d. per ton, amounted to £830, and that a saving of £206 had been effected in oil, water, &c. making a total of £1,036.

The Royal Torbay Yacht Club wrote stating that consequent upon the nuisance and damage caused by smoke from the electric light works, the Committee was authorised to commence further legal proceedings against the Corporation. The Electric Light Committee, after consideration, recommended that the Town Clerk inquire if the club was prepared to adopt the suggestion made by the magistrate at the recent police court proceedings, to consent to the heightening of the chimney, and in the event of a negative reply, it be suggested to the club that arrangements be made by it and the Council to make tests extending over a period of six weeks or two months to ascertain the extent of the nuisance complained of under various conditions of wind and weather, in order to obviate any dispute as to the facts of the case. The T.C. has approved the recommendation.

**Turro.**—The R.D.C. has decided not to oppose in any way the applications of the T.C. and the Gas Co. for prov. orders for electric lighting. The B. of T. had been asked to dispense with the Council's consent.

**Turton (near Bolton).**—The U.D.C. has acceded to an application of the Lancashire Electric Power Co. for permission to supply Egerton Hall, Dewhurst House and Egerton House with electricity direct from the mains recently erected for the supply of the works of Messrs. Deakins, Ltd., at Egerton and Belmont, subject to the company's entering into an agreement providing for the free use for the purposes of the Council of the sub-stations at Egerton and Belmont.

The electrical engineer having suggested that, in his opinion, the

time has arrived when the price of electricity might very well be reduced, it has been decided that the price be reduced from 6d. to 4d. per unit, and that the question of price be reconsidered at the end of another year's working.

The electrical engineer has been instructed to prepare a report on the cost and advisability of lighting the Eagle, Egerton and Belmont areas.

**Wallasey.**—The Council has decided that an expert shall be engaged to advise it as to the best method to adopt to meet its electricity requirements for the next 20 years. Last year, ended February, the undertaking contributed £6,000 towards the relief of the rates, and borrowing powers are to be applied for, for £13,500 for the provision of electric mains and services laid last year and to cover the cost of similar work during the next four years.

**Walsall.**—Mr. Lacey has issued an interim report upon the position of the undertaking, and expresses the opinion (1) that the action taken by the Committee so far as regards the immediate reorganisation of the power station staff was fully justified by the condition of the plant, and he was fully convinced that results would prove this in the near future; (2) that notice should be given to all the lighting consumers, who are not also power users, that the charges for electricity will be advanced from 4d. to 5d. per unit from next quarter day, and that no rents for meters will be charged from that date; (3) that assuming only the normal increase in the demand for electricity as shown in the Council's books, the existing plant will be insufficient to carry the undertaking through the winter of 1913-14, and immediate steps should be taken to provide for additional boiler power, capable of raising not less than 20,000 lb. of steam per hour. The cost of this addition, together with various small matters of expenditure, will not exceed £4,810. Concluding, Mr. Lacey states that the order should be put in hand forthwith so as to obtain such deliveries as will ensure completion not later than the beginning of September next. The Committee has concurred with the views expressed, and has decided to apply to the L.G.B. for sanction to borrow the above amount.

**Whitby.**—A deputation from the Glasgow Corporation visited the town last week for the purpose of inspecting the electrical gear of the Corporation swing bridge at the harbour. The visitors were received by the members of the local Council, and, after the examination of the bridge, were entertained and shown the places of interest.

**Wigan.**—The minutes of the Electric Light Committee, submitted for the approval of the T.C. on March 6th, contained a reference to a proposal to apply for the sanction of the L.G.B. for the borrowing of £3,000 for extensions. Councillor McQuaid said that, up to the present time, the concern had been a losing business, there being a loss, he understood, of about £1,600 on the year's working. He thought there should be some authoritative statement that the expenditure of the sum mentioned would improve the position. Councillor Grimshaw said that, with reference to the loss of £1,600, they had to pay in three yearly instalments a sum equal to nearly £2,000 for what were superseded works at Pemberton. If it had not been for this contribution, which they had to make this year and during the next two years, they would have had a balance on the right side. Even allowing for that, they would have had a balance if it had not been for the fact that, about two years ago, the Committee made a great reduction in the price of electricity supplied to the Tramways Department. The minutes were approved, and subsequently a resolution was adopted authorising application to be made to the L.G.B. for sanction to borrow £3,000 for the purpose of providing cables, transformers, &c., for the Electricity Department.

**Wimbledon.**—The B.C. has decided that 25 4-lb. and 25 6-lb. irons be purchased from the General Electric Co. for distribution on loan amongst consumers. Letters of complaint have been received upon the terms arranged with the Fixed Price Light Co. for the supply of light to premises wired by the latter, and as to the refusal of the Council to lay service lines from the mains in certain streets to premises wired by the company, if such service lines exceed 60 ft. in length.

**Wolverhampton.**—The sum of £2,125 has been transferred from the profits of the Corporation's electricity undertaking for the year ending March 31st to the credit of the improvement fund for the financial year ending March, 1914.

## TRAMWAY and RAILWAY NOTES.

**Bradford.**—A sensational mishap occurred on the tramway system last week; a car on the Thornton route was jerked off the metals, and ran into a wall which bordered a field whose level was several feet below that of the road. Upon examination of the points at which the car had left the lines, the points were found to be jammed with stones, and the opinion of the tramway officers is that the stones had been mischievously or maliciously placed there. There were about 40 passengers on board the car, and considerable panic prevailed. The mystery of the presence of the stones is being inquired into.

Alterations and additions are to be carried out at the Thornbury car depot at an estimated cost of £8,502. The tramways general

manager has prepared a report on the terms suggested by the Postmaster-General as to the basis on which the question of guard wires or other means for the protection of Post Office telegraph and telephone wires generally should be dealt with, but the Committee, owing to the fact that the Municipal Tramways Association would probably give instructions at its next meeting for the opinion of counsel to be taken on the subject, has authorised him, in the event of such opinion being unfavourable to the Association, to agree to the suggested basis at the meeting of the Association.

**Burley-in-Wharfedale.**—In reference to the matter of the suggested running of railless trolley-cars in Wharfedale by the Leeds Corporation, it appears that notwithstanding the fact that the clauses in the recent Leeds Corporation Bill relating to this matter were withdrawn, the authorities at Leeds have not yet given up the idea. At the last meeting of the Burley-in-Wharfedale D.C., a communication was read which had been received from the manager of the Leeds tramways, stating that he understood that the Corporation intended in the next session of Parliament to renew its application for powers to run the railless cars in Wharfedale, in which case he hoped that the negotiations between the Burley authorities and himself would be able to be completed.

**Cardiff.**—The question of repaving the main streets of Cardiff and relaying the tramway track, where necessary, was advanced a stage at a meeting of the Tramways and Lighting Committee. It was decided to appoint a joint sub-committee of the Tramways and Public Works Committees to discuss the matter with a view to arriving at a definite understanding as to whether the work should be done by contract or the employment of direct labour, and when the work should be taken in hand. The feeling of the Committee was that the work should be done with the least possible delay.

Sir John Curtis informed the Committee that although there was still a month to run to complete their financial year, figures supplied by Mr. Ellis, the manager, showed that the Committee would have a surplus which would enable it to vote a sum equal to 1d. in the £ to the relief of the rates. That would absorb £1,000, and would probably avoid the necessity of calling for an increase in the rates for next year.

**Continental Notes.**—**RUSSIA.**—Application has been made to the Russian Government for a concession for two projected electric railways—one from St. Petersburg to Ioukki, a distance of about 11 miles, and one between St. Petersburg and Vosnessenski, 12 miles.

**Croydon.**—On Saturday, by resolution of the B.C., the running of trams on the Whitehorse Road route was discontinued. The grounds for this action were "regular and consistent loss." Councillor Chamberlain, who moved the resolution, pointed out that the route was opened in November, 1906, and that the first year's working showed a loss of £2,150. The loss continued, and the route was closed, and now, after a second trial, the Committee had presented figures showing a loss over a given period at the rate of £3,726 a year. Councillor Denning (chairman of the Tramways Committee) said eight different methods of working the route had been tried. The track ought never to have been laid. The resolution to close the route was carried by 31 votes to 11.

**Dewsbury.**—The Electricity and Tramways Committee has decided to inform the manager of the Bradford tramways that it has no objection to a proposal of the Yorkshire (W.D.) Tramways Co. that the Bradford Corporation should take into consideration the question of through running of cars over the lines to Dewsbury.

**Doncaster.**—The T.C. has confirmed a proposal of the Tramways Committee to double the track in the Market Place and Baxter Gate, for a distance of about 130 yds., and to lay double lines from the Alma Inn to Balby Bridge, on the Balby route.

The Electricity and Tramways Committee has recommended that application be made to the L.G.B., for permission to use the £3,000 originally authorised for the construction of tramways, but not expended, the same now being required in connection with the tramways undertaking.

**Dumbarton.**—A Committee of the County Council is considering a proposal for an extension of the tramways from Clydebank to Duntocher, and the road surveyor is to examine the road and report.

**Dundee.**—The income of the Corporation tramways from May 15th to January 31st was £45,697, being an increase of £1,533. There was an advance on all the routes. The income for the railless trolley section in Clepington Road, which was started in September, was over £240.

**Edinburgh.**—A sub-Committee of the Tramway Committee recently met a deputation from the Colinton Tramway Co. in regard to the question of having the tramway from Slateford continued into the centre of the city. No decision was come to. It is stated that the Colinton Co. may make application to Parliament for authority to construct a line into the centre of the city, and, on the other hand, the Corporation, in the event of its asking the necessary power, may be opposed by the Edinburgh Tramway Co. The matter will come before the Tramway Committee shortly. The question of the extension has been raised by the approaching completion of Redford Barracks.

**Hastings.**—There has been an important development in the Front Line Tramway controversy, and hope has been revived of the possibility of the question being settled by the Tramway Co. and the Corporation without resorting to the expensive proceeding

of a fight over the Parliamentary Bill promoted by the company for the substitution of overhead wires along the front esplanade in place of the present Dolter system. The B. of T. has sent an intimation to the Corporation that the increase in the number of "live" studs on the front is such that it proposes to condemn the system six months hence. Interviews between the Law and Parliamentary Committee of the Corporation and the directors of the Tramways Co. are now taking place. The frontagers are practically unanimous in their opposition to overhead wires, and have raised a fund to assist the Corporation in opposing the Parliamentary Bill. These people would prefer a service of motor-buses to trams of any kind, and, incidentally, it may be mentioned that two London companies have arranged to give demonstrations with their latest type of vehicles.

**London.**—Another stoppage of the L.C.C. tramways system occurred on Monday afternoon for a period of about half an hour; all the cars were stopped and much inconvenience was caused. It was due to a short-circuit on the switchgear, which put one of the generators out of action, and the necessary repairs caused delay in restarting.

**Manchester.**—At a meeting of the Corporation Tramways Committee on Tuesday, £100,000 was fixed as the contribution of this Committee towards the relief of the rates for the year ending March 31st. The sum is a record for the United Kingdom; it is the highest amount ever paid in any one year to the relief of the rates by any tramway undertaking in Great Britain. In 10 years, the Committee has contributed no less than £700,000, last year's amount being £85,000.

**Morecambe.**—The suggestion that the horse-drawn tramway service should be brought up to date by means of electrical equipment, is still to the front. At the present time, those who favour the electrification of the tramway system are concerning themselves with the Edison-Beach accumulator, and, though there is opposition on the ground of unsightliness of the overhead system, and the large outlay necessary for any scheme of electric trams, it is felt that the time is now ripe for putting some definite scheme forward and bringing the matter to fruition.

**Rochdale.**—The question of the introduction of motor-buses in certain parts of Rochdale not served by tramways was mentioned at a meeting of the Tramways Committee last week, and a short discussion on the matter took place.

**Salford.**—A question was raised at the T.C. on March 6th, as to how much the cars which it was proposed to dismantle had cost, and how and when they were bought. Alderman Linsley said he could not answer the question without proper notice. The cars had been a source of great trouble. They had tried to sell them, but had been unable to do so. By dismantling the cars, and inviting tenders for the supply of car bodies and trucks to be fitted with the electrical equipment taken from them, they were adopting the best method of dealing with them.

**Silsden (near Keighley).**—The surveyor to the U.D.C. has been instructed to go into the question of laying a single track tramway from Bolton Road end to the station.

**South Africa.**—**DURBAN.**—The annual report of the Municipal Tramways manager (Mr. H. N. Thomas) for the year ending July 31st, 1912, shows very encouraging results, the revenue exceeding the estimate by £2,863, and being 74 per cent. over last year's receipts. The length of line is now 19'882 route miles, or 34'022 miles of track. The income was £122,056; operating expenses, £72,217; net income, £49,839, which, after paying capital charges and 4 per cent. to the borough fund, left £716 as net profit. The car-miles run were 1,672,220, and the passengers carried 15,655,737.

**South Shields.**—At a meeting of the T.C., on the 5th inst, the proposal of the Tramways Committee to make a general fare of 1d. was considered. Ald. Wylie, in moving the adoption of the Committee's report, said they wished to introduce a system of fares that would be common to all users of the trams, and dispense with any sectional privileges that had been in force of late. It frequently happened that a passenger, who was compelled to pay 1½d. fares through boarding a car outside a 1d. boundary had travelled into the 1d. section, but actually travelled a much less distance for his 1½d. than the distance that was given for 1d. They further proposed to abolish the privileged sections, which they instituted some time ago. On these privileged sections 1d. return fares were adopted with the object of inducing more persons to use the cars in the districts where they were poorly patronised. What had been the result? They had two of these sections, and the returns showed they had only contributed 126 per cent. of the total revenue. The Mayor seconded the resolution. He said he had found that South Shields only carried its population 74 times over in 12 months, which was practically one and a half times per week. Sunderland carried its population 99 times over in 12 months; Hull, 148 times over; Newcastle, 157 times over; and when they got into the larger towns and cities, the results were even more astounding. He favoured the proposal, as he thought it generally would lead to an increase in their traffics. Amendments were proposed to raise the age limit for children to 14 years, to make the hour for the issue of the cheap tickets 9 a.m. instead of 8.45 a.m., and extend the hours for the issue of dinner-time return tickets, from 11 a.m. to 2.30 p.m., instead of from 11 a.m. to 2 p.m., but the propositions were all negatived, and the Committee's report adopted.

**Stockport.**—The new railless cars were inspected on March 7th by Colonel von Donop and Mr. A. P. Trotter of the B. of T., and the service was opened to the public on Monday. The Bremen system, which has been adopted, is new so far as this country is concerned, and differs from the Leeds and Bradford installations.

**Stretford.**—Negotiations are to be carried on with the Tramways Committee of the Manchester Corporation with a view to a clause being inserted in the draft lease that the U.D.C. shall be entitled to exercise its powers to use the whole of the tramways for township purposes subject to a reasonable clause securing the Manchester Corporation against loss.

**Walsall.**—The Corporation Tramways Committee has decided that the net profit for the year amounting to £3,392 shall be carried to the reserve fund after payment thereof of a further contribution of £1,500 to the Borough fund, which with the £500 paid in April last, makes a total contribution of £2,600 in aid of the rates from the profits of the undertaking for 1912.

A sub-committee has been appointed to consider and report as to what extensions, if any, of the tramways should be made in the borough and in the adjoining districts, either by means of railless trolley vehicles, motor-buses, or otherwise.

**West Ham.**—The Tramways Committee has adopted the idea of fixing illuminated service numbers to the tramcars, and has authorised its manager to carry out the work.

**Wolverhampton.**—£3,777 has been transferred from the profits of the Corporation's Tramway undertaking to the credit of the Borough fund.

Three additional tram cars, with top covers and vestibule ends are to be purchased by the Tramway Committee at a cost not exceeding £2,700.

## TELEGRAPH and TELEPHONE NOTES.

**Durban.**—The annual report of the Durban Municipal Telephones manager (Mr. W. Manson), for the year ending June 30th, 1912, shows a total of 2,259 subscribers, with a revenue of £21,385 and expenditure of £7,655, giving a net revenue of £13,730, which, after paying capital charges, &c., and a 4 per cent. contribution to the borough fund, leaves a balance of £2,038.

During the year an extension has been made to the switchboard, giving room for an extra 720 connections. The trunk traffic is developing rapidly, there being a total of 153,056 calls during the year.

**New Fessenden Radio Station in Brooklyn.**—The National Electric Signalling Co., operating Prof. R. Fessenden's patents, has erected a large laboratory and works in Brooklyn. The company has engaged a large staff of engineers and mechanics, and is building one of the largest and most powerful radio-telegraphic and telephonic stations on the Atlantic coast of America. At each end of the roof of the company's six-storey building, is being erected a steel pylon, specially designed to resist sudden and sustained wind load. Between 40 ft. steel cross arms at the tops of the pylons, is stretched a multiple Tee-antenna, the span of which is 400 ft., the height of the cross wires above earth being about 250 ft. The pylons are 150 ft. in height, and are insulated from the roof by large porcelain pedestal insulators 2 ft. in thickness. The aerial wires are of phosphor bronze, and the down-take wires from the centre of the span are carried back to enter the operating room, which is on the top floor of the building, and just outside the base of one of the pylons. The company is building the Fessenden high frequency alternator for 40 key, per second and higher frequencies. The radiations emitted by a station using this alternator are heard in the receiving telephone as a shrill piping which is easily discriminated from foreign signals or disturbances. Machines are in course of design and construction which will provide frequencies up to 200 key, per second when driven at speeds up to 30,000 R.P.M., by direct coupled Laval turbines.

**Wireless Antenna at Ground Level.**—M. E. Rothé has recently carried out experiments at St. Denis regarding the reception of wireless radiations by antenna carried along and only just clear of the ground. The results obtained are rather different from those obtained by Jégou, near St. Brieuc (which is about the same distance from Paris, but in the opposite direction). The antenna used by Rothé was a single copper wire placed on short posts about 6 in. high. The insulation obtained was very poor, and the wire touched grass at several points. The "aerial" was not set towards Paris; its length was varied from 50 to 115 ft. Connection was made to a water-pipe, as earth, through a self-induction of 0'0045 henry and a detector, telephone and battery were connected in series between the water-pipe and the common terminal of the aerial and the self-induction. Under these conditions signals from the Eiffel tower were received perfectly, whether a 400-ohm telephone was used or a 150-ohm receiver shunted across a Jégou transformer. The garden in which these experiments were conducted is surrounded by a metal fencing about 3 ft. 6 in. in height.

Equally successful results are reported by M. Tavenaux (Sedan), and experiments are being conducted to determine the wave length and other characteristics of these aerials which, by their cheapness and simplicity, should find many useful applications.—*Académie des Sciences.*

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Atherton (near Manchester).**—The U.D.C. has decided, on the recommendation of the Electricity Committee, to obtain tenders for transformers, to meet the growing demand on the low-tension mains.

**Australia.**—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" to-day.

**Belgium.**—March 29th. Municipal authorities of Ixelles-lez-Bruxelles. Armoured cables necessary for the low-tension distribution service.

**Blackpool.**—High and low-tension cables and transformer switch pillars. See "Official Notices" to-day.

**Bolton.**—March 27th. Materials and stores for the year. Mr. Samuel Parker, Town Clerk, Town Hall. See "Official Notices" to-day.

**Bosnia.**—March 20th. Municipal authorities of Livno. Tenders for the establishment of a central station for public and private electric lighting purposes in the town.

**Bridgend.**—March 21st. One 400-K.V.A. steam alternator and accessories, for the U.D.C. See "Official Notices" Feb. 28th.

**Cardiff.**—March 19th. Electric light sundries for a year, for the City Mental Hospital. Mr. T. D. Morgan, clerk and steward. Mental Hospital, Whitchurch, near Cardiff.

**Carlisle.**—March 25th. Lubricating oils, greases, &c., and cables, for a year, for the City Electricity Department. See "Official Notices" to-day.

**Croydon.**—March 31st. Stores for a year, for the Corporation Electricity Department. See "Official Notices" Feb. 21st.

**Dundalk.**—March 24th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" March 7th.

**Eccles.**—March 17th. Lancashire boiler, for the Electricity Committee. Forms of tender, &c., obtainable from Borough Electrical Engineer, Cawdor Street, Patricroft. Deposit £1 1s., returnable.

**Germany.**—April 15th. The Königl. Maschinenbau Amt in Hanover. Tenders for four steam turbines, four three-phase generators, two transformers and a battery of accumulators.

**Gillingham (Kent).**—March 28th. Stores for a year. See "Official Notices" to-day.

**Halifax.**—March 18th. Electrical fittings for six months, for the B. of G. Mr. A. T. Longbotham, clerk, Carlton Street.

**Hornsey.**—March 31st. Natural draught cooling tower for the T.C. electricity works. See "Official Notices" to-day.

**Leeds.**—March 17th. (a) Overground transformer chamber; (b) underground transformer chambers, for the electric lighting department. Specifications, &c., from C. Nelson Hefford, engineer (*pro tem.*), 1, Whitehall Road, Leeds.

**London.**—L.C.C.—March 19th. Electrical installation at the Victory Place elementary school, Walworth, S.E. See "Official Notices" March 7th.

It is proposed that during the recess, the Highways Committee shall have authority to open any tenders that may be received for the construction of the authorized conduit tramways from Catford to Southend *via* Bromley Road, and the reconstruction of the existing horse tramways from Chapel Street to Nile Street, Woolwich.

March 18th.—Two 2,900-kw. turbo-generators, with condensing plant, &c. (further extension of time). See "Official Notices" February 28th.

April 3rd.—Reconstruction and rewinding of seventeen 300-kw. synchronous motor-generators and three 500-kw. induction motor-generators. See "Official Notices" to-day.

MILE END.—March 20th. Re-wiring wards, &c., at the Infirmary for the Guardians. See "Official Notices" March 7th.

BATTERSEA.—April 1st. Coal for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

**Morecambe.**—March 19th. Coal or slack (about 2,500 tons), for the Corporation electricity works. Mr. L. B. Hogarth, engineer and manager.

**Pontypridd.**—March 17th. Tramway-men's uniforms for the U.D.C. See "Official Notices" February 28th.

**Portsmouth.**—March 18th. Stores and materials for a year, for the Corporation Tramways Department. See "Official Notices" March 7th.

**Salford.**—March 31st. Stores, &c., for the Corporation Electricity Department. See "Official Notices" to-day.

**Shanghai.**—April 3rd. Extra-high-tension and low-tension switchgear for sub-stations. See "Official Notices" to-day.

**South Africa.**—PORT ELIZABETH.—Tenders will, it is expected, shortly be invited by the municipality for additions to the town's electrical plant, the new items including a 400-kw. generating set with boiler auxiliaries, and high-tension mains, to be laid from the power station to Homewood.—*British and South African Export Gazette.*

**Stalybridge.**—4,500 yards E.H.T. three-core lead-covered cable. See "Official Notices" to-day.

**Swindon.**—March 20th. The Standing Joint Committee of the Wilts County Council invites tenders for work in connection with the installation of electric light at the Old County Police Station, Swindon. Plans and specification and form of tender from County Surveyor's Office, Swindon.

**Tonbridge.**—March 15th. Cables and meters for a year, for the U.D.C. Mr. H. W. Peach, clerk, Tonbridge Castle.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

**Wallasey.**—March 15th. Fuel oil (400 tons) for a year, for the Corporation electricity department. Mr. J. A. Crowther, electrical engineer, Seaview Road, Liverpool.

**Wigan.**—March 31st. Materials and stores for the Corporation Light and Tramways Departments. See "Official Notices" to-day.

### CLOSED.

**Bolton.**—The B.C. Electricity Committee has accepted the tender of Messrs. John Booth & Sons, Bolton, for steelwork for the proposed generating station at Back-o'-th'-Bank.

**Bradford.**—The T.C. has accepted the tender of Cox-Walkers, Ltd., at £343, for a "Taylor-Scotson" voltage regulator. The following tenders have been accepted for supplies of materials required for tramway construction work:—

Walter Scott, Ltd.—Steel rails, £7,750.  
British Mannesmann Tube Co., Ltd.—Steel poles, £5,222.  
Hadfield's Steel Foundry Co., Ltd.—Points and crossings, £2,712.  
Bayliss, Jones & Bayliss, Ltd.—Tie bars, £197.  
Jonas Wells, Ltd.—Malleable iron castings, £503.  
A. G. Barrett & Co.—Iron castings, £415.  
R. W. Blackwell & Co., Ltd.—Copper bonds, £326.  
Thermit, Ltd.—Welding portions, 19s. 6d. each.

**Bridlington.**—The T.C. on Monday accepted the tender of Messrs. Willans & Robinson, Ltd., for a 600-kw. steam generating set, disk-and-drum turbine, coupled to tandem D.C. generators, made by Brown, Boveri, at £2,867.

**Canada.**—Messrs. Escher, Wyss & Co.'s branch at Montreal has been accorded the contract for the installation of three water-wheels of 6,800 H.P. each, for the extension of the City of Winnipeg's power station at Point du Bois.

**Cheltenham.**—The T.C. has accepted the tender of the General Electric Co., of Cardiff, for electric light fittings for a year.

**Croydon.**—The T.C. has accepted the tender of Messrs. Le Grand & Sutcliffe, at £240, for sinking a bore-hole at the electricity works.

**Dewsbury.**—The Electricity and Tramways Committee has accepted the tender of Messrs. Ferranti, Ltd., for a new switch panel for the turbine generator.

**Grimsby.**—The T.C. has accepted the tender of the British Westinghouse Co., at £7,524, for a 1,000-kw. turbine generator and condensing plant.

**Heckmondwike.**—The U.D.C. has accepted the tender of the Tudor Accumulator Co., Ltd., for re-making the top battery floor.

**Lincoln.**—The B.C. has approved the acceptance of a tender by Messrs. Howden for a boiler, stoker, superheater, economiser, chimney, induced-draught flues, &c., for £3,086.

**London.**—BERMONDSEY.—The B.C. last week decided to accept the tender of Messrs. Johnson & Phillips, Ltd., for the supply of 170 arc lamps for street lighting, for £1,615. Councillor G. Barrett opposed the acceptance of the tender, favouring the acceptance of the offer of the General Electric Co., Ltd., whose price was £1,568. Councillor J. Delderfield opposed the suggestion of Councillor Barrett. The electrical engineer explained why the

lamp of Messrs. Johnson & Phillips was chosen by the Committee. He said that with regard to maintenance, there was very little difference between the lamps of Messrs. Johnson & Phillips and the General Electric Co., but the former firm had given a two years' guarantee with their lamps. As stated, the tender of Messrs. Johnson & Phillips was ultimately accepted.

The Metropolitan Water Board has accepted the following tenders for annual supplies to all stations:—

Edison & Swan United Electric Light Co., Ltd.—Metallic-filament lamps. Veritys, Ltd.—Wires, cables and tapes. General Electric Co., Ltd.—Electrical accessories.

**Manchester.**—The Street Mains and Lighting Subcommittee of the Corporation Electricity Committee has recently recommended the following tenders for acceptance:—

General Electric Co., Ltd.—An additional 300-kw. rotary converter and transformer. Ferranti, Ltd.—H.T. switchgear and E.H.T. panels. Bruce Peebles & Co., Ltd.—600-kw. motor converter. General Electric Co., Ltd.—Circuit breakers. British Electric Transformer Co., Ltd.—Auto-transformers.

**Nelson.**—The T.C., on March 6th, decided to accept the following tenders for the new plant required at the electricity works:—

Tudor Accumulator Co.—Traction battery. Newton Bros., Derby.—Generator and booster.

**Newport (Mon.).**—The B. of G. on Saturday accepted the tender of Messrs. R. Alger & Sons for electric light fittings for a year.

**Peterborough.**—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for cables for the new bridge, at £187.

**Rochdale.**—In connection with the extensions at the electricity works, the Gas and Electricity Committee has accepted the following tenders:—

R. & T. Howarth.—Building work. W. H. Allen & Co.—Turbo-alternator. J. Howden & Co.—Steam turbine-alternator. General Electric Co.—Motor alternator.

**Sheffield.**—The following tenders have been accepted by the City Council:—

Ferranti, Ltd.—Two high-tension two-phase switchboards, £173. Steel, Peech & Tozer, Ltd.—1,000 tons of steel tram rails, £10 15s. per ton. British Thomson-Houston Co., Ltd.—50 B 13 controllers, complete, required for new cars, £47 19s. per pair, less 2½ per cent; two rotary converters, complete with transformers, meters, switchgear, &c., £9,286, subject to the period of delivery being satisfactorily arranged. British Mannesmann Tube Co., Ltd.—75 light tramway poles, complete with bases and joint covers, £5 14s. each; 25 medium tramway poles, complete with bases and joint covers, £7 6s. 5d. each. Naylor Bros., Ltd.—75 light span pole brackets, complete with crosses, clips and shackles, 23s. each; 25 medium span pole brackets, 24s. each. Electric Construction Co., Ltd.—Two 45-kw. negative boosters, complete with all fittings, connections and switchboards, £265. T. Wilkinson & Sons, Ltd.—Reconstruction of Home Lane tramway depot, £3,950.

The following tenders have been accepted for biennial supplies:—

#### ELECTRICITY DEPARTMENT.

Copper wires.—Ineson, Finch & Co.; British Insulated and Helsby Cables. Iron tubing.—Albert Frost & Co.; D. Ashton & Co.; Credenda Conduits, Ltd.; Wilks Bros. & Co. Timber and wood blocks.—A. W. Cliff; H. Newsum, Sons & Co.; General Electric Co. Tapes.—Thos. Furniss, Ltd. India-rubber goods.—L. Andrew & Co.; G. Maclellan & Co.; I.R., G.P. and T. Works Co., Ltd.; Thos. Furniss, Ltd.; W. T. Glover & Co. Brushes.—Thos. Furniss, Ltd.; Wilks Bros. & Co.; R. J. Stokes & Co.

#### TRAMWAYS DEPARTMENT.

Armature washers.—Samuel Pease & Sons, Ltd. Controller fittings.—Dyer & Young. Weldless steel tubes.—British Mannesmann Tube Co., Ltd. Trolley wheel spindles.—Samuel Pease & Sons, Ltd. Car electrical supplies.—G. W. Allsop; J. Turner & Sons; Edison & Swan United Electric Light Co., Ltd. Electric bell spares.—The Hallamshire Electric Co. Electric light fittings.—J. Thompson; General Electric Co., Ltd. Cable, &c.—I.R., G.P. and T. Works Co., Ltd. Fibre trolley sleeves.—Tramway Supplies, Ltd. Rubber materials.—G. Maclellan & Co.; I.R., G.P. and T. Works Co., Ltd. Insulating cloths, tapes and linen.—L. Andrew & Co.; W. T. Henley's Telegraph Works Co.; Spicer Bros., Ltd.; T. A. Ashton, Ltd.; and E. Inman & Co. Car furniture.—M. Bonser & Co.; Gabriel & Co.; Playser & Mitchell, Ltd.; R. & H. F. Phillips; G. W. Allsop; W. S. Lyscock, Ltd.; Samuel Pease & Sons, Ltd. Springs.—Cocker Bros., Ltd.; Tempered Spring Co., Ltd.; J. P. Skinner & Co., Ltd. Slipper blocks.—George Miles. Brushes.—R. Richmond & Sons; C. Hoyland & Son, Ltd.; G. B. Kent and Sons, Ltd. Glass.—Pilkington Bros., Ltd.; Alfred Webb; Hallamshire Electric Co. Overhead line material.—Brecknell, Munro & Rogers, Ltd.; M. Bonser and Co.; Tramway Supplies, Ltd.; S. Pease & Sons, Ltd.; Fleming, Birky & Gordall, Ltd.; Veritys, Ltd. n.c. copper and lead wire, to be made up into cables.—W. T. Glover and Co., Ltd.

**South Africa.**—Messrs. Siemens have obtained a contract for the supply of 31,800 "Wotan" lamps for use on the South African Railways.

**Stockport.**—The Corporation Parks, Museum and Library Committee has accepted the tender of Mr. Richard Bardsley for wiring and erection of electrical fittings at the new library.

**Stockton-on-Tees.**—The tender of the Reason Manufacturing Co., Ltd., for electrolytic meters, has been accepted by the Council.

**Stoke-on-Trent.**—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd. for cables at £3 053.

**Tunbridge Wells.**—The T.C. has accepted the tender of the Cwmaman Coal Co. for 100 tons of Welsh steam coal for the electricity works, at £1 6s. 8d. per ton.

**Watford.**—The U.D.C. has renewed its cable contract with Messrs. Henley's Telegraph Works Co., Ltd., for a further period of 12 months, on the schedule of prices revised on the basis of the present price of copper, viz., £69 per ton.

**Wolverhampton.**—The Corporation Tramways Committee has accepted the tender of Messrs. Pearson, Huggins & Co. Ltd., for the supply of caps and clothing for the tramway inspectors drivers and conductors.

## FORTHCOMING EVENTS.

**Physical Society.**—Friday, March 14th. At 5 p.m. At the University College, Howr Street, W.C. Paper on "Some Oscillograms of Condenser Discharges and a Simple Theory of Coupled Circuits," and "An Exhibition of Braun Cathode-Ray Tubes and an Electrostatic Machine for Working them, used as a High-Frequency Oscillograph," by Prof. J. A. Fleming; and other papers. Demonstration of Spark Photographs, by Mr. W. B. Haine, before the meeting.

**South-Western Polytechnic Institute.**—Friday, March 14th. At 8 p.m. Presentation of prizes and certificates by Sir C. Alfred Cripps. Conversation following.

**Junior Institution of Engineers.**—Friday, March 14th. At 39, Victoria Street. Continuation of discussion on paper on "Water-Heat-Steam."

**Royal Institution.**—Saturday, March 15th. At 8 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture VI.)

**Borough Polytechnic Institute.**—Saturday, March 15th. At 8 to 5.50 p.m. Annual exhibition of students' work.

**North-East Coast Institution of Engineers and Shipbuilders.**—Saturday, March 15th. At 7.15 p.m. Paper on "Transmission of Power by Chain Drive," by Mr. M. Ba-Gyau.

**Institution of Electrical Engineers (Scottish Section).**—Tuesday, March 18th. At 8 p.m. At 407, Bath Street, Glasgow. Paper on "Recent Developments in the Street Lighting of Manchester," by Messrs. S. L. Pearce and H. A. Ratcliff. Annual general meeting postponed from April 8th to April 15th.

**(Newcastle Section).**—Monday, March 17th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Regulation of Pressure and Continuity of Supply of Electricity under Various Aspects," by Mr. E. Wyatt.

**(Newcastle Students' Section).**—Monday, March 17th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Regulation of Pressure and Continuity of Supply of Electricity under various Aspects," by Mr. E. Wyatt.

**(Manchester Students' Section).**—Tuesday, March 17th. At 7.30 p.m. At the Municipal School of Technology, Manchester. Annual general meeting.

**Association of Electrical Station Engineers.**—Thursday, March 27th. At 7 p.m. Meeting to form Birmingham branch, at the Y.M.C.A. Dsle End, Birmingham. Meetings to form branches will also be held at Mechanic's Institute, Bradford, on Wednesday, March 19th, at 8 p.m., and at "Amalgamated Society of Engineers," Mount Pleasant, Liverpool, on Thursday, March 20th, at 8 p.m.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, March 17th.—"A" Company. Recruit training, 7 to 10 p.m. company training, 7 to 10 p.m.

Tuesday, March 18th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, March 20th.—Easter Camp.—N.C.O.'s and men attending this camp will parade at headquarters at 12.45 p.m. for issue of arms. "C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Friday, March 21st.—"D" Company. Company training, 7 to 10 p.m.

Saturday, March 22nd.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adj. For Officer commanding L.E.E.

**Educational Notes.**—CENTRAL TECHNICAL COLLEGE.—The Goldsmiths' Company of the City of London, which has consistently supported the Central Technical College since its inception, and in 1909 gave £50,000 towards the extension of the Engineering Department, has offered to bear the entire cost of the new building, the additional outlay being nearly £37,000. The only condition attached to the gift is that the money thus set free shall be added to the endowment fund, and the income therefrom shall be used for the purpose of higher educational and research work carried on in the "Goldsmiths' Company's Extension of the City and Guilds (Engineering) College," as it will be called. The offer has been gratefully accepted by Lord Crewe, the Chairman of the Governors of the Imperial College of Science and Technology.

## NOTES.

**The Easter Holidays.**—As next Friday is Good Friday the ELECTRICAL REVIEW for that day will be published two days earlier, appearing on the morning of Wednesday, March 19th. Correspondents are requested to forward news, letters, &c., at the earliest possible moment. Our advertisement department asks that new advertisement copy and alterations to existing advertisements for that issue should be received not later than to-morrow (Saturday) morning, March 15th. An announcement on the matter will be found in our advertisement pages to-day.

**Electrical Trades Benevolent Institution.**—The annual general meeting will be held on Monday, March 31st, at 3.30 p.m., at the Institution of Electrical Engineers, Mr. E. Garcke presiding. In accordance with the new rules the meeting will be composed only of "members" of the E.T.B.I. but it is hoped that there will be a good representative attendance.

**Electrical Imports and Exports in February.**—The following are the foreign trade figures for last month:—

Imports—			
(A) Electrical goods and apparatus, other than machinery and un-insulated wire ... ..	£120,957	dec. £14,038	
(B) Machinery ... ..	£520,223	inc. £10,654	
Exports—			
(A) As above ... ..	£355,965	inc. £102,976	
(B) As above ... ..	£2,712,029	inc. £365,973	

For the two months of 1913 the electrical goods imported show a decrease of £17,842, and the machinery imported an increase of £169,131; while the electrical goods exported advanced by £196,503, and the machinery by £811,805.

**Dublin Electrical Contractors' Association.**—The annual dinner of the members of this Association was held on Thursday, March 6th, at the Hibernian Hotel, Dawson Street, Dublin, Mr. F. Barrett, Chairman, presiding. There were about fifty members present. The toast of the King having been honoured, the Chairman proposed "The Institution of Electrical Engineers," and referred to the cordial relations existing between the Association and the Institution. Mr. S. T. Land, in replying, mentioned that the Institution had recently taken steps with a view to placing itself in its proper position at the head of the electrical industry. It was in a most flourishing condition, and was worthy of the support of everybody connected with the industry. He trusted that before long the term "electrical engineer" would only be used by those who had the necessary qualifications entitling them to use it. Mr. A. Porte also responded, and said that, as a consulting engineer in Dublin, he had a great deal to do with the Contractors' Association, and a more straightforward body of business men he could not possibly meet. The Chairman next proposed the Kindred Societies, including the Institution of Civil Engineers, the Royal Institute of Architects, the Architectural Association of Ireland, and the Engineering and Scientific Association. Mr. Kaye-Parry, in acknowledging the toast on behalf of the Institution of Civil Engineers, said that electrical engineering was the young man's science. In these days more was expected of engineers than could reasonably be expected from one man. They not only were supposed to understand something of the building trade, but also to be lawyers and business men, as well as to have a knowledge of geology, bacteriology, and chemistry. They were, moreover, expected to be hydraulic engineers, and now, in their old age, they were expected to be electrical engineers as well. It was impossible for them, in the discharge of their duties, to be acquainted with all these things that they were supposed to understand, but they absolutely trusted their electrical contractors. Mr. G. L. O'Connor, on behalf of the Royal Institute of Architects, said that electrical engineering was not only the science of the present, but also was going to be the science of the future. Mr. G. M. Ross, on behalf of the Architectural Association of Ireland, and Mr. George Idle, of the Engineering and Scientific Association, also responded. The toast of "The Guests" was next honoured. Captain Purcell, Dublin Fire Brigade, in replying, said that electrical engineers were dealing with a very potent energy, and it was very pliable in their hands, but it was not amenable in the hands of others. He was thoroughly convinced of the great necessity of doing the work, which the members of the Association were engaged in, in the best possible manner, and he knew that electrical contractors, under lead to themselves, did their work in a splendid manner.

**The B.A. Meeting, Birmingham, 1913.**—It is announced that Sir Oliver Lodge has been nominated as president of the British Association for the Advancement of Science, in place of the late Sir William White. Section "A" (Mathematical and Physical Science) will be presided over by Dr. H. F. Baker, F.R.S.; and the Engineering Section ("G") will have as its chairman Mr. J. A. F. Aspinall.

**The Batti-Wallahs' Society.**—At the annual general meeting held on 3rd inst., at the Golden Cross Hotel, under the chairmanship of Mr. F. J. Collis, the secretary, Mr. Pooley, gave a report on the progress made during the past 12 months. The functions held included four smoking concerts, a dinner, seven informal meetings, a down-river trip, an up-river trip, at which ladies were present, and a barge trip. The membership had

increased to 220, and the attendances at the meetings showed a remarkable increase over previous years. Mr. J. Snow Huddleston was unanimously elected president for the ensuing year, and expressions of appreciation were accorded to Mr. Collis, the retiring president, Mr. A. W. Robinson, the entertainment secretary, and Mr. F. Pooley. The Press were also thanked for their generous assistance in publishing the notices of the Society. The vice-presidents are Messrs. J. F. Avila, Haydn T. Harrison, W. A. Jones, G. Newton Russell; Committee, Messrs. Campbell, Carter, Gardner, Greenly, Smith, and Warrilow.

**London Electrical Engineers, R.E. (T.).**—On Saturday last the Corps dinner took place, at the Café Monaco; Lieut.-Col. H. M. Leaf presided, and there was a good attendance of members of the corps and their guests. After the loyal toasts, that of "The Corps of London Electrical Engineers" was proposed by Col. Hon. W. Lambton, C.M.G., who congratulated the corps on its being in a highly efficient state, and above its establishment as regarded both officers and men, an almost unique circumstance. They were all experts in their own lines, and their work in time of peace kept them fully trained to perform their duties in time of war; hence it was one of the most efficient corps in the Territorial Force. In responding, Col. Leaf remarked that last year they had acquired a new Crosley engine and other equipment, including a fine motor lorry capable of running at 8 miles an hour, which had afforded them some highly interesting experiences. Referring to the popular tendency to depreciate the Territorial Force, he urged the corps to pay no attention to what the papers said.

Col. R. E. B. Crompton, C.B., before presenting the challenge cups and prizes won during the year, said the Territorial Army had been abominably treated by the Press. The corps had always been efficient, and he regretted that the authorities failed to realise the extremely important part that electricity would play in the next war. Wireless telegraphy had completely revolutionised modern methods of warfare.

He then presented the long-service medal to Coy. Sergt.-Major F. A. Hill, the third member of the corps to obtain it through service in the corps alone. A medal was also presented to Corpl. W. J. Allen.

The Hopkinson Cup (for technical work) was won by "D" company; the Officers' Cup (for drill) by "C" company; the Bam Cup (shooting on open range) and the Leaf Cup (shooting on miniature range) by "A" company; and the Le Rossignol Cup (for sports) by "D" company.

The Rich Challenge Cup, for shooting at 500 yards, was won by Corpl. W. J. Bardwell, and the Miniature Cup, for the best score in the elementary course, by 2nd Corpl. C. H. Masters. Spoons were awarded to Sergt. E. V. Bowmaker, Sap. H. C. Redgrave, and 2nd Corpl. J. W. Rodger. A large number of prizes for sports were also awarded.

Capt. Kenelm Edgecumbe proposed "The Visitors," and, humorously ringing the changes on the motto of the corps, "Ars Martis Comes," which he thought might be freely translated, "Science linked with Valour," pointed out that they were all linked together, not only as soldiers, but also as electrical engineers, with the I.E.E. as their *alma mater*.

Mr. W. Duddell, president I.E.E., in reply, said he felt he was in the company of men who were prepared to do their duty in defending their country—a duty never more necessary than now. They were all skilled men, and, as in the event of war there would be a great demand for such, the electrical engineers would play a very big part in the next great conflict. The maintenance of communications would fall to their lot; all kinds of artifices were possible in effecting communication in the face of great difficulties, and they should know and practice these in time of peace, so as to be ready to cope with any emergency.

Captain E. N. Bennett also responded, and said he had never before met with a body of Territorials that was exempt from public criticism; for one thing, no one knew what they did, and for another, their work naturally ran on smooth lines. The loss of the battle of Lule Burgas was due to the lack of military science and the absence of means of communication along the battle-front; this was remedied at Chatalja by the installation of telephones, etc.

An excellent entertainment was provided, under the direction of Lieut. F. H. Masters, who, as organising secretary, carried out all the arrangements for the dinner.

### R.A.C. Trial of an Electrical Motor Delivery Van.

—The Royal Automobile Club has now issued the certificate relative to the week's trial under its supervision of an electric motor delivery van fitted with a battery of Edison nickel-steel accumulators, entered by Mr. F. J. Monnot, of 41, Great Portland Street, W. The vehicle, which had a rated carrying capacity of 1,000 lb. (nominally 10 cwt.), weighed 29 cwt. approximately, including a 60-cell battery. The trial was held in London from the 6th to the 11th January, or six days, and the average speed-rate was 11'52 miles per hour. The roads were "fairly heavy and some rain fell." The total mileage run was 312'3 miles, which included the distance run between the lock-up and the charging station. A total of 191'81 units was used for charging the battery, the aggregate time taken for the charging being 24 hours 30 minutes. The level of the electrolyte in some of the cells was tested on two occasions and distilled water was added to all the cells three times.

On days Nos. 1, 2, 3 and 4 the maximum distance possible was run on the battery charge. The time occupied in charging the cells was 6 hours 39 minutes, first day; 5 hours 27 minutes, second day; 3 hours 40 minutes, third day; 3 hours 6 minutes, fourth day; 5 hours 36 minutes, fifth day, and 1 hour 2 minutes, sixth day. On the sixth, or last day, the charging was repeated in six "doses" of 10 to 12 minutes' duration each. During these

short-period charges the average amperes ranged from 133.6 at 119.8 volts to 150.8 amps, and 111.9 volts. The longest distance between charging, viz., 50.2 miles, was covered on the third day; the battery had been previously charged for one hour and at the close of the run was again charged for 2 hours 40 minutes.

**Fatality.**—An inquest was held on 7th inst. concerning the death from electric shock, on 5th inst., of Benjamin Bettridge, aged 14, a pony driver at the Langwith Colliery. Mr. Nelson, electrical expert to the Home Office, attended. According to the evidence, deceased was resting his hand on a prop, and just above his hand was an electric lamp, which it was quite possible he touched, as it was pulled down when he fell. The manager of the colliery said that the screw which held the lamp to the prop was not broken; it had been drawn out of the wood. He could only account for the deceased getting a shock if there was a leak in the insulated cable. The insulation had been tested and found good. The lamp was afterwards put in a position similar to that which it occupied before it was disturbed, and it was then found that there was a possibility of a leak from the cable to the casing of the lampholder, on which there was slight evidence of fusion. That being the case, there was a liability to shock to anybody who touched any part of the metal or wire. Anybody touching the lamp at such a time would probably grip it and get it out of place. Mr. W. E. Ross, the underground electrician, said that earthing was being generally applied to the whole system. He did not think that there would be anything above 110 volts from the lamps, but he was now satisfied that the voltage was greater than he believed. The manager said that the rules required that circuits of over 125 volts should be earthed. Some of the lamps had been unearthed, but these had now been earthed. A verdict of "Accidental death" was returned. We refer to this matter in our leading columns.

**Sentence.**—For receiving about 700 yards of stolen copper telephone wire, the property of the Postmaster-General, which had been removed from poles near Paddington, Henry Newman, a dealer, was sentenced to 12 months' hard labour at the Central Criminal Court on Saturday last.

**Association of Electrical Station Engineers.**—A meeting was held at the Exeter Café, Manchester, on Friday last, for the purpose of forming a branch of the above Association. Thirty gentlemen were present at 8 p.m., and Mr. J. W. Lanham was unanimously voted into the chair. The widespread interest in the Association was evidenced by the presence of representatives from neighbouring towns such as Blackburn, Wigan, Oldham, Rochdale, Ashton, Stalybridge, &c. The proceedings were opened by the reading of a letter from the Hon. Secretary (Mr. Ebben), in which he clearly described the history of the Association, its objects and aims. It was stated that the object of the meeting was, in the first place, to form a local branch and then to obtain suggestions as to the working of the same.

The first question arising was as to the area included in the Manchester district. After a little discussion it was decided that this could be settled later by the London Conference. Meanwhile Manchester was to be the centre of as large a district as possible, compatible with the claims of other branches. It was unanimously resolved "That a branch of the A.E.S.E. be formed in the Manchester district." Mr. J. W. Thomas, B.Sc. Tech., was then elected secretary for the district.

In view of the possibility of some members not being able to attend meetings on account of their shifts, it was resolved that a Committee of at least 12 should be elected, chosen from as many of the districts as were represented, and this was done. A discussion ensued as to the qualifications which should entitle an applicant to become a member of the A.E.S.E. The following suggestions were made for consideration in London:—Eligible candidates should be—  
(1) Totally employed in electrical station work. This includes shift engineers, assistant shift engineers, switchboard attendants, sub-station attendants, mains assistants. Assistant sub-station attendants might also be eligible, provided that sufficient evidence was given as to training and ability, the Committee having the power of discrimination.

(2) Or, in entire and exclusive charge of private plant, and producing a guarantee of training and experience.

It was resolved that the Committee have power to admit candidates with the above considerations in view, emphasis being laid on the desirability of either technical training, works training, or long experience in charge of electrical plant.

With reference to the annual subscription, it was suggested that, though the one proposed was very reasonable, it might be desirable to adopt a graded subscription varying according to salary.

The question of grievances pertaining to particular districts was commented on, but the subject was postponed to some future date, as being too big. It was, however, pointed out that the organisation was something more than a trade union, its main object being to raise the status of the profession.

As to the accomplishment of the latter object, it was suggested that meetings of a social and educative character should be held, including meetings for discussion, papers, &c., on subjects calculated to interest the members. These meetings might be held in other towns in the district besides Manchester.

All the gentlemen present who were not already applicants for membership promised to become so, and the meeting unanimously volunteered to persuade others of their acquaintance to join and to make the Association as widely known as possible.

Votes of thanks were accorded to the chairman and secretary for their services, and to the hon. sec., Mr. Ebben, for his pioneer work in the inauguration of the Association, and the meeting closed.

**Annual Dinners and Socials.**—**CROYDON.**—The annual staff dinner of the Croydon Corporation Electricity Works was held on Saturday evening, the chief engineer (Mr. A. C. Cramb) in the chair. The company, which gathered at the "Greyhound" Hotel, included the Mayor (Councillor S. Rogers), Ald. T. Betteridge, Ald. T. Hillier, Councillors H. W. Umney, W. B. Roberts, F. Denning, W. Peet, J. A. Clarke and H. T. Muggidge, and Mr. T. B. Goodyer (general manager of the tramways). There were special electrical decorations, and a good musical programme. Ald. D. B. Miller (chairman of the Electricity Committee), who is abroad, sent a cordial message of goodwill, and the members of the staff on duty forwarded congratulations to their more fortunate colleagues. The chairman, proposing "The Corporation of Croydon," said the aim of the department was to give the public the best article at the lowest price. The Mayor replying, complimented Mr. Cramb on his good management, and the excellent feeling prevailing among the staff, the men being comfortable in their employment and satisfied with their wages. Councillor Denning, submitting "The Chairman and Members of the Committee," remarked—as chairman of the Tramways Committee—that his only complaint was that they wanted so much profit out of the current sold for the tramway service. Councillor Umney replied. The chairman, also responding to the toast, reminded the chairman of the Tramways Committee that his department had not had the difficulty of getting over the tight situation caused by the coal strike; nor had he to face a 40 per cent. increase in the price of coal. Mr. Cramb added that after nine years' work every department was just as he could desire.

**PERTH.**—The employés of the Perth Corporation Tramway Department held their annual social and dance last Friday night, when Councillor Moncrieff, convener, who presided, addressed the men. Bonuses to conductors and drivers were presented.

**LONDON.**—The annual dinner of the staff of the Oram and Robertson Lamp Works will be held at the Clarendon Restaurant, "Coronation Hall," on Friday evening, March 28th.

**Appointments Vacant.**—Chief engineer and manager (£700), and consumers' engineer (£300), for the Hampstead Borough Council; electrical engineer, for Heywood Corporation (£200); traffic superintendent, for the Aberdeen U.D.C. Tramways (£175); installation engineer and canvasser, for the Tynemouth Corporation electricity works (£100 and commission); assistant electrical engineer, for the electric light department of Selangor, Malay States (£360). See our advertisement pages in this issue.

**Strike.**—According to the *Daily Telegraph*, the electrical trade workers of the district of Southampton have made common cause with the engineers and others who are on strike there.

**Life Targets.**—Last week, at the invitation of the directors of "Life Targets," we inspected the remarkable device which has been developed by the company for target practice with the rifle. A moving picture is thrown on a screen, showing suitable objects in motion, such as birds, animals, soldiers, &c.; on firing at the target, the bioscope is instantly stopped and the bullet-hole, shown by a bright spot of light, remains visible for a few seconds, after which the hole disappears and the motion of the picture is resumed. The electrical arrangements, which involve the use of the "K.K." detector, are most ingenious, and so are the other details of the system, which we will describe fully at an early date. The sport obtained with this target is exciting, and splendid practice for snap shooting.

**Institution and Lecture Notes.**—**PRODUCTION MANAGERS' ASSOCIATION.**—This new Association will hold its inaugural dinner (morning dress) at the Holborn Restaurant on April 8th, the subject being "Labour Problems," which will be dealt with by experts in various phases of the problem of labour. Tickets 4s. each. The secretary is Mr. Charles F. Warren, Guest House, Leys Avenue, Letchworth, from whom further particulars can be obtained.

**INSTITUTE OF MARINE ENGINEERS.**—At a meeting of the Institute, held on Monday, March 3rd, a paper on "Recent Experiences with Babcock & Wilcox Boilers for Marine Purposes" was read by Mr. J. H. Rosenthal (member).

**INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION).**—The Committee's nominations for office-bearers for Session 1913-14 are as follows:—

Chairman—J. A. Robertson.  
Vice-Chairmen—James Lawson and T. Blackwood Murray.  
Committee—David A. Starr, J. K. Stothert, J. F. Neilson, Wilfred L. Spence, M. B. Field, J. H. Bunting, J. S. Nicholson, E. T. Goslin, George Stevenson.

Hon. Secretary and Treasurer—James E. Sayers.  
Assistant Hon. Secretary—Wm. F. Mitchell.

**MANCHESTER SECTION.**—A meeting of the Section was held on Tuesday evening, when a paper was read by Mr. A. E. Hadley on "Power Supply on the Rand." An interesting discussion followed, to which the author replied.

**YORKSHIRE SECTION.**—A paper was read at Leeds University on Wednesday by Mr. Thomas Roles on "Electric Cooking and Heating." A discussion followed.

**THE ASSOCIATION OF ENGINEERS-IN-CHARGE.**—At the invitation of the Social Committee of the Association of Engineers-in-Charge, over 200 members of the Association and their friends attended a dance held in the Holborn Hall, Gray's Inn Road. A programme of 15 dances was arranged, and, owing to the very excellent manner in which Messrs. W. H. Ball and M. C. White (M.C.'s) officiated, it was found possible to get through the whole of these, together with five extras. Dr. H. S. Hele-Shaw, F.R.S.,

president of the Association, was present, and was ably supported by Mr. H. E. Neale (chairman of the Association) and the members of the Committee. Mr. Hardy's Byron Orchestra was in attendance.

**THE FARADAY SOCIETY.**—A joint meeting of the Faraday Society and the Local Section of the Society of Chemical Industry will be held at Manchester on Friday evening, April 14th. The proceedings will take the form of a general discussion on "The Corrosion of Iron and Steel."

### OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The Watford U.D.C. has increased the salary of MR. A. W. BARRHAM, chief assistant, from £140 to £155 per annum, with annual increments of £15 up to a maximum of £200 per annum.

The salaries of MR. J. ALLWARD, station superintendent, and MR. T. A. J. MARGARY, mains superintendent, have been increased by the Islington B.C. from £200 to £225 each per annum. Increases have also been given to two shift engineers, two mains engineers, a repair engineer, three junior engineers and a draughtsman.

MR. A. E. TURPIN, senior charge engineer, Weymouth Corporation Electricity Works, has been appointed assistant foreman electrical engineer to the Indian Government at Cossipore, and sails on March 15th. Mr. Turpin has been at Weymouth for the past seven years.

MR. W. H. WOODS, of Durham, has been appointed shift engineer at the Sturt Street generating station, Manchester, at £175 per annum.

The salary of the Bermondsey B.C. electrical engineer, MR. W. E. J. HEENAN, has been increased from £525 to £625 a year, by two annual increments of £50 each, and that of MR. J. G. DORAN, chief assistant engineer, from £250 to £300 per annum, by two annual advances of £25 each.

MR. S. T. ALLEN, of Carlisle, has been appointed electrical engineer to the Wolverhampton Corporation, in succession to MR. C. E. C. SHAWFIELD, resigned. The salary commences at £600.

The Wolverhampton Corporation Electricity Committee has decided to increase the salaries of the members of the technical staff as from October 1st last, as follows:—MR. STUBBS, technical and general assistant, £160 to £200 per annum; MR. BELLHOUSE, boiler house superintendent, £125 to £150; MR. FORDER, engine-room superintendent, £120 to £150; and MR. PLATT, junior assistant, £85 to £104.

MR. A. PRENTICE, of the Central London Railway Power House, Shepherd's Bush, London, has been engaged by the Walsall Corporation Electricity Committee as station superintendent, in place of Mr. T. J. Archer, resigned, for a period of one calendar month (to be extended to two months should the Electricity Committee so desire), at a salary of £5 per week, together with railway fare to and from London; and subject to mutual satisfaction at the end of that period, and to his references being satisfactory, Mr. Prentice is to be then permanently engaged at a salary of £200 per annum, removal expenses not exceeding £10 being allowed.

The Hackney Electricity Committee recommends that owing to increased responsibilities, the designation of MR. T. DALBY, works superintendent, be altered to "works and sub-stations superintendent," and the salary advanced from £200 to £300 by annual increments of £12 10s. MR. E. MATTHEWS, testing engineer, is to advance from £130 to £180 by annual increments of £10. MR. E. WILKINSON, generating engineer, is also to be advanced.

We understand that MR. H. H. COUZENS has resigned his position as engineer and manager of the Hampstead Corporation electric supply department, in order to take up a good appointment abroad. His resignation was put before the Committee last Monday, and accepted.

**Tramway Officials.**—The Bury T.C. has decided to increase the salary of the tramways manager, MR. CLOUGH, by £50 per annum, with a further increase of £50 at the end of 12 months.

The Keighley Tramways Committee has appointed MR. HARRY WEBBER, borough electrical engineer, as tramways manager, as from October 15th last, at a salary of £100 per annum.

**General.**—The *Times* states that MR. HENRY WOLLEN has resigned his position as director and chairman of the Edison & Swan United Electric Light Co., and the vacancy has been filled by the election of MR. C. J. FORD, of Messrs. Ford, Rhodes & Ford, as a director and chairman.

MR. WALTER J. CRIDGE, who has represented Messrs. Ferranti, Limited, in the Birmingham District, has severed his connection with that firm in order to join the A.E.G. Electric Co., Ltd., as an engineer representative in the same district.

MR. E. C. TIFIN has severed his connection with Messrs. J. J. Smith & Co., electrical fittings manufacturers, of 44, Kirby Street, Hatton Garden, E.C., having resigned the managership of the above works, which he has held since they were first started in 1910.

MR. F. CLOUGH, who, out of 300 applicants, has been appointed chief assistant electrical engineer to the Essex County Council, for its large new asylum at Colchester, served his apprenticeship in the

Bradford Corporation Electricity Department prior to taking up the post of electrical engineer to the Worcester County Council, at the Barnsley Hall Asylum, Bromsgrove.

**Obituary.**—We regret to learn of the death, which occurred on Monday, 10th inst., of MR. ANDREW LIVINGSTONE LIND, A.I.E.E., who was until recently managing director of Messrs. Lind & Co., Ltd., of Liverpool.

### CITY NOTES.

#### Windsor Electrical Installation Co., Ltd.

THE directors report that the capital expenditure during 1912 amounted to £2,448, making the total £92,798. The additional expenditure chiefly represents the installation of a second Diesel oil engine of 135 kw. capacity. The profit (including £593 brought forward) is £6,823. Debenture interest absorbs £809, dividend on 5 per cent. preference shares £1,108, depreciation, renewals and reserve fund £1,750, and directors' fees £350. The directors recommend that a dividend of 5 per cent., less income-tax, be paid on the ordinary shares, leaving £451 to be carried forward. During the year new lamps were connected equivalent to 1,021 of 8-c.p.; the total connected to December 31st, 1912, being 51,076 lamps. The annual meeting takes place on March 19th.

#### Newcastle-upon-Tyne Electric Supply Co., Ltd.

THE directors' report states that the connections to the company's system at the end of 1912 amounted to 174,327 H.P., an increase of 22,700 H.P. for the year. The profit is £120,989, as compared with £114,839, plus £4,608 brought forward, making £125,597 as compared with £116,889. Against this has been charged interest on debenture stock, loans, &c., £35,078, leaving £90,518, as compared with £84,921. The directors recommend a dividend of 5 per cent. for the year on the preference shares, absorbing £34,375, a dividend of 5 per cent. for the year on the ordinary shares (as against 4½ per cent. for 1911) (of this an interim dividend of 2 per cent. was paid in July last), £34,375, the transfer to depreciation account of £15,000, carrying forward £6,768. From the reserve account have been deducted the charges in completing the conversion of debentures into debenture stock and the issue of new debenture stock to replace debentures paid off £4,644, leaving it at £10,405. The depreciation account has been increased by the transfer of £15,000, making it £145,000. From this there has been transferred £26,100 which has been utilised in writing down certain items of plant and stores (in addition to the sums of £150,000 and £2,500 previously shown as having been written off) leaving the amount of the unappropriated depreciation account at £118,900. The expenditure on capital account for the year amounted to £167,082. This has been incurred mainly in extending the distribution system of the company in both the northern and southern areas. Agreements for the supply of electrical energy have been entered into during the year, with important customers, including several large colliery companies. The Bankfoot Power Co.'s new waste heat station at Bowden Close, and the extensions to that company's station at Bankfoot, have been completed and brought into operation. The disorganisation caused by the national coal strike in the early part of the year added largely to the working costs of the company. It is gratifying to state that throughout the period affected by the strike the company was able to fully satisfy the requirements of all its customers. A resolution will be submitted for the approval of the general meeting on March 19th asking the shareholders to increase the directors' remuneration to £1,500 a year.

#### W. T. Glover & Co., Ltd.

THE directors' report for the year 1912 shows that the result of the trading is a credit balance of £38,469, plus £4,767 brought forward. There has to be deducted directors' remuneration, voted March, 1912, £1,000; directors' expenses during 1912, £41; interest at 4½ per cent. on first mortgage debenture stock, £4,250; interest at 5 per cent. on second mortgage debenture stock, £3,800; written off investments, £1,500 = £10,591; leaving £32,645 less appropriation for payment to trustees of second mortgage debenture stock, £4,000. The balance of £28,645 is to be dealt with, thus:—Dividend on 5 per cent. cumulative preference shares (£100,000) to December 31st, 1912, less income-tax, £4,708; transfer to first mortgage debenture redemption fund, £2,500; dividend on ordinary shares (£114,850) at the rate of 5 per cent., less income-tax, £5,407; bonus on ordinary shares, at the rate of 2½ per cent., less income-tax, £2,704; transfer to reserve fund, £5,000; leaving to be carried forward £8,326. The directors recommend the payment of the dividend on the 5 per cent. cumulative preference shares for the year, and a dividend at the rate of 5 per cent. and a bonus at the rate of 2½ per cent. on the ordinary shares for the same period. After making the above appropriations, the redemption fund for the first mortgage debenture stock will stand at £33,000, the redemption fund for the second mortgage debenture stock at £24,000, and the reserve fund at £20,000. The loan to the Trafford Power and Light Supply (1902), Ltd., having reached £25,000, a second debenture for that amount has been accepted in discharge thereof, and this item is now merged into the item of investments—£97,521.

The meeting is called for March 17th.

### British Engine, Boiler and Electrical Insurance Co., Ltd.

WE are informed that at the annual meeting, held at the head office in Manchester, on March 7th, the chairman (Mr. R. C. Longridge) mentioned that in the course of the past year the Royal Insurance Co., Ltd., had acquired a controlling influence by the purchase of shares, and, in consequence of advancing years, his father, the first chairman of the company, had taken this opportunity for resigning his position on the board. Mr. Moss, also, who had been secretary almost from the commencement of the company, was retiring from that position, and his place would be taken by Mr. H. F. Taylor, who had for many years represented the company in Glasgow, but these changes involved no alterations in the operations of the company, and had in no way interfered with its progress, as might be seen from the figures in the balance-sheet. Claims showed a considerable increase as compared with 1911, and this was chiefly among steam engines, possibly because trade was so good that engines were overburdened, but that explanation would not account for the fact that, in spite of a great increase in the number of electrical machines insured, the claims in that department had not increased. He ventured to hope that this improvement was due to the educational advantages derived from the repeated visits of the company's inspectors, when they explained to attendants—many of whom knew little or nothing about electricity—what should be done to keep machines in good working order. While the amount to be paid for claims was about the same, the ratio of breakdowns also remained nearly constant, namely, one out of every nine machines insured. There had been a considerable diminution in claims for boilers, and the general results spoke well for the efficiency with which the work of inspection had been carried out. It was resolved to pay a dividend of 5s. per share, with a bonus of 3s., and after re-election of directors and auditors, the meeting ended.

### Direct Spanish Telegraph Co., Ltd.

THE directors report that for the year 1912, after providing for interest on and redemption of debentures, and for the dividend (10 per cent.) on the pref. shares, there is a balance of £14,134, out of which the directors recommend a final dividend on the ordinary shares of 2s. per share, free of income-tax, which, with the interim dividend paid on October 1st last, will make a total distribution of 4 per cent. for the year, and absorb a sum of £2,586. In consequence of the entire absence of breaks on the company's cables during the year 1912, it has been possible to strengthen the reserve fund out of revenue by £11,000, which is satisfactory in view of the exceptionally large expenditure of £33,000 on the Bilbao cable in 1911. After crediting the reserve fund with £11,000, the balance of £548 is carried forward. The traffic receipts show an increase of £2,985, and the working expenses an increase of £1,080. The company's cables and the landlines in connection with them have continued in good working order throughout the year. The meeting is called for March 17th.

### Manila Electric Railroad and Lighting Corporation.

—The Municipal and General Securities Co., Ltd. (European agents), announce that a dividend of 1½ per cent. (\$1.75 per share) for the quarter ending March 31st, has been declared on the common capital stock of the above Corporation, payable in New York on April 1st.

**Continental.** — GREECE. — La Compagnie Hellenique d'Electricité Systeme Thomson-Houston, of Athens, is declaring a dividend of 5 per cent. for the last financial year, the same as for the preceding 12 months.

**Canada.** — The Halifax (N.S.) Tramway Co. in their annual report show a surplus of \$704,119, an increase of \$101,834 over 1911.

**Electrical Distribution of Yorkshire, Ltd.** — At the annual meeting at Leeds on 25th ult., the chairman, Mr. R. W. Wickham, congratulated the shareholders on the steady and satisfactory progress that was being made. During the year there had been a steady growth in the demand for electrical energy, and a large number of consumers had been added in the 10 districts in which the company was now giving a supply. The company was the holder of 14 electric lighting orders for districts in the West Riding. The profits had increased from £37 in 1908 to £2,166 last year. A dividend of 6 per cent. on ordinary shares was adopted. Subsequently, the chairman moved that the capital of the company be increased to £50,000 by the creation of 25,000 new shares of £1 each. This was carried.

**Manorhamilton and District Electric Light Co., Ltd.** — The annual meeting was held at Manorhamilton recently, Mr. A. A. Alges presiding. The annual report showed that the company was in good standing, and it was adopted.

**Stock Exchange Notice.** — Application has been made to the Committee to appoint a special settling day in Ceara Tramway, Light and Power Co., Ltd. — 85,007 ordinary shares of £1 each, fully paid (Nos. 200,001 to 285,007); and 125,000 5 per cent. first debenture stock.

### South London Electric Supply Corporation, Ltd.

THE directors' report for the year 1912 shows that the gross receipts were £48,123, while expenditure was £20,859, leaving a profit balance of £27,264, plus £998 brought forward. There is a total amount available of £28,172, and after providing for depreciation on plant and machinery (£6,000), debenture and other interest accrued, &c., £13,289, there remains £14,883. Out of this the board recommend the payment of a dividend at the rate of 5½ per cent. per annum on the ordinary shares, amounting to £14,300, carrying forward £583. At the end of 1912 there were connected to the company's mains the equivalent of 273,306 (35-watt) lamps, showing a net increase for the year of 22,585. At the present time there are 285,388 (35-watt) lamps (equivalent) connected, in addition to which applications are in hand for a further 13,830 lamps. The plant, machinery and mains have been maintained out of revenue in a high state of efficiency. The units sold amount to 5,000,118, an increase of 520,631 or 11½ per cent. the total cost per unit sold being 1'00d., as against 1'03d. in 1911. The ratio of total costs to revenue has been maintained at 13 per cent.

Units generated .. .. .	6,317,975
Sold to consumers and used by public arc lamps ..	5,000,118
Used on works .. .. .	376,015
Total .. .. .	5,376,133
Expended in distribution .. .. .	511,842
Total kilowatts connected .. .. .	9,600

The annual meeting is called for March 18th.

### British Insulated and Helsby Cables, Ltd.

THE directors' report for the year 1912 shows a profit of £218,395, plus £63,651 brought forward, making £282,046; from this have to be deducted directors' and debenture trustees' fees and remuneration to Works Committee, £5,315; interest on first debenture stock, £22,500; interest on second debenture stock, £10,000; depreciation on buildings, plant, machinery, &c., £20,000; transfer to reserve account, £20,000; transfer to special reserve account, £8,500; transfer to first mortgage debenture stock redemption account, £5,000; written off patents and goodwill, £36,500; dividend on preference shares for the year, £30,000; interim dividend on ordinary shares to June 30th, 1912, £20,000—leaving available for dividend £104,231. The directors recommend a further dividend of 6s. per share on the ordinary shares, making, with the interim dividend already paid, a total of 10 per cent. for the year, £30,000, carrying forward £74,231. The directors are pleased to report that there has again been an increased turnover during the year, which has resulted in an additional profit being earned of £30,136 over the previous year. £8,500 has been transferred to special reserve account, a further £5,000 to first mortgage debenture stock redemption account, £20,000 to reserve account, and £20,000 applied to depreciation on buildings, plant and machinery. In addition, £36,500 has been written off patents and goodwill. This account, which originally stood at £251,672, has now been reduced to £35,000. After deducting the aforementioned sums, the balance to be carried forward is £74,231. The sale of the Liverpool works to the Automatic Telephone Manufacturing Co., Ltd., referred to in last year's report, has been completed.

The annual meeting is called for March 17th.

### Giant's Causeway, Portrush and Bush Valley Railway and Tramway Co.—Dr. Anthony Traill, D.L., presided

at the annual meeting held recently at Portrush. The directors reported that the financial position of the company had been well maintained during the past year. The receipts amounted to £3,908, which, considering the extremely wet summer of 1912, must be considered satisfactory. The number of passengers fell from 136,395 in 1911 to 135,612 in 1912, and the receipts from £4,107 in 1911 to £3,908 in 1912. The expenditure last year was somewhat higher than in the previous year, and consequently the net profits were £1,222 for 1912, as compared to £1,546 for 1911. These profits were sufficient to pay the debenture interest, £612; the interest on the mortgage for the construction of the extension to the Giant's Causeway, £400; interest on temporary loans and bank interest £69; leaving a credit balance of £308, which it was recommended to be carried forward. While the wet summer of 1912 gave sufficient water to drive the full complement of electric cars, the same cause reduced the number of tourists travelling, with a consequent reduction in the receipts. The engineer reported that the number of miles run by electricity was 34,932, an increase of 1,525 over that of 1911, worked at a cost of 3½d. per mile run. The number of miles run by steam power was 3,922 worked at a cost of 2s. per mile run.

### Mid-Sussex Electric Light and Power Co., Ltd.—

Mr. T. Caffyn presided last week at the first statutory general meeting of this company.

### Melton Mowbray Electric Light Co., Ltd.—

The annual meeting was held on 7th inst., Mr. W. J. New presiding. The directors reported that satisfactory progress had been made during the year, the total number of consumers being 613. The revenue for the year, including £242 brought forward, amounted to £2,761, and after providing £1,000 for debenture interest, there remained £1,761 for distribution. They recommended a dividend at the rate of 3 per cent. per annum, that £750 be placed to the reserve fund, and £411 carried forward.

### Hove Electric Lighting Co., Ltd.

THE directors, in their report for 1912, give the following progress table:—

Year.	Houses.	Equivalent in S.C.P. lamps.	Units sold.	Gross revenue.	Net revenue.
1908	1,076	114,185	1,134,994	£24,695	£19,463
1909	1,820	122,946	1,192,548	25,205	19,981
1910	1,919	129,217	1,178,165	25,991	15,400
1911	2,129	184,200	1,139,328	21,840	14,457
1912	2,276	141,919	1,167,008	25,220	14,630

With the addition of the balance £637 brought forward and bank interest, the amount to the credit of net revenue account is £15,283, from which must be deducted the dividend on the preference shares paid September 1st, 1912 (£588), the interim dividend on the ordinary shares at the rate of 8 per cent. per annum (£2,825), a provision for debenture interest accrued and income-tax, leaving £9,283 now available. The directors propose to place £1,500 to the renewals and depreciation account and £3,000 to the sinking fund, to set aside £588 for preference dividend accrued to December 31st last, and to declare a final dividend for the six months on the ordinary shares at the rate of 10 per cent. per annum, making 9 per cent. for the year. The amount carried forward, after providing for the directors' extra remuneration of £315, is £348. The renewals and depreciation account, with the above addition, will now stand at £27,104. The sinking fund account, with the above addition of £3,000, and £2,016 received by way of dividends on investments, will now amount to £48,530. The expenditure during the year on capital account has amounted to £1,301, and the machinery, buildings and mains of the company have been kept in good repair. The Hove Corporation having given notice of their intention to purchase the undertaking of the company by payment of the legitimate capital expenditure, are promoting a Bill in Parliament to authorise the borrowing of the necessary money. The company will continue to carry on the undertaking until the transfer to the Corporation. The payment of the purchase-money will become due on December 8th next.

The annual meeting is called for March 19th.

### Chelsea Electricity Supply Co., Ltd.

MR. W. R. DAVIES (chairman) presided on Wednesday at Winchester House, E.C., over the annual meeting of the company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 396), the CHAIRMAN first referred to the death of Sir Irving Courtenay, the late chairman. He said the deceased was the only remaining member of the original board. He directed the fortunes of the company through evil report and good report, and he had the satisfaction before he passed away of seeing the finances of the undertaking in a prosperous condition and its position among London electric light undertakings well assured. They were very fortunate in having been able to obtain the services of Mr. Stanley Beeton to fill the vacant seat on the board. Mr. Beeton possessed considerable engineering knowledge and a rare commercial faculty, a combination not often met with. The net additions to capital amounted to £1,277 only. In the revenue account the sale of current had increased by £1,400, but, on the other side, the Miners' Eight-Hours Act and the Coal Strike, which had left in their train what he was afraid would prove permanently higher prices, were responsible for an increase of a similar amount in the coal bill, and the result of their trading was that they carried to net revenue £40 less than a year ago. They had, however, an increased income from dividends of £670, which gave them about £500 more than for the previous year to deal with. They proposed to put to renewals and depreciation account £13,626, which was £446 more than the amount for 1911; to transfer the usual amounts to the debenture stock premium redemption fund; and to further reduce the cost of extinguishing the founders' shares; they also proposed to write a further £1,000 off the Cadogan Electric Light purchase account; to write down their investments to the market prices on December 31st last, which would cost £1,352; and, after paying interest on debenture stock and the dividend on preference shares, to pay a final dividend at the rate of 6 per cent. on the ordinary shares, making, with the interim dividend of 4 per cent., 5 per cent. for the year, reducing the balance carried forward by about £400. That this was a conservative distribution was clear from the fact that out of a total available of £31,880, they paid only £14,159 in dividends, and appropriated £17,771 for various writings down. Their aim, as a board, was, before increasing the dividend, to see that every doubtful item in the accounts was finally extinguished, as they believed that their first business was to preserve the corpus of the undertaking in preparation for the inevitable day when their provisional order expired and their business would be taken over. Their investments as written down to market prices at December 31st stood at £54,567. The business continued to made steady progress. The S.C.P. lamp equivalents had increased by 11,597, which was distinctly better than the increase of the previous few years. The units sold had increased by between 4 and 5 per cent. This improvement in business was only arrived at by persistent canvassing, and it was both unlikely and undesirable that there would be any decrease in this work, and in the necessary cost thereof, as time went on. They had taken two important departures in the matter of the supply of current during the year. In the first place, acting under the London Electric Supply Act, 1908, they had entered into an agreement with the Central Electric Supply Co., which owned the great power station at St John's Wood, and which supplied the St.

James's and Pall Mall and Westminster Companies with a considerable portion of their current, for a supply in bulk to the northernmost of their sub-stations, and they would see an item in the accounts of £69 for current purchased. The supply was only commenced in the last month of the year, which would account for the item being so small. The arrangement was an excellent one for them, inasmuch as it provided a stand-by for an important part of their area, and it was supplied to them at a point which was the least economical for them to supply from their generating station near King's Road. The second new departure was that they had decided to order Diesel gas plant to generate a considerable portion of their current. This matter had been carefully considered for many months, and he did not think they would have any reason to regret their decision. They were in a difficult position at Chelsea as regarded generating in the most economical manner, because, being surrounded by flats and houses, they were obliged to use a high-class smokeless Welsh coal in order to avoid smoke troubles, which increased their coal costs. Further, they were unable, owing to want of condensing facilities, to install the most economical form of steam plant, viz. turbine plant. The existing reciprocating engines were of comparatively small dimensions and by no means economical, and it reflected great credit on the chief engineer and manager, Mr. Still, that with the machinery at his command he had been able to produce the comparatively economical results which had been obtained. They had every hope that when the whole of the Diesel plant, which they expected to order within the next year or two, was working regularly, the generation costs would show a great improvement. In the meantime, they had ordered a first instalment, and expected this would be in position ready for working by the end of the current year. They would naturally wish for some information as to the prospect for the present year. They saw no reason why the steady improvement of the lamps installed should not be maintained, and in the ordinary course of events, provided nothing abnormal happened, they ought to be able to increase the gross revenue. On the other hand, they had not yet come to the end of higher prices for coal, and it was probable from this cause that their costs would be increased by hundreds of pounds.

MR. H. R. BEETON seconded the motion, which was carried without discussion.

The retiring directors were re-elected on the motion of MAJOR W. F. WOODS.

**Prospectuses.**—*The New British Ever Ready Co., Ltd.*—The list is to close to-morrow. Saturday, in an issue of 85,000 7 per cent. cumulative preference shares of £1 each, participating up to 10 per cent. The company is to acquire as a going concern the business of the British Ever Ready Electrical Co. Ltd., of Holloway, on which the profits—after charging repairs and renewals of machinery and plant, and providing for depreciation, but before charging income-tax, interest and directors' remuneration—were £6,314, £8,259, £13,514, and £21,119 for the last four years. The turnover of the business for the first two months of 1913 shows an increase of more than 25 per cent. over the corresponding months of 1912. The purchase price is fixed at £206,137, out of which £10,308 is for plant, machinery, &c. £16,804 for stock-in-trade. £21,574 book debts, £10,000 for interest in subsidiary undertaking, and £144,535 for "goodwill, patents, trade marks, copyrights, &c." The vendor company is to be paid as to £115,000 (in respect of goodwill) in fully paid ordinary shares, as to £75,000 in cash and the remainder in cash or in discharge of vendors' liabilities. Mr. Samuel Stern, the managing director (who is vice-president of the American Ever Ready Co.) will act for three years, and Mr. Gustave Hitzelberger, the manager, for five years, "thus providing for continuity in the management of the business." The company employs approximately 360 persons. The business was founded in 1901, and consists in the manufacture of electrical specialities and motor-car accessories. The vendor company has acquired further patents for the manufacture of dry batteries for portable lamps, for which it claims almost "double the life of the ordinary dry battery."

So much importance appears to be attached to the prospectus to these further patents in connection with the manufacture of dry batteries, that one is entitled to ask for fuller information on this point. The patent numbers at least might have been given, or the nature of the invention, or inventions, disclosed. From the exclusion of the word "electrical" from the title, and from the statement that "an important feature of the vendor company's business is its increasing trade in accessories and fittings for motor-cars," we are led to wonder what proportion of the business is electrical. The uncertain and intangible character of the great bulk of the "assets," as indicated above, will not escape the would-be investor's notice. The amount set down for goodwill, patents, &c., we cannot help regarding as extravagant, notwithstanding that it is to be taken as to £115,000 in ordinary shares. The whole of the preference shares have been underwritten.

*The Melbourne Electric Supply Co., Ltd.*—The list is to close to-day in an issue of £100,000 5 per cent. consolidated debenture stock at 93½ per cent.

**Vickers Ltd.**—The directors report that for 1912 there is a net profit of £872,633, after the usual provision for depreciation. The directors are carrying £200,000 each to works extensions and reserve accounts, and recommend a final dividend of 5 per cent., making 10 per cent. for the year. The prospects of the current year are regarded with confidence. The directors have decided to take steps to increase the share capital by the issue of 740,000 ordinary shares at a premium of 10s. per £1 share.

### London United Tramways, Ltd.

THE directors report that the operation of the undertaking during the year ended December, 1912, resulted in gross receipts amounting to £332,016, and the working and general expenses, maintenance and repairs to £223,654, leaving, with the balance brought forward, a net revenue of £109,793. After payment of interest on debenture stock and loans for the year, and providing for income-tax, there remains a balance of £11,228, a decrease of £15,203 as compared with the preceding year. Of this amount the directors propose to place £15,000 to general reserve, £25,000 to reserve for renewals and contingencies, and to carry £1,228 forward. The gross receipts show a decrease of £11,971, and the working expenses an increase of £4,621, resulting in a decrease in net revenue of £16,592 as compared with the previous year. The number of passengers carried was 61,139,285, a decrease of 1,407,843.

The L.U. Tramways Act, 1912, received the Royal Assent on August 7th last. This Act authorised an agreement to be made with the Chiswick Urban District Council for the extension of the company's tenure of the tramways in that district until 1935. An agreement to that effect has since been entered into. This Act also relieves the company from the obligations to the Richmond Borough Council imposed by the previous Acts of the company relating to Richmond tramways. To assist the company's employees in deriving the maximum benefits under the National Insurance Act, 1911, the directors formulated a scheme for an approved society, available for all classes of employees, and their scheme duly received the approval of the Commissioners. The directors have also undertaken to add to the benefits provided by the Act.

During the past year the work of improving the permanent way on the Middlesex lines has been proceeded with. Over 3,250 rail joints have been cast welded, making a total of 14,511 joints so dealt with to date. The arbitrator's award in the matter of the purchase of the company's tramways in Hammersmith was issued in February of last year, and negotiations in regard thereto are proceeding with the L.C.C. Pending the final settlement of this question the County Council have agreed to make advances to the company for the reconstruction of portions of the Hammersmith tramways. The Uxbridge Road tramway within the borough has already been reconstructed and portions of the track in Goldhawk Road and King Street will shortly be relaid.

The scheme for the consolidation of the company's interests with those of the Metropolitan Electric Tramways, Ltd., and the Tramways (M.E.T.) Omnibus Co., Ltd., which was submitted to the shareholders in November last, was accepted by a very large majority, and consequently became binding. In accordance with the policy therein indicated, the three companies have been placed under one management. Mr. James Devonshire has been appointed managing director in place of Mr. Stanley, who, however, retains his seat on the board, and Mr. A. L. Barber has succeeded Mr. W. G. Verdon Smith as secretary.

Mr. C. J. Catercott resigned his directorship in April last, and the board have appointed Mr. W. M. Acworth in his place as chairman of the company. Mr. W. H. Brown has found it necessary for reasons of health to resign his seat on the board. Mr. F. V. Schuster has been appointed to fill the vacancy.

THE annual meeting was held on Wednesday at the Holborn Restaurant, W.C., Mr. W. M. Acworth presiding.

THE CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 392), said that the shareholders must have been more or less prepared for the report by the statement contained in the circular which the directors sent out last November. They then said: "The net profits for the current year cannot, of course, be ascertained, but unfavourable weather conditions and increased omnibus competition during the last summer have adversely affected them." The accounts showed that the receipts were nearly £12,000 down and the expenses were £4,600 up; in other words, their net balance was £16,591 worse than it was that time last year. The loss in gross receipts was due mainly to bad weather and omnibus competition. On the expense side, coal and the purchase of energy had cost them nearly £3,000 more; wages and other benefits granted to the staff had cost them an additional expense of close on £4,000, the largest item of which was owing to the granting of holidays on full pay. He believed, however, that that was money very well spent. Pending the time when the benefits under the National Insurance Act came into operation, they increased their contributions to the provident fund. An approved society had now been formed for the employees of the company, and the directors had undertaken to supplement the benefits under the State scheme. They had lost Mr. Stanley as their managing director, but they retained the benefit of his wise counsel as a member of the board. Mr. Knapp, their general manager, in whom both the board and the staff had entire confidence, and Mr. Verdon Smith, the secretary, had also left them, and they were glad to know, not to their personal disadvantage. To fill the vacancies the board had appointed Mr. Devonshire as managing director, Mr. Barber as secretary, and Mr. Pott as engineer and general manager, all from the Metropolitan Electric Tramway Company. Those appointments secured considerable economy at once, and would he believed secure larger economies in the future. The upshot of the accounts was that after payment of the working expenses, income tax, and interest on debentures and bonds, they had a balance of only £11,228 as against £56,434 last year. They proposed to place £40,000 to reserves and to carry forward £1,228. They entered the current year with a better hope for the future because of the arrangements which had been made for the consolidation of that company with other kindred concerns, under which additional sources of revenue would ensure for the benefit of the vast majority of those who had hitherto been shareholders of the London United Co. He was glad to tell them that the holders of 93 per cent. of the preference stock and 97 per cent. of the ordinary stock had acted on the advice of the board, and had exchanged their holdings for stock in the London and Suburban

Traction Co. That company would have a preponderating voice in the affairs of the London United Co., and therefore their future meetings would be of a more or less formal character. By exchanging their holdings for stock of the London and Suburban Traction Co., those who had hitherto been shareholders of the London United would have the benefit of new sources of income, namely, from the Metropolitan Electric Tramways, the North Metropolitan Electric Power Supply Co., and last, but they hoped by no means least, from the Tramways M.E.T. Omnibus Co., which would before long be working a fleet of 350 omnibuses. Some 60 were at work at the present time, and their number was increasing steadily at the rate of about 10 per week, so that by the summer time there would be quite a considerable fleet in action. He would like to point out that the London United Tramways Co. must always work under a heavy handicap, by reason of their capital expenditure on street widenings. For every mile of tramway opened, their expenditure worked out at something like five times the amount which the L.C.C. debited to its tramway undertaking. The L.C.C. had the advantage of being able to charge such portion of the cost of street widenings as it might think fit to a street improvements fund, the interest on which was payable by the ratepayers of London, but unfortunately that course was not open to the company.

THE HON. SYDNEY HOLLAND seconded the motion, which was adopted after a short discussion.

### Slough and Datchet Electric Supply Co., Ltd.

THE directors' report for 1912 states that the sum expended on capital account amounted to £3,397, bringing the total up to £58,031. The expenditure chiefly represents the installation of a second Diesel engine and dynamo of a capacity of 135 kw. The following table shows the progress of the company, the equivalent of 1,809 additional lamps of 8 c.p. having been connected last year:—

Year.	Lamps and motors connected.	Units sold.	Profit.
1909	16,380	335,983	£3,288
1910	17,876	332,295	£3,165
1911	24,115	426,136	£3,421
1912	25,914	819,733	£4,835

A railway siding has been constructed into the company's works, on a satisfactory agreement with the Great Western Railway Co., which is a great convenience and should result in considerable saving. In order to cope with the extension of business it will be necessary to increase the capital of the company. The shareholders will be asked at the meeting on 19th inst. to sanction the increase in the capital from £50,000 to £75,000. An issue of 10,000 shares at par will shortly be made, and the shareholders will be given the opportunity of subscribing to the issue in proportion to their holding. The total net profit available for distribution is £5,112. Out of this the directors propose setting aside £1,250 to the depreciation fund, bringing it up to £6,000. The directors recommend a dividend of 6 per cent., less income-tax, and that £637 be carried forward.

**Companies Struck Off the Register.**—The following have been struck off the Register and are accordingly dissolved:—

Acmé Conveyor and Machine Co.  
Dynamo Electric Car Transmission Fyndicate.  
Electrical Fittings Co., Ltd.  
Electrocarb Development Co., Ltd.  
Foxcroft & Duncan Engineering Co.  
London Electrocarb Co.  
Nitrogen Power Syndicate.  
Norfolk Electrical Co.  
Orient Electric Power Syndicate.

**Municipal and General Securities Co., Ltd.**—The directors' report shows that for 1912 the amount at the credit of appropriation account is £18,852, made up as follows:—Balance of profit from 1911, £1,621; net profit for 1912, £17,231. The directors recommend a dividend at the rate of 10 per cent. per annum, less income-tax (£5,000), adding to reserve £10,000 (making it £30,000), carrying forward £3,852. The investments are shown in the balance sheet at £73,359. The present market price of these securities considerably exceeds this figure. The annual meeting was held on February 27th. Messrs. J. G. White and W. C. Burton were re-elected as directors.

**Alley & MacLellan, Ltd.**—The directors report that, although the company's operations have been hampered by the various strikes, which increased expenses and made the getting of material difficult, and also by the increased cost of supplies, labour and taxes, they are able to show a satisfactory profit, a substantial portion of which they have transferred to the reserve fund. The profit from trading for the year to December 31st, after meeting all necessary charges, is £18,263. The directors have applied £4,800 for depreciation of property, plant, machinery, &c., have transferred £4,000 to reserve, and recommend a dividend on the ordinary shares at the rate of 6 per cent. per annum, leaving £1,729 to carry forward.

**Commonwealth Edison Co.**—The report states (says the *Financier*) that the accounts for 1912 showed a total income of \$5,582,229, and after providing for bond interest and placing \$514,000 to depreciation reserve, there remained an available sum of \$3,438,229, from which dividends absorbed \$2,516,783, leaving a balance of \$921,445, increasing the surplus brought forward to \$5,252,146.

**Brompton and Kensington Electricity Supply Co., Ltd.**

THE directors' report for the year ended December, 1912, shows a revenue account credit balance of £33,178, which, with the balance of £7,858 brought forward, and £1,000 balance of interest received and accrued, makes a total of £42,036. After deducting £1,573 for interim dividend on the 7 per cent. cumulative preference shares, and £7,002 interim dividend at the rate of 9 per cent. per annum for the half-year to June 30th on the ordinary shares, the directors recommend that the sum remaining, viz., £33,180, be dealt with as follows:—To credit of depreciation account (maintaining this fund at £80,000), £10,200; written off cost of investments, £244; dividend on the preference shares for December half-year, £1,520; dividend on the ordinary shares for half-year ended December at the rate of 11 per cent. per annum, making 10 per cent. for the year (free of income-tax), £8,606; income-tax on dividends, £910; credit of reserve fund account (raising it to £33,000), £3,000; reserve against investment in the Brompton and Kensington Accessories Co., Ltd., £1,000; directors' additional remuneration, £973, leaving to be carried forward £7,026. The following table shows the progress of the business:—

Year.	S.c.p. lamps con- nected.	Inc. in s.c.r. lamps.	Cas- tomers con- nected.	Gross rec'pts.	Expendi- ture.	Net rec'pts.	Average price per unit.	Div. on ord. shares.
1909 ..	235,802	10,976	4,883	£50,791	£23,710	£27,081	4.18	10 %
1910 ..	246,974	11,172	5,163	50,596	23,917	26,679	4.26	10 %
1911 ..	259,551	12,580	5,453	54,739	24,038	30,699	4.29	10 %
1912 ..	272,701	13,147	6,798	56,318	23,170	33,178	4.18	10 %

The meeting was held yesterday.

**Gateshead and District Tramways Co.**

THE directors' report for the year ended December 31st, 1912, shows a gross revenue of £56,964. After deducting all expenses chargeable to revenue, including repairs and maintenance, interest on mortgages, and a provision of £2,730 for renewals, there remains a balance on the year's working of £22,783, plus £1,878 brought forward, making a total of £24,661. Of this there has been placed £4,500 to reserve, and to the sinking fund for redemption of mortgages £2,126, leaving a balance of £18,035. The directors propose to pay the dividend on the 6 per cent. preference shares, requiring £757, and that on the 5 per cent. preference shares, absorbing £6,000, also a dividend on the ordinary shares at the rate of 6 per cent. per annum, in respect of which an interim dividend for the half-year ended June 30th, 1912, at the rate of 5 per cent. per annum has already been paid, requiring £8,100, and a bonus of 1 per cent. on the ordinary shares £1,350, leaving to be carried forward £1,829. Interest derived from investments has been added to the renewals fund and to reserve. Only £64 was added to tramway capital account. £1,474 was expended on account of the motor-omnibus undertaking. The general trade of the district was satisfactory during 1912, and notwithstanding the coal strike the traffic receipts show an increase of £527. Nine cars constructed on the "Pay-as-you-enter" system are now operating on the Bensham and Saltwell routes. In view of special influences affecting traffics on these routes, it has not been possible so far to ascertain accurately the financial effect of adopting the system. The directors, however, are satisfied that these cars have many advantages, and they have, therefore, decided to construct two new cars on the P.A.Y.E. principle, which will be placed in service on the Low Fell route, where further cars are needed.

In response to a request of the Chester-le-Street Urban District Council, the directors have, after very careful investigation, arranged to operate a service of motor-omnibuses between the terminus of the tramway at Low Fell and Chester-le-Street. A garage is in course of erection at Chester-le-Street, and the omnibuses are now being delivered. It is intended to commence the Chester-le-Street service early in April. The institution of experimental services on other routes is receiving the consideration of the directors.

	1911.	1912.
Passengers carried .. .. .	12,706,177	12,816,417
Average receipts per passenger .. .. .	1.02d.	1.03d.
Average expenditure per passenger .. .. .	55d.	55d.
Proportion of expenses to receipts .. .. .	54%	54%
Cars in stock .. .. .	51	51

Routes miles—81cyle line, 4.62 m.; double line, 7.64 m. 12.16 m.

The annual meeting was to be held yesterday.

**County of London Electric Supply Co., Ltd.**

THE annual meeting was held on Monday at Winchester House, E.C., Mr. J. B. Braithwaite presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 392), first referred to the capital account. The Bournemouth company had paid an increased dividend of 1/4 per cent., and had increased its allocation to reserve. At Coatbridge and Airdrie there had been quite a satisfactory increase, the units sold during 1912 amounting to 1,445,035, as against 1,538,320, or an increase of nearly a million. Coming to the business of their London stations, at the last meeting he congratulated the shareholders on the fact that the company had had a record year in almost every respect. This year, he was glad to say, had surpassed that record in every item. They had had a record number of applications during the year, amounting to

slightly over 4,000 kW., and they had a record in the number of new customers. In 1911 the new customers were 1,676; last year they numbered 1,787, making the total number of customers in their London areas 20,226, and they sold an extra 2,000,000 units approximately. That result had been obtained in spite of the fact that in 1911 they were supplying a considerable amount of current during the construction of some sewers in the South of London, which were completed in that year. Coming to the revenue account, there was an increase in the gross revenue of about £19,000, which amounted to £231,100, against £212,039, and of that, after paying various increased charges, they carried £134,082 to the net revenue, as compared with £126,228 in 1911. In other words, they retained £7,854 of the increased revenue as net. That would have been very much larger had it not been for the expenses entailed by the coal strike and the transport workers' strike. The effect of those two labour disturbances was to cost them £7,189 additional expense. He was glad to say that they came out of those labour troubles without having to inconvenience any of their customers in the slightest degree. During the whole period they did not have to cut off a single consumer, but maintained a regular and good supply the whole time, and that fact, he thought, was one of the reasons why they had had so many additional applications for power during the past year. Owing to the strikes their coal had cost them more than before, and he was afraid they would never get back to the old prices. However, by the adoption of the very latest machinery and appliances they had neutralised very appreciably the higher cost of coal. Last year he told them that they had completed their interconnection between City Road and the Wandsworth power house, and that had been of considerable use in making for economical working. They were now laying another interconnection which would save them several miles of routes. Their district at Purley, which they used to serve from a supply which they took from the Croydon Corporation had now developed sufficiently to warrant them supplying it themselves, and they were laying mains which would enable them to give that district a supply from Wandsworth. Dealing with the disposal of the profits, the chairman said they had had to pay £6,740 in dividends on the new shares. They had increased the appropriation to depreciation by £2,500, and they had added £2,081 to the carry forward. As showing the steady increase in the amount they had put aside year by year for depreciation, he might mention that it had risen from £16,000 to £25,000 in 1911, and this year it was £27,500, and but for the coal strike they would undoubtedly have increased it to £30,000. On the other side, they had written off all their plant which was of an obsolete character and which had been removed from their power house. As to the future, so far as this year had gone the business was quite normal. The units sold showed an increase of 6 per cent. over the corresponding period last year, and if they were free from labour troubles, he hoped that next year they would have a very substantial addition to their net revenue to report.

Mr. A. H. SANDERSON seconded the motion.

Mr. T. LIGHTON, while congratulating the board upon the results of the year, remarked that he would like to see the item of preliminary expenses materially reduced.

Mr. PARKER asked whether, in view of the decision in the case of the National Telephone Co., it would not be possible for the board to call a conference of the electric lighting companies to see whether it was not possible to adopt some uniform method of treating such items as preliminary expenses, the cost of obtaining provisional orders, and the depreciation and renewal account. At present those matters were treated differently by the different companies, whereas, if some common form could be agreed upon, it would probably be of considerable benefit to the shareholders when the time came for the Companies to be acquired.

Mr. EVERSHED, while complimenting Mr. Sparks, the chief engineer, upon the technical success of the company, criticised the board for not putting aside a sufficiently large sum to reserve, according to his opinion.

The CHAIRMAN, in reply, said that with regard to the depreciation fund, it must not be forgotten that four years ago when that fund stood at £60,000 they had in their City Road station a large amount of old-fashioned plant. Now, although that fund had only been increased by £3,000, the whole of that plant had disappeared from the station, having been scrapped. With regard to the preliminary expenses, the matter had already engaged the attention of the board, and steps were being taken to have a careful consideration of the whole question by as many of the electric supply companies as possible. Had the Telephone Co. instead of writing off their preliminary expenses retained them in their books, they would have recovered the money from the Government as money legitimately expended in raising the capital and building up the business. If they were advised that that was the proper policy to pursue, they would leave that item in the balance sheet, because naturally they wanted to get as much as they could for the shareholders when they were purchased by the County Council in 1931. The report was adopted.

**Hadfield's Steel Foundry Co., Ltd.**—The directors, in their report for 1912, propose to add £20,000 to the reserve and renewal account and to carry forward £49,556. They recommend that in addition to the interim dividend of 1s. per share paid in August last on the ordinary shares, a further dividend be paid on the ordinary shares of 2s. per share, together with a bonus of 1s. per share, all free of income-tax.

The annual meeting is called for March 17th. At a special meeting which is to follow, it is intended to pass a resolution changing the name to "Hadfields, Ltd."

### County of Durham Electrical Power Distribution Co., Ltd.

THE directors report for 1912, that the total connections to the company's system at the end of the year (including the connections of its associated Parliamentary company, the County of Durham Electric Power Supply Co.) amounted to 51,525 n.r., an increase of 11,000 n.r. The profit for the year is £33,736, plus £162 brought forward, making £33,899, against which has been charged interest on loans and debenture stock, £13,335, leaving £20,563, out of which the directors recommend a dividend of 5 per cent. for the year on the preference shares, £12,500, transferring to depreciation account £6,000, carrying forward £1,863. The capital expenditure on mains and works during the year has been £47,648, of which £17,193 represents this company's outlay, and £30,455, the outlay by its associated company, the County of Durham Electric Power Supply Co. During the year, the latter company transferred by sale to the Newcastle-upon-Tyne Electric Supply Co., Ltd., certain mains, &c., to the value of £15,372, the net addition, therefore, to the capital expenditure of the two companies together amounting to £2,277. The national coal strike adversely affected the progress of the company, which accounts for the smallness in the increase of the profit.

The meeting is called for March 19th.

### Metropolitan Electric Supply Co., Ltd.

THE directors' report, for the year 1912, states that the capital expenditure has now reached a total of £2,103,996, an increase during the year of £51,298, together with £62,866, representing the Acton transfer. A further amount of £56,926 3½ per cent. mortgage debenture stock was subscribed for and allotted during the year. The gross revenue amounted to £202,183, as compared with £182,622 in 1911, an increase of £19,561. The working expenses amounted to £99,086, as compared with £88,005, an increase of £11,081. The balance at the credit of the revenue account, before providing for depreciation, is £103,097. The directors have set aside £20,000 as an addition to the depreciation and reserve fund, which now amounts to £297,355, carrying to the credit of the net revenue account £83,097. This sum, with the balance brought forward from last account, interest and dividends on investments, and other receipts, makes a total of £94,314. After deducting interest on debenture stocks and loans, dividend on preference shares and other charges, there remains a balance of £46,762. An interim dividend of 2s. per share on the ordinary share capital, amounting to £20,000, was paid on August 13th, and the directors recommend that a further dividend of 2s. 3d. per share (being at the rate of 4½ per cent. per annum) on such shares be now paid, making a total distribution for the year of 4s. 3d. per share, or 4½ per cent. This will absorb a further £22,500, and leave £4,262 to be carried forward. The stocks of coal held in reserve by the company enabled them satisfactorily to maintain the supply to their customers during the coal strike, but the increase in the price of coal due to the strike, and since maintained, has materially affected the cost of production. During the year new connections representing the equivalent of 71,267 8-c.p. (30-watt) lamps, equal to 2,138 kw., were added to the company's system, making a total connection at the end of the year of 1,028,304 lamps. The company's engineer reports that the stations, machinery, and plant, have been maintained in a satisfactory condition.

The meeting is called for March 18th.

### Harrow Electric Light and Power Co., Ltd.

IN their report for 1912, the directors state that during the past year 129 new consumers, representing 79 kw. of additional demand, have been connected to the mains. The number of consumers at the end of the year was 1,510, and their aggregate requirements amounted to 1,292 kw. The output for the year was 162,737 units. In order to foster the use of electricity for heating and cooking purposes, the directors have reduced the rate of charge for such purposes to 1½d. per unit during the winter and 1d. per unit during the summer. They have also introduced an alternative "assessment" tariff for private houses with a fixed charge of 8d. per £ per quarter on the rateable value, plus 1½d. per unit supplied during the winter, and 1d. per unit supplied during the summer; this scale covering the supply of electricity for all domestic purposes, including lighting, heating and cooking. The new rates came into force on January 1st, 1913. The remainder of the 4½ per cent. debentures, amounting to £1,400, have been issued during the year. The balance to the credit of the net revenue account, after deducting debenture interest and the interim dividend on the preference shares, is £2,221, which the directors recommend should be dealt with as under: Final dividend on the preference shares, £375; dividend on the ordinary shares at the rate of 5 per cent. per annum, £1,667; balance to be carried forward, £179. It is proposed to issue the dividend warrants on 28th inst. The new offices and showrooms in College Road are now nearing completion, and will be occupied by the company at the end of March next.

The annual meeting was held at Harrow on February 20th. MR. J. N. STUART, who presided, said that at first sight it might seem that the progress of the company had met with a slight check, inasmuch as the increase in the number of units of electri-

city last year was much smaller than the increase for the previous year, but the fact was that the introduction of metallic-flament lamps instead of carbon lamps was so economical for customers, that all who used them were enjoying a reduction in their bills. They could look on this fact with equanimity and even pleasure, for it meant that electric light was becoming cheaper and as this was better recognised more consumers would be added. This was really evident this year, for the number of consumers had increased by 129—a larger number than had joined in any year since the company was formed. Harrow was somewhat behind other towns in taking to metallic filament lamps, but the use of them was now growing very rapidly. The company having now secured as customers the occupiers of nearly all the large houses in the district, the board had been considering how better to attract those of the smaller houses, who, under the existing tariff, used their electric light very sparingly. They had, therefore, introduced from the commencement of this year, a tariff of a fixed charge based on the assessed value of the premises, with an extremely low rate per unit of electricity consumed, viz., 1d. to 1½d.; this would enable customers to use their light much more freely, without feeling that they were adding materially to their bills, and would also give them the advantage of heating and cooking at a low price. Harrow had not yet woken up to the advantage of cooking by electricity, though other towns had done so to a very great extent, but at their new show-rooms, which would be opened shortly in College Road, they would be able to demonstrate the great advantage and saving of electrical cooking, as well as the best methods of lighting and heating. The depreciation account now stood at the high figure of £25,000, or more than 25 per cent. on the capital expenditure, a position attained by very few electric light concerns in England. The company had continued to be ably served by the engineer and manager, Mr. Horsley; the secretary, Mr. Bishop; the works superintendent, Mr. Adams; and all the members of the staff.

MR. G. SPENCER HAWES, in seconding, said that among technical people it was thoroughly realised that all electrical undertakings, especially those mainly dependent on lighting business, had been passing through a critical period during the last few years, not because there had been any lack of new consumers, but because of the inventive genius of electrical scientists, which had resulted in the production of a lamp which had proved to be of enormous advantage to electrical users. To show the effect on the Harrow undertaking of the use of metal lamps, he had only to state that upon a reasonable computation based upon output records, users of electric light in Harrow had had their bills decreased to the extent of something like £2,250, as compared with the position which would have existed under the old carbon lamp condition of things. This was confirmed in another direction. Some years ago their average revenue per consumer was £7 15s.; last year the average was £6 5s. That showed a decline in the period of £1 10s. per consumer. On the basis of their 1,500 consumers, this showed a direct decline of revenue of £2,250. The whole of that advantage had been reaped by their consumers. So far the company had reaped very little, excepting this—they had benefited by the improved conditions with which consumers viewed electric light. That was certainly an advantage to the company, because it brought to them business which perhaps they never would have captured in the early days with the old style of lamps.

The report was adopted, and the dividends were declared.

### Scarborough Electric Supply Co., Ltd.

THE annual meeting was held on March 5th, Mr. G. Alderson-Smith presiding.

THE CHAIRMAN, in moving the adoption of the report, said that they were going ahead. There was an increase in the lamps of 4,000 odd, an increase in units supplied of over 9 per cent., and the number of customers had increased by 16 per cent. They had sold an increase of electrical energy to the amount of £773, and the credit side was £1,000 to the good compared with last year. On the other side coal cost £358 more. They were able to keep running throughout the coal strike. The other items on the debit account were small. The "B" account—distribution—was £102 more, but they had spent a larger amount in repairs.

MR. A. A. CAMPBELL SWINTON, in seconding, said that beyond putting £1,000 to depreciation, they kept all their plant up to date out of revenue. £1,000 increase in gross revenue was something like a 10 per cent. increase. If that rate could be maintained, they would soon revert to the position of comparative prosperity that they occupied a few years ago.

A resolution was adopted declaring a dividend of 3 per cent.

### British L.M. Eriesson Manufacturing Co., Ltd.—The

directors report that for the year ending December 31st, 1912, the net profit amounts to £18,563. They recommend that after payment of 6 per cent. to the preference shareholders, the balance of £13,941 be appropriated by paying a dividend of 8 per cent. (free of income-tax) to the ordinary shareholders, requiring £8,001, and by carrying forward £5,940.

The annual meeting is called for March 19th, in London.

**Western Telegraph Co., Ltd.**—The directors have declared the second quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1913, being at the rate of 6 per cent. per annum. The transfer books are closed until the 19th inst.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, March 12th.

(CHEMICALS, &c.)	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a " Nitric .. .. .. "	22/-	..
a " Oxalic .. .. .. per lb.	23d.	..
a " Sulphuric .. .. .. per cwt.	5/6	..
a Ammoniac Sal .. .. .. "	43/-	..
a Ammonia, Muriate (large crystal) per ton	£28 10	..
a Bleaching powder .. .. .. "	£6 5	..
a Bisulphide of Carbon .. .. .. "	£18	..
a Borax .. .. .. .. "	£17 10	..
a Copper Sulphate .. .. .. "	£28 15	15/- inc.
a Lead, Nitrate .. .. .. "	£22 10	..
a " White Sugar .. .. .. "	£27 10	..
a " Peroxide .. .. .. "	£82	..
c Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks .. per lb.	84d.	..
a Potash, Caustic (88/90 %) .. .. per ton	£22 10	..
a " Chlorate .. .. .. per lb.	44d.	..
a " Perchlorate .. .. .. "	71d.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	..	..
a Shellac .. .. .. .. per cwt.	85/-	..
a Sulphate of Magnesia .. .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. .. .. "	£5 10	..
a " Recovered .. .. .. "	£5 10	..
a " Lump .. .. .. .. "	£5	..
a Soda, Caustic (white 70/72 %) .. .. per lb.	10 5	..
a " Chlorate .. .. .. per lb.	92d.	..
a " Crystals .. .. .. per ton	£28 5	..
a Sodium Bichromate, casks .. .. per lb.	84d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. .. per ton	£95	..
b " Wire, in ton lots .. .. .. "	£112	..
b " Sheet, in ton lots .. .. .. "	£120	..
b Babbitt's metal ingots .. .. .. "	£88 to £145	..
c Brass (rolled metal 2" to 12" bars) .. per lb.	84d.	3d. inc.
c " Tube (braced) .. .. .. "	104d.	..
c " (solid drawn) .. .. .. "	94d.	..
c " Wire, basis .. .. .. "	82d.	..
c Copper Tubes (braced) .. .. .. "	113d.	..
c " (solid drawn) .. .. .. "	102d.	..
e " Bars (best selected) .. .. .. per ton	£83	£2 inc.
e " Sheet .. .. .. .. "	£83	£2 inc.
e " Rod .. .. .. .. "	£83	£2 inc.
d " (Electrolytic) Bars .. .. .. "	£85 15	15/- inc.
d " " Sheets .. .. .. "	£86 10	10/- inc.
d " " Rods .. .. .. "	75/-	£1 inc.
d " " H.C. Wire .. per lb.	92d.	3d. inc.
f Ebonyte Rod .. .. .. .. "	6/8	..
f " Sheet .. .. .. .. "	4/9	..
f German Silver Wire .. .. .. "	1/10	..
h Gutta-percha, fine .. .. .. "	7/- to 8/-	..
h India-rubber, Para fine .. .. .. "	3/114	8 1/2 dec.
f Iron Pig (Cleveland warrants) .. .. per ton	62/11	2 1/2 inc.
l " Wire, galv. No. 8, P.O. qual. .. "	£14	..
g Lead, English Pig .. .. .. "	£16	15/- dec.
m Manganese Wire No. 28 .. .. .. per lb.	6/6	..
g Mercury .. .. .. .. per bot.	£7 10	5/- dec.
e Mica (in original cases) small .. per lb.	6d. to 8s.	..
e " " " medium .. .. .. "	8/6 to 6/-	..
e " " " large .. .. .. "	7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. .. .. "	3/6 to 4/6 nom.	..
o Phosphor Bronze, plain castings .. "	1/2	..
o " " rolled bars & rods .. .. .. "	1/2	..
o " " " rolled strip & sheet .. .. .. "	1/2s	..
o Platinum .. .. .. .. per oz.	185/-	..
d Silicon Bronze Wire .. .. .. per lb.	11d.	..
d Steel, Magnet, in bars .. .. .. "	£55	..
d Tin, Block (English) .. .. .. "	£216 to £217	£6 dec.
o " Wire, Nos. 1 to 16 .. .. .. per lb.	2/8	..
o White Anti-friction Metals .. .. per ton	£46 to £228	..
o Zinc, Sh's (Vielles Montagne bnd.) .. "	£28 10	15/- dec.

Quotations supplied by—

a G. Boor & Co.	/ Bolling & Lowe,
b The British Aluminium Co., Ltd.	/ Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	/ Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	m W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	p P. Ormlston & Sons
f India-Rubber, Gutta-Percha and	o Johnson, Matthey & Co., Ltd.
Telegraph Works Co., Ltd.	p
g James & Spakepears.	r W. F. Dennis & Co.
h Edward Tull & Co.	

STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange is going through another very anxious time. The focus of the financial horizon has shifted from money to money. Although trade is so good, and there is probably more money in the country at the present time than there has ever been before, for Stock Exchange and banking purposes the amount of floating capital is comparatively small. Money rates rule high. There is a great demand for accommodation. New issues have absorbed

substantial amounts, and with the unrest which is visible on all sides, people are retaining their money in banks and similar stockings rather than entrusting it to the ordinary channels of investment.

Inasmuch as the capitalist, large or small, can obtain five to six per cent. by lending money in the Stock Exchange on quite good security, it is not surprising that he should prefer to do this rather than invest it in securities, the prices of which appear to trend in one direction only. So far as electrical issues are concerned, the main feature this week is a shrinkage in the Latin-Canadian group, the news from Mexico—taken in conjunction with the monetary stringency—not only causing a feeling of depression, but also leading to realisations of actual stock.

The Home Railway market failed to derive any benefit from the settlement of the dispute between the Midland and its men. It was thought at first that the bulls might seize the occasion to make a demonstration in force; but circumstances proved too strong for them, and prices moved in exactly contrary direction from that in which they were expected to advance. The electrical stocks have given way, like most of the rest. Central London Ordinary and Deferred fell a point each, notwithstanding the favour with which they are being viewed in certain quarters. Metropolitan and Districts both fell back, and there was a shake out in Underground Electric descriptions. The £10 shares receded 5s., the 1s. shares lost 3/2, and the Income bonds at 92 1/2 shed a point that they gained the week before. East London Ordinary stock, which had been run up to 10 1/2, reacted a little, and the company's Preference stocks also went back slightly. The Traction market as a whole is quiet. A fall of 1 is registered in London United Tramways 4 per cent. Debenture stock. British Electric Traction 6 per cent. Preference at 11 is 1/2 lower.

The English Electricity Supply group remains a little on the dull side, although the falls are insignificant. The largest are those of 5s., in City of London 6 per cent. Preference—which has brought the shares down to a 4 1/2 per cent. level of return to a buyer—and in St. James's Ordinary. City Ordinary shares touched 18, but reacted to their last week's figure. County Ordinary, in spite of the excellent report—commented upon in our last number—went back 1/2; but the fraction was picked up by the company's Preference shares, which have risen to 12, while the Second Debenture stock is a point better. Chelsea's are 1/2 down. The market, as a whole, is extremely quiet.

Of the manufacturing varieties, the feature is the strength of British Thomson-Houston 4 1/2 per cent. Debenture stock. The price has risen to 97 upon a small demand, showing a gain of 1 1/2. Otherwise this section is mostly easier in those few places where changes have occurred. Dick, Kerrs, for example, are down 1/8, both Ordinary and Preference drooping. Falls of 1/2 are shown by India-Rubber Preference and Callender's Cable Ordinary; while Castner-Kellners lost a small amount. The rises in Edison & Swan shares have been maintained; the fully-paid are 1/2 higher on the week.

The Latin-Canadian section, as already mentioned, shows pronounced dulness, this being more particularly noticeable in the stocks and shares of the Mexican Companies. Mexican Light and Power and Mexican Electric Light Bonds have fallen from 1 to 2 points. Mexican Trams are 2 down, and the company's bonds are lower in each class. Rios eased off a little, and Sao Paulo bonds are 1/2 down. Montreals and Shawinigan Water show falls of 2, and Cordoba Light Ordinary are somewhat easier.

British Columbia Electric Railway has made its new issue this week, and the Deferred and Preferred Ordinary stocks were quoted ex rights on Monday, the official valuations being 3s. 3d. and 1s. 3d. premium respectively. The issue prices were 21s. for the Preference, 22s. the Preferred, and 21s. the Deferred, these being the figures at which they are offered to the present stockholders. Brazilian Traction shares have been sold extensively by speculators, and the gain of 3 last week has been lost. The Argic-Argentine group did not escape the infection of depression, which spread further to such shares as Para Electric Ordinary and United Electric Trams of Monte-Video.

Interest is reviving to a languid extent in Marconi shares, to which the bears have been paying some little attention this week. The price went back to 4 1/2, and notwithstanding the sales which had been made by the short brigade, the contango rate was the exceptionally heavy one of 9 per cent. The Preference show 1/2 fall, and the various subsidiaries' shares are rather lower. National Telephone Deferred stock keeps very steady about 94. Such, at least, is the price to-night, though when these notes appear the price will be more like 19, because 75 per cent. of the recent award money is to be distributed on the Thursday in this week. American Telephone Capital stock and Collateral Trust bonds are easier, but Commercial Cable Debenture rose 1/2. Indo-Europeans continue to advance. In the Eastern group, "China" shares lost their small improvement of last week. West India and Panama Telegraphs shared the same fate, the price going back to 3 1/2.

New issues are very much out of favour just now, but those who are on the look out for cheap stock have probably noticed the attractions of the 5 per cent. Consolidated Debenture stock offered this week by the Melbourne Electric Supply Company, Limited, at 93 1/2 per cent. The security is covered n a y times over, and so is the interest payment. At the price of issue, the return to the investor is about 5 1/2 per cent. on the money.

The Rubber market shows a steadier tendency, the price of the raw commodity keeping very close to 4s. per lb. There is, however, very little doing in the share market.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations Mar. 11th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations Mar. 11th.	Rise + or Fall	Present Yield p.c.	
Bournemouth & Poole, Ord.	10	1911. 5 1/2	94-104	..	5 4 9	Kensington & Knightsbridge, Ord	5	9 4	72-82	..	5 9 1	
Do. 4 1/2 % Pref.	10	4 1/2	84-94	..	4 14 9	Do. 4 % Deb.	Stock	4	90-93	..	4 6 0	
Do. Second 8 % Pref.	10	8	96-104	..	6 17 1	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 1/2	76-80	..	6 12 0	
Do. 4 1/2 % Deb. Stock	Stock	4 1/2	96-98	..	4 11 10	London Electric, Ord.	8	2 1/2	14-2	..	8 15 0	
Brompton & Kensington, Ord.	10	10	84-94	..	6 6 8	Do. 8 % Pref.	5	5 5	44-64	..	6 14 8	
Do. 7 % Cum. Pref.	5	7	84-9	..	8 17 9	Do. 4 % First Mort. Deb.	Stock	4	90-93	..	4 6 0	
Central Electric Supply, 4 % Guar. Deb.	100	4	95-98	..	4 1 8	Metropolitan	5	4 4 1	84-4	..	6 0 0	
Charing Cross, West End & City	5	5 1/2	44-5	..	5 0 0	Do. 4 1/2 % Cum. Pref.	5	4 1/2	42-44	..	4 17 4	
Do. 4 1/2 % Cum. Pref.	5	4 1/2	44-44	..	4 14 9	Do. 4 1/2 % First Mort. Deb.	Stock	4 1/2	97-100	..	4 10 0	
Do. "City" Undertaking	5	4 1/2	82-43	..	6 2 10	Do. 8 1/2 % Mort. Deb.	Stock	8 1/2	84-86	..	4 1 5	
Do. 4 1/2 % Cum. Pref.	5	4 1/2	82-43	..	4 5 7	Midland Electric Corporation	100	4 1/2	98-101	..	4 9 1	
Do. 4 % Deb.	100	4	91 1/2-93 1/2	..	4 17 6	Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	44-44	..	5 2 7	
Cheless, Ord.	5	5 1/2	42-56	..	4 10 11	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	5	99 1/2-102 1/2	..	4 17 7	
Do. 4 1/2 % Deb.	Stock	4 1/2	96-99	..	4 10 7	Notting Hill, 5 % Non-Cum. Pref.	10	6	92-102	..	6 11 7	
City of London, Ord.	10	8	104-18	..	5 0 0	Oxford	5	7 1/2	64-68	..	6 9 6	
Do. 8 % Cum. Pref.	10	8	124-132	..	4 10 7	St. James' and Pall Mall, Ord.	5	10	10	84-9	..	5 11 1
Do. 6 % Deb.	Stock	6	116-120	..	4 8 4	Do. 7 % Pref.	5	7	7	62-7 1/2 xd	..	4 16 7
Do. 4 1/2 % Second Deb.	100	4 1/2	100-102	..	4 8 8	Do. 8 1/2 % Deb.	100	8 1/2	84-87	..	4 0 6	
County of London, Ord.	10	6	112-114	..	6 1 1	Smithfield Markets, Ord.	5	2	2-84	..	6 8 1	
Do. 8 % Pref.	10	8	112-122	..	4 18 0	South London, Ord.	4	5	Nil	..	5 0 0	
Do. 4 1/2 % Deb.	Stock	4 1/2	104-106	..	4 4 11	Do. 5 % First Mort. Deb.	100	5	97-100	..	5 14 10	
Do. 4 1/2 % Second Deb.	Stock	4 1/2	99-102	..	4 6 8	South Metropolitan, 7 % Pref.	1	7	1 1/2-1 1/2 xd	..	4 11 3	
Edmundson's, Ord.	23	Nil	44-44	..	5 7 2	Do. 4 1/2 % First Deb. Stock	100	4 1/2	96-99	..	4 11 3	
Do. 8 % Cum. Pref.	5	Nil	44-44	..	5 1 1	Urban, Ord.	23	Nil	2-2	..	5 2 1	
Do. 6 % Non-Cum. Pref.	5	Nil	18-12	..	4 17 7	Do. 5 % Cum. Pref.	5	2	2-84	..	5 2 1	
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	81-84	..	4 17 10	Do. 4 1/2 % First Mort. Deb.	100	4 1/2	84-87 1/2	..	5 11 1	
Falkstone	5	5	42-54	..	5 12 6	Westminster, Ord.	5	10	10	84-8 1/2 xd	..	4 5 9
Do. 5 % Cum. Pref.	5	5	42-54	..	5 12 6	Do. 4 1/2 % Cum. Pref.	5	4 1/2	44-44	..	4 5 9	
Do. 4 1/2 % First Deb.	100	4 1/2	90-92	..	5 12 6							
Hove	5	8	74-8	..	5 12 6							

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 5 % Pref.	5	8	5-5 1/2 xd	..	6 14 8	Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	6	82-85	..	5 17 8
Calcutta, Ord.	5	5 1/2	54-7 1/2	..	6 1 5	Montreal, Lth. H. and Power	\$100	8	9	218-233	-2	8 17 3
Do. 5 % Pref.	5	5 1/2	42-4 1/2 xd	..	4 17 7	Northern, Lth. Power and Coal, 6 % 1st Mort. Bonds	\$500	5	5a	10-17	..	..
Calgary Power, 1st Mort. Bds.	100	5	92-94	..	5 6 5	River Plate, Ord.	Stock	10	10	217-227	..	4 8 0
Canadian Gen. El. Com.	\$100	7	115-119	..	5 17 8	Do. 6 % Non-Cum. Pref.	5	6	105-110	+1	5 9 1	
Do. 7 % Pref.	\$100	7	120-124	..	5 13 0	Do. 5 % Deb. Stock	Do.	5	5	100-102	..	4 18 0
Cordoba Lth. Power and T., Ord.	1	8	5	..	5 14 9	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	4 1/2	100-102	..	4 8 9	
Do. 5 % Deb.	100	5	96-99	..	5 1 0	Shawinigan Water, Capital	\$100	5	5	139-143	-2	3 10 0
Elec. Lth. and P. of Cechabamba, 1 % Bonds	100	6	8	..	6 6 4	Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	107-109	+ 3	4 11 9
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	5	90-93	..	5 7 6	Do. 4 1/2 % Per. Deb.	Stock	4 1/2	4 1/2	101-103	..	4 7 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5	93-95 xd	..	5 5 3	Toronto Power, 4 1/2 % Deb.	Do.	4 1/2	4 1/2	98 1/2-100 1/2	..	4 9 7
Georgetown, P. and L., Ord.	10	Nil	..	..	Nil	Vera Cruz Lth., T. & E., 5 % 1st Mort. Deb.	100	5	5	91-94	..	5 6 6
Do. 6 % Pref.	1	6	6	..	9 15 2	Victoria Falls Power, 1st Mort. 6 % Gold	100	6	8	105-107 xd	..	5 12 2
Kaminitiquis Power, 5 % G. B. Madras, Ord.	5	Nil	12 1/2-1 1/2	..	4 16 7							
Melbourne, 5 % 1st Mort. Deb.	100	5	101-104	..	4 16 2							
Mexican El. Lth., 5 % 1st M. Deb.	5	5	81-84	..	5 19 0							
Mexican Lth. & Power, Common	\$100	4	77-80	-2	6 14 7							
Do. 7 % Cum. Pref.	\$100	4	100-104	-1	6 14 7							
Do. 5 % 1st Mort. Gold Bds.	..	5	93-96	-1 1/2	6 5 8							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4 1/2	7-7 1/2	..	6 0 0	Monte Video Telephone, Ord.	1	8	6 1/2	4 1/2-1 1/2	..	5 19 0
Do. 5 % Deb. Red.	Stock	5	6	97-99	..	5 1 0	Do. 5 % Pref.	1	5	5	..	..	5 14 3
American Telep. & Teleg., Cap.	\$100	8	8 1/2	184-186	-1 1/2	5 17 8	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	98-99	..	4 10 11
Do. Collat. Trust	\$1000	4	4	90-92	+1	4 7 0	Oriental Telep. and Elec.	1	8	6 1/2	1 1/2-1 1/2	+ 3	4 8 3
Anglo-American Telegraph	Stock	8	8	554-67 1/2	..	4 9 0	Do. 6 % Cum. Pref.	1	6	6	1 1/2-1 1/2	..	4 18 6
Do. 6 % Pref.	Do.	6	6	111-112	..	6 7 2	Do. 4 % Red. Deb.	Stock	4	4	88-90	..	4 8 11
Do. Def.	Do.	80	..	24 1/2-24 1/2	..	6 1 7	Pacific and European Tel., 4 % Guar. Deb.	Do.	4	4	97 1/2-99 1/2	..	4 0 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	99 1/2-101 1/2 xd	..	4 18 6	Reuter's	10	10	10 1/2	11 1/2-11 1/2	..	8 10 2
Chili Telephone	5	7	8	7 1/2-7 1/2	..	5 1 7	Do. New Shares	..	10	..	10 1/2-11 1/2	..	..
Commercial Cable, Sulg., 4 % Deb.	Stock	4	4	79 1/2-81 1/2	- 1/2	4 18 9	Submarine Cables Trust	Cert.	6	6	127-180	..	4 12 4
Cuba Telegraph	10	6	6 1/2	84-92	..	6 9 9	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	Stock	4 1/2	4 1/2	95-97	..	4 12 9
Do. 10 % Pref.	10	10	10	18-17	..	5 17 8	United River Plate Telephone	5	8	..	7 1/2-7 1/2	..	5 4 11
Direct Spanish Telegraph, Ord.	5	4	4 1/2	81-92	..	5 6 8	Do. 5 % Cum. Pref.	5	5	5	5-5 1/2	- 1/2	4 10 11
Do. 10 % Cum. Pref.	5	10	10	6 1/2-6 1/2	..	7 8 2	West Coast of America	2 1/2	2 1/2	..	1 1/2-1 1/2	..	4 9 4
Direct United States Cable	10	6	4	6 1/2-7 1/2	..	6 15 7	Do. 4 % Deb., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	85-88	..	4 1 8
Direct W. India Cable, 4 1/2 % Reg. Deb.	100	4 1/2	4 1/2	99-101	..	4 9 0	West India and Panama Teleg.	10	2 1/2	1 1/2	8-8 1/2	- 1/2	5 14 3
Eastern Telegraph, Ord. Stock	Stock	7	7 1/2	134-137	..	5 2 2	Do. 6 % Cum. 1st Pref.	10	8	8	10-10 1/2	..	6 0 0
Do. 8 1/2 % Pref. Stock	Do.	8 1/2	8 1/2	134-80 1/2	..	4 6 11	Do. 5 % Cum. 2nd Pref.	10	6	6	94-10	..	4 17 1
Do. 4 % Mort. Deb.	Do.	4	4	96-98	..	4 1 8	Do. 5 % Deb., 1 to 1,500 guar. by Braz. Sub. Tel.	100	5	5	101-103	..	4 17 1
Eastern Extension	10	7	7 1/2	122-132	- 1/2	5 4 8	Western Telegraph, Ltd.	10	7	7 1/2	134-134	..	5 2 9
Do. 4 % Deb.	Stock	4	4	96-97	..	4 2 6	Do. 4 % Deb.	Stock	4	4	96-97	..	4 2 6
East and S. Africa Tel., 4 % (Mt. D. Mauritius Sub.)	25	4	4	98-101	..	8 19 8	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	4 1/2	97 1/2-100 1/2	..	4 10 0
Globe Telegraph and Trust	10	6	6 1/2	104-11 1/2	+ 1/2	5 6 8							
Do. 6 % Pref.	10	6	6	124-13	..	4 12 4							
Great Northern Telegraph	10	18	18	29-31	..	6 14 3							
Indo-European Telegraph	26	13	13	53-80	+ 1/2	5 8 4							
Mackay Companies Common	100	5	5	84-84	-1 1/2	5 19 1							
Do. 4 % Cum. Pref.	\$100	4	4	80-71	+ 1/2	13 6							
Marconi's Wireless Telegraph	1	20	..	44-4 1/2	- 1/2	4 14 1							
Do. 7 % Cum. Partic. Pref.	1	17	..	82-82	- 1/2	4 13 10							

\* Unless otherwise stated, all shares are fully paid.

a Paid in deferred interest warrants.

† Interim Dividend.

‡ 8s. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railways and tramways in the home market. Columns include Name, Stock or Share, Dividends for, Closing Quotations Mar. 11th., Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations Mar. 11th., Rise + or Fall, Present Yield p.c.

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railways and tramways in colonial and foreign markets. Columns include Name, Stock or Share, Dividends for, Closing Quotations Mar. 11th., Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations Mar. 11th., Rise + or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations Mar. 11th., Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations Mar. 11th., Rise + or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

## TRADE STATISTICS OF SPAIN.

The figures given below show the imports of electrical and similar goods into Spain during the year 1911, according to the official statistics recently issued. It will be observed that there is a predominance of German trade in practically every branch. The figures for 1910 are given for purposes of comparison, and notes of increases and decreases have been added:—

	1910.	1911.	Inc. or dec.
	Pesetas.	Pesetas.	Pesetas.
<i>Dynamos, electric motors, induction coils, resistances, transformers, &amp;c., up to 400 kg. weight.—</i>			
From Germany ...	2,857,000	3,173,000	+ 316,000
" France ...	410,000	453,000	+ 43,000
" Great Britain ...	320,000	324,000	+ 4,000
" Switzerland ...	6,000	177,000	+ 171,000
" Other countries ...	272,000*	174,000	— 98,000
Total ...	3,865,000	4,301,000	+ 436,000
* Sweden, 141,000.			
<i>Ditto, weighing from 401 to 2,500 kg.—</i>			
From Germany ...	2,092,000	2,278,000	+ 176,000
" France ...	342,000	240,000	— 102,000
" Great Britain ...	226,000	333,000	+ 107,000
" Switzerland ...	130,000	187,000	+ 57,000
" Other countries ...	146,000	145,000	— 1,000
Total ...	2,936,000	3,183,000	+ 247,000
<i>Ditto, weighing from 2,501 to 5,000 kg.—</i>			
From Germany ...	527,000	545,000	+ 18,000
" Switzerland ...	82,000	231,000	+ 149,000
" Other countries ...	170,000	62,000	— 108,000
Total ...	779,000	838,000	+ 59,000
<i>Ditto, weighing more than 5,000 kg.—</i>			
From Germany ...	1,714,000	3,065,000	+ 1,351,000
" France ...	91,000	142,000	+ 51,000
" Great Britain ...	207,000	194,000	— 13,000
" Switzerland ...	575,000	542,000	— 33,000
" Other countries ...	44,000	17,000	— 27,000
Total ...	2,631,000	3,960,000	+ 1,329,000
<i>Accumulators and electric batteries.—</i>			
From Germany ...	101,000	113,000	+ 12,000
" France ...	56,000	46,000	— 10,000
" Great Britain ...	10,000	8,000	— 2,000
" Other countries ...	11,000	20,000	+ 9,000
Total ...	178,000	187,000	+ 9,000
<i>Cables and wires for electricity, with or without insulating material, of 1 cm. dia. or more.—</i>			
From Germany ...	751,000	1,381,000	+ 630,000
" Great Britain ...	37,000	18,000	— 19,000
" Other countries ...	232,000	74,000	— 158,000
Total ...	1,020,000	1,473,000	+ 453,000
<i>Ditto, less than 1 cm. in dia.—</i>			
From Germany ...	173,000	135,000	— 38,000
" France ...	98,000	78,000	— 20,000
" Great Britain ...	22,000	20,000	— 2,000
" Other countries ...	73,000	16,000	— 57,000
Total ...	366,000	249,000	— 117,000
<i>Telegraph and telephone apparatus, electric meters and parts.—</i>			
From Germany ...	913,000	1,106,000	+ 193,000
" Belgium ...	38,000	123,000	+ 85,000
" France ...	238,000	259,000	+ 21,000
" Great Britain ...	168,000	166,000	— 2,000
" Sweden ...	181,000	97,000	— 84,000
" Other countries ...	53,000	37,000	— 16,000
Total ...	1,591,000	1,788,000	+ 197,000
<i>Arc lamps.—</i>			
From Germany ...	252,000	150,000	— 102,000
" France ...	74,000	30,000	— 44,000
" Great Britain ...	23,000	18,000	— 5,000
" Other countries ...	14,000	11,000	— 3,000
Total ...	363,000	209,000	— 154,000
<i>Carbons for arc lamps.—</i>			
From Germany ...	104,000	103,000	— 1,000
" France ...	17,000	22,000	+ 5,000
" Great Britain ...	6,000	5,000	— 1,000
" Other countries ...	7,000	3,000	— 4,000
Total ...	134,000	133,000	— 1,000

	1910.	1911.	Inc. or dec.
	Pesetas.	Pesetas.	Pesetas.
<i>Electrodes.—</i>			
From Germany ...	74,000	35,000	— 39,000
" Italy ...	19,000	34,000	+ 15,000
" Other countries ...	73,000*	11,000	— 62,000
Total ...	166,000	80,000	— 86,000
* France, 65,000			
<i>Incandescent electric lamps mounted.—</i>			
From Germany ...	2,208,000	3,348,000	+ 1,140,000
" France ...	130,000	152,000	+ 22,000
" Great Britain ...	87,000	50,000	— 37,000
" Other countries ...	226,000*	173,000	— 53,000
Total ...	2,651,000	3,733,000	+ 1,082,000
* Austria, 125,000.			
<i>Ditto, unmounted.—</i>			
From Germany ...	18,000	8,000	— 10,000
" France ...	—	1,000	+ 1,000
" Other countries ...	4,000	1,000	— 3,000
Total ...	22,000	10,000	— 12,000
<i>Hydraulic motors.—</i>			
From Germany ...	640,000	1,192,000	+ 552,000
" France ...	92,000	131,000	+ 39,000
" Great Britain ...	47,000	92,000	+ 45,000
" Switzerland ...	120,000	110,000	— 10,000
" Other countries ...	86,000	13,000	— 73,000
Total ...	985,000	1,541,000	+ 556,000
<i>Steam and gas engines, fixed.—</i>			
From Germany ...	936,000	1,018,000	+ 82,000
" Great Britain ...	1,474,000	857,000	— 617,000
" France ...	323,000	184,000	— 139,000
" Belgium ...	222,000	175,000	— 47,000
" Other countries ...	54,000	105,000	+ 51,000
Total ...	3,009,000	2,339,000	— 670,000
<i>Cylindrical steam boilers.—</i>			
From Germany ...	361,000	483,000	+ 122,000
" Great Britain ...	620,000	696,000	+ 76,000
" France ...	107,000	189,000	+ 82,000
" Belgium ...	226,000	122,000	— 104,000
" Other countries ...	32,000	14,000	— 18,000
Total ...	1,346,000	1,504,000	+ 158,000
<i>Multi-tubular boilers.—</i>			
From Great Britain ...	1,779,000	2,062,000	+ 283,000
" Germany ...	503,000	629,000	+ 126,000
" Belgium ...	189,000	181,000	— 8,000
" France ...	298,000	285,000	— 13,000
" Other countries ...	71,000	26,000	— 45,000
Total ...	2,840,000	3,183,000	+ 343,000

NOTE.—25 pesetas = £1.

## THE PROPOSED TROLLHATTAN-COPENHAGEN TRANSMISSION.

In connection with the above proposal, to which reference was made in our issue of December 20th last, some interesting data arising from the investigations carried out by Swedish Government experts were recently published in the *Electrical World*.

The city and suburbs of Copenhagen have a population of 581,000 and are at present served by three central steam stations, and a number of isolated plants. Extensions or improvements of these stations were not considered for the purpose of furnishing the whole supply, but in case energy should be purchased from Trollhättan, it is proposed to retain these stations with their storage-battery equipments in case of interruptions on the high-voltage system, and also for carrying the peak load. The Trollhättan plant is designed for 100,000 H.P., generated by ten 10,000-H.P. turbo-generators, of which eight are now installed. The remaining two units could be used for the generation of energy for sale to Copenhagen. During 1911, when the investigation was made, the demand in Copenhagen was about 24,000 kw., and the yearly energy consumption 65,000,000 kw.-hours. The load factor was about 31 per cent. The demand for 1913 is estimated to be about 35,000 kw., and the yearly energy consumption about 95,000,000 kw.-hours.

In planning a transmission system from Trollhättan to Copenhagen, a distance of 204 miles, a matter of primary importance was the amount of energy which could be transmitted with greatest advantage. On account of the length of the transmission line, and

the consequent large expenditure involved, a comparatively large load factor would be essential in order to make the project commercially successful. To supply the whole demand at a load-factor of, say, 30 per cent. would not be feasible, as the price in that case would be considerably higher than that of energy generated by a steam plant in Copenhagen. Further investigations proved that one-third of the maximum demand, or about 11,600 kw., would be required during 5,200 hours. As this corresponds to 20,000 h.p. at Trollhättan, which is equal to the output of the two available generating units, the calculations were made on that basis.

The route of the proposed transmission line is along the west coast of Sweden from Gothenburg to Helsingborg, where it crosses the Strait of Oresund to Helsingör, and thence along the coast of Denmark to Copenhagen. Both alternating-current and direct-current systems were considered for generation and transmission. At present 25-cycle alternating current is generated at Trollhättan and 50-cycle alternating current at Copenhagen.

Three-phase generating equipment and transmission lines involve the installation of turbines, three-phase generators, transformers, transmission line, submarine cables, and transformer stations in Helsingborg, Helsingör and Copenhagen, and frequency changers in Copenhagen. At Helsingborg it is proposed to step down the pressure to 20,000 volts, and to carry the energy by four three-phase submarine cables across the Strait of Oresund to Helsingör, a distance of 34 miles. From Helsingör to Copenhagen either 20,000 volts or 100,000 volts can be used, the latter being the more economical.

If the generators have an efficiency of 96 per cent., all the transformers 98.5 per cent. and the frequency changers at Copenhagen 90 per cent., there would be available for distribution at 10,000 volts 11,600 kw. at 25 cycles, or 10,440 kw. at a frequency of 50 cycles.

A plan for the generation of 25-cycle alternating current at Trollhättan and its conversion to direct current for transmission was studied. Either impregnated wooden poles or iron poles might be employed and an earth return. Estimates were made for this as well as for ordinary metallic-return systems. For the direct-current generators and motors a constant current of 150 amperes was proposed, which, with a total of 14,720 kw. at the turbines and a maximum E.M.F. of 91,250 volts, could be obtained with 20 4,560-volt generators. The generators would be arranged in four groups, each having five generators in series, and each group would be connected to a 5,000-h.p. turbine.

The efficiency of the direct-current generators and motors was assumed to be 93 per cent., that of alternating-current generators 96 per cent. and that of alternating-current motors 94 per cent. The advantages claimed for the direct-current system are:—Simplicity in operation of generating equipment and building of transmission lines, the pressure on the latter corresponding to only 64,000 volts alternating; elimination of trouble from voltage variations due to varying load (the current is automatically kept constant at the power stations); high-pressure underground and submarine cables can be used wherever necessary; simple protection against lightning and other disturbances; a certain amount of reserve in the earth-return system by using two wires, of which one will be able to carry the load temporarily in case of emergency. The only apparent disadvantage of the direct-current system, it was pointed out, is that relatively little is known about the operation of the system.

and more expensive sets with the direct-current scheme. Two three-phase sets were sufficient for the alternating-current plan, while the Thury system required 20 generators in four groups, each coupled to a 5,000-h.p. turbine. In the line structure the cables were completely turned, the cost of the direct-current line being only about half that of the alternating-current line, not even taking into account the difference in the cost of the cables and the presence of at least one extra transformer station in the alternating-current project. The cables for the three-phase transmission cost  $2\frac{1}{2}$  times as much as did the direct-current cables. The grand total for the alternating-current project reached \$1,593,000, as against \$1,202,000 for the direct-current project advised. When everything was footed up for the rival projects the estimated annual expense for the direct-current transmission was \$6.75 per kw., as against \$12.43 per kw. for the three-phase project, to say nothing of the fact that the multiple transformations necessary with the latter would cause it to operate at a lower efficiency, thus yielding a materially smaller amount of power for the final distribution. All this is striking evidence of the great usefulness of direct-current transmission under conditions which are favourable to its economical use.

## NEW WIRELESS DETECTORS.

The application of the Fleming valve as a wireless detector is well known; electrons are readily emitted from the cathode, and convey the negative charge thence through the vacuum, but the high-frequency current in the detector circuit cannot flow appreciably in the opposite direction. In other words, the "valve" has unilateral conductivity, whence its name. Such detectors are very sensitive, but the vacuum limits the durability of the apparatus, and with a view to overcoming this objection, Leithäuser\* has recently applied the unilateral conductivity of flames to the design of a sensitive detector.

The experimental apparatus employed comprised a small induction coil connected to a 5-mm. gap between two 1.5-m. wires with end capacity-plates. At a distance of from 33 to 65 ft. a similar receiving circuit was connected to the electrodes of a flame detector. A Bec-Meker burner was used to provide a steady flame of great intensity, with a small bright blue inner cone. The electrodes used were a 1-mm. copper wire and a ring of sheet platinum covered with a potassium salt (the object of which was simply to increase the conductivity of the flame). These electrodes were connected through a high-resistance telephone to the terminals of a resistance of some few ohms, across which a suitable p.d. could be maintained and varied by a local battery in series with an adjustable resistance. Later, a high-sensitivity moving coil galvanometer was also connected in the detector circuit and, at times, the telephone was replaced by an Edelmann vibration galvanometer. Experiments showed that the efficacy of the detector depended largely on the dimensions and relative positions of the electrodes, and on the size of the flame and its temperature round

SUMMARY OF COST ESTIMATES FOR VARIOUS SYSTEMS OF TRANSMISSION FROM TROLLHATTAN TO COPENHAGEN.

System of generation and transmission.	Without frequency-converter station at Copenhagen.				With converter station at Copenhagen for changing to 50 cycles.			
	kw. available at Copenhagen.	Total cost of installation.	Annual expenses.		kw. available at Copenhagen.	Total cost of installation.	Annual expenses.	
			Total.	Per kw.			Total.	Per kw.
Generating and transmitting A.C. ... ..	11,600	\$1,431,500	\$144,300	\$12.43	10,440	\$1,593,000	\$163,300	\$15.66
Generating and transmitting D.C. :—								
Wooden-pole transmission line: earth return	12,615	864,700	87,800	6.95	11,225	1,202,000	125,400	11.16
Metallic return ... ..	12,170	1,320,900	121,500	10.00	10,830	1,643,700	157,300	14.52
Iron-pole transmission line: earth return ...	12,615	931,400	93,200	7.38	11,225	1,269,200	130,500	11.61
Metallic return ... ..	12,170	1,390,900	127,400	10.48	10,830	1,715,300	163,300	15.09
Generating A.C. and transmitting D.C. :—								
Wooden-pole transmission line: earth return	11,280	1,039,600	108,100	9.61	10,040	1,350,600	141,800	14.12
Metallic return ... ..	10,830	1,485,300	141,800	13.07	9,640	1,782,700	174,500	18.10
Iron-pole transmission line: earth return ...	11,280	1,107,600	113,500	10.09	10,040	1,418,600	147,200	14.68
Metallic return ... ..	10,830	1,564,600	148,100	13.68	9,640	1,862,000	180,800	18.75

In its comments on the project, our contemporary points out that to cross the Strait, 34 miles wide, with cables carrying alternating current at 100,000 volts, was adjudged an utterly impracticable proposition. It therefore became necessary to plan for a reducing station at Helsingborg, bringing the pressure down to 20,000 volts for transmission under the strait, beyond which it could either continue the relatively short distance to Copenhagen at 20,000 volts, or the electromotive force could be stepped up again if desirable. On the other hand, submarine cable can actually be obtained for 90,000 volts direct current, according to the report of the Swedish engineers, and consequently the energy could be carried through to Copenhagen without any reduction in voltage on account of the submarine work. This matter alone put the alternating-current project at a serious disadvantage, rendered even more formidable by the facility with which an earthed line can be used in operating at constant current.

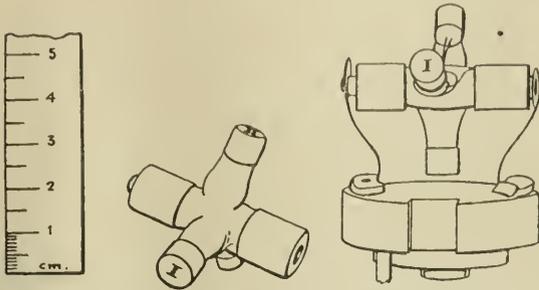
In the generating station the three-phase equipment had the advantage in first cost, as might have been expected, to the extent of nearly 30 per cent., owing to the necessity of using more units

about the electrodes. A current-voltage curve was prepared when working under the most favourable adjustments, and the steep rise and sharp change of this current proved the rectifying action of the detector to be very pronounced. That phase, corresponding to which the platinum electrode was positive, was almost entirely suppressed, but the other phase was carried with high conductivity. The delicacy of the detector was at least equal to that of a sensitive electrolytic valve, and was usually greater.

The Telefunken Gesell. für Drahtlose Telegraphie now employs Schlämilch electrolytic detectors in a form which overcomes the chief objections hitherto urged against this type, viz. :—(1) The deterioration of the platinum electrodes after considerable use, which deterioration necessitates the replacement of the detector as a whole, and, generally, the return of the defective apparatus to the makers for repair; (2) leakage of acid through crevices when the detector is inverted, as often occurs in transit.

\* See also "Phys. Zeitschr.," No. 18, 1912, and "Zeitschr. für Schwachstromtechnik," No. 2, 1913.

The new detector illustrated in the accompanying sketches comprises three Schlömilch cells radiating from the cross tube, as shown. The whole glass system is hermetically sealed, and connections are made to the terminal end caps by fused-in platinum wires; sufficient acid is contained to fill one, and one only, of the cells. The latter are inclined at 120° to each other, so that when one is vertical (as in use), the other two are completely drained of



NEW SCHLÖMILCH ELECTROLYTIC DETECTOR.

acid. If one cell fails or becomes insensitive, it is only necessary to rotate the system through 120°, to substitute another cell in circuit without appreciable interruption of working. In order that the cells may be distinguished (for experimental and maintenance record purposes) Roman numerals I, II and III are marked on the end caps.

Two springy strips carry current to the end caps on the cross tube and also act as pedestals to the latter, the end caps being provided with suitable bearing bosses. The whole is mounted on a vulcanite block, which has the same shape and dimensions as the old type of Schlömilch detector, and which can therefore be fitted at once to receiving sets designed for the latter.

In no respect is the manipulation of the new detector more complicated than that of the earlier type. In both cases, it is, of course, imperative that the polarity of the connections be correct. The electrode fused in the glass must be connected to the positive and the free electrode to the negative terminal of the local battery. So far as the detector itself is concerned, correct connection is ensured by a different formation of the cap bosses, so that the tube cannot accidentally be mounted incorrectly in the pedestal prongs.

The battery circuit connections, the P.D. required by the cell, and the electrical characteristics of the latter, are identical with the attributes and conditions of use of the earlier type.

## PAYMENT FOR CONTRACT WORK.

[BY OUR LEGAL CONTRIBUTOR.]

THE question sometimes arises in relation to works—when is payment due? If there is nothing amounting to a contract to complete the works before remuneration shall be due—as in the case of a shipwright undertaking, in the way that shipwrights ordinarily do, to put a vessel in repair—the contractor may, after he has proceeded with a portion of the work, refuse to continue it, unless he is paid for the work he has performed; and may recover to that extent (*Roberts v. Havelock*, 1832 3 B and Ald. 404). In general, if the contract is not entire (*i.e.*, to do the whole work for a lump sum), and can be divided, the Court will give relief to the contractor who has done part of the works. In contracts for large works it would be difficult, if not impossible, for the contractor to carry through the work unaided from the start. Provision is, therefore, made for payment by instalments, either (i) at certain stages of the work; (ii) by payments of certain fixed sums as they become due; or (iii) by payment of a percentage at certain periods. Thus, to illustrate the latter case, it might be arranged that at the end of the first three months the contractor should be entitled to 75 per cent. of the value of work actually done.

While a contractor is bound to conform to the specification, he cannot rely on that document in order to excuse himself from doing something which is essential to the completed work. For instance, in *Williams v. Fitzmaurice*, 1858, 3 H. & N. 844, the plaintiff agreed to build a house for the defendant, who prepared a specification which contained

particulars of the different portions of the work. Under the head "Carpenter and Joiner," there was specified the scantling of the joists of the different floors, the rafters, ridge, and wall pieces, but no mention was made of the flooring. The specification stated that "the whole of the materials mentioned or otherwise in the foregoing particulars, necessary for the completion of the work, must be provided by the contractor. The specification also contained a memorandum to the effect that "The house is to be completed and fit for the defendant's occupation by the 1st August, 1858." It was held that the plaintiff was liable to put in the flooring.

A contract for works may consist of an entire job for which the contractor is to be paid a lump sum. In that case he cannot sue or recover the lump sum until the work is completed. Where, however, the work is severable into parts which are to be paid for separately, completion of one part may enable the contractor to sue for the amount then due. Another form of contract provides for the execution of a piece of work, no mention of a price being made. It will be convenient to deal with and illustrate these three forms of contract separately.

Where a contract to build for a lump sum is abandoned after part execution, the builder cannot recover as upon a *quantum meruit* in respect of the part executed, as was held in a case where the employer himself completed the building (*Sumpter v. Hedges*, 1898, 1 Q.B. 673). So in the case of a contract to carry out an engineering work for a lump sum it would be no answer for the contractor, who has not completed, to allege that the work as done will be worth so much to the employer. He must carry out this contract to the letter. If he does not do so he stands to lose, not only the contract price, but the entire value of the materials used and the cost of work and labour expended.

A lump sum contract cannot be said to be completed when that which is really done is done in pursuance of a fresh contract. In *Humphreys v. Jones and Pickering* (1850, 5 Ex. 952), two persons entered into a joint agreement with a railway company to execute a contract called the Morley Contract, for the construction of a tunnel. After this agreement one of the parties (A) assigned all his right and interest to the other (B), and the latter agreed to pay A a given sum "on completion of the said contract." After this agreement had been entered into between A and B it became necessary to alter the levels of the line, and B, by agreement with the company, abandoned the contract, and another was entered into between the company and other persons under which the tunnel at the altered level was completed. It was held that completion of the second contract did not involve completion of the first.

In *Forman & Co. v. Liddlesdale* (1900, A.C. 190), the plaintiffs contracted with the agent of an absent shipowner to effect certain specified repairs to a ship (all confined to damage by stranding), and instead of doing the work as stipulated, alleged that they had on the agent's authority, done the equivalent thereto or better, and in the same contract stipulated that they should be paid for repairs due to deterioration at scheduled prices stated by them. It was held that as it appeared that the agent's authority to their knowledge was limited to the specified repairs, they could not recover on the contract, which was an entire one, and in its entirety had never been performed. It was further held that the mere fact of the shipowners having taken the ship as repaired did not thereby ratify the contract. In that case the original contract price was £5,995 10s., which the plaintiffs sought to increase to £15,567 8s. 7d. by a claim for work not included in the contract and for other repairs.

In *Appleby v. Myers*, 1866, 2 C. and P. 651 the plaintiff contracted with the defendants to erect upon premises in his possession a steam engine and machinery, the works being by the contract divided into 10 different parts, and separate prices fixed upon each part, no time being fixed for payment. All the parts were far advanced towards completion, and some of them were so nearly finished that the defendant had used them for the purposes of his business, but no one of them was absolutely complete, though a considerable portion of the necessary materials for that purpose were in the building. At this time the whole premises, with the machinery and materials, were destroyed by an accidental fire. The plaintiffs sued to recover either the whole price

or the proper value of the work which had been done. It was held that, by reason of the fire, both parties were excused from the further performance of the contract, but that the plaintiffs were not entitled to sue in respect of those portions of the work which had been completed, whether the materials used had become the property of the defendant or not. Lord Blackburn said: "The plaintiffs having contracted to do an entire work for a specific sum, can recover nothing unless the work be done, or it can be shown that it was the defendants' fault that the work was incomplete, or that there is something to justify the conclusion that the parties have entered into a fresh contract."

As has already been indicated, if a contract is severable, the contractor may sue in respect of the amount of work which he has done. For instance, in *Newfoundland Government v. Newfoundland Railway Co.*, 1888, 13 A.C., 200, by a contract in 1881 embodied in a statute, the plaintiff company covenanted to complete a railway in five years, and thereafter to maintain and continually operate it. In consideration of this, the Government covenanted to pay the company upon the construction an annual subsidy. It appeared that the company completed a portion of the line, and received from the Government on the completion of each five-mile section the proportionate part of the subsidy which was deemed by the parties to attach thereto. Thereafter, the contract was broken by the company, and the Government refused further payments. It was held that on the true construction of the contract: (a) Each claim to a grant of land was complete from the time when the section which earned it was completed; (b) on the completion of each section a proportionate part of the subsidy became payable for the specified term, but subject to the condition of continuous efficient operation.

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### THE MEANS FOR SECURING RELIABILITY AND MAINTAINING THE CONTINUITY OF SUPPLY.

By R. D. SPURR.

AT last year's I.M.E.A. Convention a highly-interesting paper was read on this subject, which, with the discussion, only lightly touched the surface of this very important matter.

It is a subject worthy of far more consideration and deep thinking than has been applied hitherto, and a subject that is daily increasing in magnitude and importance.

The moral effect of a shut-down of the whole or part of a public electricity supply system has a far more serious result than the stoppage of a traction supply: the latter is forgotten in most cases in a day or two, but the former remains long in the memories of those consumers whose works are stopped or left in darkness, and brings grave doubts to the minds of possible consumers, inconvenience to the public, and worry to the engineer and his staff, who generally have to bear the blame whether deserving or not.

From a financial point of view the units lost during a shut-down are but a fraction of the total loss, which cannot be given a monetary value.

It is hardly possible to take a census of shut-downs that have occurred to public supply undertakings, but such a census with the cause of each mishap would no doubt form very interesting reading. The total number would probably be a very large figure; moreover, as supply engineers are naturally unwilling to make public the number and cause of such failures, very little ever appears in print upon the subject.

Some engineers look upon these failures as unavoidable, and treat them as part of the day's work; others, whilst admitting that they can be avoided, shirk taking the necessary steps to do so; others, again, are helpless, and cannot take precautions.

The primary cause of interruptions of the supply appears to have been forgotten. The reason is decidedly unpleasant to contemplate; it is, that in the effort to reduce the total cost per unit to a minimum figure, the continuity of the supply has been ruthlessly sacrificed, cheapness has been

the predominant factor, and has resulted in the acceptance of the lowest tender when installing plant, the purchase of dirty unsuitable coal, the use of hard muddy water and poor quality oils and grease, continuously overloading antiquated plant, neglected boiler cleaning, patching up in place of overhauling, continued use of prehistoric switchgear, underpaid, incompetent, short-handed staff, and not providing capital for the purchase of necessary tools, stores and spare parts.

The above points by no means exhaust the list, but are sufficient to show that a shut-down can be directly traced to one or more of them.

It is possible that there are undertakings where everything is as it should be, yet all, or nearly all, compete for the somewhat doubtful honour of showing the "lowest costs per unit" in the tables published from time to time in the technical press.

To attain these low figures it is common practice deliberately to work one boiler less than actually necessary, and to force the others over an unexpected peak, to load the generators to their utmost capacity, or overload them if possible, and in stations where supplies are given for traction, lighting and power, D.C. and three-phase A.C., it is the prevailing practice to link up all three systems by means of synchronous machines in such a manner that a heavy fault occurring on one system is likely to result in shutting down the whole works.

Undertakings giving these supplies, varying more or less in detail, are rapidly becoming numerous, and on the grounds of economy this linking-up is deemed necessary during periods of light or heavy load according to the capacity of the plant available.

It is this linking-up indiscriminately that is the source of danger when synchronous machines are used, as the D.C. side of these machines cannot at present be arranged to change instantaneously from motoring to generating, or *vice versa*, without going through several switching operations, and moving the brushes.

Relays could, of course, be fixed to operate in either direction and limit the reverse power to 5 per cent. of the capacity of the machine, or induction motor-generators could be used for supplying D.C. from A.C., but in any case complications will occur when an abnormal fault develops on either system. Induction motor-generators are, perhaps, the nearest approach to safety where the D.C. supply is partly steam driven, and partly supplied from the A.C. system.

A traction supply can be safely handled by an A.C. system, either alone or with the help of steam-driven D.C. generators, but very reliable switchgear must be installed to prevent undue disturbance of the A.C. system by traction faults, and if synchronous machines are used, the reverse current should be limited to the lowest possible figure.

One method of linking up which is not in general use, but appears to be free from the defects common to other systems, is to use a D.C. and an A.C. generator driven by the same engine or turbine; such a combination with suitably proportioned units could be loaded up economically on either or both systems.

Some American undertakings have installed very large batteries as a stand-by, but large batteries mean heavy capital expenditure and maintenance charges; also such batteries will introduce complications in working, and to prevent rapid deterioration of the cells, regular charging and discharging are necessary.

The abnormally heavy discharges from batteries when faults occur are apt to burn up the switchgear, ammeter shunts or boosters, unless these are constructed to carry ten or more times the current at the one-hour rate of discharge. Switchgear can, of course, be constructed to carry such currents, but boosters are practically impossible.

It would be interesting to know of a battery installation where the switchgear, cables, &c., were capable of carrying double the current at the one-hour rate for any length of time.

After linking-up troubles, the next cause of many failures of the supply is the total loss of power, light and exciting current throughout the generating station, and the importance of this point is often ignored—not willfully, perhaps—but such an event is looked upon as an impossibility until it actually occurs.

In A.C. stations each alternator usually has its own exciter,

lighting is taken from the main bus-bars, and auxiliary plant of importance is more often steam driven; some again have a two-wire direct-current supply for the works only, with steam-driven generating sets assisted by a battery and induction motor-generators for all power, lighting and excitation.

In D.C. and mixed supply stations, current for power, lighting and excitation is, as a general rule, taken from the D.C. bus-bars, and as the number of such stations is increasing, the number of failures will increase unless special precautions are taken to keep the works supply entirely free from the effects of outside interruptions. Where the auxiliary plant lighting, exciting and control circuits are of such magnitude that one or more steam-driven sets could be loaded up economically for 12 or more hours per day, six days a week, it would undoubtedly be a sound proposition to put down such sets, if none were available, and run the works supply independently of the public supply, as is already the practice in some polyphase stations for railway work.

An entirely insulated works supply has many advantages that altogether outweigh objections on the score of the inefficiency of small units, high-pressure reciprocating sets, or turbines exhausting into the low-pressure stages of the main turbines or feed water heaters, or mixed-pressure turbines taking part of their steam from other reciprocating plant would meet the case in that respect; outside faults, earths, &c., would not then be able to operate remote control circuits at inopportune times, and the insulation generally of all the works plant would be subject to far less severe strain, and would naturally require less attention to keep in good order.

In three-wire D.C. stations the balancing of the two sides of the system is a weak point, especially where the balancer consists of two similar generators rigidly coupled together, either machine driving the other as may be required. Such combinations are in constant use in hundreds of stations, and few, if any, are automatic in regulation, although designed to be so. This type of machine is notoriously inefficient, and is generally far too small to deal with any abnormal out-of-balance; a heavy fault will trip one or both of the circuit breakers, and consumers are not pleased with the conditions that ensue until the balance is restored.

A three-wire balancer capable of generating 100 amperes on either side takes about 7 kW. to run light or 168 B. of T. units per day. At .5d. per unit this works out at £85 a year actual loss for which no return is given, the actual time employed in doing remunerative work being negligible.

The interest and depreciation on a 75-kw. steam-driven balancing set will be approximately £85, and running at 70 per cent. of its full load it would generate 1,260 remunerative B. of T. units per day; the voltage regulation would be considerably improved and the supply much more reliable.

Larger machines will, of course, prove even more economical, and those stations equipped with steam balancers (one engine driving two generators in tandem, each machine being connected between the middle wire and outer of the three-wire system) will be found to be practically free from balancing troubles.

Static balancing, by means of special connections on the main generators, does not seem to be altogether a success, due probably to the fact that, although the out-of-balance current can be handled quite easily, the voltage falls on the heavily loaded side, which is quite the reverse of what is wanted.

Earthing the middle wire of a three-wire system is more often a source of danger when earthed direct; in some cases a resistance is put in circuit when the leakage current exceeds a certain value, but a very heavy strain is put on the insulation of all apparatus when a fault occurs, until this resistance is in circuit, due to the heavy surges which take place.

It would be far safer to earth the middle wire through a large variable resistance, capable of safely carrying from one to three hundred amperes for a considerable length of time; such a resistance, constructed of substantial grids, could be safely worked when red hot, and faults could be regulated to a certain extent, and located more easily, or burned out when necessary.

In one station, the middle wire was earthed through a circuit breaker, set to open at 100 amperes and insert a resistance between the middle wire and earth; the negative side was accidentally earthed, with the result that, before

the circuit-breaker opened, several weak places on the positive side broke down, making a dead short across the outers.

In another case, where the middle wire was earthed through a resistance of 2.3 ohms capable of carrying 100 amperes continuously, a positive terminal in a street box came in contact with the iron and was welded on by the current passing; the fault was located and cleared without any further ill effects.

In the first case, every trifling earth would open the circuit-breaker, with a corresponding flicker of the lights, while in the second case, earthing one side through a 50-ampere fuse caused no inconvenience, nor could any flicker of the lights be observed.

The water supply is a very important factor, many stations being dependent on the continuity of the town supply for boiler feed, and, in a few cases, for condensing purposes.

The latter could possibly continue running several hours in case of a total failure of the water supply, but with the others, a total shut-down would be inevitable unless a very large reserve supply was available.

The few stations having their own wells or boreholes are fortunate, but there are a great many others so situated that a private supply would mean a considerable reduction in works costs for water charges, as the capital expenditure and running costs, even in the case of a very small supply, would not reach 6d. per 1,000 gallons, including chemical treatment where necessary, and very few, if any, water authorities will supply at that figure.

Water pipes, generally speaking, are very seldom protected against frost; even when under cover, in a draughty position, they are very liable to freeze when the flow of water is little or nothing between midnight and 7 a.m., when the temperature of the atmosphere is about the minimum point. Fortunately, severe frosts are not of very long duration in these islands, or more precautions would be taken to prevent a shut-down from that cause.

In conclusion, the human element must not be forgotten, as errors of judgment will take place at critical times. Only those who have actually been through it can understand the mental strain involved in running plant that is not exactly as it should be for the work it is called upon to do.

The slackers and don't-worry men are the immediate cause of many shut-downs; how they escape the consequences of their rank carelessness no one knows, but their elimination along with the moneyed men who work because it is considered the thing to do (fortunately, the automobile industry is attracting these gentlemen now) is only a matter of time.

## PROCEEDINGS OF INSTITUTIONS.

### Internal Combustion Engines.

By K. COX.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Sheffield, January 29th, 1913.)

AS regards the capital cost of either steam, gas or Diesel engine stations, when all the necessary auxiliaries, buildings and foundations are taken into consideration, there is not very much difference between them.

Taking a station of 650 kW., which would be a typical installation for supplying power to a moderately large works or factory, the comparative capital costs would be as follows:—

Turbo-Generating Plant...	... ..	£8,850
Gas-Engine Installation ...	... ..	£9,640
Diesel Engine Installation ...	... ..	£11,080

The running costs per kW.-hour would be as follows (it is assumed that the station is working ordinary factory hours, or a total of 3,000 hours per year):—

Turbo-Generating Plant ...	... ..	0.348d.
Gas-Engine Installation ...	... ..	0.292d.
Diesel Engine Installation ...	... ..	0.447d.

Owing to the low price of coal, the number of stations where Diesel engines show to the best advantage is not so great in this country as in many instances abroad.

Where gas exists as a by-product the gas engine has tremendous advantages; although in Great Britain there is an immense

quantity of blast-furnace and coke-oven gas available, and often going to waste, only a small percentage of it is economically used in internal-combustion engines. The old steam plant can only be gradually replaced by the more efficient internal-combustion engine. On the other hand, where new plant is being installed, the advantages of gas-driven electric plant are obvious, as the demand for power in the case of a modern colliery or coke-oven plant with by-product recovery plant is so great that the utilisation of gas engines to obtain the maximum output from the waste gas is almost a necessity, the reason being that a gas-fired boiler and steam plant will not in general give more than 35 per cent. of the power that can be obtained from a gas engine using the same volume of gas.

Except in the larger installations, there is much to be said in favour of smaller units. The following considerations are worthy of notice:—

(a) The thermal efficiency of a moderate-sized unit is not less than that of a large unit.

(b) The risk of failure of vital parts in large engines is certainly greater than in small ones.

(c) The capital cost and space occupied by a number of smaller units is very little more than that of a large unit.

(d) A number of units give a much more "elastic" station and a greater factor of reliability.

In a large double-acting gas engine one of the greatest difficulties is the cooling of the moving parts, which have to be water-cooled; and as it is customary to make the piston rod and exhaust valve stems of steel a considerable amount of pitting and wear takes place due to the condensation of the exhaust gases, which always have an acid tendency, on the cooled surfaces. One of the main disadvantages of large cylinders is the danger of cracking the cylinders and cylinder heads, due to the temperature variation. The design of the cylinder for these large-power horizontal engines must of necessity become very complicated, and the mechanism for operating the large valves is very involved, requiring the most careful adjustment and attention. The piston rods and glands also require most careful attention, as the action of the gas is extremely erosive in the case of a leaking gland, and if not immediately attended to it cuts a groove in the piston rod.

In order to get a fairly high-power engine, say up to 1,000 B.H.P., one has the alternative of having a small number of large diameter cylinders, or a large number of small diameter cylinders, and it is with a view of avoiding some of the above troubles, and, at the same time, obtaining a fairly high-power engine, that the multi-cylinder vertical engine has been developed. This type of engine has been developed on the lines of the modern high-speed steam engine, having forced lubrication to the bearings and an enclosed crank case. The stroke being fairly short, the number of revolutions is high, the whole engine being compact and taking up very little space. These engines operating on the Otto or four-cycle principle, each crank receives one impulse in two revolutions.

A still further advance on this type is the vertical tandem gas engine. This engine is of the vertical single-acting type, operating on the Otto cycle, and the cylinders are arranged two in tandem, so that the explosion stroke of one cylinder is the suction stroke of the other. By this arrangement a very even pressure is exerted on the crank pin, and an even turning moment equal to that of the highest class steam engine is produced. This type of engine, like the high-speed steam engine, is particularly adapted for electric driving, the cyclic irregularity being so small that no difficulty is experienced in paralleling alternators. In the case of engines having only one or two cylinders, it has been found necessary to drive the generator through a flexible coupling. Such couplings are frequently a source of trouble, and the elimination of such a feature is desirable. Again, with the higher speed of the vertical multi-cylinder engine, a smaller and cheaper dynamo may be used. Other advantages are that with this vertical machine the vibration is less, due to the inertia of the reciprocating parts being smaller. Consequently much lighter foundations may be used. Again, owing to the smaller volume of the cylinders the silencing of the exhaust is a much less difficult proposition. This is a most important point to be considered when installing an engine in a residential neighbourhood, as the noise of the exhaust from a large-cylindered engine can be heard for a considerable distance, even though large silencers are provided.

Turning now to the Diesel engine, one of the principal advantages of this type is the fact that the direct economical use of heavy crude or residual oils is made possible, and this form of fuel is extremely easy to handle and store, and occupies a minimum of space. It also possesses the advantage of quick and easy starting, with no stand-by losses, and the whole installation requires very little floor space.

Until recently, nearly all Diesel engines that have been constructed have been of the vertical, open type, the cylinder liners being let into A frames, and ring lubrication fitted to the main bearings. The later developments, however, have been in the enclosed type of engine with forced lubrication to the bearings. This form of engine is now built by several well-known firms, and lends itself much more readily to electric driving, as the speed is higher, and the engine, being of the multi-cylinder type, gives a more even turning moment.

The Diesel engine has also been developed on horizontal lines, several of the Continental manufacturers building this type. These engines are of necessity slow running, and consequently their great weight and large amount of floor space somewhat handicap them. In addition to this, the large size of dynamo required for the output at this low speed is a further disadvantage.

On the open-type Diesel engine, the cam-shaft operating the valves is carried on brackets at the top of the engine. This shaft is driven through skew or bevel gears from the crankshaft, a vertical shaft connecting the two. This arrangement is still

adhered to by some makers for the enclosed engine. The latest practice adopted, however, both in this country and on the Continent, is to enclose the cam-shaft in the crank-case and to operate the valves through rods. This renders the engine much more accessible, and enables the whole of the shaft, with its bearings, to be under forced lubrication.

The compressor for supplying the air for starting purposes, and also for injecting the oil into the cylinder, is now almost universally direct driven from the end of the crankshaft. This is either a two or, preferably, a three-stage machine, and must be capable of compressing up to 1,000 lb. per sq. in. It is provided with inter-coolers between the stages, and the air is stored in wrought-steel tanks. Air is taken from one of these tanks for starting purposes, one or more of the engine cylinders being, for the time, used as an air motor. The engine is thus very quickly started, no preliminary warming up being necessary. A Diesel engine can, as a rule, be started up cold and put on load in less than a minute.

The present high price of residual oil is due to lack of transport facilities. There are approximately 100 tank steamers under construction, 60 of these being built in this country. When these vessels are put into commission no doubt this fuel will fall to a reasonable cost again; but it is unfortunate that at the present time there is not the plant in this country to put on the market sufficient distillates from coal tar to supplement the residual oil and to keep fuel oil at a reasonable figure.

The modern gas or Diesel engine is as reliable a piece of apparatus as a good steam engine. The amount required for upkeep is little, if any, more than for a steam engine, provided that reasonable and intelligent care is given to the running.

#### DISCUSSION.

MR. RAVENSHAW remarked that he had two or three Diesel engines running at different places. At first they were started on Monday morning and shut down at Saturday dinner time without a stop, but now they shut down at the dinner hour for half an hour, and the bearings and cylinders wore better when they did so. He did not think that fuel oil was going to come down to what it was 18 months ago. That did not matter much, because all other fuels had gone up. While with turbines they could get 25 or 30 per cent. overload, with gas engines they could not do this. Above full load they could get a good deal more indicated horse-power, but they failed to get any more brake horse-power. He had found that both in Diesel or semi-Diesel engines, and in a large number of gas engines, the pressure of gas behind the piston rings forced them out against the cylinder, and they got extreme friction. At the moment of compression and explosion the last ring was pressing with a pressure of 100 lb. to the sq. in. against the cylinder wall, and that meant an enormous amount of friction.

MR. SMITH agreed that the cost of oil was not likely to come down to anything approaching what it was 12 months ago. As Mr. Cox said, the present price was about 80s. to 85s. a ton, and that put Diesel engines out of the running in such districts as Sheffield, where they had coal at 10s. a ton for boiler or gas producer use. He was inclined to favour the producer gas engine, particularly for districts like that. If the colliery owners in that district would look more to the question of utilising their bituminous coal where they had not waste gases, they might find it very economical for producer gas plants of the bituminous type. Up to the present time producers had not been constructed successfully as suction plants for the use of bituminous fuel. Mr. Dowson himself had admitted a few days ago that he did not now recommend bituminous suction plants. He had in mind the shipbuilding works on the Cheshire side of the Mersey, and the Cammell, Laird works, where they had a very large bituminous producer plant supplying gas engines. He believed they ran 24 hours a day and they produced current at considerably less than 4d. per unit. He knew of an instance where a similar plant was installed for more favourable conditions, running 24 hours a day, seven days a week, with a chemical process, where the working cost, apart from interest and depreciation, was 1 of a penny per unit. The station was operated chiefly by Westinghouse engines. One Westinghouse machine, of 1,000 H.P., had operated for the greater portion of six months continuously, without any shutting down worth mentioning. As regarded reliability, he knew of many instances in this country where gas engines only were installed and entire reliance was placed on them for the operation of the works which they were driving. These machines he had known to give absolute reliability for the past five years or more.

MR. WARDALE said that the firm he served his time with built both steam and gas engines, and in the latter they used piston rings of the ordinary Ramsbottom type, let in so that they distinctly filled the groove. The rings in the steam engine were let in so that they could push them round with their fingers, but the gas engine rings had to nip, and they had a special grinder made for the purpose. An engineer who had been concerned with small towns, places with not more than 10,000 inhabitants, with electric generators run by gas plants, told him that he had found it fearful work to get people to put their money into such places, principally because of the failure of gas engines, and also because of the awful mess which a certain firm had made of the supply business in small towns. He had put in an 80-kw. dynamo with a double cylinder 135-B H.P. National gas engine, and never had any trouble; his costs were a little bit high, but not seriously so. Personally, he had lately been trying to influence capital on behalf of small concerns, and these past mistakes certainly did tell heavily against them. He supposed that they could not use the Yorkshire fuel very successfully for the bituminous producer plant. It was too bituminous. As to the matter of attention, he thought that if

they paid a man about 35s. to look after steam plant, they wanted a man who was worth 40s. for gas plant, and 50s. for Diesel plant. Personally, he looked to the horizontal medium-speed engines for long life and economy and general freedom from worry if the engines were big enough for their work.

Mr. YENURY said it seemed to him that there was no reason why gas in bulk should not be at a very much lower price than it was, especially in view of the fact that there was no difficulty whatever in getting rid of their valuable by-products. The insurance companies did not think that gas engines were as free from breakdown as good steam engines. On inspecting large gas engines in Germany and Belgium a few years ago, he found quite a different class of men looking after the gas engines there—a higher type of men, and a larger number of men than one would require for a steam engine.

Mr. BOULDEN, referring to a remark which was made in the paper regarding vertical tandem engines, that an even turning moment equal to the highest class of steam engine was produced, said he, was inclined to question that statement with regard to the turning moment. He had seen an article in that morning's paper to the effect that the people engaged in the colliery world had been successful in producing an oil from the soft deposits of coal which in many cases were not even now being worked, and that a large syndicate had been formed. This oil, it was hoped, would render this country absolutely independent of the oil brought from foreign countries.

Mr. MYLAN said he had recently met a gentleman from Sweden, who mentioned that there they were prepared, in a particular installation that he was interested in, to supply at £2 per B.H.P. per annum, *i.e.* '075d. per unit. That, of course, was a particular installation of water-power, and the total capital cost—installation, buildings, power plant, transmission and everything—worked out at only £8 per kW., a figure that was certainly remarkable. It was certainly not a fact that the bituminous fuel in that district could not be used in producers. It was used in many producers in the Yorkshire district. The increase of oil fuel was not out of proportion to the corresponding increases that one had met with in coal.

Mr. COX, in reply, said a great deal depended on whether the piston ring was a good fit in the groove, but the gas pressure was practically the same in the Diesel engine, whether it was on quarter load or overload. The piston clearance was very small, and when the overload came on, the heat had to be transmitted from the crown of the piston down to the sides, and, therefore, the clearance would decrease through the expansion of the piston, and, of course, the mechanical friction would increase. He thought 50s. was the price to which oil would probably fall. Regarding accidents to Diesel engines, recently there had been two accidents, both at Falmouth. In the last case, the piston seized and the engine still went on running. It tore the cylinder and standards clean away and wrecked the engine; that was due to the small clearance. If makers would give a larger clearance they would probably get over the trouble. Springs behind the piston rings would not do, because the temperature was so great. It would take the temper out of the rings, so that the Ramsbottom ring was almost the only thing that could be used. It was necessary to use cast iron. The failure of the Walthamstow engines was due to neglect; the same type of engines had been working perfectly satisfactorily at other places.

**Some Factors in Parallel Operation.**

By A. R. EVEREST, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Birmingham, February 12th, and London, February 13th, 1913.)

IN connection with the parallel operation of alternators it is well known that serious trouble from "hunting" may occur unless the system has such characteristics as to prevent the natural oscillating frequency from approaching resonance with the frequency of engine impulse. Unfortunately, however, the results obtained in actual practice often differ seriously from those indicated by the published formulae. These notes aim to show clearly the nature and importance of the correction necessary, and a means of applying it.

The natural oscillating frequency of an alternator as one of a similar pair, or as a single machine connected to a system of indefinitely large capacity may be conveniently expressed in the form—

$$f_0 = 9.76 \sqrt{k_w} \times \text{cycles/foot-tons}$$

where—

$f_0$  = the frequency of oscillations per minute;

foot-tons = the stored energy of the revolving parts at normal speed;

$k_w$  = the kilowatts of synchronising power corresponding to one radian (electrical) of displacement from the mean position of uniform rotation.

Fig. 1 represents the E.M.F. triangle for two machines when dephased. It is readily seen that the cross-voltage or impedance E.M.F. consumed in one machine (C A) for a small angle of deviation from mean position is proportional to once the radius voltage for one radian of deviation. The value of  $k_w$  is therefore determined by the amount of current which flows as cross-current to consume in one machine a cross-voltage equal to the working voltage.

It is in the proper determination of the  $k_w$  value that errors arise. The usual methods indicate that this shall be determined from the current which will circulate in the machine on short-circuit with excitation corresponding to the air-gap excitation for no-load working voltage.

(Some writers employing the method just described insert the full ampere-turns of open-circuit excitation, instead of the ampere-turns required at the air-gap. This is obviously wrong. The magnetising force consumed in saturating the magnet poles should not enter into the short-circuit test where saturation is absent.)

But in the case of power exchange current between two machines, the amount of current flowing due to a given cross-voltage is much larger than when consuming the same voltage on short circuit, hence the synchronising power as determined from the short-circuit test is usually far too low.

On the short-circuit test the circulating current is dephased 90° from the machine voltage; it exerts a direct demagnetising effect upon the field poles, and produces no synchronising power. But when

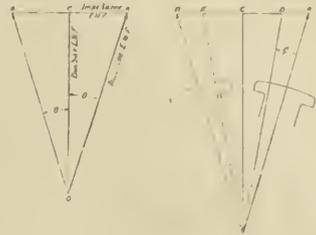


FIG. 1.

FIG. 2.

the cross voltage is at right angles to machine voltage the resultant cross current is in phase with the machine voltage; therefore it is true power current, and as a non-inductive current exerts distorting effect upon the field flux, instead of direct demagnetisation.

The reluctance of the cross magnetisation path is usually quite different from that of direct demagnetisation, and the current flowing to wipe out a given amount of cross voltage will often be two or three times as much as when cancelling the same amount of voltage by direct demagnetisation on the main poles. In other words, the real synchronous impedance which is active when "hunting" may differ widely in value from that measured on

Ratio pole-arc pole-pitch	Ratio cross reactance opposing reactance	Reciprocal.
1.0	1.00	1.00
0.9	0.73	1.37
0.8	0.51	1.97
0.7	0.35	2.85

short-circuit tests; and the latter quantity cannot give the correct value for synchronising current. This effect was pointed out by Goldschmidt as far back as 1902. He gave the correction factors as shown in the table above.

In order to determine the proper value of synchronising power  $k_w$  to be inserted in the equation for oscillating frequency, we may therefore employ the value obtained from the short-circuit test multiplied by a factor depending principally on the shape of the poles.

In fig. 2 the angle A O C of mechanical displacement is divided into two parts;  $\phi$  is the amount by which the flux axis is displaced from the pole axis by distortion from the cross current flowing. The actual E.M.F. triangle is D O C (for one machine), and the real cross voltage D C is consumed as reactive drop in the machine winding.

The angle of mechanical displacement corresponding to any assumed value of cross current, for instance, normal full-load current, is readily found. The angle D O C is given at once by the reactive drop, and we find the angle of flux distortion for any type of pole by Table I.

$$\text{Distortion angle} = \frac{\text{armature ampere-turns per pole all phases}}{\text{field ampere-turns per pole at air-gap}} \times \kappa$$

TABLE I.

Ratio pole-arc pole-pitch	$\kappa$ in degrees.
0.5	10.0
0.6	13.5
0.7	18.0
0.8	24.0

NOTE.—When the air-gap increases in depth from the centre towards the edges the effect is further to decrease the effective width of pole-arc. For such cases a correction of 10 per cent. is suggested.

These two angles together give the displacement angle for one machine at the chosen value of cross current, and hence the cross current and synchronising kilowatts proportional to one radian displacement are at once known.

In the case where the field magnet is a continuous cylinder with pole-arc equal to pole-pitch, it will be found that this method gives substantially the same result as the short-circuit method.

But for the form of pole generally employed on fly-wheel alternators, if the pole-arc is 60 per cent. of the pole-pitch, Table I shows that the distortion angle for the same current is only one-third that in the former case, so that the synchronising current flowing for a given angle of displacement would be very much larger than indicated by the short-circuit method.

The value of winding reactance employed in this method should, as suggested by Hobart, include only that part which lies within the armature surface, and must not include that part due to

reactance flux which crosses the air-gap and passes along the pole face; since this portion is taken into account in the flux distortion. In general, it is sufficiently accurate to take a value of winding reactance E.M.F. one-half that determined in the usual way.

Wherever armature ampere-turns are referred to in this paper, the "effective value," as corrected for coil-pitch and distribution factors, should be understood.

In the case of a 1,500-kw. machine, the oscillating frequency calculated by the short-circuit method was 40.5 per minute. The "distortion" method indicated a natural frequency of 68. The frequency by actual test was 68.

Another interesting case was that of two large low-speed sets designed for close regulation and operating at 94 R.P.M. The sets were intended to operate around 2,100 volts, but while fairly steady at 2,200 volts, could not (in their original condition), be operated together between 2,000 and 1,700 volts, due to the excessive hunting which occurred within this range, indicating resonance between natural frequency and engine speed at about 1,800 volts.

Calculated by the short-circuit method, the fly-wheel actually present should have given at 2,200 volts a natural frequency of 74, thus safely below the engine speed, and with increasing margin for lower voltages. By the "distortion" method, the natural frequency at 2,200 volts was 111 per minute, and approached still nearer to engine speed as voltage was reduced. Actually, the operation became worse with changes known to reduce natural frequency, such as reducing operating voltage, reducing the air-gap, or adding reactance, while the stability was increased by reducing the active turns of the stator winding so as to increase the frequency. All showed that the original natural frequency was above the engine speed, as the "distortion" method indicates.

If calculated by the short-circuit method, taking not only ampere-turns at the air-gap, but also those absorbed in saturating the pole, a near approach to observed results is obtained; this fact, no doubt, accounts for the inclusion of these ampere-turns lost in saturation by some who still advocate the short-circuit method.

So far the no-load conditions only have been considered. When operating under load, the natural frequency should be calculated, not on the terminal voltage, but on the higher voltage, which must be generated internally to overcome the impedance drop of the machine windings.

It often happens that a new machine is required to operate with one of older type.

The following method of treatment has been found useful:—

In the case of two machines A and B, writing  $K_a$ ,  $K_b$  for the  $K_r$  values of A and B, each calculated as one of a similar pair, the resultant value for machines A and B operating together is—

$$2 K_a K_b / (K_a + K_b),$$

which expression may be substituted for  $K_r$  in the numerator of the equation for natural frequency.

Similarly with two unequal fly-wheel effects, writing  $T_a$ ,  $T_b$  for the foot-tons of fly-wheel effect in machines A and B, the resultant effect is—

$$2 T_a T_b / (T_a + T_b).$$

For two machines with any values of electrical constants and fly-wheel effect, we then have the natural frequency—

$$= 976 \sqrt{\text{cycles} \times \frac{K_a K_b (T_a + T_b)}{T_a T_b (K_a + K_b)}}.$$

When specifying the fly-wheel to be supplied in connection with an engine-driven alternator it is usual to stipulate that the total amount of fly-wheel effect present must be such as to satisfy these two conditions.

(a) The angular deviation from uniform rotation due to cyclic irregularity of the engine must not exceed  $2\frac{1}{2}$  electrical degrees (shaft degrees multiplied by the number of pairs of poles). An expression in terms of cyclic speed irregularity is usually preferred by the engine makers. The following is a convenient expression:—

Permissible limit of cyclic speed irregularity =  $1/a$ , where—

$$1/a = k/6 \times (\text{number of poles});$$

$k$  is the number of engine impulses per revolution.

(b) To avoid trouble from resonant hunting, sufficient fly-wheel effect should be provided to ensure that the natural frequency of the machine shall be at least 20 per cent. different from the frequency of the predominating engine impulse. The predominating impulse in a 2- or 4-stroke cycle engine always occurs with the frequency of the cam-shaft, and is independent of the total number of cylinders contributing to the turning moment diagram. Thus in a 2-cycle engine running at 200 R.P.M. the fly-wheel would be designed to give a natural frequency below 160, but in a 4-cycle engine running at 200 R.P.M. the cam-shaft speed being 100 R.P.M. it would be necessary to design the fly-wheel to keep within a natural frequency of 80 per minute.

For operating alternating-current generators of ordinary regulation, the total amount of fly-wheel effect required for each kilowatt of rating may be indicated by the following formula:—

$$1.3 \times \text{poles} \times (\text{strokes per engine cycle})^2 / \text{R.P.M.}$$

#### DISCUSSION.

PROF. R. THRELFALL said that owing to the concentrated style of the paper he had great difficulty in following it. He drew attention to the fact that one term in the formula for the "natural frequency" of an alternator appeared to depend on the other

machines with which the alternator in question might happen to be in parallel, and asked whether it would not be necessary to calculate a fresh natural frequency every time a new unit added to the station.

DR. KAPP said that it must not be thought that the paper referred only to the older type of steam alternators; it also concerned turbo-alternators. A discrepancy existed between Goldschmidt's formula and his figures, and the author in his reply should state whether he considered the formula or the figures correct. No reason was given why the flux to be taken into account in calculating the E.M.F. of self-induction should be just one-half of the total self-induced flux. From a careful investigation made by Schueler on machines installed in four central stations, it was shown that in all cases the time of swing was shorter than corresponded to Rosenberg's formula, so that he was inclined to consider Punga's method, adopted by the author, to be the more reliable method; but it should not be worsened, as the author had done, by the introduction of Hobart's very arbitrary correcting factor of one-half. This correction made a difference of 11 per cent. in the predetermined periodic time.

DR. SUMPNER drew attention to the simplification resulting from using a consistent system of units in all engineering formulae, and urged in particular that electrical engineers should try to express all quantities in electrical units as far as possible. Thus, instead of reckoning the fly-wheel energy in foot-tons per kilowatt (at normal speed and full-rated load) it was convenient to regard this energy as so many seconds of full load. The machine instanced in Case 1 had an output of 1,500 kw. and a fly-wheel effect of 9,600 foot-tons. A foot-ton was equivalent to a kilowatt output for 3 seconds, whence, in the case cited, the fly-wheel energy corresponded with the full load for 19.2 seconds. If this fly-wheel time in seconds were called  $t$ , and if  $p$  denoted the ratio of the short-circuit current to the full-load current of the machine, and if  $f$  were the frequency, the ordinary formula for the period of the "hunting" became  $2\sqrt{\pi/p} t/f$ , and the speaker had used this formula for many years. The only uncertain quantity in the formula was  $p$ . But if corrections were introduced in accordance with the author's views, the calculated time would become close to the value actually found.

DR. M. KAHN said Mr. Everest gave in very small space the necessary information to determine the size of the fly-wheel of a prime mover suitable for an alternator. Most of the previous treatises on the subject gave such a host of calculations and formulae that the average engineer would very seldom have time to read them. He agreed that the distortion method gave the most accurate results, but he differed from the author in one part. In calculating the synchronising power Mr. Everest only took one half of the reactance into account, saying that the total reactance flux contained a part which crossed the air-gap and passed along "the pole face." No deduction need be made from the reactance in calculating the synchronising power.

MR. J. MARTIN said that it was clear that in calculating the cross current at normal excitation only the air-gap ampere-turns could be assumed as being effective in producing it. With regard to the reactance voltage, a statement was made that only half the total value should be taken, the other half being already accounted for in the distorting effect on the field. This seemed to him at first to be allowing for too much leakage flux across the air-gap, but he had had some machines checked up of the ordinary salient-pole engine-driven type, and found that the leakage flux across the air-gap actually did account for about half the total leakage flux. Mr. Everest pointed out that for a 4-cycle engine, running at 200 R.P.M., the fly-wheel effect should be such as to give a natural frequency of 80 per minute. This meant a heavy and consequently expensive fly-wheel, but, in his opinion, it was better practice to do this than to attempt to get the natural frequency of the revolving parts to lie between a frequency corresponding to the predominate engine impulse and twice this frequency, that was, to lie between 100 and 200 per minute. One was always liable to get too near to either one or the other of the frequencies, between which only satisfactory running could be obtained. The most that could be said for the plants designed to work with the light fly-wheel was that at the best they were running moderately well.

DR. E. ROSENBERG (communicated): Mr. Everest was correct in pronouncing that the synchronising currents for running conditions were considerably higher than the figures from the short-circuit test, especially if, according to his theoretical considerations, only the air-gap ampere-turns were taken into account. Recently he had been able to make experiments with two sets of synchronous motor-generators; the measurements showed quite clearly that the synchronising power for a given angle of deviation was considerably greater than that which would be measured from the short-circuit test with no load excitation. But he had never considered it possible to figure the critical value of the fly-wheel effect to an accuracy of a very few per cent., and then to make the fly-wheel just 20 per cent. heavier than the critical value. If it was not possible to make the fly-wheel much heavier, he would certainly use dampers, and take care that the engine impulses of the critical duration were sufficiently equalised, so as not to be too high for the damper. He had found in practically all cases that the simple short-circuit calculation tallied sufficiently well with the actual results. Two inaccuracies were introduced, which, however, fortunately counteracted each other, and gave a reasonably accurate result. The distortion method advocated by Mr. Everest was considerably more complicated than the short-circuit method, and was based on a good number of calculated constants and coefficients. With regard to "fly-wheel requirements," he much preferred to have as one condition a certain minimum cyclic  $\phi$  irregularity specified than a permissible angular deviation of  $2\frac{1}{2}$  electrical degrees. For high-speed machines this "permissible" deviation gave quite

impossible results. In his second recommendation, Mr. Everest did not consider the necessity which very often arose in connection with multiple four-stroke cycle gas engines to work with a fly-wheel between the critical values for impulses of the duration of one revolution, and those of two revolutions. The expression "frequency of the predominating engine impulse" might give rise to a serious misunderstanding. Damper windings on the field poles were of the greatest importance in the case of low-speed two-cylinder double-acting four-cycle gas engines, and allowed them to save many tons of fly-wheel.

Mr. BRADBURY said that since the double-acting tandem gas engine of the Nurnberg type claimed so good a cyclic irregularity as  $\frac{1}{20}$  good parallel operation was largely dependent upon the design of the alternators. Alternators were best suited for parallel running if designed to have small internal resistance and low self-induction, or, in other words, if designed for good voltage regulation, because then the synchronising current for a given angle of displacement was the greatest. His experience, however, had been rather with gas-engine driven alternators similar to each other and designed for a special purpose to have a high armature reaction in order to get constant load independent of sudden changes in the resistances of the external circuits. If these machines were in parallel, then for all conditions of load the power was equally divided between them. If, however, the alternators were of different design, and one machine had a much lower self-induction than the other, the characteristic curves crossed, and only at the point of intersection was the load proportionately distributed between the machines. It followed that alternators having dissimilar characteristics and running in parallel required for every load condition a different value for excitation current. It, therefore, seemed that in designing an alternator for parallel running one ought to compromise, if necessary, between the best value for the natural frequency of the alternator and the correct self-induction to give a characteristic curve similar to that of the alternator with which it was intended to operate.

#### DISCUSSION IN LONDON.

Prof. MILES WALKER said the avoidance of resonance was of increasing importance now that the Diesel engine was bringing the fly-wheel type of machine to the front again. He welcomed a better formula than that previously available, although it had not proved so very inaccurate in use. When dealing with machines having considerable saturation on the pole face, such as turbine-driven machines, ampere-turns on the pole face were just as important as ampere-turns on the air-gap. In the past the bad reputation of high-frequency rotary converters was often due to resonance in conjunction with disturbances in the supply. This was to be expected with approximate methods of design, and the formula in the paper would be of assistance to designers. The old rules were not so very much at fault, as shown by some curves got out by Dr. ROSENBERG, in which the calculated curve due to Mr. Everest fell just outside the curves obtained by the old rule, showing that the latter was on the safe side.

Dr. S. P. SMITH said the author enabled one to calculate a little more exactly than previously. Resonance effect was a most complicated matter, and the difficulties to which it gave rise were shown by a case where three gas engines would not run in parallel, lightly loaded, when one was independently supplied with gas, and the other two were supplied from a common pipe. If the effect of the polar arc had to be taken into account, he thought the power factor should also be considered; the position of the flux was affected both by the load and by its phase with regard to the pole centre. One could get rid of the power factor effect by using the non-salient pole machine; it was a nearly ideal machine.

A lengthy communication having been read from Dr. ROSENBERG, in which he expressed his agreement theoretically with the author, but considered the usual methods had always proved satisfactory, Mr. EVEREST briefly replied to the discussion.

### PRACTICAL NOTES ON EARTHING FACTORY APPARATUS.

By E. P. AUSTIN, A.M.I.E.E.

THE necessity of "earthing" factory motors and accessories is patent to everyone who is connected with workshop electric driving, but the means sometimes employed leads to the conclusion that earthing is best left alone unless properly carried out, as a false sense of security amongst workmen may lead to fatal results.

The Home Office terms, "well and efficiently earthed," are vague, and leave much to the interpretation of individuals. As a result, there are no hard and fast methods applicable to all cases, but the principles underlying the practice are well defined, and can be applied in all circumstances.

Briefly, the points to consider are these: Good conductance of the earthing system; mechanical strength of the contacts and bond wires (where such are necessary); bond and earth wires to carry the maximum current that will operate the fuses, &c., on any circuit without danger of fusion; and

the earthing point or points should be connected to a town or other reliable water supply wherever possible.

The method of earthing will depend on the system of wiring employed about the factory. With metal-sheathed cables of various kinds it is a common, but sometimes bad, practice to bond motor cases, &c., on to the cable sheathing, bridge all junctions with a bond wire and clip, and rely entirely on the sheathing for "earth" circuit conductance.

Screwed conduit is generally considered an ideal protection for all earthing purposes, without the provision of additional earth wires or bonds to ensure good conductance. For normal situations and runs of moderate length this is no doubt, the case, and gives ample protection for conductors becoming "earthed" to the tubing itself, but for long runs and situations where the tube joints are treated with water-proofing material, auxiliary earthing conductors are necessary.

The armouring of steel tape or steel wire armoured cables provides efficient conduction, but there remains the difficulty of jointing the armouring at junctions. Probably the best method of bridging steel tape armour joints is to clamp the cable near the end of the armouring with a cast-iron clamp and drill a hole in the end of the steel tape to take a bolt for connecting the lug of the bridge wire, a spring washer being used for security under the nut. Wire armouring can best be connected by means of a cone clamp, having an attachment to take the earth wire connection.

Lead-covered cables of various kinds are often a source of trouble and uncertainty when apparatus is improperly earthed on to the lead. Wiremen frequently leave earth wires merely twisted tightly round the lead sheath, with the result that the first fault causes the lead to melt at the point of contact and leaves the faulty apparatus unearthed and dangerous.

Lead-covered cables are quite suitable for factory work when properly installed, but the earthing should be carried out by an auxiliary conductor, to which all apparatus and cables should be bonded. As a precaution, all adjacent cables should be bonded and all bond wires should be plumbed on.

A refinement in a complete earthing system is the use of insulated earthing cables, which are earthed at one point through indicating and recording devices. Its usefulness lies in the ready indication of faults developing from small leakages, and a serious breakdown of plant may be prevented by prompt attention. On the other hand, it is advisable to earth at more than one point, in which case the use of indicators adds complications to the system, which are undesirable.

The method of providing an efficient connection with the body of the earth, requires special attention. Earth plates buried in a shop floor are most unreliable, and lead to the development of dangerous conditions. As a case in point, the writer has known the whole ironwork of a shop bay to be alive, due to a faulty motor being supposedly earthed on to a plate buried in ashes 6 ft. in the ground, and 12 ft. from the nearest iron stanchion supporting the roof.

It must be borne in mind that a low-resistance connection between structural ironwork and live conductors is quite sufficient to maintain such ironwork at high potential without appreciable leakage current flowing. If we bear in mind the Board of Trade regulations for electric tramways which call for the standards carrying guard-wires to be earthed to the rail, because their connection with earth is variable and imperfect, it is reasonable to suppose that the practice of relying on earth plates is bad.

Assuming that the main earthing system is good, the point and method of connection to individual apparatus remains to be considered. In the case of a motor with its bedplate or rails, each should be earthed. Merely to earth the bed is unreliable, since the grease, &c., between it and the motor is sufficient to cause a high-resistance connection. Switch and starter gear mounted on an iron frame should be individually bonded on to the earth wire, together with the iron frame.

Earth wires should always be sweated into lugs for connecting purposes; merely fixing a wire under a bolthead is mechanically and electrically unreliable.

It cannot be too strongly emphasised that earthing conductors require quite as much care in installation as service conductors. The failure of the latter is often serious in effect, but not necessarily dangerous, whereas the failure of earth wires is not, as a rule, known until an accident happens.

They are the bulwarks between insulation breakdown and danger to life, and consequently should be installed in a manner beyond reproach. Earth connections are exposed to all the stress of dirt, damp and other risks of mechanical damage, and call for extreme care in erection.

The type of clamp used should have large contact area, and generally should be soldered. Toothed clamps should not be used, as the contact area is small, and deteriorates with time. They are particularly harmful for lead-covered cables, as they sometimes puncture the lead.

A most important point in factory and workshop work is safeguarding portable apparatus of all kinds. The danger of shock from portable drills, hand lamps, &c., has considerably hindered the extended use of electric tools, to the loss of the manufacturer. A "live" portable device has more elements of danger than any other piece of apparatus, since it may be used in a damp situation, or the operator may be standing on a wet floor, and it must of necessity be firmly gripped.

Two systems of earthing are commonly used, namely, a flexible metal tube carrying the wires, or alternatively a wire-armoured flex, and a three-core flexible, one core being used for the earth wire. For damp situations, the three-core flexible cable, if suitably covered and compounded, is the better, as the metal coverings retain the wet, and frequently set up corrosive action on the insulation, with resultant breakdown.

Wall connectors and plugs need careful selection, and should be constructed of cast-iron, and so arranged that the removable portion (on the flexible cable) makes definite earth contact before any "live" contacts are encountered. A handle should be provided on the plug, and arranged so that the flexible is clear of it, to avoid risk of injury in case the cable fuses at the bushing. All the apparatus must be "foolproof," and withstand rough and careless usage from unskilled labour.

Hand lamps are best constructed of hard wood, with a locked wire guard on the lamp to prevent the possibility of a workman removing the lamp and getting a shock. There are several good makes on the market which conform strictly to Home Office rules, and do not require an earth conductor in the flexible.

The writer hopes that the above remarks will serve to impress the importance of earthing on the minds of wiremen, &c., who sometimes treat the matter as a fad to satisfy "somebody's rules."

## ELECTRICAL TRANSMISSION OF COLOUR PHOTOGRAPHS.

By S. M. POWELL.

It is well known that in the ordinary direct system of telephony, it is advantageous to employ a set of seven photoelectric cells in order to eliminate the inertia or hysteresis effect of the selenium. The cells are placed very close together, are shunted across the line, and each is sensitive to one of the seven fundamental components of white light (red, orange, yellow, green, blue, indigo and violet).

The use of colour-sensitive cells naturally suggests the possibility of transmitting colour photographs over an ordinary telegraph line. The solution of the problem, which is described below, is closely related to multiplex telephony, since at least three distinct high-frequency electrical oscillations are transmitted over the same line. Indeed, it appears that the fundamental parts of the apparatus required are equally applicable to multiplex telephony and to colour telephony.

Following suggestions made by Ruhmer, Algeri Marino\* has evolved an elegant system for the electrical transmission of colour photographs by the use of three oscillations of high but different frequencies, derived from: Poulsen arcs. The intensity of the oscillations at the transmitting station is controlled by analysing light beams from the picture to be transmitted, and these oscillations are employed to control other arcs at the receiving station, connected in circuits tuned to the frequencies employed. Before considering the arrangement of the sending and receiving circuits, however,

attention may be called to an important method of decomposing the image to be transmitted.

In the Korn and Belin systems, which have given the best results to date, decomposition is effected by the helicoidal movement of a cylinder carrying the image to be transmitted. The reproduced photograph then consists of a system of narrow parallel bands, but, however close together the bands may be, the gap between them can never be completely eliminated, hence the reproduced image is necessarily imperfect.

An alternative system decomposes the image by the movement of two films, one of which is displaced vertically by small successive steps, the other horizontally at constant speed. For good results the vertical moving film must be displaced with extraordinary accuracy—a result which it is not easy to secure. The new system devised by Marino appears to be as perfect as it is simple.

Referring to fig. 1, an opaque diaphragm having perforations of equal diameter, and equally spaced transversely, moves uniformly in front of an aperture in the dark chamber and quite close to the plate carrying the image to be transmitted. The diameter of the perforations is from 0.7 to 1.2 mm., according to the fineness of working, and the holes are equidistant horizontally and are in successively lower bands. As the diaphragm moves uniformly, the first hole traverses the whole image opposite to the first band, and, as soon as this hole has passed from one side to the other of the image, the next hole traverses the immediately lower strip thereof, and so on. Since the diameter and position of the holes can be determined with high accuracy, very

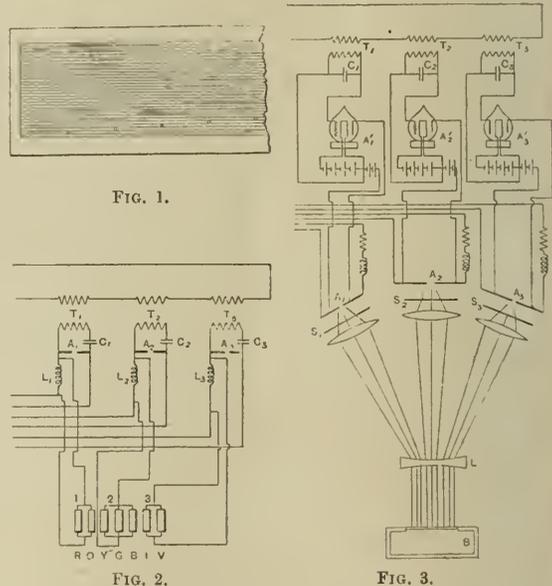


FIG. 1.

FIG. 2.

FIG. 3.

perfect decomposition can be effected and no discontinuities are visible in the reproduced picture.

The horizontal distance between perforations may be equal to the breadth of the plate, but it is better to make it somewhat greater so that an interval elapses between the tracing of successive trips. During this interval (which may be regulated by the spacing of the holes), the seven selenium cells remain in darkness and are thus afforded an opportunity of losing residual conductivity.

Returning now to the sending and receiving circuits for colour telephony, fig. 2 shows the transmitting connections in which are applied the fundamental principles evolved by Ruhmer. The selenium cells are in three groups, of which the first and third contain two cells in parallel. Each group is shunted in a battery circuit closed by a self-induction coil *L* connected in the supply circuit of a Poulsen arc as shown. The circuit of the battery may be closed on the inductance coil in the oscillating circuit, as in the Campos system of wireless telephony. These are the two best arrangements for the electrical transmission of photographs, inductive coupling being impossible at this point.

\* See also a recent issue of *L'Electricista*.

The three Poulsen arcs emit continuous trains of waves of different frequencies and induce corresponding currents in the line coils and hence superimpose three distinct oscillations in the line. At the receiving station (fig. 3) three detectors are connected in three distinct resonant circuits tuned respectively to the frequencies of the arcs at the sending station. These circuits terminate across three Poulsen arcs placed close together as shown, and in front of the arcs are three coloured screens— $s_1$ —a mixture of red and orange;  $s_2$ —a mixture of yellow, green and blue;  $s_3$ —a mixture of indigo and violet. If of equal initial intensity, the beams transmitted through these screens form white light when combined by the lens  $l$ .

It should be noted that the detectors used in the receiving circuits must have unilateral conductivity; the Forest audion valve gives the best results, but crystal detectors can also be employed satisfactorily.

At the sending station, the beam of light which traverses the colour photograph (ordinary telephoty), or the objective of the photographic chamber in the case of direct telephoty, falls on the seven selenium cells, and actuates one or more of the groups according to the constituent colours in its composition. The waves emitted by the transmitting arcs, and hence the intensities of the three high-frequency line currents, are correspondingly modulated.

At the receiving station, the three components of the line current are tuned out and rectified, and then modulate the luminous intensity of the arcs behind the three coloured screens in sympathy with the variations in the line current components, and hence, ultimately, in sympathy with the depth and colour of the image transmitted. The resultant combined beam at the receiving station is identical in colour variations with the original, and may be used to take colour photographs in the ordinary manner. In order to obtain the best possible separation of the line current components at the receiving station, the coupling of the transformers  $T_1$ ,  $T_2$ ,  $T_3$  (fig. 3), should be weak. At the sending station, however, the line transformer coupling must be as strong as possible.

This ingenious system, of practical as well as theoretical interest, marks important progress in the electrical transmission of photographs and other images.

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

A CONTRACT for the construction of a 1,500-ft. dam and the installation of a complete hydro-electric system at Grand'mère, Quebec, to cost about £300,000, has recently been awarded. The Grand'mère Fall is on the St. Maurice River, a little north of Shawinigan Falls and about 30 miles from the mouth of the river, which flows into the St. Lawrence at Three Rivers. According to the Commission of Conservation, there is about 40,000 h.p. available under a 75-ft. head at this fall. At Sydney, Nova Scotia, the Dominion Coal Co. is installing a 20,000-kw. plant. In Ontario, a great deal of talk is going on respecting electric railways. Messrs. Mackenzie & Mann, who control so many railway and electrical interests here, are said to be planning a combination of all radial electric railway lines in the Province, while the Canadian Pacific Railway, it is stated, contemplate building lines which will compete with the Mackenzie & Mann scheme. Still another proposal has been made, viz., that the Hydro-Electric Power Commission should construct lines linking up towns wherever practicable: these last would, of course, be owned by the people.

The municipal authorities of Lethbridge, Alberta, are engaging the services of an engineer to report on the question of the development of water power on the Belly and St. Mary's Rivers, which run through the adjacent territory. For two summers past the Commission of Conservation has had gauge readings taken of two large rivers in the Canadian North-West, and possible water power sites examined. It is said that during the season of navigation (May to November) it would be possible to utilise, under a total head of 135 ft., 1,000,000 h.p. at various rapids on the Slave River, and that "the volume of water is

enormous, being the combined flow of the Peace and Athabasca Rivers and their tributaries, with one of the great northern lakes, Lake Athabasca, acting as a reservoir to regulate the flow. . . . Raw material for pulp and lumber industries is found all along the river, and at the rapids."

"The Peace River Canyon has long been renowned for the wild character of its water, and no white man or Indian, be he ever so experienced in river work, or egged on by foolhardiness, ever attempts to run its rapids. . . . It is little wonder that the velocity of its waters should be so great when one considers that, as has recently been ascertained, the descent from head to foot is some 225 ft. in a distance of less than 18 miles. . . . The total minimum water power available during the open-water season (May to November) is estimated at 400,000 h.p."

The *Electrical News*, published in Toronto, recently inserted in full Mr. Hamilton Wickes's report on the Underwriters' Laboratories, Chicago, with which readers of the *REVIEW* are familiar. In the last issue of the *Electrical News* appears a letter from an Englishman resident in Canada, who, while writing strongly in favour of the work done by the Underwriters' Laboratories, says that he believes that Canada should have a laboratory for testing purposes either under the Government or Underwriters' auspices, whose rulings would be accepted by the American Laboratory, the Canadian one in turn accepting theirs, so that a uniformity of ruling would exist. He also states that "with the institution of such an examining body, the British manufacturers would not be under any disadvantage in exporting goods to Canada."

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"LOCAL" writes: "In a certain town, in which the electricity supply undertaking is owned and worked by the local authority under a provisional order obtained in 1890, a horse was killed as the result of an electric shock obtained through the roadway being made 'alive' by a fault in one of the local authority's lighting cables. In the said provisional order the following clause appears:—'The undertakers shall be answerable for all accidents, damages, and injuries happening through the act or default of the undertakers or of any person in their employment, by reason or in consequence of the undertakers' works, and shall save harmless all authorities, bodies, or persons by whom any street is repairable, and all other authorities, companies, and bodies collectively and individually, and their officers and servants, from all damages and costs, in respect of such accidents, damages and injuries.'

"The owner of the horse is claiming compensation, but the local authority deny liability, on the ground that the claimant cannot prove negligence on the part of the local authority.

"Is the said local authority liable for damages?"

\* The clause above referred to is similar in terms to Clause 77 of the Schedule to the Electric Lighting Clauses Act, 1899. It was held that the corresponding section of the Tramways Act, 1890, applied only to a wrongful act or default, and does not make the promoters or lessees of the tramways answerable for any accident caused without negligence. *Brocklehurst v. Manchester, &c., Tramways Co.* (1886), 17 Q.B., D. 118. In the latest edition of Will's "Electric Lighting," it is submitted (at p. 202) that the decision in *Brocklehurst's* case (*supra*) is applicable, and the undertakers are only answerable for such accidents, damages and injuries if occasioned by the wrongful act or negligence of themselves or their employes or by acts or omissions amounting to or causing a nuisance. This appears to have been the view of the Divisional Court in *Solomons v. Stepney Borough Council* (3 L.Q.R., 912).

In that case the plaintiff brought suit for damages for injuries received from fright or shock caused by an explosion in a street close to and in front of her. The explosion emanated from a man-hole, feeder-box or conduit under the control of the defendants, containing their electrical cables. An expert stated, in his evidence, that he had visited the scene of the explosion, and had heard the accounts of those who had witnessed it; that he should imagine the explosion was caused by a leakage of electricity causing sparks, and that there must have been some explosive mixture—gas in all probability—accumulated in the conduit. If the conduit and works had been properly ventilated the gas would not have accumulated, and the explosion would not have occurred. It was held that there was in the circumstances evidence of negligence to go to the jury, the Lord Chief Justice observing that in such a case the mere evidence of the explosion was sufficient to place the onus of proof on the respondents. It is believed there was a case some years ago in which damage to a horse, occasioned by the breaking of a wire, was recovered against the Dublin Corporation, but the reference to the case is not to hand.

"ANOTHER INQUIRER" writes: Your reply to "Inquirer" in your issue of the February 21st exactly answers some questions I was

about to ask you. May I trouble you to add (a) what a "licence" is; (b) how one may find out how to apply for it; (c) cost of licence; (d) can one proceed to supply without either licence or provisional order; (e) I presume that overhead wires are subject to Board of Trade regulations whether one works under provisional order, licence, or without either (the latter if possible)?

As to (a), "Another Inquirer" will find the last word about licences in Sec. 3 of the Electric Lighting Act, 1882. In Will's Law of Electric Lighting (1912), p. 75, it is written: "No licence is now in force, and an application for a licence will not be entertained by the Board of Trade except in very special circumstances. The object of a licence was experimental, and electric lighting has long passed the experimental stage." A provisional order is, therefore, applied for when power is sought to supply electricity for lighting and other purposes.

As to (b) and (c), see Sec. 3 of the Act of 1882, *supra*.

As to (d), supply without licence or provisional order is legitimate: but if a supply is already being given under licence or provisional order by a company or local authority, no other person can supply, unless his business is not primarily that of supplying electricity (see Electric Lighting Act, 1909, 9 ed. 7c. 34, Sec. 23).

As to (e) the reply (to use a familiar Parliamentary expression) is in the affirmative.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 4,611. "Telephone repeater system." H. E. SIBBEVE. (Convention date, February 24th, 1912, United States.) February 24th. (Complete.)
- 4,612. "Method of automatically regulating the voltage of an electrical machine, subject to variation of speed." W. DEACHER. February 24th.
- 4,618. "Selective signalling systems." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) February 24th. (Complete.)
- 4,641. "Electric glow lamps." F. LOEWENSTEIN. February 24th. (Complete.)
- 4,670. "Ignition systems." C. T. MASON. (Convention date, April 22nd, 1912, United States.) February 24th. (Complete.)
- 4,671. "Electric tachometers." N. M. HOPKINS. February 24th. (Complete.)
- 4,686. "Switch fuses." APPAREILLAGE GARDY. (Soc. Anon.) (Convention date, February 25th, 1912, Switzerland.) February 24th. (Complete.)
- 4,691. "Devices for reversing the direction of running of polyphase current commutator motors." BERGMANN ELEKTRICITÄTS-WERKE AG. (Convention date, March 14th, 1912, Germany.) February 24th. (Complete.)
- 4,692. "Devices for automatically adjusting the time of ignition of internal-combustion engines." R. BOSCH (firm of). (Convention date, March 14th, 1912, Germany.) February 24th. (Complete.)
- 4,693. "Devices for automatically adjusting the time of ignition in internal-combustion engines." R. BOSCH (firm of). (Convention date, March 14th, 1912, Germany.) February 24th. (Complete.)
- 4,704. "Antiseptic guards for telephone mouthpieces." C. V. FULLER. (Convention date, February 25th, 1912, Germany.) February 24th. (Complete.)
- 4,728. "Multiphase electric furnace for fixation of nitrogen." E. K. SCOTT. February 24th.
- 4,725. "Means of regulating arc furnaces." E. K. SCOTT. February 24th.
- 4,726. "Electric furnace for the fixation of nitrogen." E. K. SCOTT. February 24th.
- 4,727. "Double electric lampholder with a special bridge for easier access in wiring for use in corners, crevices and the like." B. MEAKER. February 24th.
- 4,773. "Electric machines having commutators." B. LUNGSTROM and A. D. WIDSTROM. (Convention date, February 26th, 1912, Sweden.) February 25th. (Complete.)
- 4,777. "Apparatus employed for wireless telegraphy and the like." F. J. CHAMBERS. February 25th.
- 4,778. "Apparatus employed for wireless telegraphy and the like." F. J. CHAMBERS. February 25th.
- 4,779. "Receiving apparatus for wireless telegraphy." F. J. CHAMBERS. February 25th.
- 4,787. "Holders for the electrodes of electrical arcs." H. AYRTON. February 25th.
- 4,788. "Feeding mechanism for electrical arcs." H. AYRTON. February 25th.
- 4,792. "Impulse transmitters for automatic telephone plants." G. A. BERTLANDER. (Convention date, February 28th, 1912, Sweden.) February 25th. (Complete.)
- 4,823. "Electrical order transmitting systems and the like." E. A. GRAHAM and W. J. RICKETS. February 25th. (Complete.)
- 4,836. "Electric switches." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 25th.
- 4,847. "Electricity meters." J. ELSTER. February 25th. (Complete.)
- 4,858. "Electric switch attachments for clocks." J. W. ROBINS. February 25th.
- 4,862. "Resistance boxes, Wheatstone bridges, switches, contact-makers, breakers and the like." T. E. GAMBELL. February 25th.
- 4,867. "Electric battery hand lamps." W. F. STEPHENS and B. HEAR. February 25th.
- 4,869. "Controller for electric lifts and hoists." W. J. F. COOPER and F. BARLOW. February 25th.
- 4,890. "Pendulum indicators for use with electric bell systems or for like purposes." I. H. PARSONS and H. B. WADSWORTH. February 25th.
- 4,907. "Incandescent electric lamps." C. COLLY. February 25th.
- 4,917. "Electric ignition and lighting apparatus." F. R. BIRMS. February 25th.
- 4,922. "Process for the manufacture of artificial thread filaments, or other shaped objects from copper cellulose solution." VEREINIGTE GLANZSTOFF FABRIKEN AG. and E. BRONKHORST. (Convention date, September 2nd, 1912, Germany.) February 25th. (Complete.)
- 4,926. "Magazine arc lamps." J. BROCKIE and JOHNSON & PHILLIPS, LTD. February 25th.
- 4,927. "Electric contact devices particularly applicable to arc lamps." J. BROCKIE and JOHNSON & PHILLIPS, LTD. February 25th.
- 4,931. "Section insulators, supporting ears and the like for overhead conductors." J. IANSEY and A. W. MALEY. February 25th.

- 4,945. "Electric circuit interrupting devices." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 26th.
- 4,946. "Electric arc lamps." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) February 26th.
- 4,955. "Ignition apparatus of gas engines." C. B. BENDHAM. February 27th.
- 4,978. "Shields for the holders of electrodes of electric arcs." H. AYRTON. February 27th.
- 4,984. "Electric level." C. C. COLLEY. February 27th.
- 5,013. "Generators of electric current for ignition purposes." C. A. VAN DERVELL and A. H. MIDGLEY. February 27th.
- 5,014. "Electric starting and lighting arrangement, more particularly for motor-cars and the like." C. A. VAN DERVELL and A. H. MIDGLEY. February 27th.
- 5,020. "Automatic regulating devices for use in connection with variable speed dynamos." COMPAGNIE FRANCAISE POUR L'EXPLOITATION DES PROCÉDES THOMPSON-HOUSTON. (Divided application on 19,537 of 1912, August 26th. Convention date, August 26th, 1911, France.) February 27th. (Complete.)
- 5,028. "Arrangement of the filaments of incandescent electric lamps." S. CHARLES. (Convention date, February 27th, 1912, Belgium.) February 27th. (Complete.)
- 5,040. "Transmitters for wireless telegraphy." C. SCHOD. February 27th. (Complete.)
- 5,060. "Telephone apparatus." E. A. GRAHAM. February 27th. (Complete.)
- 5,063. "Combination connection adaptor for electrical fittings and the like." A. MILHAM. February 28th.
- 5,078. "Portable electric battery lamps." H. F. JOEL. (Divided Application on 5,170/12, March 1st, 1912.) February 28th.
- 5,082. "Submarine signalling apparatus." E. C. R. MARKS. (Submarine Wireless Co., United States.) February 28th. (Complete.)
- 5,088. "Electric safety lamps." G. A. DICKIE. February 28th.
- 5,117. "Electric heating elements." J. O. GIRDLESTONE. February 28th.
- 5,132. "Secondary electrolyte for alkali metal manufacture." E. A. ASHCROFT. February 28th.
- 5,150. "Process and apparatus for producing malleable tungsten and other metal at very high temperatures." J. CANELLO. February 28th.
- 5,157. "Electricity meters." J. ELSTER. February 28th. (Complete.)
- 5,158. "Regulators for dynamo-electric machines." J. R. JOHNSTONE and T. FERROUSON. March 1st.
- 5,173. "Magazine arc lamps." A. E. SPENCER and JOHNSON & PHILLIPS, LTD. March 1st.
- 5,194. "Overhead electric cable equipment for power or lighting purposes." F. H. GILROY. March 1st.
- 5,199. "Electric arc lamps for projection." A. SCHMIDT. March 1st.
- 5,200. "Overhead system of driving electric vehicles." T. TOBE. March 1st.
- 5,209. "Electric incandescent lights." H. W. FULLER. March 1st. (Complete.)
- 5,213. "Electric arc lamps." SOUTH METROPOLITAN GAS CO., and D. CHANDLER. March 1st.
- 5,228. "Pendants, or the like, more particularly pendants for electric lamps." A. LUDERS. March 1st. (Complete.)
- 5,242. "Insulating gloves." ST. HELENS CABLE and ROBBEY CO. March 1st. (Complete.)
- 5,249. "Electrical impulse transmitting devices." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) March 1st. (Complete.)
- 5,250. "Submarine signalling apparatus." E. C. R. MARKS. (Submarine Wireless Co., United States.) March 1st. (Complete.)
- 5,253. "Electric heating apparatus." LONDON ELECTRICAL TRADING CO., LTD., C. O. BASTIAN and J. H. ALMOND. March 1st.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

ELECTRICAL RELAYS. S. G. BROWN. 27,953. December 12th. (Cognate application, No. 8,427 of 1912.)

### 1912.

- CONTROLLING DYNAMO-ELECTRIC MACHINES RUNNING AT VARYING SPEEDS. H. F. FOSTER and A. W. S. POCKINGTON. 3,105. February 7th.
- ELECTRIC RAILWAY SYSTEMS. J. J. DESCHAMPS. 3,123. February 7th. (June 30th, 1911. Patent of Addition not granted.)
- ELECTRICAL RESISTANCE BODIES and the MANUFACTURE THEREOF. G. COOPER. 3,325. February 9th.
- PROCESS and APPARATUS FOR CARRYING OUT GAS REACTIONS IN THE ELECTRIC ARC. A. J. BOULT. (DYWIDAG Akt.-Ges. vorm. Alfred Nobel & Co.) 3,342. February 9th.
- METHOD OF, and APPARATUS FOR, GENERATING HIGH-FREQUENCY CURRENTS. A. HEYLAND. 3,555. February 12th.
- ELECTRIC SWITCHES and the CONDUCTOR CONNECTIONS THEREOF. H. C. SHELDON (Sächsische Gruppenwechselschalter Ges.). 3,590. February 13th.
- TELEGRAPHY and TELEPHONY BY SUBMARINE CABLES, LONG-DISTANCE OVERHEAD LINES and the LIKE. J. SCHIESSLER. 4,001. February 17th. (Convention date not granted.)
- ELECTRICAL SWITCHES. A. WYNNE. 5,462. March 5th. (Cognate application, No. 13,195 of 1912.)
- ELECTROMAGNETICALLY-OPERATED SWITCHES. British Thomson-Houston Co. and E. GATON. 5,576. September 5th. (September 5th, 1912.)
- IMPREGNATION and COATING OF ELECTRICAL APPARATUS WITH INSULATING MATERIAL. H. W. TURNER. 5,856. March 8th.
- ELECTRICAL CONDUIT FITTINGS. L. G. BYNG and T. TAYLOR. 6,052. March 11th.
- ELECTRICALLY-DRIVEN DENTAL ENGINES and the LIKE. S. M. KROPFMAN. 7,648. March 29th.
- LAMPHOLDERS FOR ELECTRIC CANDLES. E. J. WILSON and CANDOLITE CO. 7,729. March 30th.
- ALTERNATING-CURRENT MOTORS. British Thomson-Houston Co. (General Electric Co.) 9,210. April 18th.
- ELECTRIC CONNECTION FITTINGS. B. TROOD and J. H. DALE. 9,911. April 26th.
- PRODUCTION OF DUCTILE IRON BY ELECTROLYTIC MEANS. H. PLAUSON and G. TISCHENKO. 10,882. May 7th.
- APPARATUS FOR THE CONTROL OF ELECTRIC CIRCUITS IN SYSTEMS EMPLOYING VARIABLE-SPEED GENERATORS. H. LEITNER. 11,175. May 10th.
- APPARATUS FOR PREVENTING THE FRAUDULENT USE OR THEFT OF ELECTRICAL ENERGY. M. G. DIAZ and AZAROLA A. Y. GRESILLON. 11,259. May 11th. (Addition to No. 14,259 of 1908.)

# THE ELECTRICAL REVIEW.

Vol. LXXII.

MARCH 21, 1913.

No. 1,843.

## ELECTRICAL REVIEW.

## STREET LIGHTING.

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The interesting paper read by Messrs. Pearce and Ratcliff before the Institution of Electrical Engineers, at four centres, brings before us again the conflict between the gas and electricity departments of the Manchester Corporation, a Titanic struggle which has raged more or less fiercely for 20 years. Seeing that some corporations owning electricity supply undertakings, but not gas works, have been known to favour electricity for street lighting even when an unduly high price was charged for it, we are not disposed to reproach the Gas Committee for retaining the street lighting in its own hands as long as possible; but we have no doubt that the citizens of Manchester have paid, not only in money, but also in time, convenience and reputation, many times over for the questionable privilege of gas-lighted streets, and the fact that their great city is universally shunned by all who can contrive to do their business elsewhere is probably due in great part to the funereal gloom with which its streets have become firmly associated in the minds of its visitors. It should be borne in mind by those responsible for lighting parks, and other public decorations or ornaments, that a city develops a "character" just as truly and inevitably as an individual; it may be a good one or a bad one, cheerful or gloomy—but whatever it be, the mental impression is linked with the very sound of its name, and traffic is diverted towards or away from it according as the impression is attractive or the reverse. It is the duty of the public representatives to remember all these things, and to lose no opportunity of improving the character and raising the status of their community. Fortunately for Manchester, the Corporation has at last realised the futility of expecting impartiality and altruism from a Gas Committee, any more than from an Electricity Committee, and has appointed a new Street Lighting Committee to deal with the subject without bias towards either illuminant, seeking only the best results for the benefit of the public.

The authors in their paper (of which we commence an abstract in this issue) give data which amply justify the report of Mr. Haydn Harrison on the same subject, abstracted in our issue of November 1st, 1912. It will be remembered that Mr. J. Abady, who carried out tests at the same time, also agreed that the gas lamps were giving an illumination far below their rated candle-power, and that electric lighting came out the cheaper; he held that the efficiency of the gas lamps could be greatly increased, but if so, why was it not done? The Gas Department had as free a hand as the Electricity Department; "each was to do its best," say the authors, and the result is an emphatic and unanimous verdict for the flame arc.

While we hail this result with satisfaction—though it is no more than we expected—we may point out that by no means the last word has yet been said on the subject of the arc lamp for street lighting. In point of fact, by their

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION

Ready.

**H. ALABASTER, GATEHOUSE & CO.,**  
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careful tests the authors have revealed defects in the ordinary design of shades or reflectors and globes, and have shown that these may have a very marked effect upon the uniformity and efficiency of the illumination obtained. In passing, we are inclined to regret that they have imported into a subject already sufficiently complex and involved a new factor—a suggested standard height of 5 ft. for these measurements; the proposed international standard is one metre, which is in general a very convenient height and enables results to be compared with greater confidence than when they have to pass through a conversion process beforehand. Even yet, it appears, the authors have not completed their investigations, but it is clear that certain definite conclusions can be drawn from the work already done—the central suspension is to be preferred; partially frosted globes are practically as effective as dioptric globes; and flame arc lighting has nothing to fear from high-pressure gas lighting, either on the score of cost or on that of uniformity of illumination.

The authors have also demonstrated very plainly the primitive condition in which the design of arc lamp globes remains, and the remarkable improvements that can be effected by simple means; it is surprising that greater attention has not been devoted to this subject by the makers, for the requirements of lamps for street lighting have been understood for many years. No doubt, in view of the results set forth in this useful paper, suitable changes will be quickly effected, doing away with the drawbacks in question.

#### The German Electrical Industry in 1912.

ACCORDING to the report of the Association of Electrotechnical Special Works, which claims to represent practically the whole of the industry apart from the three or four huge undertakings, the year 1912 was favourable to the special works, which were again able to secure an increase in the turnover. This was accomplished without any corresponding addition to the number of workmen, as the improvements introduced in manufacturing enabled the firms to satisfy the greater requirements. The course of business was chiefly stimulated by the erection of overland stations, the large demand experienced from industrial establishments, and the rapid extension of electric lighting in private dwellings. Nevertheless, the financial results did not always keep pace with the volume of trade, this being due to the sharp advance in the prices of copper, brass, lead, porcelain, &c.; and the extra charges which some branches impose as a condition in connection with contingent rises in the cost of materials, were only able to offer partial compensation. Concerning the larger turnover in 1912, it is mentioned that this principally applied to the domestic market, the export trade participating to a lesser extent. The exports to Italy suffered from the effects of the war in Tripoli, and those to the Balkan States from the war in that region. It is considered in this connection that the German firms must make still greater efforts in order to be able to meet the native electrical works, rapidly developing under the protection of high import duties in Italy, Austria-Hungary, Russia, and in the Scandinavian countries in general, and Sweden in particular.

After these general observations the report proceeds to deal with the different branches of the industry. In the case of electrical machinery, the interested works all experienced good sales. Unfortunately, however, the extra charges made for rises in materials were only applicable to types of over 5 H.P., as the large firms excluded the smaller machines, which are of great importance to the special works, from any improvement in prices. The cable department was satisfactory, as the effects of the cable

syndicate guaranteed the obtaining of profitable prices, although the level of prices was depressed in many cases by the operation of foreign competition. With reference to the very unfavourable rates realised in 1911 for insulated wires, the report points out that an improvement in this direction was effected in the spring of 1912 by the formation of a price convention, whilst a price syndicate for insulating tubes, the manufacture of which had long been unremunerative, was also constituted towards the end of 1912. On the other hand, the department for meters continued to suffer from inadequate prices, especially owing to the endeavours of the large firms to obtain possession of the supply works of communal authorities.

A slight improvement took place in the arc lamp branch. It was found possible to relieve to some extent the pressure exerted through the operation of the tax on lighting appliances by the introduction of new types of arc lamps having a longer lighting duration, although the tax continued to render business in arc lamps difficult in the home market. The competition of high candle-power metallic-filament lamps, which had unfavourably influenced the arc lamp trade until a short time ago, seems to have reached a parting of the ways, as it is shown that arc lamps still offer undisputed advantages over wire lamps in many cases. The glow lamp department also continued to labour under the disadvantages of the lighting tax; not only on account of the difficulties which the tax causes to the works, particularly the small glow lamp factories, but also because of the exceptional injury which has recently been inflicted on the export trade. In explanation of this remark, it is stated that both the United States and Canada have now for some time past included the glow lamp-tax in the German market value, which is based upon *ad valorem* duty, so that the rates of duty on glow lamps of German origin have been increased and have a prohibitive effect. The manufacture of measuring apparatus suffers from the depression in prices caused by the erection of new works of small size, and the makers of apparatus for heavy currents and of installation materials also complain of unfavourable prices, especially for staple articles. In conclusion, the report refers to the continuance of the monopolistic efforts put forth by the large manufacturing establishments.

It has often come within our province to deplore the ignorance of the ordinary newspaper writer, as exhibited whenever he has had to describe any mechanical contrivance, or otherwise enter upon engineering ground. Of late years some of the daily papers have professed to run an engineering page or two every week. But some of the effusions which grace the engineering columns of the daily Press are painful to read. In the *Standard* of March 11th, for example, there is what purports to be a description of a new system of boiler feeding which preserves the water-level constant. We are not finding fault with the appliance, for, to begin with, the description of it is too meagre to enable either praise or blame to be awarded. But we do object to the verbose, bombastic language of the article. A steady feed is desirable, but its attainment is not a novelty. There are many ways by which it has been, and may be, attained. But reasonable and small variations of water level are not accompanied by those horrible symptoms of engineering indigestion which our daily contemporary works up into a veritable witches' cauldron of disease to be exorcised by the engineer, surgeon or physician. These appeals to human ills and the medical profession, as applied to engineering matters, are out of place.

Engineers who read these florid and overdrawn descriptions are prone to disregard even the good things to which such misplaced language may have been applied. The daily Press should surely be able to secure the services of writers who, with a knowledge of technics, combine the ability to employ plain and simple descriptive language when dealing with mechanical subjects. We have all long ago sickened of the "extraordinary," the "revolutionary" and the "unprecedented" by which some writers think to goad up public interest in even the most trivial of improvements or the worst forms of perpetual motion.

## NEW TYPE OF TRAMCAR.

The new type of tramcar, illustrated herewith and now in use in New York, offers several interesting features, among which attention may first be called to the very low platform level secured by the use of the special bogie-trucks shown in fig. 2. From the passenger's standpoint, this alone is a most important innovation, and one which is confidently expected to reduce considerably the present annual number of accidents occurring when mounting or descending from cars.

The longitudinal members of the car framework must generally be about 1 m. above street level, over the wheels, in order to clear the latter, but there is no reason why the chassis should not be sunk between the bogies, and this has now been done, as shown in fig. 1.

The new car is carried by a bogie (with one motor and one trailing axle) at each end, passenger doors being arranged at the centre of each side of the vehicle. The side frames of the bogies and the side members of the chassis are so arranged that the floor of the car is as low as possible

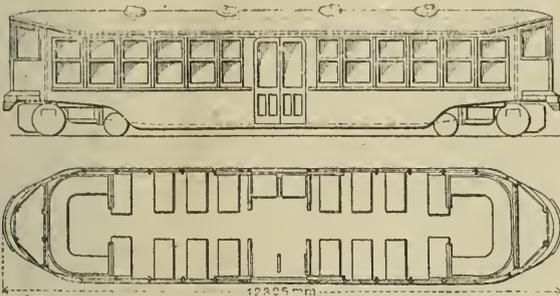


FIG. 1.—NEW TYPE OF TRAMCAR.

while permitting free rotation of the bogies on curves of 40 ft. radius. The driving cabs are elevated and partitioned off from the remainder of the car. The leading dimensions of the new cars, which seat 51 and provide standing room for 32-40, are as follows:—

Length over buffers	41 ft.
Length between end partitions	34 ft.
Overall width	8 ft. 3 in.
Overall height above rail	9 ft. 6 in.
Height of step (passengers)	10 in.
Height of floor in body of car	1 ft. 4 in.
Height of floor in driver's cab	2 ft. 8 in.
Internal height of car	8 ft.
Minimum height above rail	7 in.
Width of double side doors	3 ft. 10 in.
Distance between bogie centres	29 ft.
Distance between axles	5 ft.
Diameter of driving wheels	2 ft. 6 in.
Diameter of trailing wheels	1 ft. 7 in.
Net weight of chassis	6,25 tons.

The transom of each bogie is mounted on inverted springs hung from the side frames of the truck, and a Westinghouse motor is mounted on each driving axle.

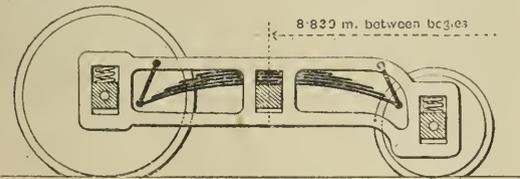


FIG. 2.—BOGIE OF NEW CAR.

The floor of the car consists of an angle-iron framework held by transverse angle-irons, to which are riveted the 3-mm. side plates. The principal cross-beams are 152 x 89/17.5 mm. and the joints to the longitudinal members are stiffened by riveted plates. The cross-beams are bent to suit the depressed floor of the car, and are connected to the buffers by double Z-irons. The latter, which are also bent to pass over the motors, carry the bearings for the bogie pivots.

The side doors are moved in or out of the recesses shown by pneumatic gear controlled by the conductor, who is seated on an elevated bench at the rear of the car. Eight top ventilators each provide the air supply requisite for ten passengers. The opening of the ventilators is automatically controlled by the car springs, so that the air supply is always proportioned to the number of passengers on board. In summer, additional ventilation is provided by opening the lower part of the side windows. Electric heating is provided, when required, chiefly by the controller rheostats.

## REVIEWS.

*Poems.* By E. L. HILL, M.I.Mech.E., A.M.I.E.E. London: The *Electrician* Printing and Publishing Co. Price 2s. 6d. net.

That an engineer may be an artist we know; but it is rarely that he breaks out into poetry, and when he does, we usually wish he didn't. But there are exceptions, and we are glad to include amongst them the author of this little book. Although a mechanical and electrical engineer, Mr. Hill does not drag technicalities into his poems; these are simple, and often touching, and though they are not highly finished, they bear the stamp of true and earnest sympathy with life. Some slight deficiencies of composition and punctuation may well be excused in view of the admirable sentiments which the author has embodied in his verses.

*A Primer of the Internal-Combustion Engine.* By H. E. WIMPERIS, M.A. London: Constable & Co. 1913. Price 2s. 6d. net.

This little book is intended for the use of students in their first or second years of study. It is well arranged, and commences with a table of useful constants with their initial abbreviations. Both British and metrical equivalents are given, and we welcome the metrical equivalent of the United States gallon, for it is too little known that the United States gallon is only about four-fifths the capacity of our 10-lb. imperial gallon, ignorance of which fact has, to our knowledge, worked injury to British interests. Some Americans are cute enough to sell, say, a 1,000-gallon article and let their motto be *Caveat Emptor*—Mr. Emptor buying the large number of gallons in ignorance of their less cubic measure.

But we must quarrel with Mr. Wimperis over his use of the bastard C.H.U., which, being interpreted, is the number of heat units per pound per degree Centigrade. Useful it may be, for we have seen it used in a report in such a way as to deceive the unwary. It is a constant which ought not to be allowed, and if, as may happen, an engineer may need to use a Centigrade thermometer when working with pounds, he ought to translate his results into one or other system, and not use such a likely deception as the Centigrade pound heat unit. The calorie and the B.T.H.U. are sufficient.

The author gives a brief historical *résumé* of the gas engine, and gives credit to Beau de Rochas for the invention of the so-called Otto cycle. It still puzzles many people to know how Otto could uphold his patent in face of de Rochas' earlier patent. But de Rochas was not the only gas engine inventor who did not profit from his invention, for Clerk, who invented the two-stroke engine, has only had the satisfaction of seeing it adopted in some of the best modern engines. Daimler and Diesel complete the history to date. There is a very brief section on fuels, after which comes Chapter II, an excellent chapter, only marred by the C.H.U. Why not have introduced the F. Calorie while on the job of multiplying these units?

Chapter III is a good exposition of the laws and properties of gases, especially the note on volumetric heat, so useful in gas-engine work.

The author describes entropy as a quantity which cannot be directly measured or simply defined. As a definition of entropy useful to the engineer whose ideas are usually

tied up to the P.V. diagram, we would suggest that entropy be defined as length on a diagram of energy of which the ordinates are temperature: just as the ordinary indicator diagram is defined as an energy diagram of which ordinates are pressure and length (or abscissae) is volume. This definition is really that given in this book at p. 34.

Chapter IV and V deal respectively with the ideal and the real engine, with its various mechanical details, but as in so many books, when the exhaust valve opens the gases lose their interest just where, in practice, they begin to give trouble and make themselves heard. When will the author arise who will tell us something of silencing and show how to silence an engine without loss of work? The author treats of the horse-power rating of petrol engines, but does not indicate what is the mean pressure on which ratings are based. Nor is the rotative speed named.

Fuels are treated more fully in Chapter VI, as well as gas producers, engine details in Chapter VII, and testing in Chapter VIII.

As a student's book, this is very good and clear.

*Winding Engines and Winding Appliances.* By MESSRS. McCULLOCH and FUTERS. London: Edward Arnold. Price 21s. net.

As mines deepen, the problem of winding becomes more important. The output of a coal mine is measured by the quantity of coal that can be raised at the shaft rather than by the capacity of the miners to get the coal. As mines deepen, the amount that can be raised per day must be reduced unless there is a corresponding improvement in winding efficiency. Winding involves the starting of a heavy load from rest, and its acceleration to, say, 2,000 ft. per minute, with final reduction to rest, also without shock.

Fortunately, for deep mines, the maximum speed can safely be higher than for shallow depths. Thus, any lift may be divided into three parts—acceleration, steady running, deceleration. The two end periods may be alike for deep and for shallow pits, but the middle steady run will be longer for deep pits, though not proportionately longer. A pit of 400 yards is wound, let us say, in half a minute. If it were 1,400 yards deep, there would be an additional 1,000 yards' run at maximum velocity, and if a maximum velocity of 1,000 yards per minute were allowed, this extra depth would demand 1 minute nearly, or a total time of 3 to a depth ratio of  $3\frac{1}{2}$ .

The authors introduce the reader to the few main systems, including the cylinder drum, the cone drum, the flat rope, the combination cone and cylinder, the tail rope, and the Koepe systems.

All mine winding is based on the same principles: but in colliery work there is the advantage of long periods of work from one depth, whereas in a gold mine there are frequent changes of depth.

In winding the first requisite is the rope, which we are told had better be worked to death, and often replaced, than made heavy and lasting, for the rope is easily the main load in a deep mine; and the less its weight the less must be all other costs. This applies more especially when depths exceed 1,000 yards. Usually a factor of safety of 7 to 10 is employed. Thus in a 1,000 yards' pit the rope and its load will weigh close upon 5 tons if 1-in. diameter, and it will break at  $45\frac{1}{2}$  tons if of plough steel of 110 tons tenacity. Here the actual factor of safety is about 9. With a factor of 7 the rope would be only 0.835 in diameter, and its weight 3,620 instead of 5,300 lb. For the first case a torque of 15,338 lb. is required. The authors work out the moments and negative moments with reference to the danger of over-winding, and so arrive at the heavily stressed rope and conical drum for deep mines, and more especially at the tail rope, whereby moments are kept statically equal. But the tail rope is limited to about 2,600 ft., because of its liability to sway and whip.

In their consideration of these various types of winding systems, the authors show themselves to be unbiased, pointing out the defects of all alike as well as the advantages, and thus greatly helping a mining man to select the best for any particular case. On the subject of electric winding, the authors see little in it on the basis of economy, as compared with direct steam winding, partly owing to the amount of

machinery necessary. But they do realise that electric winding with its regular speed minimises the tendency to dancing the cage and thereby seriously reduces the rope stresses. Is not this factor alone one of major importance in a process which is limited really by rope stresses? In any case, they condemn the conversion of old winders to electrical driving, for this plant must be new throughout. But with transmitted power from a central station for all purposes, electrical winding must surely be adopted. Yet the authors are not even sure on this point. The drum of an electrical winder may be a cylinder, thus saving the cost of the cone drum, for the difference of moment matters less to an electric motor with a powerful source to feed it.

Then tail ropes may be used to a greater depth than in the case of steam winding, for the rope surges less. Also speeds may be higher, which is an important item in deep mines, and though in the multiplicity of gear there is risk, experience does not seem to show such risk to have been great.

If the book has a fault it is that the authors see so far round all sides of every system that the reader is faced about from page to page.

Various examples are given of winding gears, electric and otherwise, with very full particulars, and in arguing out systems actual figures are used and very little mathematics.

Old belting and sheet lead are advised as a better facing for a brake than wooden blocks, but the belts must be of rubber, not of balata. And post brakes are better than hand brakes. Pit sheaves, if lined with wood, should not be done at home and exported. They should be done locally from indigenous timber. This is a practical point doubtless picked up in dry Australia, where imported articles of timber so seriously shrink on exposure to the parched atmosphere. Safety gears against overwinding on the illness of the engineman are described, and a special chapter is given to ropes, and is very good. Then there is a chapter on cages and safety hooks, &c., and guides, and another on cages and decking in coal mines. The whole is a thoroughly sound and practical treatise on the subject of winding, a subject of increasing importance, as mines become deeper and low-grade propositions become more common, for these require such a heavy winding tonnage to bring up with the pay stuff so many tons of dirt.

*La Télégraphie sans fil, la Télémechanique, &c.* By E. MONIER. Paris: H. Dunod et E. Pinat. Sixth edition, revised and enlarged. Price 2 fr. 50 c.

This edition has been supplemented to bring it in accordance with more modern practice. Among the additions are descriptions of the uses which may be made of radiophores or shore stations giving directive transmission to enable ships to obtain their bearings and distances; methods of transmission giving musical notes; wireless telephony, &c. A special chapter is devoted to a description of the important Eiffel Tower station. Branly's method of producing mechanical results at a distance by means of Hertzian waves still forms a main feature of the work, but no special advances in this direction are recorded. They appear to be still very much in the air. Numerous other possible applications of electric waves are suggested, the author being evidently of a very sanguine turn of mind.

*Wireless Telegraphy for Amateurs.* By R. P. HOWGRAVE-GRAHAM. London: Percival Marshall & Co. Revised edition. Price 2s.

This interesting and useful little work for amateurs has been somewhat extended and improved since its first appearance.

The first two chapters are devoted to the outlines of the history and theory of wireless telegraphy, while the remaining chapters mainly concern practical methods so far as they are desirable for the amateur. In regard to the former part, the author is inclined to lay too much stress on absence of tuning in the early forms of Marconi transmitters. The earliest Marconi aeriols consisted of elevated capacity areas which undoubtedly gave efficient syntonie transmission, but the receiver was not adapted to make effective use of the

syntonic properties of the transmitter. Such aeri-als will ordinarily emit trains of waves with quite small damping, though there may be a weakness in selective properties arising from their tendency to produce shock excitation.

A point of criticism in regard to the efficiency of quenched spark transmitters may also be usefully referred to. The overall efficiency is said to be about 75 per cent., as against 25 per cent. for the unquenched spark. Possibly this is a fair statement so far as the production of energy in the aerial is concerned, and it is one which is commonly made. It does not follow that the radiation efficiencies are in this proportion, since the dissipative factor is made up of a radiative and a non-radiative part. The ratio of these two parts may be quite different in the two cases. The point is one which demands considerably more investigation than has yet been given to it.

On the whole the book is well suited to young amateurs, to whom it should prove a helpful acquisition, both from its simplicity and from its interest.

*Magneto and Electric Ignition.* By W. HIBBERT, A.M.I.E.E. London: Whittaker & Co. Price 2s. net.

The author, who is the head of the Physics and Electrical Engineering Departments of the Regent Street Polytechnic, has already written a book entitled "Electric Ignition for Motor Vehicles," but, in view of the way the high-tension magneto has practically displaced all other forms of ignition on automobiles, he has deemed the time appropriate to produce an entirely new work on the subject, on which, on the whole, he is to be complimented. He has set out with the object of endeavouring to impart to the ordinary non-technical motorist some idea of what goes on in connection with the production of the spark, the vagaries of which, in the early days of the motor movement, were the cause of much worry and anxiety, but which, in the hands of experts, has in modern times been so tamed as to behave with wonderful regularity, and, given a modicum of attention, with a minimum of trouble.

The introduction, which extends to 30 pages, will repay careful study, as Mr. Hibbert, in the method adopted of explaining the fundamental principles, has been very happy, his definitions being clear and striking, notably those explaining the difference between "electricity" and "a current of electricity," and his comparison of the human heart and its influence on the circulation of the blood, with the production of a mechanically-generated current of electricity and its distribution, most apt. Following the introduction is a description of a number of the best-known magnetos at present on the market, such as the Bosch, Eisemann, Simms, C.A.V., Mea, and Fuller. This section is useful so far as it goes, but if a motor-cycle type of magneto had been included, the book would probably have appealed to a much wider circle of readers.

Another useful chapter is that devoted to "gearing"; this deals with the relative speeds of magnetos and engine cranks, the firing sequence for motors with from one to eight cylinders and cranks being given, accompanied by diagrams. Seeing that, so far as motor-cars are concerned, the type has long been obsolete, the firing sequence of three-cylinder engines might, perhaps, have been advantageously replaced by that for the V-type of twin-cylinder motor now being largely used on cycle-cars. There is a good deal of other information in the book, which, while instructive to an extent, will not prove of much value to modern motorists and motor-cyclists, as, for instance, the description of low-tension magnetos with make and break inside the engine cylinders, a method which is no longer used on automobiles. A similar remark applies to the 40 pages (out of a total of 152) devoted to "Ignition by Battery and Coil," and "Faults in Cells," although the latter may serve a useful purpose to those owners of cars that have electric lighting installations fitted. The last chapter deals with dual or combination-ignition systems, with a brief reference to the Delco electrical arrangement for engine starting, lighting and ignition, as employed on the Cadillac cars. The promising future for arrangements of this kind—several new ones have lately been introduced—renders it desirable to embody as early as possible as much information as can be given of the different systems, and of the points that need

care and attention, and this section will doubtless be extended in the next edition.

Apart from the few points we have criticised, Mr. Hibbert's book leaves a good impression, and can be well recommended to motorists, particularly to those who drive and look after their own cars.—C. J. W.

*Applied Electrochemistry.* By M. DE KAY THOMPSON, Ph.D. London: Macmillan & Co., Ltd. 1911. Price 9s. net.

This book, unlike existing text-books treating of special branches of the subject, covers the whole field of applied electrochemistry and electrometallurgy, and, on that account, should prove very useful to students unable to consult a whole range of books or the original sources. Its special feature is a theoretical discussion of the scientific principles of each process before giving the description of the process as realised in practice, so that the closest possible connection is maintained between theory and practice, to the obvious advantage of both. A sound knowledge of chemistry is rightly assumed; a person with only a smattering of chemistry is in a position neither to understand nor to work efficiently modern electrochemical processes.

As already stated, the book covers practically the whole field of the subject, but the treatment accorded to the various branches is very unequal. Thus, while the chapter on the electrolysis of alkali chlorides is admirably clear and well covers the ground both on the theoretical and the practical sides, that on electroplating is so thin and superficial as to serve hardly any useful purpose. To a less degree this applies to other chapters in the book.

In the chapter on electrometallurgy of iron and steel there is no reference to the important subject of ferro-alloys. We think, moreover, that more attention should have been paid to the pure metallurgy of the subject. It is very strange how little it is realised, even by many practical electro-metallurgists, that an electric furnace is primarily a metallurgical apparatus, and it is on its merits as such, rather than on its electrical efficiency, that it will succeed or fail. Neither here nor elsewhere is sufficient stress laid on the all-important question of costs, which, in our opinion, should be brought before the student at the earliest stage of his technical career. If the simple principle were borne in mind that a new process will succeed not on account of its beauty, but because it does something more cheaply or better than it has been done before, the world would be spared much wasted effort and ill-spent invention.

In spite of these undoubted limitations, which, as a matter of fact, are unfortunately the common faults of nearly all technical books, Dr. de Kay Thompson has given us a very well-written and a very comprehensive text-book on a subject that is most difficult to write about both clearly and soundly. He has avoided most, if not all, of the pitfalls that abound, and his book is a welcome addition to the still scanty English literature on a subject which is every day becoming more and more important.

**Electric Arcs to Ignite Tunnel Gases.**—Large quantities of gas were encountered during the cutting of the aqueduct tunnel through the Santa Ynez range (California) for the water supply of Santa Barbara, and in order to dispose of this inflow, electric arcs were used to ignite the gas after firing shots in the heading. Specially designed open lamps were placed about 200 ft. apart in high points along the tunnel up to 150 ft. from the heading. Half an hour after blasting the arcs were switched into circuit (an ammeter at the switch indicating whether the arcs lighted or not). After switching on the lamps controlled from the tunnel mouth, the foreman and a mate advanced to another arcing station 3,500 ft. from the portal, and again switched on current. If no gas explosion occurred, the tunnel ahead was explored with safety lamps, and if no "pockets" were discovered, the inspectors returned to the in-by station, switched the arcs into circuit, and, leaving them alight, proceeded to the heading and placed torches at intervals of 100 ft. through the gas section. These torches were kept burning during the next shift, and four hours were occupied in testing before a heading gang was allowed to go on shift after blasting had been performed; apart from these testing intervals, work was continuous. The completed tunnel is 19,560 ft. in length.—*Electrical World.*

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

## The Electro-Harmonic Society.

I was very pleased to read your footnote to the letter which appeared in your issue of March 7th. In order to anticipate criticism of my remarks, I will state at the outset that I smoke, drink, go to Bohemian concerts and am a Democrat—all in reason. But (and this is important) just as the strength of a chain is that of its weakest link, so the tone of any assembly is determined by the laxity of its rules.

Now I do not wish to say too much about what is, obviously, a delicate matter; but one of the privileges of belonging to the E.H.S. which a social or financial junior enjoys, is that he mixes with the seniors of his profession or industry. Once introduced smoking, and drinking will surely follow. Even then no harm would be done if all the members were seniors—but it is not necessary to push my argument to its logical conclusion. Suffice it to say that the majority of members, who like the present high tone of the E.H.S., and who can be in a lady's presence without feeling the necessity to smoke—would either resign or cease to bring their womenfolk.

Whilst it is true that we must move with the times, music halls and cinemas have not superseded theatres and concert halls. Similarly, Bohemian concerts need not supersede our ladies' nights, and those who prefer the former exclusively will find plenty of opportunities to gratify their taste.

Member, E.H.S.

## Electric Branding.

I should be much obliged if you could assist me, through the medium of your paper, in finding some manufacturer who has had experience of electrical heating of large-size branding machines for marking wooden box sides; the maximum overall sizes of the branding would be 3 ft.  $\times$  2 ft.

Any assistance that you could give me in this matter would be very much appreciated.

H. A. Nevill,  
City Electrical Engineer.

Wakefield, March 13th, 1913.

## Morse Signalling on Submarine Cables.

As a sequel to Mr. E. Raymond-Barker's article on Mr. Gott's discovery, and the observations made thereon by Mr. P. O'Neil and Mr. Fraser, will you give me leave to recall to the mind of your readers a telegraphic system of old date, viz., "The American Rapid Telegraph," patented by Messrs. Foote, Anderton and Randall, and described in some technical papers about the years 1879 or 1880. I, at that time, experimented with this system and was very much impressed with a most ingenious mechanical apparatus, invented to prepare the perforated slip, by means of which the currents were sent and changed in direction at each consecutive signal. Nevertheless, however great may have been the ingenuity of this mechanism, I do prefer incontestably (at least on lines with a return current) the method devised by Mr. Gott for realising this part of his discovery. It is not only as simple as it is elegant, but, above all, more electrical, sure, and much less expensive.

If I were not afraid to abuse the hospitality of your columns, I would add another souvenir: 25 years ago, an Italian inventor, the late Marquis Tommasi, had contrived a secret arrangement which appeared to me to be founded upon the same principles. His apparatus were locked up in a closed box, because intended for military purposes by Marquis Tommasi, who was convinced of the impossibility for a spy to decipher the signals fraudulently obtained either by means of a derivation, or otherwise—therefore, he was extremely amazed when I presented to him a correct slip obtained in such a manner with the help of two parallel

polarised relays and a Morse inkwriter, and he left very politely, but without further explanation concerning his invention.

F. Godfroy, Manager,  
Compagnie Française de Câbles Télégraphiques.

Brest, March 10th, 1913.

## The "Load-Factor" Question.

In fixing yearly contracts for the supply of current to factories, &c., on a load factor basis, I shall be glad to have the opinion of some of your readers as to whether the time element should be for, say, a certain number of days, the number of days run  $\times$  24, or the actual hours run by the factory.

Consumer.

## LEGAL.

## TRAMWAY ACCIDENT CLAIMS.

A ROAD accident, in which the driver of a phaeton, named Frederick William Betts, was seriously injured, was the subject of an action in the King's Bench Division, on Wednesday, March 12th. The L.C.C. as owners of the electric tramways, and Mann, Crossman & Paulin, Ltd., the owners of a motor lorry, were the defendants. On August 12th last the plaintiff was driving his employer's phaeton in the High Road, Streatham, when the brewers' lorry, while passing the tramcar, was struck on the hub of his wheel. The blow caused the lorry to swerve and collide with the phaeton, throwing the plaintiff out and pinning him against the wall, causing injuries from which he still suffers. The injury was not disputed, and the only question for the jury who tried the case was whether the tramcar or the lorry was to blame. A large number of witnesses were called by both the L.C.C. and the brewers, each of whom tried to cast the blame on the other, and in the result the jury found for the plaintiff, as against the L.C.C., assessing the damages at £800, and for the defendant in the case against Mann, Crossman & Paulin.—Judgment was entered accordingly.

A Court of Session action has been settled in which a vanman claimed payment of £500 as damages for personal injuries from Glasgow Corporation. While driving a van he was run into by a tramway-car. A payment has been made by the Corporation, which the pursuer has accepted, of £65 and expenses.

Sheriff Umpherston heard proof in the Sheriff Court in three conjoint actions against the Dunfermline Tramway Co. for damages in respect of personal injuries. Pursuers were a miner and an engineman and his wife, who were passengers. They each claimed £100. It was their contention that a car was being driven at such an excessive and dangerous rate of speed that it failed to negotiate a loop, and, jumping the metals, ran into an embankment. Defenders, on the other hand, stated that the car left the rails through some obstruction on the line, and that it was almost immediately thereafter pulled up by the driver. The driver, they state, drove cautiously and carefully while approaching the crossing. The hearing was adjourned.

## THE NATIONAL TELEPHONE CO., LTD., v. H.M. POSTMASTER-GENERAL.

THE Court of Appeal on 14th inst. decided to hear the appeal and cross-appeal from the decision of the Railway and Canal Commissioners respecting the purchase, on April 15th.

## DISPUTE ABOUT AN ACCUMULATOR SHED.

THE question whether a shed erected by the Metropolitan Railway Co. in Euston Road to hold accumulators for electric signalling, comes within an exemption of the London Building Act of 1894, although it is erected beyond the building line, was decided on Friday, March 14th, by Justices Channell, Bray and Coleridge in the King's Bench Divisional Court.

MR. MACMORRAN, K.C., who appeared for the Metropolitan Railway Co., said his clients had been convicted by a metropolitan magistrate for an offence under the London Building Act. It appeared that they were given power in their Act to erect a ventilator in the forecourts of two houses in Euston Road. That was at the time the trains were run by steam. When the railway was electrified, a system of electric signalling was installed, and the ventilator was removed and an accumulator shed erected. The County Council then alleged that the company had no right to erect the shed beyond the building line without the sanction in writing of the Council, and that they had been guilty of an offence. For the company it was contended that they were exempted by a proviso in their Act of 1866, and a section of the London Building Act. The magistrate, however, decided in the Council's favour. Mr. Macmorran argued that the mere fact that the ventilator was succeeded by an accumulator shed did not

alter the fact that what was erected on the spot was something for the purposes of the railway, and although that was beyond the building line, it was exempted.

After hearing Mr. DALRY for the London County Council, the Court allowed the appeal, with costs, holding that the shed, as it held accumulators for electric signalling, was necessary for the purposes of the railway and was, therefore, within the exemption in the Building Act of 1831.

THE OSRAM LAMP WORKS, LTD., v. THE YORKSHIRE  
INCANDESCENT ELECTRIC LAMP CO.

IN the Chancery Division, on Friday, March 14th, Mr. Justice Swinfen Eady had before him a motion in the above action.

Mr. LUNGE, who appeared for the plaintiffs, said that the matter had stood over until that day for the purpose of plaintiffs receiving the defendants' evidence. No reply to his clients' affidavits, however, had yet been received, and he would ask that the matter should be allowed to stand over again for the purpose of complying with a somewhat singular request. Plaintiffs' evidence was exceedingly succinct, and to the point on the question of infringement, but it was suggested that the defendants desired to send to Germany, where the filaments of the lamps in question were made, for the purpose of ascertaining whether there was any infringement or not.

His LORDSHIP: Is it another Osram lamp petition?—MR. LUNGE: Yes.

Mr. FROST, for the defendants, said the filaments of the lamps complained of were made in Berlin by a well-known firm there. The defendants desired to make their evidence stronger, and to get it as complete as possible.

His LORDSHIP: When did you have the plaintiffs' evidence?—MR. FROST: About a fortnight ago. We have been in consultation with German manufacturers through their agents, and yesterday we reached the stage that they will demonstrate to us the process by which the lamps were made and permit us to take an independent expert with us.

His LORDSHIP asked why the defendants could not file an affidavit stating exactly what the process was. They could surely have done that in a fortnight.

Mr. FROST said they thought their case would be stronger if they got independent evidence by means of experiments.

His LORDSHIP: Never mind the experiments; why don't they show exactly the way they are made? That could easily be done if the gentleman who makes the lamps were to file an affidavit.

Mr. FROST said his clients were very busy communicating with the manufacturers.

His LORDSHIP: Do you mean they are busy making the lamps or making affidavits?

Mr. FROST said they were busy preparing the evidence. The plaintiffs should have the evidence directly defendants had got it themselves.

His LORDSHIP said defendants could easily file evidence showing how the lamps were made; it need not be long.

Mr. FROST: It will not be long, but we wish to make it quite clear that there is none of the mysterious water vapour.

His LORDSHIP: Set out your process in plain English!

Mr. FROST: That is what we are going to do.

His LORDSHIP said he would let the motion stand over until the first motion day of next sittings, but the defendants must be ready then or, in the ordinary course, judgment would go.

WATSON, LAIDLAW & CO. v. POTT, CASSELS & WILLIAMSON.—  
APPEAL.

THE Second Division of the Court of Session last Friday disposed of an appeal in the action by Watson, Laidlaw & Co., 93, Dundas Street, Kingston, Glasgow, against Pott, Cassels & Williamson, Motherwell, for interdict against the infringement of pursuers' patent for improvements in centrifugal machines, and for £5,000 damages. Pursuers, having obtained a judgment on the question of infringement, the case was remitted to Lord Dewar to dispose of the question of damages. Defenders lodged a tender of £1,500, and the Lord Ordinary decreed against them for that sum in full of the conclusions for damages, found defenders liable in expenses to the date of the tender, and found pursuers liable in expenses since that date. Pursuers appealed against the finding as to damages. Lord Dundas, in giving the decision on the appeal, held it was fairly established that the loss of profits which the pursuers might have realised, if they had effected all the infringing sales of machines, 252 in number, amounted to very nearly £5,000. Considerable deduction must, no doubt, be made, but his Lordship thought £1,500 quite inadequate, and that the Court would not be treating defenders with any severity, but with some leniency, if it fixed the damages at £3,000. The other judges concurred in this opinion.

**Meeting of Creditors.**—A meeting of the creditors of Wm. HENRY MICKLEWAITE, electrician, of Belmont Terrace, Forest Road, Knarsborough, and 12, Coronation Grove, Harrogate, was held at York on March 13th. The accounts showed gross liabilities amounting to £214, assets valued at £113, and a deficiency of £101. The estate remains in the hands of the Official Receiver for realisation.

RADIOPHARES NEAR BREST.

WHEN, in time of fog, luminous signals from lighthouses or ships cannot be seen, the risk of disaster on dangerous coasts is enormously increased unless warning code signals are dispatched and received by "wireless" from a coastal station. By noting the intensity of the signals received, an approximate idea of the distance from the sending station can be formed by a skilled wireless operator—particularly if the signals be continuously compared with those from another station situated at a second point on the coast. The installation of a Blondel orientation frame or a Bellini or Arton radiogoniometer on board a vessel enables the bearing of the latter to be determined fairly accurately with regard to two coastal stations. Were every vessel equipped with wireless transmitting apparatus, a more convenient arrangement would be to provide directive aeriels at two land stations, thus enabling the latter to

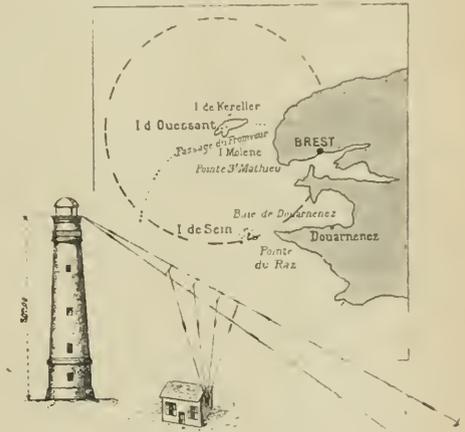


FIG. 1.

determine the bearing of any ship issuing inquiries, and then to communicate the bearing to the vessel. Even the simplest form of radiophare, emitting a pre-arranged code signal but employing and requiring no directive aerial, enables rough bearings to be taken by the navigator of a vessel, and prevents those radical misapprehensions which are so frequently the cause of disaster; the assistance thus rendered, supplements such information as is obtainable by sounding, dead reckoning and by listening for submarine signal bells, and it is more than probable that such radiophares—emitting signals capable of reception by all ships equipped with receiving apparatus costing only a few pounds, and capable of manipulation by any member of the crew—will soon be installed in as great numbers as light ships and houses are at present.\*

The French Admin. des Phares has lately installed radiophares at the entrance to the Port of Brest (see fig. 1), the equipment in each station comprising an alternator driven by a petrol or electric motor, an automatic transmitter and a suitable aerial. Referring to fig. 2, showing the general lay-out of a radiophare equipment, a Bêthend alternator A (125 volts, 1 key. per second), enables resonance to be established once for all between the primary and secondary circuits of the transformer T (secondary pressure 10 kv.). A board mounted above MA carries the requisite switch-gear and measuring instruments. The whole of the high-tension equipment is mounted in a glazed case with an automatic isolating switch on the door, so that the attendant is exposed to no danger. Four 30-kv. Moscicki condensers are used, and the spark gap E is composed of a brass tube and copper plate; the former is ventilated by a small electric fan v above the transformer. A motor-driven

\* It is not, however, to be expected that visual or any other signals at present in use will be abolished, even when the provision of radio-receiving apparatus is compulsory on every vessel. Fast elements of uncertainty must always enter into the problem of securing the safety of ships at sea, and every possible means must be adopted to attain this end. Luminous signals depend on no delicate receiving apparatus, if they can be seen at all; but they may become useless, almost at a moment's notice, owing to the formation of fog. Again, wireless transmitting and receiving apparatus has now attained to a high degree of reliability, but it is difficult to see how a certain considerable risk of derangement can ever be completely avoided in sets designed for use by unskilled men on small vessels. Under such circumstances, the most trivial defect may completely prevent the reception of radiophare signals, just as an "accident" of nature may render ineffective the most powerful lighthouses. Every safety measure must, therefore, be simultaneously adopted.

Blondel automatic transmitter\* is employed to make and break the small field current of the Bèthenod alternator, and the whole equipment operates automatically without any attention for at least 30 hours.

The International Radio-Convention, held in London last year, determined 150 m. as the maximum wave length, which should be employed by radiophares,† and the Brest aerial has been designed to transmit radiations of from 80 to 150 m. wave length up to distances of 30 nauts. As shown in fig. 1, the guy-cables carrying the

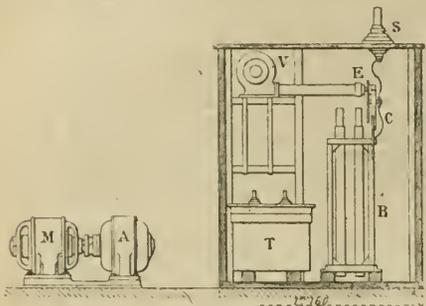


FIG. 2.

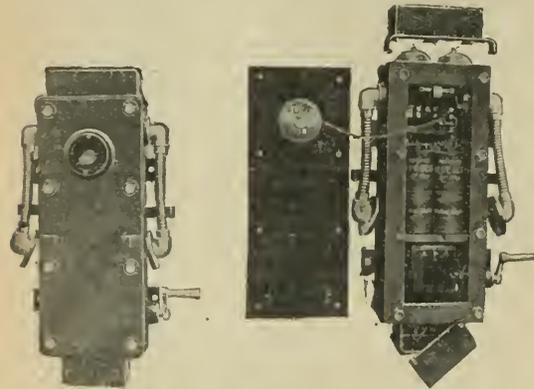
four radiating aerial wires are anchored to the platform of the existing lighthouse; the aerial remains suspended, and working can be continued, even should one of the guy-cables break.

The whole radiophare equipment described costs hardly as much as a wireless equipment for ships, and can be attended and operated by the present lighthouse staff. The equipment needed on ships to enable them to take advantage of this service costs from £14 to £16, and can also be used to receive time signals and weather reports from the Eiffel Tower and other stations which have now established a regular service of this kind.—*Génie Civil*.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Mining Telephones.

THE WESTERN ELECTRIC CO., LTD., of North Woolwich, have introduced a new pattern of mining telephone to comply with the requirements of the Home Office in gassy mines. The set, which



FIGS. 1 AND 2.—W.E. MINING TELEPHONE SET, OPEN AND CLOSED.

is illustrated in figs. 1 and 2, is a local-battery magneto set, enclosed in a heavy cast-iron case, which is neither airtight, gas-tight nor watertight. Special provision is made for the drainage of any condensed moisture, and an explosion-proof flange joint

\* Two contact makers are connected in series. In the present case, one contact is closed by a cam for 10 secs. at intervals of 30 secs., and the second contact is opened and closed continuously, and repeatedly transmits the code call of the station during the period in which the first contact is closed. By varying the control cams, an indefinite number of code-signals can be arranged, and there is nothing (beyond general undesirability), to prevent three contacts being used in series to provide more complex signals.

† In order that the continuous working of these stations should not interfere with other wireless work. At Caennant a radiophare, is only 1½ miles from a public service station, the operation of which is, however, in no wise affected by the 195 m. waves used by the radiophare.

prevents the transmission of flame from the interior to the surrounding atmosphere—this being the chief feature of the set. The transmitter is fixed on the cover, with a steel guard, and the receivers are mounted on rotary arms with short hinged tubes and earpieces. All the apparatus is so arranged that it can be removed from the set while it is in position, and the internal dimensions have been made as small as possible, to reduce the risk of explosion. The magneto generator is permanently bridged across the circuit and the only chance for a spark to occur is when the contact of the switch-hook is broken on the completion of a conversation. The set is fixed to the support by steel plates screwed to the case, so that there is no danger of damaging the castings when driving or drawing spikes. Every precaution is taken to render the apparatus reliable and foolproof, and to provide for the replacement of parts by an unskilled attendant.

### New Fuse Box.

THE METALLIC SEAMLESS TUBE CO., LTD., Wigan Street, Birmingham, are marketing a new pattern fuse box, which is supplied single and double-pole, and tapped to receive ½-in. or ¾-in. conduit. The boxes are fitted with either single or double



FIG. 3.—NEW PATTERN FUSE BOX.

pole fuses, which are mounted on a small slate base with a dividing fillet in the case of the double-pole box, and fitted with pillar-type terminals for front wiring, with a capacity of 5 to 30 amperes.

## BUSINESS NOTES.

**Consular Notes.—Argentina.**—The British Consul at Buenos Ayres reports that the output of the German trans-Atlantic Electrical Co. during 1911 was as follows:—Light, 46,909,800 kw.-hours; power, 18,200,500 kw.-hours; traction, 63,718,800 kw.-hours; total, 128,829,100 kw.-hours. The returns of the same company for 1910 show a total of 97,927,900 kw.-hours. A syndicate of British, French, Belgian and American bankers is reported in the newspaper Press to have formulated a scheme for the building of an electric power station at Buenos Ayres for the supply of electricity for motive power and lighting purposes at prices considerably below those at present prevailing. A concession was applied for, which would bring the German monopoly of the supply of electricity to an end. The proposed contract stipulated that the plant should become the property of the Government at the end of 1957. Italian financiers are also said to be endeavouring to obtain a similar concession, the new company to be known as the Italo-Argentine Compania de Electricidad. The German company having their mains extended to every part of the capital, are naturally firmly established in this city.

The British Vice-Consul at La Plata reports that the British Electric Light and Power Co. inaugurated their new station on March 10th, 1912, and it was understood to be their intention to double the capacity of the station. The La Plata Electric Tramways Co., Ltd., are now laying rails from La Plata to the Port, thus giving an electric tramway connection, in addition to the railway service. There are several new concessions applied for by the existing tramway companies for the extension of their lines, the principal one being that asked for by the La Plata Electric Tramways Co., Ltd., for the outskirts of the city, and to connect up with the new station of the provincial narrow-gauge railway. The telephone wires in the town are now being put underground, and the area lighted by gas or electricity is being extended.

The British Consul at Buenos Ayres, reporting on the tramways of that city, states that although the streets in the centre of the town are only 10 yards wide, the excellent service of the Anglo-Argentine Tramway Co. flies in almost every street. The cars

are worked on single tracks laid along the side of the street within 15 in. of the narrow foot pavement, and receive their power from overhead cables. The ear routes intersect one another at the end of every block of buildings, that is, at intervals of about 450 yards, and are undoubtedly a great source of danger to pedestrians. Blocking of the traffic in the centre of the town is of frequent occurrence, notwithstanding that the cars, as well as all other vehicles, are allowed to run in one direction only in each street, i.e., up one street and down another. With the increase in the population the congestion of the street traffic is becoming a difficult problem to deal with, and it will sooner or later have to be met by the adoption of either underground electric railways, or by a system of overhead tramways. A scheme has, in fact, been put forward by the Argentine Tramway Co., for the construction in the congested area of underground lines to work in conjunction with the present lines. The total length of tramway track is about 450 miles. The traffic receipts of the various tramway companies in Buenos Ayres during the first seven months of 1912 amounted to £1,886,100, representing the fares of 217,292,200 passengers. In 1910 and 1911 the traffic was as follows:—

	Passengers.	£
1910 ... ..	323,782,700	2,658,600
1911 ... ..	353,682,900	2,930,000

**Honduras.**—The British Consul in Honduras reports that at present all contracts for public works, all concessions for railways, &c., are given to United States contractors. The Government does not make public such contracts, and, indeed, does not even initiate them, but generally waits until some enterprising contractor makes suggestions and submits prices. There is no reason why British firms should not receive a part of the business. They should make themselves known to the Honduran Government, and appoint an agent in the capital to keep them informed of any likely business. This the Consul cannot do for obvious reasons, and principally because these negotiations are usually kept quiet until the contracts are signed.

The ports on the north coast have sprung so rapidly into being with the construction of railways that no doubt their importance has not yet been realised by British merchants. They would be well advised to send out representatives to examine the trade possibilities, which, although at present comparatively small, are likely to grow rapidly and to be of great importance before British merchants are able to get into the market. Our United States competitors are not only supplying articles which British manufacturers could supply if they took an interest in the market, but they are gradually learning to manufacture goods after the British style, although not so good in quality or so advantageous in price. Nevertheless the orders being small and the delivery from the United States more rapid, together with the total absence of British commercial travellers to show their goods and arrange terms of credit, the merchants very naturally take little interest in British trade. There is no doubt that British firms could, if they made an effort, regain a large part of the trade that has been lost. This is the opinion of a great number of merchants. But an effort must be made. It is not sufficient just to send out catalogues in English. They must be printed in Spanish, otherwise they are of little value; and at the best catalogues, unless followed up by commercial travellers, are little more than an unattractive bait to merchants who have long been used to the misrepresentations in foreign catalogues. Terms of credit, too, must be made attractive and such as to suit the exigencies of the local money market, which is entirely dominated by the banana crop. For example, when drought sets in or heavy winds blow down the crops, money is scarce and merchants are unable to meet their obligations punctually. United States travellers watch and understand perfectly the embarrassments of their clients, and consequently arrange to meet them half-way. There is no apparent reason why British manufacturers should not imitate their competitors and seek to manufacture that which suits the market at attractive prices, even if the particular article must be inferior in quality. The trade of Germany with the Atlantic coast of Honduras is small at present, but is likely to expand now in view of the new steamship service opened up by the Hamburg-American Line between Hamburg and Puerto Cortez. In June last an experiment was made by the company to carry bananas from Cortez to Hamburg. The venture was, it is said, a great success, and since then two other voyages have been made. It will, therefore, readily be seen what an advantage this will be to German trade, and British firms would do well to follow the example of their competitors.

**Catalogues and Lists.**—**Messrs. GENT & Co., LTD.**, Faraday Works, Leicester.—Catalogue No. 12 (44 pages) containing illustrations, brief particulars and prices, of a variety of electric bells and telephone instruments for domestic, office, mining and other service; also indicators, batteries, cables and wires, and accessories. A hanging wall show-card is to hand illustrating their "Electromatio" telephones (automatic C.B. interphones). Further, we have received a copy of a testimonial from the rector and churchwardens of Ruardean Parish Church concerning the satisfactory service that is being rendered by a Gent electric clock installed three years ago in the church tower.

**Messrs. NEVILLE & Co.**, Midland Electrical Works, Brazebridge Street, Birmingham.—40-page art paper catalogue, giving illustrations with prices of a representative selection of electric light fittings—brackets, ceiling fittings, pendants, electroliers, hall pendants, lanterns, floor and netel standards, luminous and Bastian type radiators and advertising signs.

**INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS, Co., LTD.**, Silvertown, E.—04-page catalogue arranged and fully illustrated

catalogue of "Silvertown Instruments," including Morse and Wheatstone apparatus, sounders, portable testing sets, vibrators, lightning protectors, reflecting and needle galvanometers, portable batteries for testing sets, resistance boxes, the Appleyard conductometer, testing keys, condensers, switches and commutators, patent terminals, water-level apparatus, and numerous other manufactures of the same character.

**Messrs. SIMPLEX CONDUITS, LTD.**, Garrison Lane, Birmingham.—Eight-page list (No. 477, catalogue section "W") giving tabulated particulars and prices of wires and cables, including the usual grades of vulcanised cables for electric lighting, flexible cords, and bell wires.

**THE SUN ELECTRICAL Co., LTD.**, 118-120, Charing Cross Road, London, W.C.—Thirty-six page catalogue (Section "S"), in which they give full information, with numerous illustrations, also photometric tests, and prices, concerning their "Sunlite" and "Sun-line" reflectors. The contents in the main include wireless china, lineal, curved picture lighting, box, and other reflectors, window reflector signs, window fitting lighting accessories, indirect lighting fittings, outside lanterns, and metal and carbon lamps for same. The picture lighting reflector described, concentrates the light upon the middle portion of the picture where it is most desired. It is fixed at the top close to the picture, and can be decorated to harmonise with the frame or surrounding decoration.

**BRITISH ARC WELDING Co., LTD.**, Suffolk House, Laurence Pountney Hill, E.C.—Pamphlet describing the system employed (using an iron welding pencil instead of a carbon rod, so as to avoid a hard weld) in repairing ships' boilers, furnaces, frames, gears, &c., in position, with the aid of portable generating plant. Numerous illustrated examples of work done are given.

**THE BRITISH THOMSON-HOUSTON Co., LTD.**, Mazda House, London, E.C.—New edition of their folder "The Necessity for Scientific Reflector" (S. 2,317), dealing briefly and popularly with the functions and advantages of a scientific reflector. The contents include description and prices of Veluria, Holophane and Mazda reflectors, also galleries and Mazda lamps. Folder No. S2,319 describes and prices the various types of "Veluria" reflectors. These have not long been on the market, but they are already widely used.

**Messrs. SIEMENS BROS. DYNAMO WORKS, LTD.**, Tyssen Street, Dalston, N.E.—Price list No. D7 (12 pages) giving illustrations, prices and other particulars of close upon 20 different designs of their rise and fall pendants for dressing rooms, &c.

**Trade Announcements.**—**MR. G. ELLAM** (who for some years has acted as branch manager of the supply department of the British Westinghouse Electric Co. for the London district) has been appointed assistant manager of the supply department at the company's headquarters at Long Millgate, Manchester. **Mr. F. Rook** (late of Messrs. Baxter & Caunter, London) has been appointed to succeed Mr. Ellam as London branch manager of the supply department at 179, Wardour Street, W.

**Messrs. G. HARLAND BOWDEN & Co.**, announce that for greater convenience in their business, they are moving their offices from the City to Westminster. Their address is now 1, Victoria Street, Westminster, S.W.; telegraphic address, "Harbowdeco, Vic., London"; telephone number, "Regent 1009."

**Book Notices.**—*The Chemical Trade Directory, 1913.*—London; *The Chemical Trade Journal.*—This is the fifth edition of a very serviceable work, in which there are arranged both alphabetically and in classified sections, the names of chemical manufacturers, merchants, brokers and agents, and makers of chemical plant in Great Britain and Ireland. The closing section of the book (some 20 pages) contains a copy of the Alkali, &c., Works Regulation Act of 1906, an abstract of the Alkali Report for 1911, a statement from the Census of Production relating to the chemical trades, price diagrams of metals, chemicals, acids, &c., also tabular statistics regarding three years' exports and imports of chemicals and allied products.

"Science Abstracts." Vol. XVI, Part 2. February 25th, 1913. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Transactions of the N.E. Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 4. March, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"Transactions of the Institution of Engineers and Shipbuilders in Scotland," Part 5. 1912-13. Glasgow: The Institution.

"Journal of the American Society of Mechanical Engineers." Vol. XXXV, No. 3. March, 1913. New York: The Society. Price 35 cents.

**Patent Application.**—Application has been made by **HARVEY HUBBELL** for the restoration of patent No. 15,301 of 1901 for "Improvements in Holders for Electric Incandescent Lamps," which expired on August 6th, owing to non-payment of renewal fee.

**Dissolutions.**—**DEWHURST, TAYLOR & Co.**, mechanical and electrical engineers, Soho Works, South Street, Heywood.—Messrs. A. S. Dewhurst and J. Taylor have dissolved partnership. Mr. Taylor will attend to debts, &c.

**FLAMWELL & SHOTTON**, mechanical and electrical engineers, Church Walk Works, Workop.—Messrs. T. H. Flamwell and E. W. Shotton have dissolved partnership. Debts, &c., are being attended to by Mr. Shotton, who, since January 1st, has carried on the business under his own name at the same address, and will continue to do so.

**Bankruptcy Notices.**—SAMUEL SMITH (Smith & Sons), Victoria Square, Widnes, "*Music and Musical Instrument Dealer*," *Electrical Engineer and General Dealer.*—Receiving order made March 10th at Liverpool, on debtor's petition.

MITCHELL, J. & F. (Fred. Mitchell & Co.), electrical engineers, Ardwick, Manchester—First meeting, March 27th; public examination, April 25th, both at Manchester.

WILLIAM LONGDON and VERNON GEORGE COBB (trading as Longdon & Cobb), electrical engineers, 101A, Derby Road, Nottingham.—The adjourned public examination of the above-named debtors was held at the County Court House, St. Peter's Gate, Nottingham, last week. In answer to the Official Receiver, the debtor, Longdon, said that it was in August of last year that he first found that the firm was financially involved, and the trading losses during the 10 months totalled £250. Asked why he had continued to pay a money-lender 10s. a week after he had met his creditors, debtor said that some of his creditors had expressed the desire that he should go on, and if he had not paid, the money-lender would have taken all his assets. The Official Receiver said he thought that the examination of Longdon should be adjourned. This the Registrar ordered, while the examination of Cobb was declared closed.

JAMES WILLIAM LEWSLEY, electrician, 65, Brierley Street, late 103, Mansfield Road, Nottingham.—The public examination of the above-named debtor was held at the County Court House, St. Peter's Gate, Nottingham, last week, when the case was ordered to stand adjourned in order that an amended statement of affairs might be furnished.

**For Sale.**—The Ayr Corporation has for disposal a number of open-type A.C. arc lamps and accessories. Messrs. Fuller, Horey, Sons & Cassell will, on March 27th, sell by auction the electrical rolling stock used on the "All Red-Route Railway" at the Crystal Palace. See our advertisement pages in this issue.

**Battery Manufacture in France.**—La Société de l'Accumulateur Robust is the name of a new concern which has just been formed at Glos-sur-Lisieux (Calvados), with a capital of £16,000, to manufacture a new accumulator.

## LIGHTING and POWER NOTES.

**Acton.**—The Metropolitan Electric Supply Co. has sent in a tender of £25 for the lighting of the Acton Cottage Hospital by electricity, which very many members of the governing body are in favour of, regarding it as a great improvement on the present methods.

**Altrincham.**—The U.D.C. has received from the Altrincham Electric Supply Co. a portion of the scheme for the suggested lighting by electricity of Railway Street, Stamford New Road, and George Street. This consists of 41 lamps of 100 c.p. each, extending from the foot of the Downs to the junction of Barrington Road and Stamford New Road, the cost of the installation being given as £383. The matter is to be further considered at a meeting of the Highways and Lighting Committee.

**Arbroath.**—A proposal to work the dockgrates by electric power has been under the consideration of the Harbour Trustees, and recently a deputation inspected the electric motor gear at Kirkcaldy Harbour. On the ground that it would take "thousands of pounds to equip the Arbroath dockgrates similarly to those at Kirkcaldy," the proposal has been dropped.

**Argentina.**—The Compagnia Italo-Argentina di Elettricità is the title of one of the two companies which have obtained concessions in Buenos Ayres in competition with the German Transmarine Electricity Co. the other being the Lacroze Co., as previously mentioned in this journal. Originally formed as far back as October, 1911, the Italian company received the grant of its concession in August, 1912, and the plans of the power-station and distributing network are to be completed by the end of April, so that two or three years will have elapsed before the works are completed. The share capital is £440,000, and the undertaking will, therefore, be a comparatively modest enterprise which is said to reckon chiefly upon the custom of the Italian colony in Buenos Ayres. Most of the capital has been subscribed by Italians, the remainder having been furnished by Argentine subjects. Among the former are the firms of Pirelli & Co., of Milan, Franco Tosi, of Legnano, and the Tecnomasio Brown-Boveri, of Milan, who are said to have been induced to participate because Italian firms have no longer been given orders, as in former years, by the German Transmarine Electricity Co. These firms, which respectively make cables, engines, and generating plant, have assured themselves, by co-operation in the provision of the capital, of contracts of the value of £400,000.

**Ashton-under-Lyne.**—A startling discovery was recently made at the Corporation refuse destructor, which adjoins the electricity works. An employé, in delivering refuse to the destructor, discovered among the rubbish a 12-pr. lydite shell, which, on examination, proved to be a live one. Had the shell reached the destructor furnace, there is little doubt that the plant would have been wrecked.

During the past month, 29 street lamps have been converted from gas to electric light.

**Barnsley.**—The Electricity and Lighting Committee has had under consideration a report by the borough electrical engineer, on the condition of the old mechanical stokers at the electricity works, and has decided that four of the original mechanical stokers be replaced by four Bennis sprinkler stokers, at a cost of £525, to be defrayed from the reserve fund.

**Bradford.**—The city architect has been instructed to arrange for the construction of an electricity sub-station at Odsal at the same scheduled rates as those for Thornbury sub-station.

**Brillington.**—Owing to delay on the part of the L.G.B. in holding an inquiry into the Corporation's application for sanction to borrow £4,100 for the installation of a steam generating set at the electricity works, it has been necessary to hold a special meeting of the T.C. to consider the matter. Alderman Colline said the development of the town and the demand for current made it absolutely essential that they should have new plant, and though he did not anticipate that the L.G.B. would place any impediment in the way of the extension, if the Corporation were to cope with the summer demand for current, the work would have to be proceeded with at once. The Council unanimously decided to authorise the Committee to accept a tender of £2,867 for the plant required, and to accept the tenders for the installation.

**Bristol.**—At the last meeting of the City Council, Ald. Lloyd, speaking on the report of the Finance Committee, called the attention of the Council to the fact that in the matter of street lighting it was proposed, with the help of the Electrical Committee, to reduce the cost of electric lighting in the streets by £1,000 in the coming half-year, and stated that, no doubt, there would be a similar reduction in the following half.

At a meeting of the Sanitary Committee held later in the week, it was reported that a letter had been received from the City electrical engineer (Mr. H. Faraday Proctor) setting forth suggested alterations, which amounted to a reduction of the cost of the arc lamps by £2,000 per annum; and the conversion of some 700 gas lamps to electric lamps, to which the current would be supplied free of cost.

**Continental Notes.**—SPAIN.—A comprehensive scheme of water-power utilisation is now being carried out under perpetual concessions by the Compagnie Barcelonaise de Traction, d'Éclairage et de Force. The water-powers are located on the Rio Noguera Pallaresa, the Rio Segre and the Ebre, and are capable of furnishing 300,000 H.P., of which 137,000 H.P. is to be first brought into use by two large and two auxiliary stations. The Seros station, on the Rio Segre, will comprise four generators of a total of 56,000 H.P. and is expected to be set in operation at the end of the present year. In the case of the Los Tarradets station on the Noguera Pallaresa, there will be five generators with a total output of 70,000 H.P., and the work is to be completed in October, 1914. The two auxiliary stations are situated at Talarn and at Pola respectively, and will yield 11,000 H.P., the latter being now finished. The stations of Seros and Los Tarradets, which are both 86 miles distant from Barcelona, will be connected with the latter by means of two transmission lines carried on steel standards, the current being transmitted at 110,000 volts to sub-stations in the suburbs of Barcelona. These lines are already in course of erection, and with their branches will have a total length of 228 miles, whilst the length of the secondary distributing network will be 210 miles at 25,000 volts, and 85 miles at 6,000 volts. It is definitely believed that the company will be able to meet all the power requirements in Barcelona and district, apart from the working of the tramways, which are already in the company's possession. During the past 12 months the company has secured contracts to supply 80,000 H.P., and it is expected that these will have risen to 100,000 H.P. when the first stations are brought into operation this year.

It is stated that an end has now been put to the ruinous competition which has existed for a long time past between the electric supply companies in Madrid, and which has only been of advantage to the consuming public in consequence of the very low prices charged for supply. It has now been agreed that the companies shall form two groups—the Electra and Gamberi on the one hand, and the Union Electrica on the other—and the receipts are to be pooled and divided in equal shares. A joint committee of inspection consisting of eight members has been constituted, and the chairman of each group will occupy the presidency of the committee in alternate years. The tariff, which had fallen to 1.92d. per kw.-hour under the effects of the competition, has been raised to 5.76d. The agreement is for a term of 60 years, and it is expected to be extended shortly so as to include the Hidro-Eléctrica Española and the Hidráulica Santillana.

FRANCE.—A new company has lately been formed in Paris (159 Boulevard Pereire) with a capital of £20,000 and the title La Société Électrique de Saint Priest et Extensions.

RUSSIA.—It is reported that the Moscow Electric Co. has acquired a large deposit of peat in the Bogorodsk district, and proposes to establish a large generating station near the same, with the object of transmitting the current generated to the city of Moscow.

**Crumpsall.**—At a meeting of the Manchester B. of G. recently, the clerk reported that the L.G.B. had sanctioned an installation of the electric light at Crumpsall Workhouse at a cost of £4,755, and also the borrowing of £4,300 for carrying out the work, which has been let to a firm of Salford electrical engineers.

**Darlington.**—Unlike some municipal electricity undertakings, that at Darlington has always been able to show satisfactory results. Up to the end of 1911 the total capital expenditure on generating plant, mains, &c., was about £82,000. The total capacity of the plant, including the batteries and allowing one set for traction and one set as spare, is about 1,900 kW., and the maximum load during the present winter has exceeded 1,800 kW., which is 50 per cent. higher than the maximum load of the previous year. For the nine months ended December 31st last, the output was 60 per cent. higher than that of the previous corresponding period, and for the year ending March 31st next it is anticipated by the Darlington Corporation's electrical engineer, Mr. J. R. P. Lunn, that the output will amount to over four million units. The bulk of this increased output has been taken by power consumers, but there has also been a large increase in the private lighting units. It is estimated that for the current year the cost per unit, excluding only interest and depreciation, will be less than 1d., in spite of the increased cost of coal. This will be the lowest on record for any undertaking with an output of less than ten million units per annum, and there are only five larger undertakings with costs lower than 1d. per unit. There are now 392 motors, representing 4,351 H.P., connected to the Darlington mains, and 14 of the large works in the town are being supplied with electricity for power purposes from the municipal station. Recently a supply has been given to the works of the Cleveland Bridge and Engineering Co., and in this connection and also owing to the fact that it is anticipated that, during the next 12 months, the output will increase by about 300 kW., it has been decided to install a 1,000-kw. turbo-generator with rotary converters and condensing plant, and the cost of these, together with the necessary pipework, foundations and switchgear, is estimated at £7,770. In order to cope with the increased output, it has been decided also to provide a new boiler, which, including fittings, superheater, mechanical stoker, pipework, foundations and setting, will cost about £1,460. There will also be provided an additional feed pump to the two boilers, which will supply the new turbo-generator, and the cost is estimated to be £130, and of two superheaters, including the pipework, £230. An additional coal storage, of 1,000 tons capacity, will be provided, at an expenditure of £470. Accordingly, contracts have just recently been entered into with Messrs. Richardsons, Westgarth for one 1,000-kw. turbo-alternator; with the British Westinghouse Co. for one 750-kw. and one 250-kw. rotary converters; and with Messrs. Babcock & Wilcox, for one water-tube boiler. Application is being made to the L.G.B. for a loan of the afore-mentioned amounts, as also for £530, the cost of a new fuel economiser, recently installed; and for £8,000 for prospective expenditure on mains and services; and for £1,500 for static transformers for supplying alternating current at high pressure and thus reducing the cost of the large power mains.

The Council has decided to fit penny-in-the-slot meters in houses where required, the charge being at the rate of 4d. per unit, including the supply of metal-filament lamps to consumers.

**Edinburgh.**—The Electric Lighting Committee has considered a communication from the Colinton Tramway Co. asking on what terms the T.C. would give it a supply of energy for resupply to Redford Barracks. The company's order entitles it to get a supply of electricity at the boundary for the tramway at the same price as charged ordinary consumers. It was understood from the application for a supply that the company desires afterwards to sell it at its own price. To that attitude objections were expressed by members of the Committee, and the town clerk is to write to the company and the military authorities pointing out the objections. It is stated that the view is that the Corporation should, if possible, supply the lighting direct to the barracks.

**Farnworth (near Bolton).**—The Electricity Committee has decided that the price of electricity for lighting purposes be reduced, from April 1st next, to 4d. per unit, subject to a discount of 1d. per unit if accounts are paid within 21 days. It was also resolved that power consumers of 2,000 units and over per quarter be allowed 10 per cent. of the same for lighting and other purposes, current for lighting in excess of this quantity to be charged for at lighting rates.

**Hereford.**—An inquiry has been held by the L.G.B. relative to the application of the Corporation for sanction to borrow £1,600 for the installation of electric pumping machinery at the waterworks. It was stated that the adoption of the scheme would have the effect of converting the electricity undertaking into a profitable concern, owing to the increased supply of current when the load was lightest. Some opposition was raised, an expert being called, but the Corporation officials declared he was taking a fictitious basis of calculations, and one which was out of date. A petition containing 317 names was put in against the scheme, but several of the chief objectors merely desired the scheme postponing in order that the merits of another make of pump should be considered. The Inspector, however, refused to admit discussion of this pump. It is proposed to use the existing plant as a stand-by, and it was urged by the promoters that if the £1,000 on the cable were not sanctioned, an expenditure of £800 would have to be made to meet the increased demand for current and light.

**Holmfirth (Yorks.).**—The Electricity Committee, last week, reported to the District Council that the Yorkshire Electric Power Co. had declined to supply electricity in bulk, and has recommended that an engineer be instructed to prepare a scheme

for the generation of electricity for the town. The Council already has powers of distribution, and has decided to invite competitive schemes from engineering firms.

**Kirkcaldy.**—The Harbour Committee of the T.C. is considering the substitution of electric light for the gas lighting at the harbour. From figures submitted it appears that for three recent months gas cost £69, while mantles for the same period cost £35. In view of this, the borough electrical engineer is to submit estimates for electric lighting.

**Lowestoft.**—The T.C. has decided that from the current March quarter the charge for energy for power shall be 2d. per unit up to a consumption of 2,000 units per quarter, and 1½d. beyond. The charge for private lighting is to be increased to 5d. per unit, with 5 per cent. for prompt payment of accounts, and the charge for incandescent outside shop lighting is to be increased to 2s. per quarter per fitting.

**Lytham.**—The interesting contest for the right to supply electricity to Lytham between the Lytham D.C. and St. Anne's D.C. reached its final stage on March 13th, when a B. of T. inquiry into the applications was held. Years ago Lytham Council possessed powers to supply electricity, but transferred them to a private company, which did not proceed with the scheme. Within the last two years another effort was made by a local company to supply electricity, but owing to the poor public response the company dropped the scheme. Following this came an application to St. Anne's Council from residents in Ansdell to supply them with electric light. In view of this move both Councils almost simultaneously applied for the necessary powers.

Mr. W. Fielden, of Lytham, presented a petition, signed by 270 ratepayers, against the Lytham application.

Mr. Browne, in presenting Lytham's application, said anyone who had gone over the district would be convinced the area afforded an exceptional field for the supply of electricity. He read a letter from St. Anne's Council offering to supply electricity within the Lytham district at 1½d. per unit for 75,000 units, 4d. per unit for 100,000 units, and at the same proportionate rate down to the minimum of 3d. per unit. In addition, he proceeded, Lytham was to pay the cost of the order. Lytham Council thought the prices were too high, and in January, 1905, entered into an agreement with Messrs. Foote & Milne to carry out the supply of electricity within Lytham. Messrs. Foote & Milne got the necessary order, but they did not proceed, and the order lapsed. The order was revoked in April, 1912, and immediately afterwards the Council took the matter into its own hands. The Board, he claimed, should give preference to Lytham. He did not think the tramway company was in a position to put up a generating station for its own supply. The site of the proposed generating station was near the railway station, and the Council was bound by contract never to put up a chimney and not to use steam upon the site. The proposal was to use Diesel plant.

Mr. J. H. Tonge, engaged to prepare Lytham's scheme, said the first year he estimated the receipts at £2,500 and expenses at £3,000; in the second year, receipts £3,500 and expenses £3,400; and in the third year, receipts £4,300 and expenses £3,600. The profit in subsequent years would continue to increase.

The inquiry was continued on Friday. Mr. Browne called Mr. Robert Hammond to give evidence in support of Lytham's application.

Mr. J. Ainscough, chairman of the Lytham Council, said it would be most objectionable that the powers asked for by St. Anne's should be granted. He believed if the works were erected at Lytham they would get many customers.

After additional evidence on similar lines, the Lytham case was closed.

Mr. Askworth, for the tramway company, said it had been advised not to take current from Lytham under any circumstances. It had power to supply its own current, and would erect a station. If the order was granted to Lytham, the latter would never supply the company. St. Anne's came to the aid of the company with electricity when Lytham was unable to supply, and the company was compelled to go to the expense of putting mains down in Lytham.

The St. Anne's case was presented by Mr. Hutchinson.

**Newport (Mon.).**—In view of the extremely heavy capital charges of the undertaking, and of the proposals for extending the plant, the erection of offices and stores at the east power station has been postponed, and the application to the L.G.B. for sanction to borrow the estimated cost of such buildings withdrawn.

The lighting of Commercial Street is to be improved, and, as an experiment, central suspension lamps are to be used. A total of 56 lamps in various parts of the borough are to be converted from gas to electricity. The question of extending the plant at the electricity works, at an approximate cost of £12,974, is under consideration.

**North Yorkshire Water Power Schemes.**—*The Morning Post*, in a recent article, points out that many of the small villages in the North Riding are going straight from the use of candles and oil to electricity. This is due to the abundance of streams in the Yorkshire Dales, and an inquiry addressed to secretaries and others connected with these undertakings has elicited some interesting facts. A number of schemes are still in embryo, but of those in actual operation special mention is made of the installations at Grassington, Hawes, Askrigg, Kettlewell, and West Burton. All have been organised locally, and the proprietors are, in most cases, if not all, inhabitants of the places supplied. Reference is made to the scheme being adopted at Kettlewell, where, at a cost of £560, it is proposed to provide a supply for 77 buildings, and about 400 lamps.

**Rishton.**—The Council has considered a letter from the Accorington Corporation in regard to the supply of electricity to the Rishton Paper Works, and has decided that it cannot consent to the Corporation's supplying electricity within the Rishton district.

**Romford.**—The U.D.C. has declined an offer made by Mr. W. T. Presland, to transfer, when obtained, his Electricity Provisional Order, on payment of a consideration, provided that the Council would consent to the order being granted.

With reference to the application of the County of London Electric Supply Co. for a prov. order for electric lighting in the rural area, the R.D.C. has practically arranged terms, except on the question of maximum price and damage for severance on purchase. The company has expressed willingness to forgo damage on severance provided the Council is willing to take a supply in bulk for a period of 15 years, if it desired to purchase the undertaking after the expiration of the statutory period.

**Ruthin.**—The T.C. has appointed a Committee to go into the question of an electric lighting installation for the town.

**St. Anne's-on-Sea.**—At the March meeting of the U.D.C. the electrical engineer reported that for the year there was an increased sale of 58,000 units, and that the number of consumers was now 1,251, against 1,104.

**Sidmouth.**—The sum awarded in the arbitration for the purchase by the Council of the Sidmouth gas and electricity undertaking is £34,654; an additional £8,500 represents costs and other expenses incurred in the proceedings.

**Southampton.**—Arrangements have been made for the supply of energy to the proposed factory on the Western Shore, subject to the lessees taking all energy from the Corporation for 15 years, with a minimum consumption for the second year of 500,000 units, for the third year 600,000 units, and for the residue of the term 750,000 units per annum, at 6'25d. per unit from midnight to half an hour after sunset, and 1'5d. from half an hour after sunset to midnight.

**Stockton-on-Tees.**—The T.C. is considering a scheme, suggested by the electrical engineer (Mr. J. J. Smith) of municipal maintenance of consumers' lamps.

**Sunderland.**—At a meeting of the T.C. on the 12th inst. Alderman Bruce moved the adoption of the report of the Electricity and Lighting Committee. This recommended that the minute passed by the Council, adopting a scheme for paying off the balance of the outstanding loans on the disused steam-generating plant be rescinded; that the L.G.B. be informed that the Council, in accordance with the request in the Board's letter, has reconsidered the scheme for extinguishing the debt on the superseded plant, and has decided to sell such plant, and to undertake to pay off the outstanding debt thereon within a period of five years from April 1st, 1913, and, further, that the proceeds of the sale together with interest thereon be paid to a separate "Superseded Plant Account" until such time as the balance of the outstanding loans have been met, and that meanwhile the profits of the electricity undertaking be carried to a reserve and renewals fund. Mr. Bruce said, if they accepted the tenders they had received, and supplemented the amount received by an annual sum of £520 from the yearly profits, it would wipe out the whole of the outstanding debt in five years. Mr. R. J. Wilson, seconded the report. Mr. Lawson said it was an unpleasant surprise to hear that the electricity undertaking now recognised the advantage of a reserve and renewals fund. They had always been given to understand that this was met by the sinking fund. The report was adopted.

In connection with the sale of the plant, it is stated that offers have been received from eight firms for amounts totalling £7,250.

**Swinton.**—The Tramways and Electricity Committee have decided to offer current to the Highway and Street Lighting Committee for street lighting at 1½d. per unit, for all-night burning, provided that each lamp is of not less than 80 watts capacity. This offer has been accepted. Subject to certain conditions the Committee resolved that current be offered to shopkeepers and others for outside lighting on the following terms:—For consumers using current at the alternative rate, 1s. per quarter for 63-watt lamp, and 1½d. per unit; for consumers using current at the flat rate, 2½d. per unit plus meter rent.

Experiments are to be tried at various points with electric street lighting, preparatory to a considerable extension of the system along the local tram routes.

The L.G.B. has sanctioned the borrowing of £600, repayable in 15 years, for the supply of electricity in Broad Oak Park. The Electricity Committee has been empowered to accept suitable tenders for the extension and for the supply of materials.

**Taunton.**—The Council has decided, on the recommendation of the E.L. Co. to apply to the L.G.B. for sanction for a loan of £2,500 for new plant at the electricity works.

**Truro.**—At the B. of T. inquiry held respecting the application by the T.C. and the Gas Co. for prov. orders for electric lighting, it was stated that the Gas Co.'s scheme was estimated to cost £7,535, and the estimated profit after four years was £494. Mr. A. E. Brooks, manager of the Ascot Electricity Co., expressed the opinion that it was extremely doubtful whether anyone, apart from the Gas Co., could make electricity pay in Truro.

**Troon (Ayrshire).**—The T.C. has instructed the clerk to ascertain the probable cost of obtaining an Electric Lighting Order, with power to transfer the same to a company.

**Tynemouth.**—It has been decided to reduce the lighting tariff as follows:—Flat rate from 4½d. to 4d. per unit; demand system from 5d. and 2d. to 5d. and 1½d.; arc lamp rate from 3½d. for a 6-ampere arc to 3½d. per hour. The engineer estimates that this scheme will entail a reduction in profits of approximately £660, but, if not put in force until the second quarter of the ensuing financial year, this sum would be reduced to £600. It is estimated that the profit of the present year's working will amount to about £1,250, which will go towards the paying off of the deficit (£1,600) still remaining on the undertaking. The Tynemouth Traction Co. have decided to postpone taking action in the matter of severing the electrical connection between the Tyneside Co.'s rails and their own rails until the matter has been discussed between the Corporation and the company. The carrying out of this scheme will, it is stated, entail considerable readjustment of matters on the part of the electricity department of the Corporation.

**Uruguay.**—The directors of the State Electric Light Stations have presented their report to the Finance Minister on the working of the various stations during 1912. The increase of subscribers was 1,050, of incandescent lamps installed 69,818, and 1,411 new motors, equivalent to 8,113 H.P. The output for the stations in 1910-11 was 12,266,410 kw.-hours, and in 1911-12 15,281,410, and from July 1st to December 31st, 1912, 11,209,771 kw.-hours. The net profits for 1910-11 amounted to \$556,566.26, and for 1911-12 to \$725,350.60. A considerable decrease was made in the tariff during the past year for power purposes. Amongst the new works carried out in 1912 were 151,778 m. of subterranean cable for both high and low tension, 145,870 m. of aerial lines and 13 new substations.—*Review of the River Plate.*

**Wakefield.**—The City Council has entered into an agreement with the West Riding C.C. for the supply of electricity to the County Hall and the extensions thereto.

**Whitehaven.**—The T.C. has decided that in future in the case of wiring of consumers' premises for connecting heating and cooking apparatus to the mains, the length to be supplied free should be limited to 25 ft., and that the consumer pay cost price for the excess, provided that on the termination of the agreement the excess payment be returned, less 10 per cent. for each year's use.

**Whitworth.**—The U.D.C. has received from the B. of T. an intimation that the question of revoking the E.L. order, 1905, is deferred until April 17th next. The Council has appointed Mr. H. Wilkinson, electrical engineer to the Radcliffe U.D.C., as consulting electrical engineer in connection with a scheme for which a loan of £5,000 is being sought.

**Worcester.**—At a recent meeting of the Council, the Electricity Committee recommended the Council to enter into a contract with the British Insulated and Helsby Cables, Ltd., to purchase from it all cable the Council required for three years. The contract came before the Council for the second time. Several members had previously said that the Council would prejudice their interests by accepting the contract. Mr. W. Sharpe contended that the bargain was a bad one. He believed a ring had been formed among the makers of cable, and the Corporation should try to buy outside it. Members who had hitherto voted against the contract, now said they were satisfied that it was an advantageous one. The Committee's recommendation was adopted.

## TRAMWAY and RAILWAY NOTES.

**Bradford.**—The general manager of the City tramways (Mr. C. J. Spencer) has reported upon the working of the revised system of fares from the time of the change on May 1st last year to December 31st. The revision fixed fares on cars boarded before 9 o'clock in the morning at ½d. for every 1d. stage, instead of the previous arrangement of 1d. for any distance. This, of course, reduced the fares for short-distance passengers, but increased those of some of the longer distances. The report shows that, dealing with the hours before 9 a.m., the car-mileage has increased upon that of the corresponding period of the previous year by 92,738, the receipts have decreased £2,394 (2'09d. per car-mile), and the passengers have increased 2,439,095, or 2'44d. per car-mile, an increase of 49 per cent. Notwithstanding this the receipts, it is seen, have decreased 11 per cent. At 7'428d. per car-mile the operating cost of the additional 92,738 car-miles was £2,870, so that, in the eight months, the experiment has cost the department £5,264. The traffic after 9 a.m. has yielded an increased car-mileage of 113,687, an increase of passengers of 64,893, a decrease per car-mile of 0'32, an increase of receipts of £4,345, and a decrease in receipts per car-mile of 0'10d. The additional car-miles have cost £3,520, leaving a net profit on this traffic of £825, instead of £4,345, which would have accrued had not the car-mileage been "pushed up somewhat unnecessarily." Traffic for the whole day shows that an increased mileage of 206,425 has been run, the increase in receipts being £1,951. The Tramways Committee, after receiving the report, decided to continue the present arrangement to the end of the 12 months' trial.

**Chile.**—The Chilean House of Deputies has authorised a new call for tenders for the electrification of the first section of the State Railways. This section comprises the line from Valparaiso to Santiago, a distance of 117 miles, and the branch line from Las Vegas to Los Andes, a distance of about 28 miles. The waters of the River Aconcagua will be utilised to generate the power required.—*Board of Trade Journal.*

**Continental Notes.**—**ITALY.**—It is stated that the Società delle Forze della Maira has just concluded an agreement with the Italian State Railway authorities for the supply of power for the working of the Giovi auxiliary line between Ronco and Sampierdarena (Genoa). This power supply company's hydro-electric works on the Maira, near Dronero, in Piedmont, will be completed in a few months, and have a capacity of 50,000 h.p., and power will also be furnished later on to the Mont Cenis line, as the power station of the city of Turin, near Chiomonte, which is provisionally giving a supply, will eventually be inadequate for the purpose. It is understood that the Minister for Railways has under consideration the extension of electrical working on the State lines. Among others, it is proposed to convert the Riviera railway, between Ventimiglia and Genoa, and the power would be delivered by the Società Negri, which has already undertaken to furnish the energy for the Savona-San Giuseppe railway. Various transformations are also projected in Central Italy, including the Bologna-Florence railway, which climbs to an altitude of 3,250 ft.

**RUSSIA.**—Application has been made to the Russian Government for a projected electric railway between St. Petersburg and the Finnish frontier. It is proposed to utilise the water power of the River Vonoksa in the generation of the necessary electrical energy. The cost of the proposed line is estimated at 2,950,000 roubles.

**Douglas.**—It was reported at the meeting of T.C. that, for the quarter ended December 31st last, there was a deficiency on the tramway receipts as compared with the expenditure, of £1,422. A motion to increase the fares on the cable tramway was negatived, as was also a proposal to purchase a motor-bus, at a cost of £1,000, to run the service to the Peel Road district.

**Dunfermline.**—Negotiations are at present proceeding between the T.C., the superiors of the new Rosyth area, and the tramways company regarding tramway extensions. At a meeting of the T.C. it was stated that there was every probability of the tramways being extended to Milesmark during the summer. The question of 4d. fares has been brought before the tramway authorities.

**Edinburgh.**—The Tramways Committee is to ask power from the T.C. to negotiate with the Colinton Tramway Co., and, if thought necessary, with the War Office. The Committee has had an offer of sale from the company of the whole of its undertaking. Formal intimation was made that the company had resolved to apply to Parliament for a prov. order for powers to make a line from Slacford, via Fountainbridge to the centre of the city.

**Gower.**—At Swansea on March 13th the Light Railway Commissioners held an inquiry into an application for power to construct a light railway in the Gower Peninsular. There was no opposition, and all the public bodies interested supported the application, with the sole exception of the Glamorgan County Council. The Commissioners intimated that an exceedingly strong case had been made out, and subject to satisfactory financial arrangements, they would be prepared to grant the order.

**Hove.**—Considerable correspondence has been going on during the past month between the Hove and Brighton Councils in reference to a suggestion from the latter that a conference should be held to consider the system of overhead equipment to be adopted for the "through routes" in the two towns, which, under the Brighton Corporation Act, of 1912, and the Hove Corporation Act, of 1913, should be completed within two years from August 7th, 1912, together with other works necessary for running the vehicles. The Hove Corporation appointed a sub-committee to meet Brighton, and expressed the opinion that the conference was somewhat premature, on the ground that, unless the B. of T. sanctioned double-decked cars, it would not be of interest to either borough to carry out the trolley system, and also that, owing to recent developments, it should be open to the conference to discuss matters on broader lines than those indicated. Except the conference was upon these lines, the sub-committee did not see its way to attend for any other purpose. To this Brighton replied that its representatives were appointed specifically to attempt to agree on the system to be adopted for the purpose of its Act and the Hove Act. It appeared, the letter continued, that Hove had appointed its representatives to deal with an altogether different matter, and, under the circumstances, in default of its carrying out of the provisions of Sec. 16, Brighton would submit a system for the approval of Hove. On this letter, the Traction Committee of Hove states that it is still quite prepared to confer with delegates from Brighton but it must be on a broader basis than that suggested, and under these circumstances, it has decided to make a full inquiry into the matter and let the question of a conference stand over for the present.

**Hford.**—The tramways general manager has been authorised to purchase a quantity of tramway trolley wire, not exceeding two miles. The centre tramway poles in High Road, from Cleveland Road to Seven Kings Railway Station, are to be removed and re-erected on the footpath. The cost of this work is estimated at £450. The general manager expresses the opinion that, from the point of view of general traffic, he thinks that it

would be an advantage to have the poles removed, as there would be less obstruction to other vehicles in pulling out of the way of cars when necessary.

**London.**—The Metropolitan Boroughs' Standing Joint Committee has circularised all the London borough councils asking them to take action to prevent sanction being given to Clause 16 of the Metropolitan Electric Tramways (Railless Traction) Bill, 1913, which permits the use of trolley vehicles on routes not specified without the consent of the road authority being obtained.

**Morley.**—The B. of T. has extended, until December 31st next, the period for the completion of the whole of the lines authorised by the Morley and District Light Railways Order, 1901.

**Ramsbottom.**—There has been considerable delay in proceeding with the work of railless traction construction, but it was announced at the Council meeting last week that the firm who had been ordered to do the work had agreed to finish it by the end of July. The overhead equipment will then be completed, and, in the meantime, the furnishing of the cars and so forth is being gone into by the Council.

**Sheffield.**—A recommendation has been made that tramway facilities be provided for the residents of Uppertorpe, the intention being to lay rails from the Hillsborough section, up Albert Terrace Road and Oxford Street to Harcourt Road, where they will join the Walkley section.

**Southampton.**—It has been decided to equip the Corporation tramcars with meters for checking the waste of energy, and the offer of Ferranti, Ltd., has been accepted to supply sufficient meters to equip the whole of the cars on the understanding that at the end of six months they are to be purchased outright at £3 5s. each, or returned without expense.

## TELEGRAPH and TELEPHONE NOTES.

**Brazil.**—The Government has decided upon the erection of wireless telegraph stations at Fortaleza, capital of Ceará, and at Porto Murinho, State of Matto Grosso. The total amount provided is about £26,700. The construction of a special telegraph line between the Federal capital and the State of S. Paulo has also been authorised. The amount provided is about £26,700.—*Board of Trade Journal.*

**Canada.**—According to statistics published in the *Financier*, the telephone companies in Canada number 683, an increase of 146 during the year. In Manitoba and Alberta the systems are owned by the Provinces. The aggregate capital is \$46,276,851, an increase of \$6,232,869 over the previous year. The gross earnings of all companies in the year were \$12,273,620, operating expenses \$9,094,688, and net earnings \$3,178,987. The operating expenses were 74 per cent. of the gross. A total of 370,884 telephones are in use in Canada, equal to one for every eight of the population. Employees numbered 12,873, and salaries last year totalled \$2,659,641.

**Imperial Wireless System.**—The Advisory Committee appointed by the Postmaster-General has had before it representatives of Government departments and of those firms claiming to be able to carry out the work. It has also visited wireless telegraph stations under the control of the Government, and intends to visit other installations of importance in the United Kingdom and on the Continent.

**Italy.**—A second scheme has been submitted to the Government for the expenditure of a further sum of over £2,600,000 on the systematisation of the Italian telephone network, and for the construction of new international lines. Of the proposed new expenditure, £2,097,000 will be allotted to the underground cable network, and £537,000 to the installation of new overhead lines. The scheme is expected to be completed within a period of 10 years.—*Telegraph e Telefono.*

**Post Office Telegraphs and Telephones.**—According to accounts published last week (dated November last), the total expenditure on the telegraphs (including telephones) for the year ended March 31st, 1912, amounted to £6,906,898, while the receipts fell short of this by £796,457. The receipts included a sum of £201,964 in respect of royalties paid chiefly by the National Telephone Co., Ltd., which, of course, will not recur. Adding the annual charge on the purchase price of the telegraphs (£271,691), the total deficit was £1,068,148. The amount expended on the telephones amounted on March 31st, 1912, to £15,266,699, besides £1,586,151 retained by the National Telephone Co. in part payment of the purchase price of their undertaking. The total deficiency since 1869 amounted to £20,839,529; if items of the nature of capital were excluded, this deficiency was reduced to £8,093,159.

**Sweden.**—The patent rights of the Nya A.B. Autotelefon Betulander Co. have been sold to the Marconi Co., except those for Sweden, for over 2,000,000 kronen. The sale includes the patents previously owned by the French exploiting company. Usufruct rights in Betulander's automatic telephone system are retained by the Swedish Telegraph Administration.—*Aftarsårlden.*

**The Telephone Service.**—According to a recent announcement, the Postmaster-General will in future accept three months' notice of termination of contract for telephone service.

At a meeting of the Associated Chambers of Commerce last week, a resolution was passed expressing the view that the telephone service should be carried on as a commercial undertaking in the hands of a special authority, and asking the Government to appoint a Select Committee to consider the question.

**Trans-Atlantic Wireless Telegraphy.**—In reply to a question in Parliament, Captain Norton said that no licence had been given or promised to the Marconi Co. in respect of a further station for trans-Atlantic communication; but the company had been informed that the question of granting a licence for such a station would be considered when a final report had been received from the Select Committee on the contract for the Imperial wireless chain. It was understood that the company was proceeding with the erection of the buildings intended for such a station on a site in North Wales, but it had been warned that its action was entirely at its own risk. Subject to any considerations which might arise out of the recommendations of the Select Committee, and subject to reasonable conditions as regarded non-interference between the various stations, it would be the policy of the Post Office to grant a licence for this purpose to any British wireless telegraph company giving adequate proof of financial standing and technical competence.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" to-day.

**Belgium.**—March 29th. Municipal authorities of Ixelles-Bruxelles. Armoured cables necessary for the low-tension distribution service.

**Blackpool.**—High and low-tension cables and transformer switch pillars. See "Official Notices" March 14th.

**Bolton.**—March 27th. Materials and stores for the year. Mr. Samuel Parker, Town Clerk, Town Hall. See "Official Notices" March 14th.

**Bridgend.**—March 21st. One 400-K.V.A. steam alternator and accessories, for the U.D.C. See "Official Notices" Feb. 28th.

**Cairo.**—March 30th. Tenders are required for the machinery and accessories for the electric lighting of the town of Damietta. Provisional deposit, 2 per cent. of amount of tender; final deposit, 20 per cent. Particulars, Ministère de l'Intérieur, Cairo, Egypt.

**Carlisle.**—March 25th. Lubricating oils, greases, &c., and cables, for a year, for the City Electricity Department. See "Official Notices" March 14th.

**Croydon.**—March 31st. Stores for a year, for the Corporation Electricity Department. See "Official Notices" Feb. 21st.

**Dundalk.**—March 24th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" March 7th.

**Germany.**—April 15th. The Königl. Maschinenbau Amt in Hanover. Tenders for four steam turbines, four three-phase generators, two transformers and a battery of accumulators.

**Gillingham (Kent).**—March 28th. Stores for a year. See "Official Notices" March 14th.

**Hornsey.**—March 31st. Natural draught cooling tower for the T.C. electricity works. See "Official Notices" March 14th.

**London.**—L.C.C.—April 3rd. Reconstruction and re-winding of seventeen 300-kw. synchronous motor-generators and three 500-kw. induction motor-generators. See "Official Notices" March 14th.

—April 2nd.—Electrical installation at the Avery Hill Hostels, Eltham, S.E. See "Official Notices" to-day.

**BATTERSEA.**—April 1st. Coal for a year, for the B.C. Electricity Department. See "Official Notices" March 14th.

**Peterborough.**—March 31st. 1,028 yards of cable, for the Corporation. See "Official Notices" to-day.

**Salford.**—March 31st. Stores, &c., for the Corporation Electricity Department. See "Official Notices" March 14th.

**Spain.**—The municipal authorities of Salvaleon (province of Badajoz) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

**Shanghai.**—April 3rd. Extra-high-tension and low-tension switchgear for sub-stations. See "Official Notices" March 14th.

**Stalybridge.**—4,500 yards E.H.T. three-core lead-covered cable. See "Official Notices" March 14th.

**Uruguay.**—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

**Wigan.**—March 31st. Materials and stores for the Corporation Light and Tramways Departments. See "Official Notices" March 14th.

### CLOSED.

**Ashton.**—The T.C. has accepted the tender of Messrs. Switchgear & Cowans, Ltd., for high-tension switchgear.

**Australia.**—SYDNEY.—The *Australian Mining Standard* publishes the following list of tenders for electrical machinery and accessories that were before a February meeting of the Electric Light Committee:—

Storage batteries, motor generators, &c.—

N. Guthridge, Ltd.—Alternative tender, No. 1. Sec. B. £12,590; do., No. 2. Sec. B. £12,500.

Ferranti, Ltd.—Formal tender, Sec. C, £6,525.

Noyes Bros.—Formal tender, Sec. A, £39,311; do., Sec. B, £11,095; do., Sec. C, £2,122.

British General Electric Co.—Formal tender, Sec. B, £7,873.

Australian Metal Co.—Formal tender, Sec. A, £32,015; do., Sec. B, £6,247; do., Sec. C, £5,751; alternative tender, No. 1, Sec. A, £32,090; do., Sec. B, £6,348; alternative tender No. 2, Sec. A, £32,595.

Tudor Accumulator Co., Ltd.—Formal tender, Sec. A, £32,060; alternative tender No. 1, Sec. A, £32,770; do., No. 2, Sec. A, £29,030.

Siemens Bros., Ltd.—Formal tender, Sec. A, £32,350, Sec. B, £14,522, Sec. C, £6,342; alternative tender No. 1, Sec. A, £32,770; do., No. 1, Sec. B, £10,858; do., No. 2, Sec. B, £9,205.

Australian General Electric Co.—Formal tender, Sec. B, £11,847; do., Sec. C, £5,154; alternative tender No. 1, Sec. B, £10,247; do., Sec. C, £6,362.

Dick, Kerr & Co.—Formal tender, Sec. A, £32,090, Sec. B, £10,924, Sec. C, £6,525; alternative tender No. 1, Sec. A, £32,770, Sec. B, £10,924, Sec. C, £6,525.

Hess & Eggers.—Formal tender, Sec. A, £26,160.

D.P. Battery Co., Ltd.—Formal tender, Sec. A, £34,810.

Chloride Electrical Storage Co., Ltd.—Formal tender, Sec. A, £27,749; alternative tender No. 1, Sec. A, £34,539.

**Transformers.**—

British General Electric Co.—£1,020.

Siemens Bros., Ltd.—£1,160.

Australian General Electric Co.—£1,230.

Australian Metal Co.—£1,265 (informal).

**Maximum demand indicators.**—

Australian General Electric Co.—£165.

W. G. Watson & Co., Ltd.—£308.

**Arc lamp contact and suspension gear.**—

Lawrence & Hanson Electrical Co., Ltd.—£214.

W. G. Watson & Co., Ltd.—£215.

The same exchange states that the Prahran and Malvern Tramways Trust has accepted the tenders for trucks, wheels and axles, brakes and motor equipments for 16 new cars as follows:—

Trucks.—Noyes Bros. Pty., Ltd., at £67 5s. per truck.

Wheels and axles.—Noyes Bros. Pty., Ltd., at £24 17s. 6d. per set.

Magnetic brakes.—Australian Metal Co., at £50 per set.

Motor equipments.—Australian Metal Co., at £255 per set.

**MELBOURNE.**—P.M.G.:—

Seven rotary converters, £2,065.—Maritime Wireless Co. (Sbaw System), Ltd., Sydney.

**BRISBANE.**—P.M.G.:—

Glazed earthenware conduits, £1,894.—Brunswick Brick, Tile and Pottery Co.

1,416 tubular cross-arms, galvanised iron, £198.—E. Sachs & Co., Ltd.

15,000 wood cross-arms, 1s. 6d. each.—F. E. Barbat & Sons.

13,500 insulators, porcelain.—Theodore Zwicker & Co.

78 manhole covers and frames, £1 7s. 3d. each.—Balmer & Crowther.

**ADELAIDE.**—P.M.G.:—

0½ miles paper-insulated lead-covered cable, £1,070 per mile; 2½ miles, £82 per mile.—Siemens Bros. Dynamo Works, Ltd.

8 miles various ditto cable.—W. T. Henley's Telegraph Works Co.

**VICTORIAN RAILWAYS.**—

n.d. bare copper cable.—B.I. and Helsby Cables, Ltd.

Electric street railway and tramway crossing, £320.—Sewell & Gaskell.

**STATE RIVERS AND WATER SUPPLY COMMISSION.**—

One motor-driven centrifugal pump, &c., for Hopetoun, £184.—Robison Bros. & Co. Pty., Ltd.

**Bridlington.**—The T.C., at a specially called meeting, unanimously approved the recommendation by the Electricity Committee that, subject to the approval of the L.G.B., in connection with necessary extensions at the electricity works, the tender of Messrs. Willans & Robinson, Ltd., for a diaphragm turbine, coupled to a tandem D.C. generator of Messrs. Brown, Boveri's manufacture, amounting to £2,867, be accepted.

**Bolton.**—The Bolton Electrical Co. has received the contract for installing electric light at premises at 121, Deansgate, Bolton.

**Burton-on-Trent.**—The tender of Messrs. Richards for installing electric light at Christ Church has been accepted.

**Heywood.**—The Electricity Committee has accepted the tender of Mr. J. Smith for repairs to the chimney at the electricity works.

**King's Lynn.**—The T.C., on March 12th, accepted the tender of Messrs. Holdsworth & Sons, Ltd., for a Lancashire boiler, economiser and steam and other piping for the electricity works, at £957.

**London.—KENSINGTON.**—The Guardians have accepted the tender of the Sun Electrical Co., Ltd., at £20 12s., for an annual supply of electric fittings. Five other tenders were received, at prices ranging from £21 18s. 2d. to £35 10s. 9d.

**STEPNEY.**—The B.C. Electricity Committee received the following tenders for a.i. chambers, pavement frames and covers for one year:—

J. Every .. .. .	(recommended)	£69
E. & F. Wright .. .. .		70
Carron Co. .. .. .		88
W. Creighton .. .. .		119

Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract for the supply of "Wotan" drawn-wire and carbon-filament lamps for the ensuing 12 months for the County of London Asylums.

**Sunderland.**—The T.C., on March 12th, accepted the following tenders on behalf of the Electricity and Lighting Committee:—

P.L. and Helsby Cables, Ltd.—472 yd. low-tension cable.
W. G. Farrow & Co.—Cast-iron troughs.
Brotherton & Co., Ltd.—Pitch and thinning oil.
W. T. Henley's Telegraph Works Co., Ltd.—Switch-pillar fuses, and 24 bifurcating boxes.
I. R., G.-P. and Telegraph Works Co., Ltd.—440 yd. of 19.20 cable.

**West Bromwich.**—The T.C. has accepted the tender of Messrs. W. H. Bowter & Co., Ltd., for 10,000 tons of coal for the electricity works.

**Whitehaven.**—The T.C. has accepted the following tenders:—

Doulton & Co., Ltd.—Earthenware troughs.
Dussak Bitumen Co.—Bitumen.
General Electric Co., Ltd.—Electric lamps.
Verity, Ltd.—Clear glass wall globes.
W. T. Henley's Telegraph Works Co., Ltd.—Tapes.
P.L. and Helsby Cables, Ltd.—Fuse boxes.
Feranti, Ltd., the Bastian Meter Co., Ltd., and the British Thomson-Houston Co., Ltd.—Electricity meters.

**Worcester.**—The City Council has accepted the following tenders in connection with the electricity undertaking:—

B.L. and Helsby Cables, Ltd.—Cables required during the three years ending December 31st, 1915, at scheduled prices.
Heenan & Froude, Ltd.—Extension of coal storage bunkers and existing elevator at Hylton Road electricity works, £390.
Stokes Bros.—Builders' work in extension of boiler house at Hylton Road electricity works, £577.
E. Bennis & Co., Ltd.—Bennis patent improved smokeless chain-grate stoker, £112.
Phoenix Dynamo Co.—350-k.w. motor-generator, £690; the company to take out the 100-k.w. complete motor-generator set, which cost £475, and for which an allowance of £425 will be made. The balance of £265 will be provided by the sale of an old 120-h.p. engine and obsolete 75-k.w. alternator, and of part of the old copper now in stock.

## FORTHCOMING EVENTS.

**Association of Electrical Station Engineers.**—Thursday, March 27th. At 7 p.m. Meeting to form Birmingham branch, at the Y.M.C.A., Dale End, Birmingham. Meetings to form branches will also be held at Mechanic's Institute, Bradford, on Wednesday, March 19th, at 8 p.m., and at "Amalgamated Society of Engineers," Mount Pleasant, Liverpool, on Thursday, March 20th, at 8 p.m.

**Manchester Electro-Harmonic Society.**—Friday, March 28th. At the Albion Hotel, Manchester. Last concert of the season.

**Institution of Electrical Engineers (Scottish Section).**—Annual general meeting postponed from April 8th to April 15th.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

WITH regard to the Orders published in our last issue, those interested are requested to note that the arrangements announced for 21st inst. should have been omitted, that date being Good Friday.

## NOTES.

**The G.E.C. "At Home."**—Instead of their annual dinner, which has hitherto been one of the events of the electrical world, the directors this year decided to celebrate the twenty-fifth anniversary of the formation of the company by giving an "At Home" to their numerous friends. The difficulty of accommodating so large a gathering was met by engaging the Royal Opera House, Covent Garden, for the evening, and on Saturday last the guests assembled there to the number of over 2,500. The proceedings took the form of an entertainment provided by a selected company of leading artistes and humorists of the day; the auditorium was furnished with small tables and was occupied by the male portion of the audience, while the rest of the house was devoted to lady visitors, of whom a large number were present. Members of the staff of the G.E.C. drawn from all parts of the country, and from various foreign and Colonial centres, acted as stewards, there being a steward to each of the 80 tables. Smoking was permitted in the auditorium, and abundant provision to this end was made, while an elaborate and appetising menu was served at the various buffets. The arrangements, which were in the able hands of Mr. H. Clifford Palmer as organising manager, were in every way all that could be desired, and nothing was left undone to ensure that every guest should, in the words of the wish expressed on the flyleaf of the programme, "Spend a very pleasant evening." The Chairman,

Mr. H. Hirst, with the Vice-chairman, Mr. E. G. Byng, the general manager, Mr. M. J. Ralling, and their co-directors, Dr. A. Ralling and Messrs. L. G. Byng and F. S. Sells, mingled with their guests, but there was no formal reception, and no speeches were made.

Amongst those present were most of the leading lights of the electrical world, including Mr. Duddell, President of the I.E.E., Dr. de Ferranti, Prof. Perry, Dr. Sumpner, Messrs. Sparks, Highfield, McMahon, Wright, Sheppard, Slingo, &c., as well as many distinguished representatives of the professions and Government departments, such as Sir George Moore, Sir John Taverner, Mr. A. Colefax, Mr. A. Walter.

The orchestra, under the direction of Mr. Herman Finck, needless to say, fulfilled its duties with the highest efficiency. The programme included items by Harry Dearth, the Sunshine Girls, Miss Wish Wynne, Mesdames Olga and Elgar Hudson and Eli Hudson, Miss Clarice Mayne and "That," Edmund Payne and Geo. Grosmith, Miss Ruth Vincent, Harry Tate, Miss Lydia Kyaast and Theodore Kosloff and Barclay Gammon; all these, obviously, were sure of a cordial reception, and fully maintained their respective reputations; but without detracting from the merit of the other performers, we cannot refrain from expressing appreciation of the delightful feast of harmony, perfect in every detail, with which the audience were regaled by that charming trio, Mesdames Hudson and Mr. Hudson, which alone would have rendered the occasion a memorable one. Interspersed amongst the musical items were several series of bioscope pictures representing the various works of the company and the operations carried on therein, and we do not hesitate to say that these were amongst the most interesting features of the entertainment. The Witton staff at work and at play, the manufacture of the Osram lamp, the making of teleph. nets, and a variety of other subjects, including the offices of the G.E.C. both at home and "all-round the world," were shown in quick succession, and the views bore telling witness to the wide scope of the company's operations and to the diversified activities of the multitude of workpeople to whom it gives employment. Altogether the entertainment was in the highest degree successful, without a single jarring note, and the company is to be congratulated upon the thorough and efficient manner in which it carried out this novel and original birthday party.

We are pleased also to offer our congratulations to the company on the completion of its first quarter century, a period which covers practically the whole history of electrical engineering apart from the telegraph branch. Starting on a modest scale, the company has continuously grown until it is now the largest electrical manufacturing company in the kingdom, with a capital of over 1 million sterling, and employing nearly 10,000 hands, while it has also established subsidiary companies in South Africa, Australia, New Zealand, India, South America, France, Belgium and Spain. It is capable of providing almost everything electrical, from the equipment of a generating station to an electric bell, and owns factories at Witton and Edgbaston (Birmingham), Salford, and London. A specially commendable feature of the company's policy is the care shown for the well-being of its employes, not only in the factories, but also outside them, provision being made for their entertainment and recreation, of which full use is made by the workpeople. Athletic grounds are provided for all the works and for the head office; at Witton, in addition to cricket and football, grounds are set apart for bowls, tennis and hockey, and a scheme is on foot for the erection of an institute or club house, affording accommodation for recreation and refreshment on a comprehensive scale. Social clubs have been organised at most of the works. The G.E.C. athletic clubs have attained distinction both in London and in the provinces, and the Lamp Works Fire Brigade has scored a long list of triumphs. The fortunes of the company are bound up with those of British industry, and we cordially wish that the completion of its second quarter century may find it in a position in every way as satisfactory, but many times more prosperous even than the present.

**Electric Car-Lighting Competition.**—A cup value £50 for the best electric car-lighting installation in an R.A.C. certified trial has been offered to the Royal Automobile Club by *Country Life*, and accepted, a condition being that there shall be at least four entries for the competition. The judges will be the Technical Committee of the club. The following are the conditions of the competition:—

1. The whole equipment must be entered for trial and must be properly installed upon a car.
  2. The distance run upon the road shall not be less than 2,000 miles.
  3. All lamps (not less than two head-lamps, two side-lamps, and one tail-lamp) shall be alight at the same time and for at least six hours every day.
  4. The Technical Committee of the R.A.C. shall decide which of the performances as shown in the trials' certificates is the best.
- Entries will be received by the R.A.C. under the general regulations for certified trials, until September 15th next, any equipment entered before that date, and completing its trial before October 15th, 1913, being eligible for the prize.
- The following data (*inter alia*) will appear upon the certificates, and any equipment entered for a certified trial in order to compete for the prize will be subjected to such tests as may be necessary to obtain such data: (a) Full description of equipment entered, including battery and its fitting to car, together with weights of parts, and the wattage and candle-power of the lamps; (b) total distance run; (c) number of lamps expended; (d) wear of parts during trial and general condition after trial of the equipment, including accumulator; (e) the behaviour of the equipment at different car speeds on the various gears at Brooklands; (f) the convenience of the adjustments of the dynamo and control of the lamps.

**Ghent Exhibition.**—Preparations are advancing for this Exhibition which opens on April 26th. No less than 130 Congresses are to be held during the six months that it is open. Of these about one-half are to be international. Most of these 130 Congresses will last several days, and there will be occasions when as many as five will be sitting at the same time. But we are informed that there will be plenty of accommodation, for an indefinite number might find room in the great permanent building, the Palais de Fêtes et d'Horticulture, which is one of the most striking sights of the whole Exhibition. The span of its main hall is far greater than that of the Crystal Palace; the hall contains 3½ acres, and the second or small hall 2 acres.

Ghent is, as yet, not nearly so well known to the British public as it should be. To the business man it is the most thriving of Belgian commercial towns, the centre of Belgium's cotton and linen industries; to the general public, a city full of old monuments and relics of the day when, as capital of Flanders, the town was in the forefront of medieval commerce and warfare. But few business men even recognise the important part which Ghent plays to-day in Belgium's commercial prosperity. In addition to being a port, Ghent is a great and growing manufacturing town in the centre of Belgium. In the cotton factories there are twice as many spindles as in the whole of the rest of Belgium; Ghent linen factories employ yet more hands than the cotton; Ghent machinery is exported world wide. To build an hotel to hold 1,000 guests on purpose to prepare for the rush of visitors to the Exhibition, and then to pull half of it down again when the Exhibition closes, is one of the striking pieces of enterprise which the municipal authorities of the town have undertaken. The hotel is in no way a temporary structure, but brick-built throughout, and the remaining half will continue under the management of the town as a station hotel at the new railway station on the main line from Ostend to Brussels. This station, the Gare St. Pierre, may almost be described as an Exhibition enterprise too, for it is just on the edge of the grounds, and the work has been specially put forward so that it may be ready for the Exhibition traffic.

The special hotel is being built to provide rooms at a fixed and reasonable price for visitors. But apart from the erection of this hotel, a "bureau de logement" has been formed to inspect and classify all the private apartments available. The price of these, 3 fr., 5 fr., 6 fr., 10 fr., or 15 fr. for the night and breakfast, is also fixed by the bureau, so that the keepers of hotels and boarding houses will not be able to raise their charges to famine rates in the face of this competition. This bureau, which is not a business concern, and has no financial interest in the work, will have offices at both the railway stations and at the Exhibition, and on applying there, visitors will be given the addresses of vacant rooms at the price selected. As there will all have been inspected and priced by the Committee, there will be little trouble in finding suitable accommodation. In order to provide for the visit to the Exhibition of large parties from workmen's clubs and institutes, the Bureau has also hired a number of large halls, and is fitting them up, with the assistance of the military authorities, as dormitories where as many as 100 or 150 men can be lodged at a time. The charge for these dormitories will only be sufficient to cover the expenses, but arrangements will have to be made beforehand with the Bureau de Logement. Yet another fact which should prevent any great rise in prices in Ghent is the nearness of Brussels, Bruges and Ostend. Bruges can be reached from Ghent by train in 35 minutes; Brussels in 50 minutes; and Ostend in 60 minutes.

It is interesting to learn that a contract has just been signed by the Zeppelin firm and the directors of the Exhibition for a regular passenger service from Dusseldorf to the Exhibition grounds. The service will be maintained throughout the months of August, September and October, and the fare for the flight, which is about 130 miles, will be £14.

**Breach of Colliery Rules.**—At Heanor on 10th inst., George Maxwell, collier, of Dunstead Road, Langley Mill, was summoned by Henry R. Watson, manager of the Butterley Co.'s collieries, for a breach of the colliery rules on February 21st.

According to the report in the *Nottingham Daily Guardian*, defendant was employed at the Ormond Colliery, Loscoe. On the date named he opened an electrical switch and applied a piece of wire, which had the effect of making a short-circuit, which caused a flash. The colliery was one in which safety lamps had to be used and a great deal of danger might have been caused, not only to the defendant and his fellow-workmen, but to the mine. The wire was insulated at one end, and so caused no injury to the defendant, but it appeared to be a case of foolhardiness. Mr. Watson said the voltage was 650. If the wire had been wet or the insulation in any way defective, the defendant might have been instantly killed.

Mr. Robinson said the lights went out in the pit, and work was stopped for 10 minutes. Defendant, in pleading guilty, said he did not know what he was doing; he was "acting the fool." A fine of £1, with 16s. costs, was imposed, the alternative being 14 days' imprisonment.

**Parliamentary.**—PRIVATE BILLS.—It has been decided that the following, amongst other Bills, shall originate in the House of Lords: Bradford Corporation, Brighton Corporation, Central London Railway, City and South London Railway, Ely Valley Gas and Electricity, Hastings Tramways, Hove Corporation, Huddersfield Corporation, Leeds Corporation, Leicester Corporation, London Electric Railway, Metropolitan District Railway, Metropolitan Railway, Porthcawl and District Gas and Electricity, and Wimbledon and Sutton Railway.

Petitions have been deposited in the Private Bill Office against the following private Bills: Brighton Corporation, Central London Railway, City and South London Railway (numerous petitions in this case), Hastings Tramways, Hove Corporation, Leicester Corporation, London Electric Railway (11 petitions), Metropolitan District Railway, Metropolitan Railway (33 petitions), Wimbledon and Sutton Railway, Ely Valley Gas and Electricity, Porthcawl and District Gas and Electricity, London and South-Western Railway, Morley Corporation, Folkestone, Sandgate and Ilythe Railless Traction, Crowborough District Gas and Electricity, I.C.C. (Tramways, Trolley Vehicles and Improvements) (many petitions), Metropolitan Electric Tramways (Railless Traction), Mexborough and Swinton Tramways (Railless Traction), Western Valleys (Monmouthshire) Railless Electric Traction, Chesterfield Corporation Railless Traction, Rhondda Tramways (Railless Traction), Coventry Corporation, Southport Corporation, Tottenham and Edmonton Gas.

**Automatic Time Signals at Rugby School.**—An ingenious device, known as the "Universal" programme ringer, has been installed at Rugby School for the purpose of controlling the time-table of class periods, so that the sessions of the entire school are now directly regulated by the headmaster to the nearest half-minute of Greenwich time. The apparatus comprises a perforated band of thick paper, 10 in. wide, which passes horizontally over trains of brass drums, so that at the appropriate instant electrical contact is made through the holes in the paper between a spring pointer and the surface of the drum. Signals are by this means transmitted to ring electric bells in various parts of the building. There are two sets of eight electrically-insulated disks, each set mounted in fixed relationship on a spindle. One disk is reserved for operating a daily change of mechanism, and other disks are assigned to the separate days of the week, the correct wheel being brought into the proper circuit automatically by the above mechanism.

The whole mechanism moves, carrying the perforated paper roll forward, every 30 seconds, by means of an electro-magnetic impulse device controlled by a master clock, which at the same time operates secondary "Pulsynetic" electric impulse clocks in the classrooms and elsewhere. There are eight signal bells and nine "Pulsynetic" clocks in the school. A simple means of perforating the roll is provided, so that additions can be made to the time signals. Parts of the system can be temporarily cut out of service by means of local switches.

An entire change of programme, as, for instance, between summer and winter, is effected by changing the roll. Power to work the ringer is supplied by a battery of Leclanché cells, which need but little attention. The ringer has been working satisfactorily since October last, and was erected to the design of Mr. Hardy Parsons, managing director of Messrs. Gent & Co., Ltd., of Faraday Works, Leicester, whose firm carried out the work.

**Electricity in the Reclamation of Marshes.**—For peat getting by machine, a species of dredger is employed. In a special apparatus made by Messrs. Strenge (Oldenburg), the collecting tackle is driven through a worm and worm wheel from an electric motor, while a second motor drives the whole collector to and fro on a 13-ft. spindle. The wet peat collected is carried by a chain conveyor, from the trough into which it is first thrown, to an electrically-driven press. Thence the peat issues as a uniform pulp which flows along two troughs, and is distributed by electrically-driven "spreaders" over the surface of the drained land. The whole apparatus runs on broad heavy beams, and one of the motors it carries drives it forward in the direction of the channel to be dredged in the bog. The scattered peat-cake is (first by hand and then by an electrically-driven cutting machine), cut into sods which are superficially dried and collected in small heaps. When the peat is dried to about 30 per cent. moisture content, it is collected in trucks and hauled by a small petrol loco, to neighbouring works, where it is stored in bunkers, or immediately delivered to the stokers, according to the needs of the case.

Another method of peat getting is practised by Messrs. Dolberg. Labourers dig the peat from the bog and throw it into a conveyor trough, whence an elevator carries it to a machine in which two oppositely rotating worm shafts (driven by a 1½-h.p. electric motor) masticate the peat and deliver it through a mouth-piece, where it is cut into sods. The latter are then carried on timber frames to the drying fields. Such a machine will deliver up to 80,000 sods in 10 hours.

The Wiesmoore electricity works depends entirely on the combustion of peat for steam-raising purposes, and, incidentally, is rendering the community a valuable service by cultivating the bog land from which it collects its fuel. Main canals are cut, into which the bog water drains, and a system of tributary ditches and furrows is laid out, the drained areas being then sown with grass seed. The grass binds the soil together, and the smaller drainage furrows can soon be replaced by drainage pipes, which are then covered up. The reclaimed land is next ploughed electrically—a 50-h.p. motor, driving ploughing tackle, being supplied through high-pressure lines and a 60-k.v.a. transformer. After ploughing, the land is harrowed, rolled, manured and sown, electrical energy being used for power purposes throughout.

About 12½ acres can be ploughed, 25 acres harrowed and 37 acres rolled per diem. The cost of reclamation and cultivation averages £12 per acre. As far as possible, the reclaimed land will be leased in holdings of from 15 to 25 acres each, and the incoming population will be collected in villages, which will then form an admirable load for the electricity station. It is expected to realise 25 per cent. profit from this overland scheme.—*E.L.R. and F.W.M.*

**Lamp-making on the Cinematograph.**—On Monday afternoon at the studio of Messrs. Pathé Freres, Ltd., in Wardour Street, W., at the invitation of Messrs. Siemens Bros. Dynamo Works, Ltd., Dalston, we had the pleasure of attending a private exhibition of a film showing the processes of manufacture of "Wotan" and tantulum drawn-wire lamps.

We were privileged to make a tour through the different departments of the lamp works at Dalston without the usual discomforts attending works' visits. The various operations (hand and machine) connected with the preparation of the filaments, bulbs, and the fitting together of the complete lamps, also their subsequent testing, packing in cartons and dispatch, were shown with great effect. The strength of filament was demonstrated in several ways, including the suspension of weights therefrom, and the handling of cases packed for carrier, while from the illumination point of view a domestic scene illustrates the effects of such brilliant lighting upon an average household.

**Heavy-Service Lampholders and Adapters.**—Referring to the recent correspondence on this subject in our pages, Mr. L. Hamilton writes that he has just seen a new type of lampholder, which has been produced as a result of these letters. He says:—"As the invention is, I understand, now protected, I may say it is really an ordinary type of bayonet holder, but instead of the plungers being actuated by springs they are made solid with the terminals. The socket, which is screwed as usual on the outside, has straight slots instead of the bayonet type of slot, and the tops of the solid plungers are bushed with small balls of fine copper wire to form cushions, so as to make good electrical contact with the standard type of lamp-cap terminals. On the outside of the screwed socket there is a screw cap which consists of a screwed ring, very like the ordinary shade-carrier ring, and it has a plain tubular extension with an inwardly projecting flange at the end without slots, for gripping the pins of the lamp cap. In placing the lamp in position, the flange of the screw cap is first passed over the side pins in the lamp cap, the lamp is then placed in the socket, the side pins being in the slots in the socket, and the screw cap screwed home, when the lamp terminals are pressed hard on to the cushions on the solid plunger tops."

**Picture Palace Lighting.**—The Angel Picture Palace at Islington, which we understand, is the largest and latest in London, is fitted throughout with Pope's "Elasta" wire lamps, ranging from 5 to 600 C.P.

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting on Thursday last, the president announced that in future, in order to make the proceedings more quickly available, especially to the provincial members, the *Journal* would be issued at fortnightly intervals (during the session only), in quarto size, without advertisements.

(BIRMINGHAM SECTION).—The sixth annual dinner was held on Friday evening last at the Grand Hotel, Birmingham. Mr. A. M. Taylor, chairman of the Section, presided.

The toast of the King having been duly honoured, the chairman proposed the Institution of Electrical Engineers, pointing out that it had passed its 40th year, although he hoped it had not passed the prime of its life. It was thoroughly representative of the industry and very much alive. An active Council and President had combined to further its objects, and he took the opportunity of congratulating the President on having been nominated for a second year of office, which he was sure would be a successful one.

The President, in replying, referred to the steady growth of membership of the Institution, mentioning that the raising of the subscription had had the curious effect of increasing the number of applications for admission, as it had done once before, when there was no question of an examination in the future. He reassured those present as to the character of the proposed examinations, which would not be academic, but suited to practical requirements. The Institution had decided, probably at the end of the year, to issue the *Journal* fortnightly, and he hoped in this way they would keep more closely in touch with members scattered over the country.

To Major W. A. J. O'Meara fell the toast of "The Birmingham Local Section." He mentioned that a visit to Birmingham had been considered an essential part of his education as a Royal Engineer, and referred to various incidents in his active service on the Indian frontier, which showed the extent of Birmingham's trade connections, even in little known countries. The I.E.E. had followed the nation in the matter of colonising, and he thought there was something of military organisation in its arrangements. Mr. C. F. C. Shawfield briefly responded.

Prof. Gisbert Kapp proposed "Our Guests." He was very glad that Dr. Ferranti, who was one of themselves, was also a guest. Electricity was the handmaiden of every other industry, and it was well for them to welcome mechanical engineers, municipal representatives and others at their gatherings; he wished it were possible to offer the guests an electrical feast with speeches of telegraphic brevity. Dr. S. Z. de Ferranti said he was replying to the toast partly as a visitor, but more "because he always did it." As regarded their Local Section, he was reminded that Wolverhampton had had a good deal to do with his early career. In those days each arc lamp had its own dynamo, but a very big machine would run six arc lamps. He recalled having been sent out to light an exhibition at Wolverhampton in 1880, where a portable engine plant supplied four arc lamps and 40 incandescents, and where during the first week there was not a single evening without some kind of shut-down. He agreed that electricity was entering into every other industry, and thought that if the price of energy

could only be reduced below a certain critical figure it was difficult to understand how the various industries could avoid the use of electricity. It would be greatly to their advantage in the future to turn all their coal into electricity.

After the toasts a short, but interesting, entertainment was provided, in which the efforts of Mr. J. Woodward at the piano, the recitations of Mr. W. E. Warrlow, and the conjuring of Mr. E. Hermann were greatly appreciated. Music was provided during the evening by the G.E.C. orchestral band, and the proceedings concluded with a vote of thanks to the Chairman, proposed by Mr. Maurice Solomon.

**INSTITUTION OF MECHANICAL ENGINEERS.**—The rules for graduateship and associate membership examinations have now been issued. The first examinations will be held in October next, and afterwards twice annually. Intending candidates can obtain particulars from the Secretary, Storey's Gate, S.W.

**INSTITUTE OF MARINE ENGINEERS.**—The annual meeting of the Institute was held on March 7th. A net increase in the membership of 66 was recorded, bringing the total number on the roll up to 1,350. It was stated that the negotiations for the acquisition of a site on Tower Hill were now completed, the total amount subscribed to the special fund being £6,015; £197 was added to the revenue account during the year. Mr. Thomas L. Devitt was unanimously elected president for session 1913-14, Mr. Jas. Adamson hon. secretary, and Mr. Alex. H. Mather hon. treasurer.

**ILLUMINATING ENGINEERING SOCIETY.**—On Tuesday, April 15th, a paper on "Standard Clauses for a Specification of Street Lighting" will be presented by Mr. A. P. Trotter at a joint meeting of the Illuminating Engineering Society, the Institutions of Gas and Electrical Engineers and the Institution of County and Municipal Engineers. Advance proofs will shortly be available, and can be obtained by those wishing to join in the discussion on application to the hon. secretary of the Illuminating Engineering Society (Mr. L. Gaster, 32, Victoria Street, London, S.W.).

**Appointments Vacant.**—City electrical engineer, for the Carlisle Corporation (£500); electrical mechanic, for the Postal and Telegraph Department of the East Africa Protectorate (£200). See our advertisement pages in this issue.

**Inquiry.**—A correspondent wants condensers for voltages from 100 to 2,200, to improve the power factor on a 60-cycle single-phase system.

**Proposed Strike at Aberdeen.**—The local branch of the Electricians' Union has petitioned its National Executive for permission to strike if its demand for an increase of a 1d. per hour is not conceded.

**Legal.**—In the City of London Court, on Monday, before Judge Lumley Smith, K.C., and a jury, Messrs. Watson, Marsh & Co., electrical engineers, 347, High Road, Brondesbury, claimed £60 3s. 8d. against Messrs. Clayton, tailors and clothiers, 33, Finchurch Street, Tooting, and elsewhere, for supplying four Sunshine arc lamps with outside cases stoved and, highly enamelled in green shade and with special protective varnish. Defendants paid £46 17s. into Court, with a denial of liability, and said that in any event that was enough to satisfy the claim. Mr. Brandon appeared for the plaintiffs and Mr. Samuel for the defendants. Plaintiffs' case was that defendants wanted blaze lamps exactly the same as those outside the premises of Messrs. Lockwood & Bradley, Oxford Street. They quoted £65 for these, and defendants said that it was too much. Some alterations were made to reduce the price, and defendants had to wait three months for the lamps, as they came from "the only place where things come from nowadays—Germany." Defendants had asked them to quote for £100 more work, but that had been declined in the circumstances. Defendants' case was that the plaintiffs had never completed their work, and therefore were not entitled to more than the amount paid into Court. The bands of copper were not of the quality stipulated for. The jury stopped the case, and found for the plaintiffs for the full amount claimed.

**Industrial Projects in Russia.**—The industrial journal *Norden* states that a Belgian company has recently obtained about 20 concessions for electric tramways and lighting in various places in Siberia and Central Asia, while another group of Belgian financiers is contemplating the erection of large factories for the manufacture of woodwork at Novoborissow, the necessary sites having already been acquired. An English company which has obtained a concession for the harnessing of a large waterfall and the building of an electrical power station at the river of Terek in Caucasia, is said to intend to utilise the electrical energy derived from same for the purpose of connecting the towns of Vladikavkas, Natchik and Kislovoyok by means of electrical tramways. The Imperial Railway Committee are now examining a project laid before them, in which it is proposed to supply the province of Ferghana, the leading cotton-producing district in Central Asia, with a complete system of railways. The total capital expenditure of this project is estimated at £1,283,333. The Russian State Bank has decided to distribute 71 new corn elevators in various places, which will be erected and installed in good time to deal with the crop in 1916. The elevators are to be capable of dealing with 772,800 tons of corn. It is proposed in connection with this project to organise a special department of elevators to which will be attached a technical staff.

**Annual Socials, &c.**—The Devonport Dockyard Electrical Apprentices' and Ex-Apprentices' Association held their annual social and dance at the "Criterion" Restaurant, Keyham, on Saturday, March 1st. The evening was spent in a very pleasant manner, beginning with games interspersed with singing and music, and after refreshments, dancing was indulged in from 9.30 till midnight. Most of the officers of the department were present, and credit is due to the secretary and committee for carrying out the arrangements.

**Association of Electrical Station Engineers.**—A meeting was held last week at the Y.M.C.A., Bothwell Street, Glasgow, the object being the formation of a branch of the above Association for Glasgow and the West of Scotland. There was a representative attendance, and a resolution was unanimously passed that a branch be formed. Mr. A. W. Lamont was appointed hon. secretary, and after some discussion, it was decided not to appoint a permanent committee until the next meeting, but until that meeting a provisional committee will look after the interests of the Association. The next meeting was arranged for April 2nd, same place as above at 7.45 p.m.

**The Marconi Libel Litigation.**—Before Mr. Justice Darling, in the King's Bench Division on Monday afternoon, Sir Edward Carson, K.C., applied that the libel actions by Sir Herbert Samuel and Sir Rufus Isaacs against *Le Matin* might be in the list for hearing on Wednesday. The paper, he said, had already published an apology, so that the defendants did not intend to contest the case, but, having regard to plaintiffs' public capacity, it would be necessary to put both Sir Rufus Isaacs and Sir Herbert Samuel in the witness box.

His Lordship directed that the action should be in the list next Wednesday.

**Electric Car Construction in Great Britain.**—It is reported that the Arrol-Johnston Car Co., Ltd., of Paisley, makers of the Arrol-Johnston petrol cars, have secured the sole concession for this country from Mr. F. J. Monnot, of 41, Great Portland Street, London, W., for the construction of electric pleasure cars, fitted with the Edison battery. The new vehicles are expected to make their appearance early in the 1914 season.

## ELECTRICAL DEVELOPMENT IN PERU.

In considering the possibilities of expansion of trade abroad, one is always apt to confine attention to countries which, because of the development obvious in them, are "in the public eye," and to forget that in the less advanced countries the greater opportunities often exist. Only the favoured few realise the advantages of opening up relations with these countries, and although they probably risk much, they undoubtedly gain a very great deal in the long run. The countries which are just beginning to open out are eminently suitable for trade, particularly in engineering and electrical lines: they have little to pull down before they build up, they are not hampered with work carried out on obsolete lines, consequently they are easily able to adopt the newest and most up-to-date principles. In South America, Argentine and Brazil, for instance, form the centre of our operations, whereas, in the smaller countries such as Peru, Bolivia, Colombia, &c., where the same natural advantages obtain, and where competition is not nearly so keen, we attempt but little.

That the natural advantages of Peru, from an electrical point of view, are realised, and developments already being effected, is shown in a report from Peru recently made to the American Government. This report points out that about 26 rivers of more or less importance flow into the Pacific Ocean, descending from the Andes at an average altitude of 15,000 ft., and rarely exceeding 100 miles in length. These rivers are more or less torrential, and can, therefore, furnish abundant power, both in the coast region and at their sources in the heart of the mountain ranges. Many cities of Peru obtain their power for lighting purposes, &c., from hydro-electric plants, the largest being those near Chosica and Lima on the River Rimac, furnishing Lima, Callao and their suburbs with about 7,000 h.p., and that of Charcani, near Arequipa, furnishing 1,000 h.p. Water-power plants are also plentiful in all the mining districts, with capacities varying from a few horse-power to 1,000 h.p. Some of these transmit energy to points up to 12 miles distant. There is thus plenty of opportunity for the mines to adopt electricity for power purposes, and there should be a large field for expansion of trade on these lines. As a rule there is more fall than volume of water, and Pelton wheels are used. The rivers flowing into Lake Titicaca are confined in the high plateau between the two branches of the Cordillera. They are torrential only near their sources, becoming slow-flowing streams on the more level plateau, but with a large volume of water. On the Atlantic watershed where the immense basin of the Amazon is formed by numberless rivers, the amount of available water-power is so vast as to be inconceivable. These precipitous rivers fall from 3,000 to 15,000 ft. in from 30 to 50 miles. Concessions of water for generating power as well as for other purposes are mainly governed by the Mining Code, each application being considered on its merits by a delegation appointed for the purpose. There is no tax whatever on this kind of concession.

As regards electric railways and tramways, the most important tramway system in Peru is the Associated Railway, Light and Power Co., of Lima, commonly called the Electric Trust (Empresas Electricas Asociadas), which has the monopoly of the three industries for Lima, Callao and their suburban towns. Its water-power stations are located near Chosica and at Santa Rosa, on the Rimac River, with auxiliary steam plants for cases of emergency. The dividend of this company was raised to 1½ per cent. for 1910, as against nothing for 1909, and one-half of 1 per cent. for 1908. This increased prosperity was chiefly brought about by the purchase in 1909 of the old National Line to Chorillo, and the suppression of its disastrous competition. The use of the £30,000 received from the sale of the Encarnacion station property in Lima for the redemption of outstanding debentures brought about an annual saving in interest of £1,500. The Electric Trust has a paid-up capital of £1,500,000, and its profits for 1911 amounted to £100,000, as against £80,000 in 1910. On June 21st, 1911, was completed the organisation of the Sociedad Electrica del Cuzco, Ltda. (Electric Co. of Cuzco, Ltd.). The board of directors was elected from representative Arequipa business men, and the company was formed to supply electric light and power to the City of Cuzco, the ancient Inca capital and present terminus of the main division of the Southern Railway, on the route of the proposed Pan-American line. The plan is to take water from Lake Chincheros by canal, or more likely, to go east of Cuzco and use the waters of the Vilcanota River. Plans for the installation of electric light and power in Cuzco are said to have been approved by the President.

By a Federal decree of August 11th, 1911, a private joint-stock company, the Compania de Tranvia Electrica de Arequipa, was recognised as the concessionaire for the construction and operation of the electric street railway system of Arequipa, by virtue of the assignment to it by the Crédito Urbano de Arequipa, then in liquidation, of the contract of May 13th, 1910, entered into for the purpose indicated. According to a local publication, the actual construction work and laying of the rails on the Arequipa tramway lines was to begin in February, 1912, 8½ miles of single track being comprised in the original installation. Sixty-pound T rails were to be used, with steel poles and brackets for the overhead construction. Power was to be taken from the Arequipa Electric Co., whose power station was then being enlarged to provide the extra capacity, the current being transmitted from Charcani.

The Compania de Tranvia Electrica de Arequipa was incorporated under the laws of Peru with a capital of £30,000 in fully-paid shares, absorbing the urban railway system which operated the horse tramways since 1890. A bond issue of £75,000 was said to have been taken up by a syndicate of bankers which included the Bank of Peru and London, the Italian Bank, and W. R. Grace & Co.

Increase of business led the Arequipa Electric Co. to erect an additional power plant at Charcani to include two new hydro-electric units of 330 kw each, the construction being well advanced both on the new canal and the building. The machinery will be installed by the end of this year. A new transmission line is being erected between Charcani and Arequipa, doubling the present capacity and assuring the continuance of service in case of breaks.

The gross income of the company for 1911 was £16,000, and the net income £11,000. A dividend of 10 per cent. was paid on a capital of £60,000. The capital has since been increased to £75,000. Favourable credit arrangements were made with the Banco Aleman Transatlantico, and the income is expected to be materially increased through the consumption of power by the new Arequipa Electric Tramways Co. mentioned above, for which purpose the additional plant was necessary.

There has also been considerable expansion in the adoption of wireless telegraphy. In March, 1912, the wireless telegraph offices of Callao and Lima, under the direction of the Department of Posts and Telegraphs, were thrown open for public use for communication to and from vessels at the following rates: Telegrams, in Spanish, in either direction between the stations in Lima and Callao and steamers, up to 10 words, 25 cents, each additional word, 2½ cents; telegrams in other languages or in code, double rates. Double rates are also charged between other Government telegraph offices and steamers in either direction, or over the wireless line to or from the eastern part of the country, adding the rate of that line to the Lima or Callao rate. These rates are in addition to the charges of the companies supplying the services aboard steamers, which are collected in advance with the rate for the Government service.

The direct wireless service now in operation between Iquitos and Lima is under the direction of the Department of Public Works and Development.

In the summer of 1912, the Government ordered four new wireless stations, to give communication between the Southern Railway's station of Tirapata and ports in the Madre de Dios region. It is also proposed to place several stations along the coast and at points in the interior difficult of access by wire lines. Since the beginning of this year, wireless equipment has been installed on the naval transport *Chalaco* and on the *Limari* and other steamers in the Chilean trade. At the General Post Office and Telegraph Office in Lima, there has been installed a radio-telegraphic station, the apparatus for which was all made in a small workshop belonging to that branch. It has a radius of 300 miles, which will be increased to 500 miles.

According to official information, there were in active operation in Peru in 1912 the following radio-telegraphic stations:—At Lima a 10-kw. Telefunken system and a 2-kw. Peruvian system; at Iquitos, a 10-kw. Telefunken system; at Callao, a 2-kw. Peruvian system; and at Puerto, Bermudez, Masisea, Orellana, and Requena 2-kw. Telefunken systems.

## MESSRS. PARMITER, HOPE & SUGDEN'S WORKS, MANCHESTER.

ABOUT ten years ago Messrs. Parmiter, Hope & Sugden moved into a small building in Ellesmere Street, almost opposite their present works.

In the interval the growth of the firm's switch and fuse business necessitated a removal into larger premises, which, it is satisfactory to know, are still being extended, and constitute the Hulme Electrical Works, as we know them to-day, a building with 100 yards of frontage and several floors in height.

The works are laid out for the production of standard lines of ironclad switchgear and distribution fuseboards for power and lighting, and the mention of the Hope "honey-comb" fuse and "bi-metal" fuse wire will be sufficient to remind our readers of the firm's activities particularly in fuse-gear. The business has, in fact, been built up on specialisation and standardisation, in conjunction with originality in design, and some idea of its scope can be gathered from the output of about 1,000 switches and fuses per week, a large percentage of which goes abroad, chiefly to Australia and South Africa.

The works comprise, on the lower floor, an erecting shop for power distribution boards, with examining, painting and packing departments, and general stores for parts and fittings adjoining. The stores receive their complement of machined parts for stock from the general machine shop on the next floor—this section of the works being fully equipped

with necessary tools for dealing with the class of work undertaken by the firm.

A further floor houses another section of the works devoted almost exclusively to small switch work of a cheaper

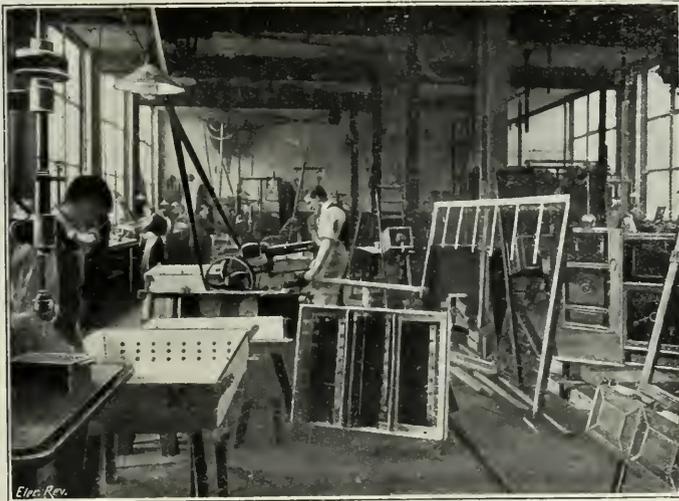


THE HULME ELECTRICAL WORKS OF MESSRS. PARMITER,  
HOPE & SUGDEN.

type—one outstanding feature of this department is the enormous output of the familiar small K type switches, a pattern of switch which, we understand, was originally designed by the firm, and has undoubtedly become very popular.

Another department is devoted to small fuse fitting, and here also the firm's well-known bi-metal fuse wire—an alloy fuse wire with a copper core—is dealt with.

A fully equipped test room is provided, and extensive general and drawing-office accommodation. In the course of our visit a considerable order for three-phase "unit" distribution boards for a Yorkshire mill was passing through the works. The Hope unit system consists of cast-iron fuse-boxes so constructed that either end can be removed and additional fuse-boxes added, the bus-bars being extended to suit. These and other types of fuseboards are built up of standard single fuses on black china bases, each one fixed to the case by a central screw, and therefore easily detachable and replaceable.



THE ERECTING SHOP FOR DISTRIBUTION BOARDS, &c.



SMALL FUSE DEPARTMENT.



THE GENERAL OFFICE.

This construction dispenses with the usual slate base. The firm, of course, builds motor-starting panels and pillars of the water-tight and gas-tight patterns, particularly for mining work.

In the smaller type of fuseboard for lighting work, the new "Home Office" pattern of fuse—in which the usual method of construction is reversed, the live parts being fixed at the back of the china bases instead of in front, so that the fuses make contact through slots in the china—is interesting.

In fuseboards of this kind the bases can be fixed on hinged battens, thus enabling wiring at the back to be got at easily without interfering with the board. We understand that several thousand fuseboards with "Home Office" fuses are on order from these works at the present time.

However, the speciality of the firm is probably the "honey-comb" fuse, which is constructed in stock sizes between 20 and 650 amperes capacity, and largely employed in the various fuseboards built in the works.

Many of our readers are, no doubt, familiar with its construction, which includes a peculiarly wired hollow cellular china body enclosed in a lined fibre carrier, and so arranged that when the fuse blows, the volatilised metal is deflected by end baffle plates into the interior of the china body and there condensed. Another feature is the wiring of

treatment in the endeavour to gain reliable information as to their probable behaviour.

Although we have not mentioned specifically the numerous patterns of Ajax ironclad switches and switch



THE FINISHED STORES.

fuses, these are standard lines with the firm with which our readers are well acquainted.

Standardisation and organisation have enabled the firm to successfully carry through some very large orders—exhaustive stocks of regular pattern switches and fuses being always available for despatch the same day as ordered.

In conclusion, we are indebted to Mr. Vernon Hope for an instructive visit and an interesting, if unintentional, demonstration of the success which attends originality of design and specialisation.

### CRANE PLANT OF AN ITALIAN STEEL WORKS.

BY DR. ALFRED GRADENWITZ.

RECENT extensions of the iron and steel works of Terni (Rome) entailed the installation of a number of cranes



THE GENERAL MACHINE SHOP.

the china interior by means of small through copper strands—which normally carry the bulk of the current—in conjunction with a central fusible tin band coupled by copper strands to the terminals; a double path is thus provided for the current so long as the full normal capacity of the fuse is not exceeded. Any increase of current beyond this raises the temperature of the fuse carrier and melts out the tin band; all the current then passes by way of the through strands which immediately blow.

Although such a fuse has a very heavy overload capacity for a short period, the fusible band controls the overload definitely and it is possible to supply the fuse under a guarantee as to performance.

Many tests have proved that this fuse will stand the heaviest short-circuit without damage to the terminals; indeed, the firm can point with pride to a collection of undamaged fuse sections which have withstood most unmerciful



MACHINE AND FITTING SHOP FOR SMALL IRONCLAD SWITCHWORK.

destined for the most diverse purposes. After a very lively competition, in which the foremost crane builders of the chief industrial countries took part, the Maschinenfabrik Oerlikon, of Oerlikon, near Zurich, was entrusted with the construction of the crane plant. As this is one of the most remarkable installations of its kind in existence, a short description of the more important cranes will be of interest.

All the motors used in connection with this plant are fed from the three-phase current system of the works, at 42 cycles, 310 volts, and are designed as enclosed slip-ring motors, only the servo-motors for operating the brakes being enclosed motors with squirrel-cage rotors.

1. *Travelling Foundry Crane of 120 + 25 Tons' Capacity.*

—The extensive foundries of Terni, where the heaviest castings are made, necessitated the installation of a travelling crane of 120 tons capacity, which was tested with a load of 150 tons on delivery.

Fig. 2 shows the crane with its ladle (which with its contents is 120 tons in weight). The main crab is designed to lift 120 tons, while an auxiliary crab with two motors serves for the lifting of loads up to 25 tons in weight, and is mainly used for tipping the ladle suspended from the main crab. The span between centres of crane rails is 18.25 m., and the lift of main hoist about 12 m. The auxiliary hoist has a lift of 17 m.

The main hoist lifts 120 tons at a speed of 1 m. per

chords and substantial cross bracings. A gallery is arranged along one side, and the driver's cage is at one end of the bridge. The girders carry two rails for the main crab and

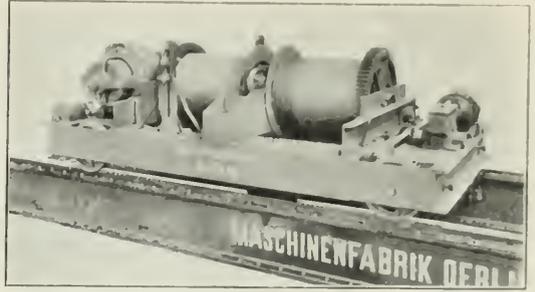


FIG. 4.—AUXILIARY TROLLEY OF FOUNDRY CRANE.

two for the auxiliary crab, and two balancers fitted into the cross girders receive the axles of the travelling wheels.

The crane travels longitudinally on eight cast-steel wheels with steel axles, four of which are fitted with toothed rims for the drive. The longitudinal shaft, which is driven in

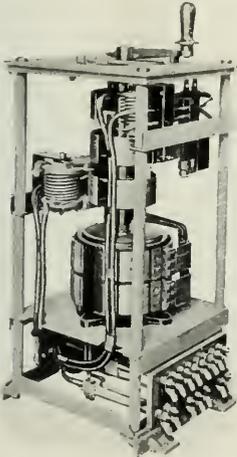


FIG. 1.—REVERSING STARTER OF 120-TON CRANE.

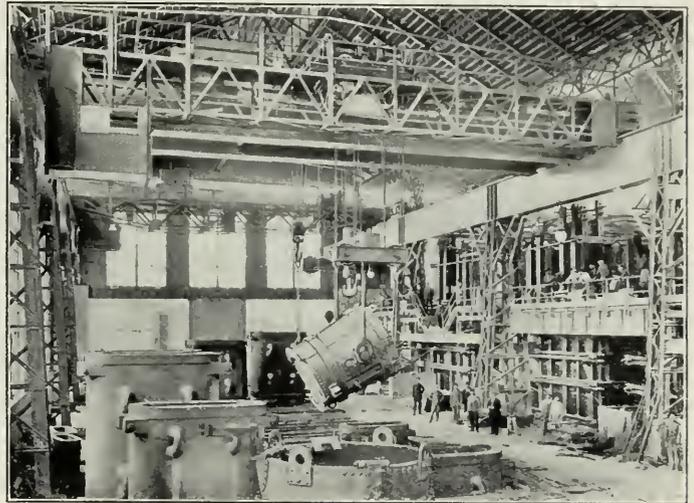


FIG. 2.—FOUNDRY CRANE OF 120 TONS' + 25 TONS' CAPACITY.

minute, and 60 tons at 2 m. per minute; the travelling speed of the crane at full load is 20 m. per minute, and of the main trolley 12 m. per minute. The lifting speed of

the centre, carries two steel pinions, and is supported at several places by bearings. The main trolley carries two motors for lifting and traversing respectively. The lifting motor is direct-coupled by means of clutches with two worm gears running in oil in a casing, the axial thrust being taken by ball bearings. Pinions on the two worm-wheel shafts engage with the toothed rims of four cable drums, 680 mm. in diameter. The traversing motor of the trolley similarly communicates through a clutch with a worm-gear driving the shafts of the trolley rollers. The eight rollers, 500 mm. in diameter, are made of cast-steel and run on steel axles, four of them being fitted with toothed rims for the drive. Both motors can also be rotated by hand.

For holding the load there are provided two toggle-joint brakes automatically actuated by servo-motors, and there are also auxiliary safety brakes acting directly on the cable drums. This arrangement comprises four friction brakes

for the four drums, each provided with a pinion and designed to be actuated from the driver's cage in case of emergency, by a pawl and ratchet wheel. All toothed

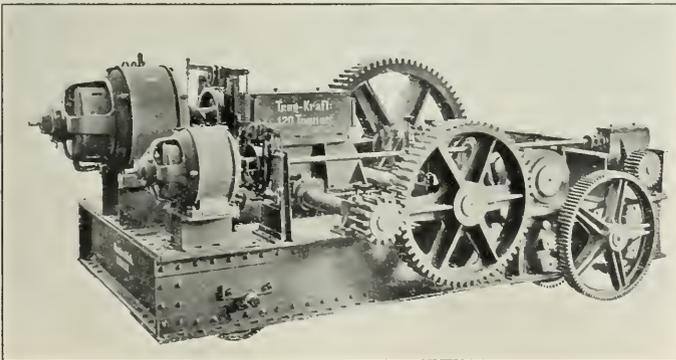


FIG. 3.—TROLLEY OF 120-TON GANTRY CRANE (see next page).

the auxiliary trolley (fig. 4) at full load is 3 m. per minute, and at half load 6 m. per minute.

The crane consists of two stout box girders with parallel

wheels have been milled on special machines. An especially flexible high-grade plough-steel wire was used for the load cable, which is 20 mm. in diameter and about 340 m. in total length. This carries in a  $4 \times 6$ -fold suspension from



FIG. 5.—TWIN GANTRY CRANE OF 120 TONS' CAPACITY.

a pulley block comprising eight pulleys, a substantial iron beam fitted at the ends with two jointed hooks for receiving the ladle, and in the middle with a double hook resting on ball-bearings for a load of 120 tons.

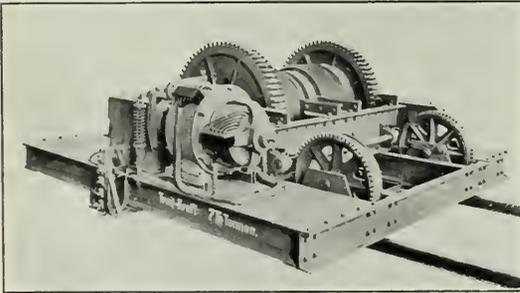


FIG. 6.—TROLLEY OF 75-TON TRAVELLING CRANE.

The auxiliary crab travels on rails arranged inside the box girders, and carries on a wrought-iron frame, two motors for traversing and for the lifting of loads up to 25 tons respectively, which can also be operated through a hand-crank, the energy being likewise transmitted to two worm gears connected by clutches. A toggle-joint brake and servo-motor are provided for stopping the load. The shaft of the worm-wheel carries two pinions engaging with the cast-steel toothed rims of the two cast-iron cable drums. The steel cable is 14 mm. in diameter and 210 m. in length, and is guided by four pulleys: it carries a simple wrought-iron crane hook on ball-bearings.

The traversing motion of the auxiliary trolley on four rollers is effected from the motor through worm gearing and a pair of bevel wheels, two of the rollers being fitted with toothed rims for the drive.

Both trolleys derive their current from 10 trolley contacts fixed by insulators on brackets, from the conductors running alongside of the crane girder.

The lifting motor of the main trolley, which is designed for lifting loads of 120 tons at a speed of 1 m. and 60 tons at a speed of 2 m., is wound for two different numbers of poles, viz., 8 poles for 120 tons and 4 poles for 60 tons, its output being 45 h.p. The traversing motor has at full load,

with a speed of 12 m. per minute, at 1,200 R.P.M., an output of 18 h.p.

The lifting motor of the auxiliary hoist is designed for an output of 26 h.p. (for the lifting of loads of 25 or 12.5 tons at a speed of 3 or 6 m. respectively per minute) as a two-speed motor with the same numbers of poles and revs. per min. as the main motor, and the traversing motor has an output of 4 h.p. for a load of 25 tons at 20 m. per minute.

The motor effecting the longitudinal motion of the crane is—like all the rest—connected through a semi-elastic clutch with a worm gear transmitting the energy to the longitudinal shaft, and is fitted with a mechanical brake operated by a pedal from the driver's cage. Its output in transporting the crane at full load at a speed of 20 m. per minute is 40 h.p. This motor can also be driven by a hand crank.

All the motors are controlled from the driver's cage through a combined starter, comprising an electrically braked reversing starter for the main hoisting motor, a reversing starter with starting resistances and fuses for the motor effecting the longitudinal motion of the crane, and a similar one for the traversing motor. The auxiliary trolley is controlled through a reversing starter with starting resistance and fuses for the hoisting motor, and the same for the traversing motor of the winch.

2. *Gantry Cranes of 120 tons' Capacity with Turning Gears, for the Operation of a Hydraulic Press.*—In manufacturing heavy armour plates and guns for the Navy and for other purposes, the Terni Iron and Steel Works frequently use huge hydraulic presses, e.g., a press of 4,500 tons' pressure, allowing the heaviest castings to be forged.

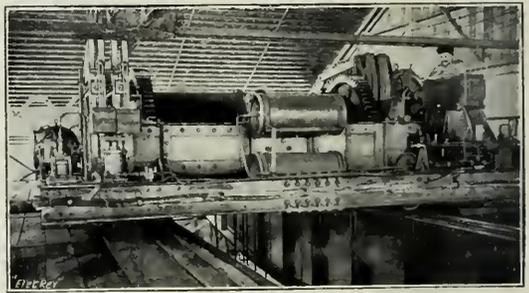


FIG. 7.—TROLLEY OF 60-TON CRANE.

The pneumatic hammer formerly used for the same purpose was served by two hand-operated gantry cranes designed as a rotating twin gantry crane with common central pillar, which, on account of its wide range (about 22 m.), allowed

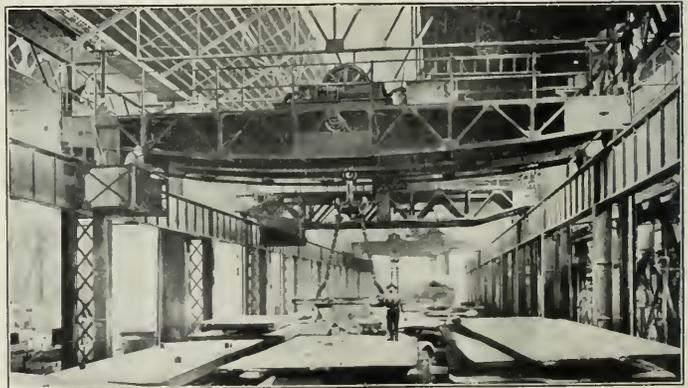


FIG. 8.—TRAVELLING CRANE OF 75 TONS' CAPACITY.

the ingots to be taken from the furnace directly to the press without unloading. These cranes have now been reinforced, raising their capacity to 120 tons and converting from hand to electrical operation. The main data of this twin crane (fig. 5) are as follows:—Normal capacity (useful load)

120 tons; ganges of trolleys, 1.625 m. and 1.995 m.; radius of crane track, 21.6 m.; lifting speed with load of 120 tons, 3 m. per minute; traversing speed of trolley with 120 tons, 20 m. per minute; speed of rotation of gantry as measured on the crane track, 15 or 30 m. per minute (the lower speed being used during pressing); minimum distance between press and axis of load suspension, 1,400 mm.

The electrical arrangements of both cranes are identical. The design of the motors and gear generally corresponds with that of the foundry crane. Two of the four rollers of the trolley have toothed rims for the drive, and a Gall chain, the length of which has been so designed that the turning gear suspended by it may touch the ground in an erect position, serves to carry the load (fig. 5). This has been designed as a 2 x 4-fold chain. An alarm bell is sounded as soon as the terminal positions are reached.

The main current supply to each crane is in the pivot above the presses, and is designed with slip-ring contacts. Current supply to the trolleys and to the motor of the turning gear is effected by means of 16 insulated roller contacts fixed to a bracket. The output of the lifting motor is 135 H.P. at 1,220 R.P.M., and that of the traversing motor 25 H.P., at the same speed. The drive for the rotation of each crane comprises a two-speed motor of 65 H.P. at 810 R.P.M., or 35 H.P. at 410 R.P.M., with 6 or 12 poles respectively.

In order to allow heavy and clumsy castings to be dealt with as easily and simply as possible, turning gears suspended by the crane chain are used for turning the ingots round below the press. Each of these turning gears is an iron structure 2.3 m. in width, with lateral sheet metal walls and a bracket for receiving the motor and drive. It is suspended from the Gall chain by means of a beam with ball bearing and rollers, and is free to rotate round its vertical axis. The driving motor is designed to yield 35 H.P. during 4.5 hours' continuous operation.

The piece suspended by this turning gear is turned round at will below the press, in accordance with the requirements of the service. The motor is connected with a worm gear by a friction clutch ensuring a smooth operation. The turning gear is controlled from the driver's cage of the gantry crane, its speed of motion being regulated in three to four steps by inserting resistances. By regulating the speed of motor, ingots of different sizes can be turned round at practically the same peripheral speed.

The service of the turning gear requires considerable skill and foresight on the part of the crane driver, who with one hand controls the lifting and lowering, and with the other the turning-gear motor. In view of the rapid working of the press, a continuous regulation of the crane starters is required, the load being lifted quickly after each pressing operation and turned round by the turning gear. The resulting fluctuations in the load on the motors had to be allowed for in the design of them.

The several motors for lifting, traversing and turning respectively, can be controlled by means of two independent sets of starters. This double control allows the pressing process to be watched more easily by the driver.

3. *Travelling Crane of 75 tons' capacity for the Operation of the Armour-plate Rolling Mill and Hydraulic Moulding Presses.*—The main data of this crane are as follows:—

Span between centres of crane rails, 13.43 metres; height from floor to upper edge of crane rails, 7.9 metres; capacity, 75 tons, with lifting speed of 1.80 m. per minute; 37.5 tons with lifting speed of 3.60 m. per minute; traversing speed, with full load, 12 m. per minute; travelling speed, with full load, 25 m. per minute.

The equipment of the crane corresponds to that of the foundry crane described above, apart from the auxiliary trolley used in connection with the latter. Three motors are provided for the various motions, the lifting motor of 40 H.P. being designed with eight and four poles in accordance with the two lifting speeds of 1.8 and 3.6 metres per minute, with loads of 75 and 37.5 tons (at 600 and 1,200 R.P.M. respectively). A pole switch operated by remote control from the driver's cage is provided for changing from one speed to the other. The traversing motor has an output of 10 H.P. at 1,200 R.P.M., and the motor for the longitudinal motion of the crane (which is coupled by a semi-elastic clutch to toothed gearing), 25 H.P. at 1,200 R.P.M.

The brake of the lifting motor is controlled automatically by a servo-motor. The lifting hook is a wrought-steel double hook resting on ball bearings and suspended by 2 x 6 steel cables, each 23 mm. in diameter (figs. 6 and 8).

4. *Travelling Cranes of 60 and 20 tons' capacity respectively for the gun-hardening factory.*—Two special cranes built by the Oerlikon Machine Works are used to immerse gun barrels, vertically suspended from the hook, in oil tanks for hardening; they suffice for the longest tubes manufactured at Terni, and are especially remarkable for their considerable lowering speed, which is accurately adjusted.

In accordance with their special use, these cranes had to be mounted at a considerable height above the floor. The cranes are installed in two adjoining shops at different levels, the 60-ton crane being situated at 22 m. and the 20-ton crane at 11.4 m. from the upper edge of the crane rails to the ground. Both cranes are of the same design as those already described, their main data being as follows (fig. 7):—

	60-ton crane.	20-ton crane.
Lifting speed with full load ...	6 m. per min.	8 m. per min.
Lowering speed with full load ...	80 " "	80 " "
Traversing speed ...	20 " "	20 " "
Travelling speed ...	50-25 " "	60-30 " "

The lifting motors are fitted with a pneumatic brake on the Jordan system, which being operated from the driver's cage through electric remote control allows the lowering speed to be kept constant.

The brake is designed as a jaw brake, being put on by a weight and relieved by the piston of a brake cylinder fed with compressed air. A small air pump driven from the lifting motor produces compressed air, which is accumulated in a special tank, whence it is supplied in accordance with requirements to the brake cylinder. On a given air compression being reached, the air supply is cut off automatically by a pressure regulator, the compressor running at no load until the pressure falls again. A regulator permanently coupled to the lifting drum adjusts the air pressure in the brake cylinder, so that the lowering speed remains constant with any load (as well as at no load). During the lowering operation the lifting motor is uncoupled by a claw clutch actuated by compressed air, and the hook and load can then be lowered at 13 times the lifting speed (80 m.) without carrying the motor along. The control of the lowering motion is so arranged that lowering cannot be effected before uncoupling the motor. On account of the considerable power (about 1,000 H.P.) absorbed by the brake in lowering, the mechanism is designed most substantially. In order to eliminate any risk of failure of the brake during the hardening process, which would be liable to have the most disastrous consequences, four brake disks are provided on the 60-ton crane and two brake disks on the 20-ton crane, each of which alone is able to keep the load suspended.

Enormous difficulties, which could not be foreseen, were met with in designing this braking arrangement to comply with the special conditions to be met by the special cranes and to ensure a smooth operation: the braking effect is absolutely reliable and the lowering speed is kept constant, while all shocks and jerks are avoided and braking distances reduced to a minimum.

For traversing, there is provided a toggle-joint brake operated automatically by a servo-motor. The wrought-steel double hook is free to rotate on ball bearings round its vertical axis. It is suspended in the 60-ton crane by a 12-strand cable and in the 20-ton crane by an eight-strand cable.

The motor outputs are as follows:—

	60-ton crane.	20-ton crane.
Lifting motor with full load ...	110 H.P.	50 H.P.
Traversing motor with full load ...	15 H.P.	6 H.P.
Travelling motor with full load ...	36 H.P.	20 H.P.

All these motors run at a speed of 1,200 R.P.M.

The arrangement of the trolley contacts is the same as in connection with the other cranes, 13 bare copper conductors, 6 and 9 mm. in diameter respectively, with insulators and tightening screws, being used to convey the current to the trolley motors.

In addition to the cranes above described, a number of transporting cranes of the most diverse capacities and of the Maschinenfabrik Oerlikon's standard design have been supplied to the various workshops of the extensive Terni Iron and Steel Works.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—At the meeting on the 13th inst., of the Ealing B.C., the Mayor said he desired publicly to thank Mr. J. D. KNIGHT, borough electrical engineer, and Mr. A. E. PULLEN, for having very kindly acted as stokers at the electric light works on a recent evening when the employes were being entertained at the Town Hall. It only showed, said his Worship, how ready the head officials were to do anything to enable those under them to have an evening's enjoyment.

Mr. G. A. BRUCE, electrical engineer and tramways general manager to the Lowestoft T.C., has tendered his resignation.

With reference to the paragraph inserted in our issue of February 7th with regard to the decision of the Electricity Committee of Poplar to give prominence to the managerial side of the department, the Committee has now reconsidered its decision as regards the salaries of Mr. V. H. CRICKSHANK, station engineer, and Mr. E. R. INGRAM, mains engineer, and these gentlemen are now to receive salaries of £225 per annum, rising by annual increments of £12 10s. to £300 per annum.

The Installation Engineer of the Tynemouth undertaking has handed in his resignation, which has been accepted by the Electricity Committee, who invite applications for filling the vacancy on the same terms and remuneration as at present.

The salary of the electrical engineer at Rhyl was increased, at a meeting of the Rhyl District Council last week, from £170 to £200 per annum.

**Tramway Officials.**—The Bournemouth T.C. has, on the recommendation of the Tramways Committee, decided to increase the salary of Mr. VICKERS, chief assistant and electrical engineer, from £325 to £375 per annum, with annual increments of £25 to a maximum of £450; that of Mr. BALDWIN, tramway traffic superintendent, by £25 a year; and that of Mr. HARTLEY, works superintendent, by £25 per annum.

Out of some 300 applicants, Mr. G. M. BARRELL, chief cashier of the Leeds Tramway Department, has been appointed to a similar position under the Huddersfield Tramways.

**General.**—Mr. SIDNEY ANDREWS has severed his connection with Messrs. Veritys, Ltd., for whom he acted as manager for Scotland for many years, and is now representative for Scotland and Ireland for Messrs. Royce, Ltd., of Manchester. His address is 133, Mount Annan Drive, Mount Florida, Glasgow, and all communications should be sent there.

Mr. HENRY C. CREWS, M.I.E.E., of Manchester, has been appointed by the governing body of Denstone College to act as consulting electrical engineer in charge of the electrical installation at the college.

On the occasion of their golden wedding, Mr. and Mrs. COX-WALKER have been presented by the present and past employes of Messrs. Cox-Walkers, Ltd., electrical engineers, of Darlington, of which Mr. Cox-Walker is a governing director, with a silver hot-water jug.

Mr. COLIN P. SUTHERY, of the staff of the British Thomson-Houston Co., Ltd., of Rugby, who is leaving to take charge of the electrical business of Messrs. Johnson & Fletcher, at Bulawayo, Rhodesia, has been presented by his colleagues with an attaché case.

We are informed that the old-established firm of Clark, Forde and Taylor (H. A. Taylor, A. L. Dearlove and R. M. Sayers), consulting engineers to the Pacific Cable Board and many of the large submarine cable companies, has been joined as partner by Dr. J. Erskine-Murray, D.Sc., F.R.S.E., the well-known expert in wireless telegraphy. The style of the firm after March 25th will be Clark, Forde, Taylor & Erskine-Murray, 4, Great Winchester Street, E.C. By this combination the firm will be in a position to advise upon, and act as consultants in, all branches of telegraphic engineering. The firm has been going for over 40 years, and at one time or another has acted as engineers for nearly all the large cable companies, supervising the making and laying of over 175,000 nautical miles of submarine cable. It must not be supposed that the firm fears the effect of wireless on cable work: it is associating the two systems in the belief that they will be helpful to each other, and that their interests do not really clash. Mr. Herbert Taylor will not now take such an active part in the firm as heretofore, but his valuable experience and advice will be available.

**Obituary.**—We regret to record that the death occurred suddenly at Aberdeen on 15th inst., of MR. WILLIAM BULLOUGH, of Messrs. Howard & Bullough, Accrington, in his 50th year.

## NEW COMPANIES REGISTERED.

**Cunningham, Ltd.** (127,664).—This company was registered on March 10th, with a capital of £1,500 in £1 shares, to take over the business of an electrical and electrical engineer carried on by R. N. Cunningham, at Ware Road, and 3, Wellington Terrace, Hayswater Road, W., as "R. N. Cunningham & Co." The subscribers (with one share each) are:—R. N. Cunningham, 171, Edgware Road, W., electrical engineer; L. Isaacs, 63, Abdon Road, Newington Green, N., traveller. Private company. The first directors are R. N. Cunningham (permanent governing director), R. L. Isaacs. Registered office, 171, Edgware Road, W.

**British Electric Heater Co., Ltd.** (8,571).—Registered March 7th, by Dalgleish, Debbie & Co., 26, Charlotte Square, Edinburgh. Capital £50,000 in £1 shares (80,000 participating pref.). Objects: To carry on business as electricians, mechanical, hydraulic and general engineers. The signatories (with one share each) are:—T. R. McLaren, 105, West George Street, Glasgow, clerk; M. Blair, jun., Gairland, Hamilton, clerk; K. Patrick, Trafford Bank, Bishopbriggs, clerk; J. R. Dunlop, 181, Douglas Street, Glasgow, clerk; J. McGavin, Cambusketh, Kilmarnock, clerk; H. J. Fiverson, 160, Onslow Drive, Dennistown, Glasgow; Miss I. W. Armstrong, 66, Ardwall Terrace, Rutherglen. The first directors (to number not less than four or more than nine) are A. W. Terrance, A. Green-Thompson, G. Ritchie, R. H. Crossman, C. H. Urquhart, and G. B. Young; qualification, 100 shares; remuneration, £50 per annum (£20 extra for chairman). Registered office, 105, West George Street, Glasgow.

**C. A. Parsons & Co., Ltd.** (137,619).—Registered March 7th, by Crossman, Pritchard, Crossman & Block, 16, Theobald's Road, W.C. Capital, £150,000 in £100 shares. Objects, to carry on the business of electrical, hydraulic, mechanical and general engineers, founders and workers in metals, boiler makers, machiners; and implement manufacturers and designers, shipowners, &c., to acquire the businesses and undertakings of C. A. Parsons and Co., of the Heaton Works, Newcastle-on-Tyne, and elsewhere (including as part thereof the business carried on by Scott & Mountain, Ltd., at the Close Works, Gateshead), and to adopt an agreement with the Hon. Sir Charles A. Parsons. The signatories (with one share each) are:—Hon. Sir Charles A. Parsons, K.C.B., 1, Grosvenor Gardens, W.; W. H. Johnston, Heaton Works, Newcastle-on-Tyne, engineer; W. H. Johnston, Heaton Works, Newcastle-on-Tyne, engineer. Private company. The first directors (to be not less than three or more than seven, are Hon. Sir Charles A. Parsons, K.C.B., and not more than six others, to be nominated by him; qualification, £1,000; remuneration as fixed by the company. Solicitor, T. W. Thompson, Newcastle-on-Tyne. Registered office, Heaton Works, Heaton, Newcastle-on-Tyne.

**J. W. Courtenay, Ltd.** (187,549).—Registered March 4th, by G. D. Perks, 86, New Broad Street, E.C. Capital, £50,000 in £1 shares (10,000 6 per cent. cumulative preference, and 40,000 ordinary). Objects: To carry on the business of advertising agents and contractors, billposters, manufacturers of and directors in advertising specialties, electrical and mechanical signs and apparatus, printers, lithographers, designers, publishers, booksellers, &c., and to adopt an agreement with J. W. Courtenay, 6, Park Street, W.C. The signatories (with one share each) are:—J. T. Chapple, 79, Gresham Street, E.C., solicitor; W. W. Wright, 39-4, Broad Street Avenue, E.C., chartered accountant. Private company. The first directors are J. W. Courtenay, W. W. Wright and J. T. Chapple; remuneration (except managing director) £100 each per annum.

**Spiral Regulating Dynamo Co., Ltd.** (127,532).—This company was registered on March 3rd, with a capital of £5,000 in £1 shares, to acquire from A. A. Price patent rights relating to an electric dynamo. The subscribers (with one share each) are:—J. H. Turner, The Films, Willesden Green, N.W., contractor; F. T. W. Price, 122, Aldersgate Street, E.C., merchant; A. A. Price, 25, Charlotte Street, W., engineer. Private company. The number of directors (not to be less than three or more than five) are:—J. H. Turner, F. T. W. Price and A. A. Price; qualification, £100; remuneration according to profits. Registered office, 25, Charlotte Street, W.

**Rotary Units, Ltd.** (127,656).—This company was registered on March 8th, with a capital of £600 in £1 shares, to carry on the business of founders, engineers, makers of steam, gas and oil engines, petrol and other motors, motor-cars and buses, motor-boats, gas-producer plants, boilers, steam and water turbines and air compressors, electricians, manufacturers of electrical apparatus, &c. The subscribers (with one share each) are:—C. W. Jamieson, 2, Sunningdale Gardens, W., engineer; A. G. Orice, Drumceith, Dundee, engineer; J. T. Wood, Home Works, Datchet, engineer; C. M. Kellar, Home Works, Datchet, engineer. Private company. Table "A" mainly applies. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**Rodonit Syndicate, Ltd.** (127,627).—This company was registered on March 8th, with a capital of £5,000 in £1 shares, to take over the business of manufacturers of "Rodonit," carried on by W. Hermann and F. D. Bull, at Southbury Road, Enfield, as Hermann, Bull & Co. The subscribers (with one share each) are:—F. D. Bull, merchant, 149, Manor Road, Stoke Newington, N.; R. Abernethy, 30, Springfield Avenue, Manswell Hill, N., electrical engineer. Private company. The first directors are W. Hermann, Secretary, and Housley, Ltd., 11, Broad Street, W., and G. W. Beckmann, Secretary, C. W. Beckmann. Registered office, 20, Victor Road, Finsbury Park, N.

**Anger Manufacturing and Supply Co., Ltd.** (127,703).—This company was registered on March 12th, with a capital of £2,000 in £1 shares, to acquire from J. E. Anger and G. H. Anger the invention of an automatic brake adjuster, and of improvements in apparatus for automatically adjusting or taking up the slack in brakes of trams and other vehicles, together with the business of engineers carried on by them. The subscribers (with one share each) are:—G. H. Anger, 186, Strand Road, Preston, engineer; A. Foster, 10, St. George's Square, St. Anne's-on-Sea, cotton spinner and manufacturer; J. Wilson, 53, Higher Back Road, Fulwood, Preston, rubber merchant. Private company. The number of directors (not to be less than three or more than five) are:—G. H. Anger (managing director), A. Foster and J. Wilson (all permanent, subject to holding 100 shares); qualification of ordinary directors one share; remuneration of managing director, £260 per annum. Solicitors, W. R. & W. Ascroft, Preston. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**Parana Power Syndicate, Ltd.** (127,747).—This company was registered on March 19th, with a capital of £10,000 in £1 shares, to acquire shares, debentures and securities of tramway, light and power companies in Brazil or elsewhere, and to adopt an agent with A. J. Bynington. The subscribers (with one share each) are:—W. J. Simpson, 85, Kings Road, Willesden Green, N.W., clerk; J. M. Tolley, 2, Rond Court, Walkbrook, E.C., clerk. Private company. The number of directors is not to be less than two: the first are W. J. Simpson and J. M. Tolley. Registered office, 4, London Wall Buildings, E.C.

**New British Ever-Ready Co., Ltd.** (187,638).—Registered March 7th by Corbould, Ellis and Mitchell, 14, Clement's Lane, Lombard Street, E.C. Capital £200,000 in £1 shares (115,000 ordinary and 85,000 7 per cent. cum. participating preference). Objects: To carry on the business of electricians, electrical engineers, manufacturers of and dealers in electrical appliances, wires, accumulators, batteries, dynamos, lamps, switches, torches, novelties and specialities, mechanical engineers, printers and suppliers of electricity and power, and to take over the business of the British Ever-Ready Electrical Co., Ltd. Power is also taken to manufacture and deal in motor vehicles, flying machines and the like. The signatories (with one share each) are:—S. Stern, Ever-Ready Works, Hercules Place, Holloway, N., merchant; G. F. Ritzelberger, Hercules Place, Holloway, N., works manager; M. Goodfellow, Hercules Place, Holloway, N., company secretary; C. H. Dade, 1, Kingsway, W.C., manager of public company; B. R. H. Baker, Craigden, Blanchford Road, Stamford Brook, W., accountant; E. McNair, 3, East Ham Road, Littlehampton, secretary of public company; G. Bostock, 21, Ironmonger Lane, E.C., chartered accountant. Minimum cash subscription, 85,000 preference shares. The first directors (to be not less than three or more than five) are, Mr. S. Stern, G. F. Ritzelberger, M. Goodfellow, C. R. C. Soller (7½, Colman Street, E.C.), and C. J. Dada (Electrical Federation Office, 1, Kingsway, W.C.); qualification, £250 preference shares; remuneration not more than £100 each per annum (managing director, £750 per annum), with any extra amount voted by the company. Registered offices, Hercules Place, Holloway, N.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Sun Electrical Co., Ltd.** (63,261).—Capital, £45,400, in £1 shares (20,000 pref.). Return dated January 6th, 1918, 5,400 ord. and 19,704 pref. shares taken up. £19,164 paid. Mortgages and charges: £3,875.

**Melbourne Electric Supply Co., Ltd.**—A memorandum of satisfaction in full on March 5th, 1918, of mortgage dated August 3rd, 1911, securing not more than £250,000, has been filed.

**Chippenham Electric Supply Co., Ltd.**—Particulars of £2,000 debentures created February 3rd, 1918, and secured by trust deed of even date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and part of the old gasworks, Chippenham, with fixtures, plant and machinery, &c., thereon. Trustees: A. Cotes and A. A. Douglas.

**Tyler & Co., Ltd.**—Particulars of £7,000 debentures, created February 27th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Sun Electrical Co., Ltd.**—A memorandum of satisfaction to the extent of £275 on March 5th, 1918, of debenture stock dated March 31st, 1911, securing £7,000, has been filed.

**City of Ly Electric Light and Power Co., Ltd.** (79,285).—Capital, £5,000 in £1 shares. Return dated January 7th, 1918; 3,008 shares taken up; 2s. per share called up; £300 6s. paid. Mortgages and charges Nil.

**Electrical Industries Development Co., Ltd.** (89,461).—Capital, £25,000 in £1 shares (20,000 pref.); return dated January 13th, 1918; 9,007 pref. and 5,000 ord. shares taken up; £1 per share called up on 4,007 pref.; £4,007 paid; £10,000 considered as paid on 5,000 pref. and 5,000 ord. Mortgages and charges: Nil.

**India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.** (1,122 Cl.).—Capital, £812,000 in £10 shares (50,000 ord., 25,000 pref., and 6,200 unissued); return dated December 31st, 1912 (filed February 10th, 1913); 50,000 ord. and 25,000 pref. shares taken up; £750,000 paid. Mortgages and charges: £400,000.

**"Dac" Accumulator Syndicate, Ltd.** (40,763).—Capital, £25,000 in £1 shares. Return dated January 14th, 1918. 19,486 shares taken up. £1 per share called up on 4,486. £4,461 paid, leaving £25 in arrears. £15,000 considered as paid on the remainder. Mortgages and charges: Nil.

**Cutting Bros., Ltd.** (81,178).—Capital, £6,000 in £10 shares. Return dated January 4th, 1918. 500 shares taken up. £10 per share called up on 100 shares. £1,000 paid. £3,200 (3 per share) considered as paid on 400 shares. Mortgages and charges: £4,000.

**Supplies Construction Co., Ltd.** (66,081).—Return dated December 31st, 1912. Capital, £350,000 in £5 shares. All shares taken up. £350,000 paid. Mortgages and charges: Nil.

## CITY NOTES.

### Madras Electric Tramways (1904), Ltd.

THE directors' report for 1912 states that there was a gross profit of £20,032. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and transferring £5,000 to the depreciation and renewal fund, there remained a balance of £9,419, plus £1,104 brought forward, making £10,523. Out of this £3,450 was devoted to a dividend of 6 per cent. per annum on the old preference shares; £551 to a dividend of 6 per cent. per annum on the new preference shares; a dividend of 4 per cent. per annum on the ordinary shares is to be paid, absorbing £2,290; and there is devoted to writing off from the cost of issue of new preference shares £500, leaving to be carried forward £3,732. The traffic receipts show an increase of 11.98 per cent. upon the 1911 figures. The undertaking has been maintained, as heretofore, out of revenue, and special improvements and renewals have been debited to the depreciation and renewal fund, as formerly. The reserve arising from the debenture stock sinking fund now amounts to £4,608. During the year 5,860 6 per cent. cumulative preference shares were issued to repay the temporary loans obtained for the extensions to Washermanpet and Royapuram, which were opened in March and September respectively. Four new large double bogie cars have been supplied, and six trailers are being provided for the increased traffic. Further extensions of the tramway are also contemplated. The board record the death of their chairman, Mr. W. S. B. McLaren, M.P. They have elected Mr. Arthur Maxwell Quill as his successor.

The annual meeting was held on March 13th at the offices, Dashwood House, E.C. Mr. A. M. Quill presiding.

The CHAIRMAN, in proposing the adoption of the above report, said it was a great pleasure to him, on the first occasion of his chairmanship, to be able to present accounts which again showed a satisfactory improvement. The traffic receipts amounted to Rs. 598,092, being an increase of 11.98 per cent., and the number of passengers carried was 15,895,245—an increase of 8.45 per cent. Part of that increase was due to the opening of two short extensions in March and September respectively, but, obviously, some time must elapse before the full benefit of those extensions could be received. The greater part of the improvement, therefore, was obtained from the old lines, which was very gratifying, considering that the traffic had shown a steady upward tendency since the fares were reduced some years ago. Their fares were probably lower than on any other tramway in the world, but as they had to depend almost entirely upon the native population, they were compelled to

adopt low fares. The percentage of working expenses to receipts was less than on most tramways, proving that the undertaking was efficiently and economically managed. Under existing conditions, they could hardly look for any further marked development from the existing lines. The blot on the system was a mile of single track which passed through very narrow streets where a double track was impossible. That caused great congestion at times, but they could not increase the number of the cars on the system. He told them at the last meeting that negotiations were proceeding for a diversion of the lines, but he was sorry to say that little real progress could yet be reported in that direction. They had offered to contribute a substantial amount towards the cost of widening two bridges which the diversion would entail, and they were urging upon the authorities the necessity of the diversion, if they were to properly fulfil their obligations to the travelling public. Further extensions of the undertaking were contemplated, but they could not be proceeded with until the diversions had been authorised. He trusted that before this time next year a solution of the difficulty would have been arrived at. The amount expended on renewals £3,007 was less than they anticipated, but the two extensions absorbed the time of the staff to a great extent. The substitution of 90-lb. rails for 60-lb. would, he hoped, be practically completed before the end of 1914, and as the larger part of the replacement had been completed, they had fixed the contribution to the renewals fund for 1912 at £5,000. The balance at the credit of that fund at the end of the year was £7,645.

MR. JAMES GRAY seconded the motion, and the report was adopted.

MR. P. E. BEACHCROFT, in proposing a resolution fixing the remuneration of the directors at £200 a year each, as from January 1st, 1912, said that hitherto those gentlemen had not been at all adequately recompensed for the work they had done for the company. The board were to be congratulated upon the fact that the ordinary dividend this year was 4 per cent., as compared with 2 per cent. a year ago, and in view of the satisfactory progress the company had made, he thought it quite time that the directors were properly paid.

MR. W. BULLOCH seconded the resolution, which was carried unanimously.

The auditors and the retiring director having been re-elected, the proceedings terminated with a vote of thanks to the chairman.

**New York Telephone Co.**—The report states that the combined telephone earnings of the company and its associated companies for 1912 amounted to \$65,632,689, showing an increase of \$6,613,278 over 1911. The net telephone earnings, including \$1,510,072 other income, were \$18,631,070, an increase of \$2,164,775. Interest charges absorbed \$3,179,573 and dividends \$10,009,335, leaving a balance to surplus and reserves of \$5,492,162, an increase of \$1,572,126. On December 31st last there were 985,780 stations in the system directly operated by the company and its local connecting companies, an increase of 97,445. Including the associated and connecting companies, there were in service in the whole system 1,756,343 stations, an increase of 232,319 stations.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in—

Sun Power Co. (Eastern Hemisphere), Ltd.—Further issue of 2,050 ordinary shares of £1 each fully paid, Nos. 168,505 to 170,557.

And to allow the following to be quoted in the Official List—

Vancouver Power Co., Ltd.—Further issue of £50,000 4½ per cent. perpetual guaranteed debenture stock.

**Llanely and District Electric Lighting and Traction Co., Ltd.**—The directors' report states that the profit for 1912, including the balance brought forward, and after payment of loan and debenture interest charges, is £6,401. After paying the 6 per cent. preference interest there remains to be carried forward £2,801. The business, especially in the power and lighting departments, continues to expand, and the above results, which were obtained notwithstanding the coal strike and other abnormal causes seriously affecting the revenue, are regarded as entirely satisfactory.

**O. C. Hawkes, Ltd.**—The directors' report for 1912 shows a balance of £9,687, out of which 5 per cent. is paid on the preference shares, absorbing £4,250, and £4,000 is added to the reserve fund and £1,437 carried forward. The turnover has been progressive, and the profits would have paid a dividend, but it has been thought politic to place an increased amount to reserve bearing in mind that a further development of new branches is in view.

**Tynemouth and District Electric Traction Co., Ltd.**—The total revenue for the year 1912 was £13,661. After deducting all expenses chargeable to revenue, including a provision of £1,000 for renewals, and writing off a loss of £277 on sale of Consols, there remains a surplus of £4,377, plus £4,929 brought forward. The directors have placed £1,250 to reserve, and after paying a dividend of 5 per cent. on the cum. preference shares, a dividend of 4 per cent. is given to the ordinary shares, £297 being carried forward. Bad weather affected the receipts.

**Liverpool District Lighting Co., Ltd.**—The directors have declared a dividend at the rate of 4 per cent. per annum (less tax) for the last half of 1912.

**Winnipeg Electric Railway Co.**—The directors have declared a dividend at the rate of 3 per cent. for the quarter ending March 31st.

### Durham Collieries Electric Power Co., Ltd.

A MEETING of the debenture-holders was held on Monday, at Winchester House, E.C., Mr. A. W. Tait presiding.

The CHAIRMAN said that the meeting was held in accordance with an order made by the Registrar, for the purpose of considering a scheme of arrangement proposed to be made between the company and the debenture-holders. The agreement, which had been entered into with the Newcastle company for the purchase of the undertaking and property of the company contained the following eight undertakings:—

1. 10,000 fully paid ordinary shares of £5 each of the Newcastle company are to be issued to the company's debenture-holders in proportion to their holdings, subject to the proviso that fractions of shares may be sold by the Receiver for the benefit of those entitled to them.

2. The surrender by the Newcastle Co. of £19,860 debentures in the company for the benefit of the holders of the remaining debentures.

3. The discharge by the Newcastle Co., with interest, of a loan to the company of £3,500, made by third parties, and the procuring of the surrender to the company for cancellation of £8,000 prior lien bonds (ranking in priority to the debentures) deposited as security therefor.

4. The release of the principal and interest due in respect of a further £4,000 of such prior lien bonds held by the Newcastle Co.

5. The surrender by the company for cancellation of a further £19,900 of such prior lien bonds, deposited with the Newcastle Co. as security for a debt of £12,437 10s. owing by the company, and the release of the debt.

6. The release by the Newcastle Co. of their claims to have further prior lien bonds allotted in respect of a debt of £8,900 for work done, on the express agreement that the same should be secured by a further deposit of prior lien bonds.

7. The payment by the Newcastle Co. of all the costs and expenses of the debenture-holders' action and of carrying the agreement into effect.

8. The settlement of certain outstanding liabilities for trustees' fees, rent, office and other expenses.

Continuing, the CHAIRMAN said that if the agreement was passed by the meeting and sanctioned by the Court, the result to the debenture-holders would be that they would receive approximately £28 in fully-paid ordinary shares of the Newcastle company for every £100 debenture. That, of course, was a very disappointing outcome, and involved a very heavy loss to the debenture-holders, and the step had only been taken after the most careful consideration and the obtaining of expert advice. It was also put forward, with the concurrence and approval of the Committee of debenture-holders, which was appointed in 1908. They would probably remember that at that time owing to the poor results which had been shown and the financial difficulties of the company a rearrangement of its affairs was then carried out, which rearrangement was approved by the debenture-holders at a meeting held in December, 1908. Under the rearrangement the debenture-holders agreed to waive their foreclosure rights in respect of interest on their debentures for a period of five years to December 31st, 1913, on condition that any net profit earned by the company during that period, after meeting prior lien debenture interest, should be distributed among the debenture-holders. Only one distribution had been made, to the extent of 1½ per cent., on the debentures. An agreement was also entered into with the Newcastle-upon-Tyne Electric Supply Co., Ltd., and the County of Durham Electric Power Supply Co., under which the former company agreed to operate the company's generating station at Philadelphia, and to supply any current which might be required by its consumers at fixed prices, and also to manage the company's distribution system on a sliding scale according to the output; this arrangement to last for a period of 42 years from January 1st, 1909. At the time those arrangements were made the technical advisers of the company believed that with the growth of the company's business, profits would be earned which would gradually enable them in time to meet the debenture interest. As, however, those anticipations were not borne out in actual operation, the board decided to obtain independent expert advice on the position, and they accordingly requested Mr. W. A. Chamen to make a report. In this Mr. Chamen said that he had gone carefully through the consumers' agreements, and he regretted to say that he did not see any way in which the company could hope for any improvement in the price paid during the terms for which the agreements were to run, unless the consumers were willing to grant a revision of the price, which there did not seem to be much hope of their doing. Regarding the agreement with the Newcastle company as to operation, it was a somewhat complicated one. In it they protected themselves in the event of a rise in the price of coal, and the result had been that the company had suffered materially, and the recent trouble in the coal trade had not helped the situation. Under the terms of the agreement with the Newcastle company the prices could only be revised after 21 years by arbitration. There was no doubt that the estimates made by the technical experts at the time when the consumers' arrangements were made, and at the time the agreement of operation with the Newcastle company was entered into, had been seriously at fault. The only thing that could be said in this connection was that there was no experience available in this country at the time with regard to large loads for colliery requirements. The agreements with the consumers and with the Newcastle company were based on a probable load factor which had never been attained, and in fact they had fallen very far short of it. The present output of the company was at the rate of about 24,000,000 units per annum

with a load factor of approximately 40 per cent., and, in the opinion of the expert, it would require an improvement in the load factor up to 70 per cent., with an output of 35 millions per annum, to enable the company to pay debenture interest, assuming the price of coal did not exceed 6s. per ton, and that no further money was required for the purpose of extending the supply. In the opinion of the expert, none of those assumptions were warrantable, and he stated that, unless some alteration could be made in the controlling agreements, the company must get into a worse and worse position as time went on. After the expert's opinion had been carefully considered, and after the directors had endeavoured to obtain concessions from the consumers and from the Newcastle company, without success, they approached the committee of debenture-holders with regard to the position, and acting under their advice, negotiations were entered into with a view to the sale of the company's undertaking. They would appreciate that this was a very difficult matter. The company was not an authorised undertaker under the Electric Lighting Acts, and the whole of its distribution system, with the exception of a small part, was under wayleave and other agreements. As to the company's power station, a large amount of the plant required for the supply to the consumers did not belong to the company, but was the property of the Newcastle company, and there was, therefore, only one possible buyer of the assets. The negotiations for sale took a very considerable time, and it was only after great difficulty that the present offer was finally adjusted. He could only recommend under the circumstances that the offer should be accepted. There was practically no alternative, and if the assets were sold at a break-up he did not believe that the debenture-holders would get anything. He concluded by proposing a resolution authorising the board to carry the scheme into effect.

MR. W. S. POOLE, in seconding the resolution, said he did so as a member of the Debenture-holders' Committee. They realised that it was a very bad outcome of the business, but having carefully looked into the matter, they advised their fellow-holders to accept the scheme, lest something worse might befall them.

MR. MIDDLETON asked what was the value of the stock of the Newcastle company which they were asked to accept.

MR. T. A. HARDMAN remarked that, in his opinion, the company was in a rotten position in 1908, and the best thing would have been to have wound up then.

The CHAIRMAN, in reply, said that the position of the Newcastle company was quite sound, and was improving. They had just paid 5 per cent. dividend on their ordinary shares, and the market price to-day was about £4 for a £5 share. He did not think any of the directors could be blamed for the present position, because not only were the company's technical experts at fault with regard to the revenue which would be produced, but those estimates were practically confirmed by the engineers of the Newcastle company. The position was that a load of this kind was practically unknown in this country—they hoped for a 60 or 70 per cent. load, but they had never got more than 40 per cent.

The resolution was carried without a dissentient.

**Tramways, Light and Power Co., Ltd.**—The statutory report submitted at the meeting held in London last week states that the total number of shares allotted is 475,007 of £1 each (300,000 6 per cent. cum. preference shares, 90,007 ordinary shares and 85,000 deferred shares). 300,000 preference shares and seven ordinary shares have been allotted, payable wholly in cash. 45,000 ordinary shares and 85,000 deferred ordinary shares have been allotted, credited as fully paid-up, in part payment of the purchase consideration, and 45,000 ordinary shares have been allotted, credited as fully-paid up, in part payment of underwriting commission. The total cash received by the company to date in respect of the shares issued wholly for cash is £185,511.

**Huelva Gas and Electricity Co., Ltd.**—The report states (says the *Financier*) that the net profit for 1912, including the balance brought forward, amounts to £1,648. After providing for the dividend on the preference shares, £1,000 is to be written off for depreciation of gas and electric plant.

**Globe Telegraph and Trust Co., Ltd.**—The directors have declared an interim dividend of 2s. per share on the ordinary shares for the three months ended February.

**Canadian General Electric Co., Ltd.**—The directors have declared a quarterly dividend of 1½ per cent. for the three months to March 31st (at the rate of 7 per cent. per annum) on the common stock, and a half-yearly dividend of 3½ per cent. for the six months ended March 31st (at the rate of 7 per cent. per annum) on the preference stock.

**Ascot District Gas and Electricity Co.**—At the annual meeting recently held, it was stated by the chairman that the gas manager, Mr. A. E. Brooks, had made himself quite expert as an electrician. The speaker referred to the all-round economy and efficiency resulting from the manufacture of gas and electricity under one management in one undertaking, and said that gas companies were the right authorities to do electricity supply. The year showed an increase of 15.7 per cent. in electricity sold, and an increase of 6.07 per cent. in gas supplied.

**Farnham Gas and Electricity Co.**—The chairman at the recent annual meeting said that the electricity department started last May was increasing its income, especially from slot meters, and it would not be long before it was paying its way.

**Direct Spanish Telegraph Co., Ltd.**

SIR JOHN DENISON-PENDER, K.C.M.G. (chairman), presided on Monday at Electric House, E.C., over the meeting of this company.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 111), said it was gratifying to the board to be able to report an increase in the traffic receipts of nearly £3,000 as compared with the year 1911, and also to report that the traffic from January 1st, up to the present date, also showed a slight increase over the figures of last year. The working expenses were £1,079 in excess of those of last year. Salaries in London had increased by £86, due to normal increase under the salary scheme and to the fact that extra assistance had been required owing to the continued increase in the company's business. Salaries at stations showed an increase of £678, which was partially due to normal increase and partly to the improvement in the salary scheme of the operating staff, which the directors found necessary in the interests of all concerned. No interruption of the company's cables had taken place during the year under review, and this had enabled the directors to place the sum of £11,000 to reserve, which they considered good policy, in view of the very heavy expenditure they were obliged to incur in 1911 in connection with the extensive renewal of the Bilbao cable. It must also be remembered that it would be necessary to realise some of the company's securities to enable them to redeem the necessary debentures in June, 1914. The securities now stood in the company's books at £83,956, which was the cost price, but the depreciation, which was something over 16 per cent. or £13,750, had to be deducted from the amount standing in the accounts.

MR. F. A. JOHNSTON seconded, and the report was adopted without discussion.

The retiring director, Mr. Johnson, having been re-elected,

MR. S. COLLETT proposed a vote of thanks to the board. He said the company had passed through difficult and troubled waters, but the directors had steered the ship very wisely, and to-day they had arrived at a very satisfactory state of things. He believed they had never before put by such a large sum as £11,000 to the reserve fund, and in view of the fact that the debentures would be paid off next year, their prospects certainly seemed brighter than for several years past.

The motion having been carried,

The CHAIRMAN replied on behalf of the board and the staff, and said that last Christmas he visited the Bilbao station and saw a great many of the staff there, and he complimented the company on the fact that the station was in perfect order, and everything bore a thoroughly business-like appearance.

**Bournemouth and Poole Electricity Supply Co., Ltd.**

MR. AYMOR H. SAUNDERSON (chairman) presided, on March 13th at Moorgate Court, E.C., over the annual meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 394), the CHAIRMAN went through the various items in the balance-sheet, and pointed out that £1,761 had been added to the leasehold and special redemption accounts. The slot meter reserve, amounting to £2,671, had also this year been transferred to this account, which now stood at £19,096. The loan account stood at £30,500, as against £24,000 last year, the increase being due to a loan from the bankers for temporary purposes. On the asset side the amount expended on capital account stood at £469,577, of which £9,371 was spent during the year. The amount actually expended was £11,051, and the difference was accounted for by machinery written off during the year amounting to £1,680. As in previous years, the greater portion of the expenditure had been on mains extensions, and this was inevitable in an undertaking such as theirs, as they had such an extensive area to supply, and new residential districts were continually being opened up. This, of course, was a healthy feature, and one on which they congratulated themselves. As to the investment in the Richmond company, a loan of £2,200 had been advanced to that company during the year. The chairman next dealt in detail with the revenue account, and pointed out the various small increases and decreases. There was an increase of £2,358 in the item for coal, waste, &c., and there was an item of £174 for the insurance and superannuation fund, which, he thought, was an item which would commend itself to the shareholders. The company suffered considerable loss from the coal strike and the transport workers' strike, in common with all other electrical supply companies, and the local directors and Mr. Ingram, the chief engineer, had a very anxious time while the strikes lasted. Now the trouble was over they had the satisfaction of knowing that the steps they took to cope with the difficulties were the best they could have taken, and he was glad to report that the continuity of supply of current was not affected in the slightest degree. They estimated that the trouble cost them approximately £1,800, which they might otherwise have raked into their coffers, and could have used for paying an extra 1 per cent. to the ordinary shareholders, or else have utilised to strengthen their reserves. The repair of meters cost them £286 extra, due to their having overhauled all the meters both in stock and in their consumers' premises. Altogether, during the year they had written off £7,309 on various accounts, which was equal to 4.93 per cent. on the ordinary shares of the company. It appeared to him that their position might be summed up as follows: First, they showed an increase in the gross receipts from all sources of £5,604 over the previous year. Secondly, £7,399 had been added to depreciation reserve and redemption funds. Thirdly, the reserve for depreciation now stood at £54,703, as against £51,983,

showing an increase of £3,320. Fourthly, the dividend on the ordinary capital was at the rate of 5 per cent. per year, compared with 5½ per cent. for the three previous years. Fifthly, the carry forward amounted to £2,144 against £1,209 for 1911. The general progress of their business had been he was glad to say quite satisfactory during the year. The applications for the supply of current received during the year amounted to 614 k.w., as compared with 535 k.w. in 1911, thus showing an increase of 11 per cent., and the units sold were 3,338,125 as against 3,078,116 in 1911, being an increase of 8 per cent. During the past year the rates of supply to the Bournemouth Corporation for tramway traction had been revised in accordance with the provisions of the agreement, which contained powers to revise the rates every five years. The matter necessitated careful and lengthy negotiation, and ended in a friendly adjustment of the price, and hence the costly resort of arbitration was avoided. With regard to the Richmond Electric Light and Power Co., in which they held a large interest, it was a matter for congratulation that the company had been enabled to pay them in respect of last year a much larger contribution to their revenue than usual. It had maintained its position and given satisfaction to them in every way. They would remember that, at the last meeting, he told them he believed the time had passed when metallic-filament lamps could have anything but a most beneficial effect on their revenue, and he was glad to say that the results quite justified that view. The lamps rendered the current cheaper to the consumer and were making electric light far more popular than before. Practically all the chairmen at the meetings of the electric supply companies which had been held that year told them that last year had seen a great increase in the quantities of electricity supplied to their consumers compared with the previous year, not only for lighting, but for heating, cooking and power purposes. He was convinced that the electric supply industry generally speaking, had a very bright future before it. The Bournemouth Co. had certainly not lagged behind, and their prospects of increased business during the present year were distinctly encouraging, and he hoped next year to come before them with a statement showing improved results all round. In conclusion, the chairman referred to the appointment of Mr. H. B. Renwick, the former secretary, as managing director, the appointment of Mr. W. D. Brightman, previously local secretary, as secretary of the company, and the appointment of Mr. F. C. McQuown as London secretary.

DR. J. ATKINSON HOSKER seconded the motion and the report was adopted without discussion.

In acknowledging a vote of thanks passed to the board and staff, the CHAIRMAN said he would convey the shareholders' appreciation to the staff at the staff dinner which it was proposed to hold shortly, when the food would be cooked by electricity.

**Prospectuses.—Clyde Valley Electrical Power Co.—**

The list of subscriptions was to close on Wednesday, 19th inst., in an issue of 30,000 6 per cent. cumulative preference shares of £10 each at par. The development of the business renders extensions to generating plant, cables and sub-stations necessary, and it is for providing capital for these purposes, for further extensions in the future, and for the repayment of temporary loans that the present issue has been made. The profits for 1910 were £29,316, for 1911 £45,782, and for 1912 they were £54,440, notwithstanding coal strike effects and consequent dislocation of business.

*The Cuban Telephone Co.*—The list was closed on 14th inst., earlier than was expected owing to its success—in an offer of £1,500,000 6 per cent. cumulative convertible preferred stock in shares of \$100 each at \$19 per share, equivalent to, say, \$92½ per \$100 share. The company, which has already issued 85,000,000 common and \$2,000,000 preferred stock, has acquired very large holdings in the Havana Telephone Co. and the Havana Subway Co. The proceeds of the present sale of preferred shares will be applied to further construction, extension and betterments rendered necessary by the growth of the company's operations. The Havana old telephone system was superseded at November, 1910, by the automatic, and the number of subscribers is now 11,494, and the ultimate capacity is 100,000. The business and the receipts are showing continuous increases. The concession confers the right, without limitation of time, to install and operate a general and long-distance telephone system extending over 1,000 miles, covering practically the entire island of Cuba.

**Rhondda Tramways Co., Ltd.**—The accounts for the

year 1912 show a balance to the credit of the revenue account of £18,680. After deducting rent to the Rhondda U.D.C., debenture interest, sinking fund for the redemption of debentures, interest on loan, &c., there remains £2,778, plus £1,193 brought forward. There is to be placed to reserve and renewal account £2,000, carrying forward £1,976. It is estimated that the profit for the year was adversely affected to the extent of at least £6,500 by the national coal strike and by the strike of the company's drivers and conductors in May. For the six months to June 30th, during which these labour troubles prevailed (according to the *Financial*) the traffic receipts were £19,700, but for the second six months they were £30,000. The company is promoting a Railless Traction Bill in Parliament to enable it to serve a large and increasing colliery district about six miles from Tonypandy.

**Dublin and Lucan Electric Railway Co.**—The gross

receipts for the half-year ended December 31st are £3,867, being £93 less than those of the corresponding period of 1911. The expenditure increased by £177. After providing for debenture interest and paying the usual half-yearly dividend on the 5 per cent. preference shares, £379 is to be carried forward.

### Gateshead and District Tramways Co., Ltd.

MR. C. R. GREENE presided on March 13th at the offices, Kingsway, W.C., over the annual meeting of this company, and in moving the adoption of the report (see ELECTRICAL REVIEW, page 444), he said that the excellent result of the past year's working had constituted a record. The profits on working showed an increase of £364 over 1911, and the directors were in a position to recommend the payment of a bonus of 1 per cent. on the ordinary shares in addition to the usual 6 per cent. dividend. Traffic receipts showed an increase of £572, and this was most satisfactory in view of the labour troubles during the year. The company benefited materially during the period of the coal strike from the reduced railway service in the districts served by the tramways, but when the strike was over the increase was soon lost, owing to the effect of the strike on general trade. Traffics, however, picked up rapidly again towards the latter part of the year, and they finished on December 31st with an increase of £572. The satisfactory expansion in the receipts had been continued in the current year, and the prospects so far for the current year were good. During the year the company took the whole of the advertising on the cars under its own control, and the change had been satisfactory. Turning to the other side of the revenue account, power and running expenses showed a decrease due to decreased current consumption, to which the fitting of meters on the cars had materially contributed. There were 6,572 more car-miles run during the year. Having regard to the size of the undertaking and the work carried out on the administrative and general expenses were on the low side. During the year the National Insurance Act came into operation, and in future years this would cost them considerably more. Repairs and maintenance had increased by £627, due to the heavy expenses on the bodies of the cars. Most of the cars were now 12 years old, and the wood-work needed extensive repairs. Nine cars were constructed during the year, and the whole cost had been charged against revenue. Repairs and renewals to the electric equipment and trucks of the cars had cost £252 less. Permanent way repairs were up £142, and in addition £485 had been spent on renewing portions of the track, and charged against renewals account. £1,473 had been expended on the motor-bus undertaking. Applications had been received from time to time from local authorities in districts adjoining Gateshead for the company to extend their tramways, but the board after careful consideration felt that this would not be profitable. Application had, however, recently been received from the Chester-le-Street Urban District Council for them to provide a regular service of motor-buses between the tramway terminus and Low Fell and Chester-le-Street. On careful consideration the directors decided to give the service, and nine buses of the latest type had been purchased, and a garage was in course of completion at Chester-le-Street, and it was hoped to commence the service within the next few weeks. There was every prospect of the service being a success, and there was always, in addition, the traffic brought by the omnibuses to the tramways. They had a further advantage in the form of the excellent tramway organisation, which would help to keep the expenses of the omnibus department at a minimum. There were other omnibus routes which the directors had under consideration, and one of the most promising was that between the tramway terminus at Felling and Usworth to Washington. The Chester-le-Street Rural District Council, in whose area these places were situated, had approached the board on the matter, and had provided them with useful information and assistance. As soon as the Chester-le-Street service was completed, it was proposed to operate an experimental service from Washington to Felling. The "pay-as-you-enter" cars had operated satisfactorily during the year, but owing to the exceptional influences affecting the traffic on the Bensham and Saltwell routes upon which these cars were running, it had not been possible to satisfactorily ascertain the effect on the traffic receipts. The directors, however, were satisfied that the results had been beneficial, and, as new cars were needed for the Lowfall route, the directors had authorised the construction at the depot of two new cars on the "P.A.Y.E." principle. The directors congratulated the shareholders on the results of the past year, and, in the absence of further strikes in the labour world, similar results might be anticipated for the current year. The general results of the undertaking had been materially assisted by the loyal way in which the whole of the staff in Gateshead and in London had worked.

MR. C. S. B. HILTON seconded the motion, and it was carried without discussion.

The retiring directors were re-elected, and a resolution was carried, on the motion of MR. BOWER, seconded by MR. BOWKER, fixing the remuneration of the board for the year at £450.

### Brompton and Kensington Electric Supply Co. Ltd.

MR. H. R. BEETON (chairman) presided on March 13th at Winchester House, E.C., over the annual meeting of this company.

The CHAIRMAN in moving the adoption of the report (see ELECTRICAL REVIEW, page 444), said that the accounts revealed the satisfactory progress of the company's business. During the past year they connected 345 additional customers, which was a larger number, with two exceptions, than in any previous year, and 13,147 35-watt lamps, which was the largest number since 1906. The sales of electricity had for the first time exceeded 3,000,000 units. The income therefrom was £56,348 being an increase of

£1,618, whilst the expenditure had amounted to £23,170, being a decrease of £868, thus showing an increased profit of £2,486 over the previous year. This result was largely due to the fact that, owing to the more economical plant they now had in operation, they had consumed 1,820 tons less coal, and had thus been able to save £478, notwithstanding that, owing to the strike, they had had to pay about 1s. per ton more. But for the introduction of the turbine plant their coal cost last year would probably have been £2,000 in excess of what it actually was. The growth of business had at length overtaken the reduction in demand which the metallic-filament lamp entailed upon them, to the advantage of their customers, and the gross and net receipts once more constituted a record in the company's history. In a purely residential district and at a pressure of 100 volts, as in their case, the metallic-filament lamp found its most profitable field, and he thought they might assume that the invention in its present stage of development had reached its full application in their area. In other words, they had not only been called upon to bear, but they had now faced, the full brunt of the metallic-filament lamp, and it would be interesting, therefore, to compare their position now with the position in 1907, before the advent of this current-saving device. Broadly stated, the position was that although they were now selling rather more current than in 1907, they were supplying about 30 per cent. more customers and lamps, and at the same time the maximum demand for current which they were called upon to supply at any time was actually less by more than 10 per cent. From this it followed that, inasmuch as their maximum demand determined the extent of the plant they required, they had now a larger reserve of plant to meet future expansion of business, and that the smaller extent of plant required was more fully, and, therefore, more profitably employed. In short, their "load factor," as it was technically called, which was the measure of the profitable character of their production, had risen from 16 per cent. to 18½ per cent. It was to the use of electrical accessories, which they had assiduously fostered of late years, that this improvement was due, and as such use extended, as it assuredly would, this favourable tendency would continue. Moreover, not only did they now require less plant to do the same business, but the plant installed was so much more economical than that which was installed five years ago, that they could now produce the same quantity of current at more than 10 per cent. less cost. This relief from additional capital expenditure, in conjunction with the accumulated profits in the interval, had enabled them to substitute up-to-date for obsolete plant to the extent of about £30,000 and at the same time to increase their reserve funds by another £30,000. On the basis of the appropriations which they now recommended, their reserves and undistributed balances would amount to upwards of £120,000, or 60 per cent. of their subscribed capital, and the radical demolitions of plant shown in the depreciation account of last year would permit of a reduced appropriation of this nature in the near future. "In order to maintain their prosperity in a progressive industry, such as that in which they were engaged, they were obliged to keep up with the latest developments, and since they last met them the board had continued to be actively engaged in the study of electric cooking through the agency of the Accessories Co. As he had occasion to tell them last year, they looked for considerable improvement in supply from this source, and at the same time they were confirmed in the expectation that they might be able to turn to profitable account the experience they had gained in the development of cooking appliances. To this end, and by way of demonstrating the advantages, and especially the reliability, of electric cooking, the Accessories Co. was opening the first all-electric restaurant in London, on premises adjoining their showrooms, at an early date. They did not conceal from themselves that there was a speculative element in this departure, but even so, it was one which their surplus resources justified them in entering upon. So far as they could judge of the prospects for the current year, they looked forward to at least as satisfactory results as those they had achieved in the year now under review.

MR. W. R. DAVIES seconded the motion.

DR. BERKWELL asked how the cost of electric cooking compared with that of gas.

The CHAIRMAN said that it was difficult to give an answer to the question without causing some misapprehension. It depended largely on the cost of current; just as electric lighting progressively declined in cost, so could electric cooking. The fact was that experience showed that electric cooking was a vastly superior form of cooking, and had advantages associated with it which did not exist in the case of gas or coal. He believed it would grow to such an extent, that eventually they would derive a greater revenue from cooking than from lighting.

MR. FOX having congratulated the company on the enterprising manner in which it had encouraged the use of electricity for domestic purposes.

The report was adopted.

The retiring director, Mr. Davies, was re-elected, and the meeting closed with a vote of thanks to the board.

**Stewarts & Lloyds, Ltd.**—The directors, after setting aside £100,000 for depreciation, recommend, subject to audit (says the *Financial News*), the usual dividend of 10 per cent. on the preferred ordinary shares and a dividend of 1s. 6d. per share on the deferred shares, placing £50,000 to reserve, and carrying forward £90,000. Last year 1s. per share was paid on the deferred shares, £70,000 each applied to both depreciation and reserve, and £86,500 carried forward.

### City of London Electric Lighting Co., Ltd.

MR. J. B. BRAITHWAITE (chairman) presided on Wednesday last week, at Salisbury House, E.C., over the annual meeting of this company. The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, p. 400), said that so far as their business was concerned the year had been a normal one. The capital expenditure, £45,508, was almost identical for the last two years, and the whole of this had, in accordance with the practice of some years past, been provided out of revenue: so that there had been no occasion to make any additional issue of capital. During the year the completion of further turbine generating plant had released the greater portion of the old alternating current plant, which, although seldom used, had been retained as a reserve. They had, therefore, disposed of it, and had entirely written it off. This accounted for the fact that £191,150 had been written off plant, as compared with £45,000 a year ago. The fact was that they had now written off and scrapped the second generation of their generating plant, if he might use such an expression: the first plant put in in 1891 had disappeared from their station for some years, and had been entirely written off, and now they had removed the last remains of the second generation of generating plant altogether, and there was nothing in their station now except comparatively modern plant, although, of course, there was plant which in due time would ripen for removal, and then from year to year they would put in more and more modern plant. It was the adoption of this policy which had enabled them to pay increasing dividends. The result of the writing off that year would be that the total reserve funds would now show the figure of £210,000, as against £377,127 a year ago. This was after placing the increased amount of £50,000 to the depreciation reserve. As to the reserve they had experienced an advance almost identical with that of last year. Last year the revenue showed an increase of £9,455, and this year it showed a further increase of £9,035, so that during the last two years, their revenue had increased to the extent of £18,500. Last year out of the increase of £9,000, they were able to retain over £5,000 net. This year they would have done equally well had it not been for the coal strike and the transport strike, which materially interfered with their coal supplies, and also had the effect of raising the prices of coal; the rise was still continuing. On account of these strikes they had to pay £4,194 additional for coal. They had also this year felt the full effect of the quinquennial valuation, resulting in a further increase of the rates of £882. These, and other items had increased their expenses altogether by £7,220, so that of the £9,000 increased revenue, they had only been able to retain £1,550 as net. In the report they had set out how it was proposed to dispose of the balance available, and he would only call attention to one item, viz., contribution to employees' provident fund, and under the National Insurance Act, £1,804. In 1902 the shareholders gave them authority to become contributors to the British Electrical Superannuation Fund, but the constitution of that fund did not appeal to a large portion of the staff, and up to 1911 the company were never called on to contribute more than £400 a year, and owing to various circumstances the board had thought it well to withdraw from that fund, and had decided to establish a staff provident fund of their own, which was greatly appreciated by their staff, and there were now 140 members contributing to it. Their contributions for that fund this year would amount to £1,800, and he thought the shareholders would agree that no portion of their expenditure was more wise than that which went to make proper provision for the loyal and faithful members of their staff, who earned their dividends, when in due course their places would be taken by younger men. Therefore he anticipated that the resolution he was going to ask them to pass could be passed unanimously, giving approval to the scheme they had set on foot. They had made further progress in reducing the loan to their bankers and generally improved their financial position. Whereas, the bankers' loan stood last year at £85,000, it had now been reduced to £59,000. On the other hand, the amount due to their creditors was about £12,000 more, and investments were £4,000 less, so that the financial position showed a net improvement of £10,000 in the course of the year. With regard to public lighting there was nothing fresh to report beyond what was mentioned last year, that an agreement had been come to with the Corporation by which the public lighting in the City would be approximately divided between the Gas Co. and the Electric Lighting Co. In the report there were some particulars given with regard to the right of the Corporation to purchase their undertaking in 1914. So far as he was aware the Corporation had no intention of exercising that right. That was to say they had received no communication from them which would lead them to suppose they had, but, of course, their right did not arise until next year. He merely said that because there had been rumours in the papers that the Corporation were actually considering the question and that negotiations had been entered into. Nothing of the kind had taken place at all, and he had no reason to believe they had any intention of exercising their right of purchase. It was fair, however, that he should say that if the Corporation did not exercise their right next year the right would entirely lapse. Under the recently passed Electric Lighting Act the County Council became the ultimate purchasing authority of all the electric supply undertakings of London in 1911; and that being the case, unless the Corporation exercised their right next year, the view of the company was that their right lapsed entirely. The average price received for current was still slightly on the down grade, and they received an average of 2'37d. per unit, as against 2'39d., which, of course, was an answer to people who said they overcharged for current. The number of consumers being supplied showed an increase of 483 over 1911, and the number of KW. connected showed an increase of 2,029, so that evidently

the City, as a field of electrical supply, was by no means exhausted. They got a considerable number of applications for connections, and one could only suppose that the use of electricity was extending in all directions. There was still, he thought, a considerable field for its use for heating in various directions, and he anticipated that they would see a considerable growth in that source of revenue in future years. Apparatus was now supplied at a very low rate, which enabled the occupier of any office in the City to have all the facilities of hot water and that sort of thing for a very small expenditure of money. They must look forward in the future to a gradual and steady growth of their load, and also, he hoped, in the results to the company. This year the board recommended a bonus of an extra 1 per cent. out of the dividend equalisation account they started some years ago to make provision for a possible drop in their revenue, due to the introduction of the metallic-filament lamp. So far as they could judge, that danger no longer existed, and therefore they felt justified in distributing half the fund by way of a bonus of 1 per cent., which would make the dividend for the year 9 per cent. On previous occasions they had never made an advance in their dividend unless they saw their way, humanly speaking, to maintain it, and he need not say that the same consideration had been present in their minds on this occasion.

MR. F. W. REYNOLDS seconded the motion.

MR. HEDGES asked if there were any particular terms on which the Corporation would acquire them if they exercised their rights, and whether the board considered it would be to the advantage or otherwise of the company to be bought out.

The CHAIRMAN said the Corporation would have to buy them as a going concern, with payments for goodwill and all the rest of it. He did not know that he ought to be asked to express an opinion as to whether it would be to the company's advantage to be bought out. That would depend on the arbitrator. They were quite content with their undertaking, but, of course, seeing that they were paying 9 per cent., the City would be able to raise money much cheaper and probably make something towards the rates.

The report was then adopted, and resolutions were also carried re-electing the retiring director and approving of the action of the directors in forming a Staff Benefit Fund.

### Cambridge Electric Supply Co., Ltd. — Mr. D.

Munsey presided at the annual meeting held in February, and in presenting the report (see ELECTRICAL REVIEW, page 314) he said that the year had been a very successful one. They had sold 110,000 more units than in 1911 (lighting increase, 83,000 units; power, 27,000 units). The extension of business had been going on in all directions, and their extra profit was £1,400, out of which an extra £750 would be put to depreciation account, and ½ per cent. more would be paid in dividend. Their depreciation addition for the year, £3,500, was not too much. They not only had coal enough to last through the whole of the strike, but could have lasted another four or five weeks. Mr. A. A. C. Swinton seconded, and the report was adopted, and the dividend of 5½ per cent. declared. There was a vote of thanks to the staff, the chairman specially mentioning Mr. R. C. Pierce (the engineer) and Mr. J. H. Taylor (the secretary).

**Australia.**—According to the *Australian Mining Standard* the Electric Light and Power Supply Corporation, Ltd., Balmain (N.S.W.), for the half-year ended December 31st, made a profit of £6,006, of which after deduction of interest on debentures, there remained £3,505. A dividend at the rate of 7 per cent. per annum absorbed £1,505, suspense and preliminary expenses account, £1,000, depreciation £865. The private consumers totalled 1,203, an increase of 563 for the year. Portions of the new 2,000-H.P. turbo-generator were delivered early in the year 1913, and it is expected that it will be in operation before the capacity of the present machinery is reached. Owing to the increase in population in Balmain, a larger quantity of garbage was collected, and it was found advisable to provide for the garbage being burnt in one shift per day by installing an additional cell: this is completed and working satisfactorily.

**Davis & Timmins, Ltd.**—At the annual meeting held at King's Cross last Friday, Sir Henry Mance, in moving the adoption of the report, referred to its satisfactory nature. Last year he informed them that the bonus, in addition to their 8 per cent., would be 5 per cent., and this year they were justified in recommending that it be 10 per cent. This was a record. In 12 or 13 years, though the capital was only £107,000, they had paid to shareholders in dividends £109,000. In 1912 business was remarkably good. Increased business had necessitated increased machinery, and no expense was spared to keep the latter up to date. Stock items were, of course, larger on account of the increased volume of business. In regard to prospects, judging from the two months' working so far, they had no reason to think that 1913 would be any worse than 1912. The works were full of work. The chairman thanked the energetic managing director, Mr. G. E. Davis, and the staff, for the excellent service rendered during the year. The report was adopted.

**Mirrlees Watson & Co., Ltd.**—The directors state that the balance at credit of profit and loss account for 1912, after providing for depreciation and directors' fees, amounts to £32,719, plus £2,478 brought forward. The directors recommend a dividend of 10 per cent. and a bonus of 5 per cent., less income-tax, and that £12,500 be transferred to the general reserve account, £5,042 being carried forward.

### Greenock and Port Glasgow Tramways Co., Ltd.

THE directors report that the total revenue for 1912 was £43,383. The traffic receipts, which amounted to £12,214, show an increase of £4,267. After providing for all expenses chargeable to revenue, including £2,137 for interest, payments to Corporations amounting to £1,448 and setting aside £1,000 to the renewal account there was a surplus on the year's working of £13,296, plus £1,072 brought forward. The directors propose to put to reserve sinking fund for loan redemption £1,773, to reserve £1,200, to pay 5 per cent. per annum on the preference shares £3,500, a dividend at the rate of 6 per cent. per annum on the ordinary shares £6,900, leaving £296 to be carried forward. The capital expenditure during the year amounted to £2,591, the greater portion of which was in connection with the purchase of motor-omnibuses. The directors believe that with the reliable vehicles now available there is scope for a profitable service of motor-omnibuses in the Greenock district, and a service will be commenced in the early spring of the present year for which purpose six chassis of the latest type have been arranged for. The continued activity of the trade in the district is reflected in the satisfactory increase in the traffic receipts, and there are indications that equally good results will be experienced during the present year.

	1911.	1912.
Miles open —Routes miles	742	742
Single line	81	81
Double line	661	661
Passengers carried	9,235,376	10,493,274
Average receipts per passenger	·97d.	·96d.
Average working expenditure per passenger	·60d.	·51d.
Proportion of working expenses to receipts	51·2%	52%
Cars working	43	43

### Oxford Electric Co., Ltd.

SIR HENRY MANCE presided at the annual meeting on March 7th, and in moving the adoption of the report (see ELECTRICAL REVIEW, page 359), he referred, first of all, to the death of Sir J. Irving Courtenay, a director of the company since its inception. The chairman's observations respecting the accounts were then read by the secretary, after which Sir Henry, in referring to general matters, said that at the close of the coal strike they still had a month or six weeks' supply of fuel in hand. The result was, of course, unfavourable to their coal figures; but thanks to the partial assistance of the Diesel engine, which they had had running for some months, the figures were just as good as in the previous year. They had learned the wisdom of not being dependent upon a particular kind of coal or fuel, and they could get some by water and some by rail. The Shops Closing Act had had a noticeable effect on revenue derived from shopping districts; but, perhaps, the most important thing against them had been the metallic-filament lamp. They had, however, now touched bottom in this respect. They had added 146 new consumers, including some of the college buildings, &c. The equivalent of 10,000 lamps had been connected to the mains. They were hoping for a more rapid increase in the electric cooking business; appliances had been steadily improved, but the great difficulty was the objection of the cooks. They had been brought up to use coal, and did not like to try anything strange. In regard to the tramways, if the proposals now before the City Council did not succeed, he thought the alternative for tramways was self-contained traction cars, which had answered very well in other parts of the world. What, he thought, was wanted was a new battery—one durable, reliable and cheap—that would do for electric traction what the metallic-filament lamp had done for electric lighting.

The report was adopted, and Prof. T. L. Bullock was elected a director.

The meeting closed with thanks and best wishes to Sir Henry Mance, who has been associated with the company for 20 years.

### STOCKS AND SHARES.

Saturday Morning.

MARKETS round the Stock Exchange threw off some of their depression after the conclusion of the settlement. It happens generally that prices are advanced on the eve of a holiday, this being one way in which the incurable optimism of the Stock Exchange asserts itself year after year. Prices, moreover, had had a very considerable fall, and it was time that there should be some kind of upward reaction, for no small part of the decline was due to the simple process of marking down quotations, irrespective of any sales taking place.

The Home Railway market presented a firm front, on the assumption that prices here had reached levels which discounted a good deal of trouble. Taking the list through, a good selection of British railway stocks can be bought to yield from 5 to 5½ per cent. on the money, and such returns cannot be ignored, even in times like these. The Undergrounds are somewhat overlooked in the better feeling that prevails in the market as a whole, though Districts rallied to 5½, and Metropolitans to 5½. Business has

been done in Central London Ordinary up to 7½, and it would require very little demand to put the Central London trio substantially better. A fair amount of speculation in East London is a feature amongst the lower-priced issues, bullishness having been fanned by irresponsible whippers that the stock was being bought up by some of the powerful interests connected with what has been called the Traffic Trust.

English Electric Supply shares are now mostly *ex* their spring dividends, and on Thursday last, dividend deductions were made from County of London, City of London, Chelsea, Charing Cross, Oxford, Kensington, and London shares. Cities are *ex* 12s., this being the dividend and bonus. It will be seen from our lists overleaf that the return on the Ordinary shares of the principal electric lighting companies is now round about 5½ per cent. on the money; and if it were not for the uncertainty attaching to the prospect of what may happen to the companies in 1913, it is safe to assume that prices would stand considerably higher. As things are, however, brokers scarcely like to recommend the shares for investment, having regard to the obscurity of the prospect. Could this be lightened in any way, there is no doubt but that the electric lighting group would become a great deal more popular than it is at present.

In the Latin-Canadian department, it is increasingly evident that South American undertakings require ever more and more capital to meet their need of expansion. The railway companies are the principal claimants, but their appeals for money react upon the shares in the utility concerns as well as those which are more directly concerned with their own industry.

The position in Mexico is still far from settled, and although it is generally assumed that the worst has been seen in that country, there is still a possibility to be reckoned with of some fresh, unexpected outbreak. Mexican Light and Power Securities are easier, and there has been a little selling of Mexico Tramway bonds, but there is not much quotable change in the rest of the Mexican securities. Sao Paulo Trams went back a little, the loss being picked up, however, by Sao Paulo Electric Fives. Rio bonds are steady. Shawinigan are a point down, and Montreal Common shares at 227½ show a fall of 3.

We took the opportunity of having a long talk the other day with a gentleman, back a fortnight ago from the United States, who spent a day on the property of the Mississippi Light and Power Company, and he bore emphatic testimony to the wonderful piece of engineering work that has just been accomplished. We understand that the machinery is all but ready to commence work, and the result of the operations will be watched with intense interest. The Company's Common shares have recently fallen to the neighbourhood of 50; and while the Stock Exchange remains so non-commercial and unenterprising as at present, it is not likely that there will be much revival in the price. Quiet business, however, is being done in the 5 per cent. bonds at 90½.

Remembrance of the Georgia Light and Power episode is still with us, and those who bought the shares when they were run up to about 47 upon anticipation of a 4 per cent. dividend are not likely to pay much heed to the renewed talk of a distribution being made in the near future. Such rumours are afloat, however; and while we should hesitate to place much reliance upon them, they are certainly of interest. Of course, if the Company should pay a dividend this spring, it will certainly provide a very pleasant disappointment to many of the proprietors. The price of the shares keeps steady at about 39, while Alabamas at 44 are equally stagnant.

The Cuban Telephone issue of 6 per cent. Preferred stock, to whose advent we referred two or three weeks ago, has now been made, and the security looks good, while the price of 92½ cannot be called excessive. The Melbourne 5 per cent. Debenture stock, which came out last week at 93½, was, we believe, fully subscribed, but the lists have to be kept open a few days longer for the Australian subscriptions. There are buyers of the scrip in the market at 1 premium for cash.

National Telephone Deferred is quoted at 19½ *ex* the 75 per cent. return that was made to proprietors on Thursday last, but the reduction in the price of the stock has not stimulated speculation to any extent. On the other hand, Marconis have started into fresh life upon covering by the bears. Such, at least, is the Stock Exchange theory to explain the demand, though whether it is the correct reason for the improvement or not, it is difficult to say, in view of the very stiff contango rate charged on the shares last Tuesday. The price at 4½ shows a rise of ½, while the Preference shares are ½ higher. West India and Panama shares went back to 3.

The Anglo-American group is unchanged, but the market is watching somewhat narrowly for manifestations of the new President's probable policy in regard to trusts. To judge from his first efforts, Dr. Woodrow Wilson is likely to be at least as erratic as was his famous predecessor-before-last. Globe Telegraph Trust shares rose ½ over and above the dividend deduction at 2s. The Mackay issues are *ex* dividend, allowing for which there is little change in the quotations. United River Plate Telephone Preference have been in some demand, and Oriental Telephones hardened, while Telephone of Egypt 4 per cent. Debenture stock is a point up.

The Manufacturing division is quiet, though there is much talk of the strong accession of business which the companies are declared to have gained by reason of the trade boom. The market for raw rubber remains steady at about 3s. 11d. per lb. Many of those who have been watching it, express disappointment at the failure of the commodity to improve in price, but the steady way in which large supplies of rubber come forward every fortnight at the Mincing Lane auction sale is sufficient reason to account for the disinclination of consumers to buy more than they require for their immediate purposes.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

Table listing English Electricity Supply and Power Companies. Columns include Name, Stock or Share, Dividend for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c., and Name, Stock or Share, Dividend for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c.

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Table listing Colonial and Foreign Electricity Supply and Power companies. Columns include Name, Stock or Share, Dividend for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c., and Name, Stock or Share, Dividend for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c.

TELEGRAPH AND TELEPHONE COMPANIES.

Table listing Telegraph and Telephone Companies. Columns include Name, Stock or Share, Dividend for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c., and Name, Stock or Share, Dividend for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railways and tramways in the home market. Columns include Name, Stock or Share, Dividends for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railways and tramways in colonial and foreign markets. Columns include Name, Stock or Share, Dividends for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations Mar. 15th, Rise + or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

## TRADE STATISTICS OF HOLLAND.

THE following figures, showing the imports of various goods into Holland in 1911, are taken from the recently issued annual trade statistics; the figures for 1910 are added for purposes of comparison, and notes of any increases or decreases are given:

	1910.	1911.	Inc. or dec.
	Gulden.	Gulden.	Gulden.
<i>Machinery, steam, industrial and agricultural.</i>			
From Belgium ...	2,487,000	2,400,000	- 87,000
" Great Britain ...	5,779,000	8,192,000	+ 2,413,000
" Hamburg ...	117,000	153,000	+ 36,000
" Germany ...	15,468,000	17,711,000	+ 2,246,000
" United States ...	2,747,000	3,292,000	+ 545,000
" Other countries ...	297,000	378,000	+ 81,000
Total ...	26,895,000	32,129,000	+ 5,234,000
<i>Gutta-percha, raw.</i>			
From France ...	103,000	300,000	+ 197,000
" Great Britain ...	202,000	127,000	- 75,000
" Dutch Guiana ...	655,000	603,000	- 52,000
" Java... ..	5,077,000	4,073,000	- 1,004,000
" Other countries ...	410,000	272,000	- 138,000
Total ...	6,447,000	5,375,000	- 1,072,000
<i>Gutta-percha manufactures.</i>			
From Belgium ...	477,000	459,000	- 18,000
" Great Britain ...	515,000	226,000	- 289,000
" Germany ...	608,000	455,000	- 153,000
" Other countries ...	156,000	1,000	- 155,000
Total ...	1,756,000	1,141,000	- 615,000
<i>Iron wire.</i>			
From Belgium ...	3,197,000	3,793,000	+ 596,000
" Great Britain ...	25,000	67,000	+ 42,000
" Germany ...	20,279,000	23,116,000	+ 2,837,000
" Sweden ...	166,000	288,000	+ 122,000
" Other countries ...	52,000	9,000	- 43,000
Total ...	23,719,000	27,273,000	+ 3,554,000
<i>Instruments, physical, chemical, &amp;c.</i>			
From Belgium ...	532,000	692,000	+ 160,000
" Great Britain ...	484,000	515,000	+ 31,000
" Hamburg ...	39,000	132,000	+ 93,000
" Germany ...	4,554,000	5,106,000	+ 552,000
" Other countries ...	99,000	242,000	+ 143,000
Total ...	5,708,000	6,687,000	+ 979,000
<i>Copper wire.</i>			
From Belgium ...	123,000	174,000	+ 51,000
" Great Britain ...	96,000	109,000	+ 13,000
" Hamburg ...	154,000	9,000	- 145,000
" Germany ...	2,494,000	3,074,000	+ 580,000
" Other countries ...	68,000	279,000	+ 211,000
Total ...	2,935,000	3,645,000	+ 710,000
<i>Steel wire.</i>			
From Belgium ...	446,000	589,000	+ 143,000
" Great Britain ...	644,000	950,000	+ 306,000
" Germany ...	1,595,000	1,067,000	- 528,000
" Other countries ...	21,000	2,000	- 19,000
Total ...	2,706,000	2,608,000	- 98,000
<i>India-rubber manufactures.</i>			
From Belgium ...	238,000	546,000	+ 308,000
" Great Britain ...	2,083,000	2,261,000	+ 178,000
" Germany ...	1,951,000	2,446,000	+ 465,000
" United States ...	20,000	19,000	- 1,000
" Other countries ...	70,000	196,000	+ 126,000
Total ...	4,392,000	5,468,000	+ 1,076,000
<i>Glass manufactures.</i>			
From Belgium ...	271,000	279,000	+ 8,000
" Great Britain ...	103,000	99,000	- 4,000
" Germany ...	1,902,000	1,908,000	+ 6,000
" Other countries ...	13,000	40,000	+ 27,000
Total ...	2,289,000	2,326,000	+ 37,000
<i>Porcelain.</i>			
From Belgium ...	151,000	174,000	+ 23,000
" Great Britain ...	48,000	56,000	+ 8,000
" Germany ...	1,104,000	1,312,000	+ 208,000
" Other countries ...	49,000	44,000	- 5,000
Total ...	1,352,000	1,586,000	+ 234,000

Note: Gulden = 1s. 3d.

## RELATIVE EFFICIENCY AND ADVANTAGES OF DIRECT, SEMI-DIRECT AND INDIRECT LIGHTING.

By L. CROUCH.

ILLUMINATION received from any lighting source can be regarded as due to direct and indirect components; "direct" lighting proceeds from the source to the illuminated plane, with or without diffusion by an opalescent screen, but without that complete screening of the source itself and reflection of light from a ceiling, wall, or special diffusing reflector, which characterises "indirect" lighting. In the majority of lighting schemes, the illumination provided has both direct and indirect components, and, as shown below, this condition is generally to be desired.

Some years ago, when illuminating engineering was no more than a name, the endeavour of most lighting "experts" was to increase the luminous efficiency of their lighting schemes by increasing the direct component of the total illumination. Owing to the considerable absorption of light by the diffuse reflecting surfaces, indirect lighting is naturally less efficient than direct lighting which, if secured by high-grade silvered reflectors, or, better still, prismatic reflectors, renders practically the whole of the luminous radiations from the source available in a more or less restricted field, whence a certain illumination of adjacent areas is effected (but in a manner which cannot be subjected to predetermination), by diffuse reflection. However, the low efficiency of indirect lighting is justified in many cases by the uniformity of illumination obtained. In a room lighted entirely by indirect illumination, there are practically no specular or regular reflection on working surfaces, no deep and sharply defined shadows, and no surfaces of sufficiently high intrinsic brilliancy to fatigue the eye. In such places as drawing offices, these characteristics are wholly advantageous, but in general offices, and, to a greater extent, in residences, &c., some shadow is very desirable to allow of a rational appreciation of relief and perspective. Once its novelty has worn off, purely indirect illumination becomes wearisome, depressing, and even fatiguing to the eye by its very uniformity. The tiresomeness of purely indirect illumination is particularly noticeable when the walls are of light-coloured material; much more pleasing effects are secured by the choice of a dark wall covering, and the luminous efficiency thereby sacrificed is, to some extent, compensated by keener visual acuity. The overall luminous efficiency of indirect lighting may be as low as 10 per cent. (particularly if the light fittings and ceiling, or other diffusing surface, be dirty or coloured); in very few cases can a higher luminous efficiency than 40 per cent. be secured.

There is now a general appreciation of the fact that interior illumination is usually best effected by semi-direct lighting; good diffusion and a reasonable minimum illumination should be provided by indirect light, but "life" should be given to the net illumination by a direct-lighting component arranged so as to secure faint shadows, but definite shading,\* while completely avoiding glare. So much biased matter has lately appeared concerning the relative advantages of various lighting systems, that it is refreshing to study the results of a series of tests† undertaken to determine the actual merits of direct and indirect illumination and the percentages of each which should be combined in a semi-direct illuminating scheme.

By proper design, including the judicious proportioning of direct and indirect illumination, the undoubted advantages of indirect lighting can be secured while correcting its disadvantages to a great extent, by direct lighting. The efficiency of

\* A striking example of the dangers of too uniform illumination is to be found on the library staircases in the Institution of Electrical Engineers' Building, Victoria Embankment, London. The ceilings are white, and the walls and stairs are surfaced with white marble, and as a result of the almost perfect diffusion of light, it is quite difficult at night to distinguish the edges of the steps when the latter are clean.

† Further particulars of these tests are to be found in the *Southern Electrician* for December, 1912, whence the subjoined data are drawn.

indirect lighting itself must always be low, but the overall efficiency of illumination may be increased by increasing the proportion of direct lighting, so long as the desirable features of the indirect lighting are not thereby sacrificed. The inefficiency of indirect lighting does not detract from its illuminating advantages; it merely increases the cost of securing the latter.

The problems to be solved are: (1) To what extent is diffusion of light desirable, as determined by the avoidance of specular reflection and by the depth and sharpness of shadows; (2) what is the maximum intrinsic brilliancy to which the eye should be exposed; (3) what percentage of direct illumination will compensate the "flatness" of indirect lighting without introducing undesirable features?

The diffusion of the net illumination provided should be such that no appreciable direct reflection or glare is noticeable from the highly glazed paper now so frequently employed—particularly for the printing of half-tone blocks. This consideration requires that direct illumination should be provided by opalescent bowls sufficiently large to avoid specular reflection and of no greater intrinsic brilliancy than the ceiling (or other diffuse reflector) area of maximum brilliancy. Great accuracy in determining these conditions and in estimating the percentage of direct illumination is not necessary—indeed, it is impracticable.

Tests undertaken by Sweet and Doane with semi-direct lighting units showed that, in a particular case, the proportions of illumination received directly and indirectly with

diffusion which can be secured by indirect, as compared with direct, lighting; in picture galleries and drawing offices, &c., this value is high, but in other instances it is negligible. In any case, a well-designed direct-lighting scheme is preferable to a semi-direct system, in which the direct component is sufficiently great to reduce seriously the illuminating advantages of the indirect component.

*Comparative Efficiencies.*—As the average result of a large number of tests, it may be taken that two lumens can be obtained per watt expended in an indirect lighting equipment under favourable conditions. In small rooms with light walls and ceilings, the efficiency may rise to 2.5 lumens per watt, falling to 1.5 lumens per watt, or less, in large rooms with high ceilings. Definite test data which, apart from their intrinsic interest, show the comparatively high efficiency which can be obtained in indirect and semi-direct lighting systems under favourable conditions, were recently presented by Henninger and are reproduced in abstract in Table I (see also *loc. cit.*).

In Case II, tests with the lighting unit at various distances below the ceiling gave the following results:—

Hanging height below ceiling.	3 ft.	1 ft. 6 in.	2 ft.	3 ft.
Extreme per cent. var. illum.				
Above mean ...	21.5	19.3	22.7	21.4
Below mean ...	22.0	21.1	20.2	17.6
Effective lumens per watt...	2.65	2.90	2.69	2.66

Tungsten lamps in prismatic glassware were used in Case IV; the direct illumination measurements were made

TABLE I.—TEST DATA COMPARING EFFICIENCY OF DIRECT, SEMI-DIRECT AND INDIRECT LIGHTING.

Case.	Size of room Length x width x height.	Walls.	Ceilings.	Lamps (Tungsten) globes, &c.	Direct, semi-direct, or indirect.	Average foot candles.	Watts per sq. ft.	Effective lumens per watt.	Relative per cent. efficiency*
I.	19 ft. x 39 ft. 7 in. x 12 ft. 2 in	Light yellow	White	Eight 150-w. clear lamps bowl frosted	Direct, indirect	6.39 2.77	—	4 1.73	100 43.3
II.	9 ft. 10 in. x 8 ft. x 8 ft. 3 in.	Black White	White White	Lamp 12 in. from ceiling.	Direct, indirect	5.63 2.40	—	3.52 1.51	88 37.7
III.	36 ft. x 18 ft. x 12 ft. 6 in.	36 ft. white marble wainscot and 4 ft. mirrors	Light Buff	Three 4 x 100-w. fittings.	Semi-direct	5.78	1.875	3.08	—
IV.	18 ft. 10 in. x 23 ft. x 13 ft. 10 in.	Natural wood	White	Prismatic glassware.	Direct, semi-direct, indirect	— — —	—	3.04 1.54 1.03	100 50.6 33.75
V.	38 ft. x 20 ft. x 10 ft.	Light yellow	Cream	Six 150-w. lamps in light opal bowls. Shade rims 15 in. below ceiling.	Semi-direct	4.14	1.16	3.56	—

\* Based on clear lamps and direct illumination.

white ceiling and white, medium and dark walls respectively, were:—11 per cent. and 89 per cent.; 13 per cent. and 87 per cent.; 14 per cent. and 86 per cent. If the direct component of the illumination does not exceed 12 per cent. of the total, no trouble should be experienced by specular reflection, and the amount of direct illumination should be kept as near as possible to the upper limit thus determined, in order that the overall efficiency of lighting may be a maximum.

It is desirable that no sharp shadows of greater density than 15 per cent. should be present on working surfaces; for drawing office work, 10 per cent. is a better limit, and in very few cases can a 30 per cent. shadow be tolerated. The lower limit of shadow desirable is determined by considerations of perspective and relief. As regards intrinsic brilliancy, the sources of direct illumination should be no more intense than the brightest patches on the ceiling, and even the latter are sometimes brighter than is desirable for eye-protection.

Summarising, we may say that the direct illumination should be: (1) About 12 per cent. of the total from the standpoints of specular reflection and intrinsic brilliancy; (2) from 10 per cent. to 15 per cent. of the total for best shadow results.

If the percentage of direct illumination falls below 10 per cent., there will be loss of perspective and lack of "life" in the illumination, while if it much exceeds 15 per cent. of the total, the advantages of the remaining indirect illumination will hardly justify the cost of its provision. In this connection, the illuminating problem reduces to a determination of the money value to be attached to the more perfect

with the fittings hung in their normal position, after which they were inverted, but kept at the same height as before. Finally, the inverted reflectors were surrounded by a cone of blackened Bristol board in order to isolate and determine the true indirect component of the total lighting. The maximum variation in the illumination was 55 per cent. in the direct lighting scheme, 44 per cent. in the semi-direct arrangement, and 78 per cent. under the total indirect illumination.

Efficiency considerations undoubtedly favour semi-direct as compared with indirect lighting and, if anything, a higher actual effective illumination is required in the latter case to produce the same impression of good lighting and the same ability to see well.

**Electrical Congress in Russia.**—A Russian General Electrotechnical Congress has just been held in Moscow, when among the papers read was one by M. Pilkevitch on "Central Generating Stations," in which he advocated the erection of the generating plants near the source of the fuel supply, and the transmission of the current to the point of distribution in preference to locating the station in the town to be supplied, and conveying the fuel thereto.

M. Koltvanoff, the director of the Moscow Urban Railway, submitted a scheme to the Congress for the construction of an underground electric railway in Moscow.

A resolution was adopted by the Congress in favour of a law with regard to electrical units in Russia, while it was decided to recommend the Government to enforce the adoption of officially-approved electricity meters.

## THE NATIONAL INSURANCE ACT, 1911.

## COURTS OF REFEREES.

By JOS. J. H. STANSFIELD, F.C.I.S.

THE National Insurance Act, 1911, came into force in July, 1912, but it was provided by Sec. 84 that unemployment benefit was not to be paid in respect of any period of unemployment occurring during the first six months. This period has now expired, and as claims for benefit are being made, it becomes advisable to consider the conditions under which benefits are payable, and in what way employers are affected or interested.

The statutory requirements and conditions under which benefits are payable are set out in full in Secs. 84 to 86, but it may be shortly stated that, subject to contributions having been paid by an employer on behalf of a workman and of himself, every workman of 17 and upwards, so long as the conditions are fulfilled and the workman is not disqualified, is entitled to benefits if he has been employed in an insured trade and is unemployed.

The workman must prove (1) that he has been employed in an insured trade in each of not less than 26 weeks during the preceding five years; (2) that he has applied in the prescribed manner; (3) that since the date of application he has been continuously unemployed; (4) that he is capable of work, but unable to obtain suitable employment; and (5) that he has not exhausted his right to benefit.

The disqualifications for benefit are by Sec. 87 (1) unemployment through trade disputes, so long as the dispute lasts, unless the workman has become employed elsewhere in an insured trade (2) for six weeks from the date of leaving if the unemployment is caused through misconduct, or voluntarily leaving without just cause; (3) being an inmate of any prison or workhouse, or other institution supported wholly, or partly, out of public funds; (4) residence temporarily or permanently outside the United Kingdom; and (5) in receipt of sickness or disablement benefit, or disablement allowance, under the Health provisions of the Act.

The unemployment provisions of the Act apply to persons of 16 years and over, but no benefit is payable for unemployment occurring before the age of 17, and only half benefits are allowed from 17 to 18, but after the age of 18 the benefit is 7s. per week for each five weeks' contributions.

A consideration of the qualifications and disqualifications for benefit will show that these are partly questions of fact and partly of opinion, and as it was anticipated that there might be disputes between a workman and the Insurance Officer as to the amount of benefit due, or whether benefit is payable or not, the Act provides (Sec. 88) for the setting up of Courts of Referees to which such disputes may be referred.

The United Kingdom has been divided provisionally into eight divisions, again sub-divided into 82 districts for each of which a panel of employers' and workmen's representatives have been constituted, the names of the divisions and the number of districts in each division being as follows:—London and South-Eastern (14), South-Western (7), West Midlands (6), Yorkshire and East Midlands (13), North-Western (14), Wales (5), Scotland and Northern (19), and Ireland (4). For these 3,158 representatives have been elected, one-half on behalf of employers and the other on behalf of workmen.

The members of employers' panels have been elected by the Board of Trade, and the members of the workmen's panels by ballot of workmen engaged in insured trades. If an Insurance officer refuses or stops benefit, or allows benefit of an amount not in accordance with the claim, the workman may require the case to be referred to a Court of Referees consisting of three persons—one drawn by rota from each of the two panels, with an impartial chairman appointed by the Board of Trade, the latter being neither an employer nor a workman in an insured trade.

Should the Court of Referees make a recommendation in agreement with the decision of the Insurance Officer, its recommendation is final, but if the Court disagrees the

officer must either accept the recommendation or, if desired by the Court, refer the matter to the umpire appointed by the Crown under the Act, his decision being final.

If an Insurance Officer thinks fit, he may refer a case direct to the Court, instead of deciding it himself when the decision of the Court is final.

Where a workman has required an Insurance Officer to refer his claim to a Court of Referees, the Chairman of the Court may at any time before the matter has been taken into consideration by the Court, refer it for report to two persons residing in the same neighbourhood as the workman, one of these persons being drawn from the employers' panel, and the other from that of the workmen.

Questions bearing upon the administration of Unemployment Insurance, may be referred by the Board of Trade for consideration and advice to the persons constituting the panels when special meetings will be held.

Courts of Referees usually meet weekly in some central town, but the number of representatives on the panels is sufficiently large as not usually to require an attendance of any individual member more than once a quarter.

It is as yet too early to say how Courts of Referees will succeed in settling disputes to the satisfaction of all concerned, but it is likely that some difficulty may be found in respect of the disqualification for six weeks of benefit where a workman leaves employment through misconduct or without sufficient cause. Indeed, Trade Unions already threaten agitation with regard to this, on the ground that workmen are being deprived of benefit where the misconduct has been due to a conflict between the rules of a Trade Union and the regulations of an employer.

Although employers are only indirectly concerned in the question whether a workman is entitled to benefit or not, it should not be overlooked that economical administration of unemployment benefit funds is of importance, and that, although the unemployment part of the Insurance Act at present only applies to a limited number of trades, that number may at any time be extended, within limits, by the Board of Trade, and if this part of the Act is considered to be a success, it is not unlikely that extensions may take place from time to time.

## PROCEEDINGS OF INSTITUTIONS.

## Electric Resistance Welding.

By P. BUCHER.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester, December 17th, 1912.)

If the correct interpretation of welding signifies the joining of two pieces together so as to form one while hot under pressure, then the only one of the new methods which can rightly be classified under this head is the electric resistance welding. In every one of the other methods the metals are actually heated to melting-point, and are in reality fused together.

The provision of the necessary current is one of the greatest difficulties with which the introduction of electric welding has to contend, where there are no public mains supplying single-phase alternating current. Where the public supply is direct current, it becomes necessary to install either a motor-generator or a rotary converter for generating single-phase alternating current.

In three-phase systems it is sometimes permissible to put a welder in one phase only, but in the case of larger welders the unbalancing effect would be too serious, and means must be provided to transform three-phase into single-phase current. This can be done by a three-phase motor driving a single-phase generator. A rotary transformer with two distinct stator windings, which gives a load on the three-phase primary balanced to within about 90 per cent., is considerably cheaper than the motor-generator.

The current is transformed down to about 2 volts in a special transformer, which in almost every case forms part of the welding machine itself. The secondary winding takes the form of a copper casting corresponding to a single turn, fitted with suitable means for transmitting the current to the pieces which are to be welded.

All the parts which are exposed carry only the low-voltage secondary current, so that the process is absolutely free from danger through shock. It is important that the secondary circuit be kept as short as possible.

The method of working is, in all cases, the same. The pieces to be joined are gripped in the clamps or placed between the electrodes and brought into contact. The primary circuit is closed either by an independent act of the attendant or automatically by the machine. The heavy current flowing through the joint heats it up at once, and welding temperature is reached very rapidly, in a

fraction of a second in light wire or the spot-welding of thin sheets, or in several minutes in the case of a heavy tire. The flow of current is interrupted as soon as the required heat is reached, and therein lies one of the advantages of resistance welding—it never consumes energy unless it produces work. Simultaneously with the interruption of current and the cessation of the heating comes the upsetting or shutting of the weld by continuing or increasing the mechanical pressure which was first used to bring the two parts into contact. The application of this pressure in butt welding raises at the joint a lump or burr, which generally must be got rid of.

Somewhat similar conditions to the raising of the burr in butt-welding prevail in spot-welding. When the current passes from electrode to electrode it brings a cylinder of metal to white heat, and thereby into the plastic state. This soft cylinder is surrounded by a shell of cold and hard metal. When end-pressure is applied to it for making the weld, its volume is reduced by the amount to which the electrodes enter into it. Some of the surplus metal escapes round the circumference along the sides of the cone of the electrodes, forming a low ridge, but some of it—and this is a drawback to spot-welding—is extruded between the two sheets to be joined, slightly driving them apart. This means that spot-welding cannot be relied upon to make a water or gas-tight joint between two sheets. If that type of joint is required, the cone-shaped electrode of the spot-welder must be replaced by the roller of the seam-welder. The principle of its working is simply a repetition of spot-welding, but its result is an uninterrupted seam or lap weld.

The use of very heavy currents makes the necessary machinery heavy, cumbersome, and expensive. The field is therefore not jobbing, where arc and hot-flame welding reign supreme, but repetition work, where it scores immensely by virtue of its simplicity, accuracy, reliability, speed, and economy.

Chain links are welded at an average rate of 10 to 15 per minute, or 30 to 40,000 per week. An average week's output of a heavy tire-welder was 625 tires, varying in width from 2 in. to 9 in. A bank of spot-welders worked by boys on miscellaneous hollowware dealt with 120 to 180 gross of articles per machine, corresponding to about 35,000 welds per machine per week.

The heat efficiency of a welder is about 75 per cent. The above-mentioned weekly output of chain, assuming about 3 s.w. gauge, would use from 100 to 130 units. The tire-welder already referred to used, according to the supply company's meter, 737 units, and a spot-welder on miscellaneous hollow-ware uses about 1 to 1½ units for 1,000 welds.

The most important question is: How strong is an electric weld? The reply to this is very favourable. Actual figures were quoted in "Experiments on the strength and fatigue properties of welded joints in iron and steel," a paper read before the Institution of Civil Engineers by Messrs. Stanton and Pannell. These experiments were made on sample welds prepared by 16 different engineering firms in the kingdom according to their usual practice. The condensed result for tensile strength is expressed in percentage of the tensile strength of the unwelded material:—

Hand-welded iron.	Hand-welded steel.	Electric-welded iron.	Electric-welded steel.
Mean of 24 tests 89·3	21 tests 81·6	7 tests 89·2	8 tests 93·4

In the same way for fatigue properties:—

Hand-welded iron.	Hand-welded steel.	Electric-welded iron.	Electric-welded steel.
Mean of 21 tests 97·6	28 tests 78·4	5 tests 92·6	12 tests 87·0

The authors state that with reference to the respective merits of hand and electrical welding, the tests show that more uniform results are obtained by the electrical welding method; and there appears to be no evidence that the want of uniformity in the material, which is usual in the region of a welded joint, is liable to cause failure of the joint under repeated applications of the load, provided the weld be originally sound.

Electric welders are in daily extended use in brass and copper wire mills for joining up rods and slottings, which afterwards pass through the drawing dies.

High-carbon steel can be welded up to about 0·8 per cent. carbon, but the results are not so satisfactory as in mild steel. When high-carbon wire is welded the heat of the weld is a very short one, and the bulk of the adjoining cold metal seems to have a quenching effect on the steel, so that the wire when taken from the machine is glass-hard at the joint and snaps on the slightest effort. To overcome this the wire must be locally annealed—for preference in the welder itself—and this heat treatment weakens the wire for the length to which it has been applied as compared with the rest of it.

Generally speaking, the strength of a welded high-carbon wire is about 60 to 70 per cent. of the unwelded wire.

Pure copper welds quite satisfactorily, and so do most of the brasses unless the percentage of zinc in them is too high, when the weld becomes brittle and will not draw. Nickel and most of its alloys also weld very well; so do aluminium, silver, gold, platinum and iridium.

Only iron and mild steel lend themselves to spot-welding in a satisfactory manner.

#### DISCUSSION.

PROF. E. W. MARCHANT said he had recently made experiments on the actual amount of energy used in making electric resistance welds between samples of iron wire. The energy consumption was remarkably small, as was seen from the fact that a weld between a

pair of  $\frac{1}{8}$ -in. rods took 20 watt-minutes, or in other words, 1,000 welds of this kind could be made with only  $\frac{1}{2}$  B.T.U. of energy. Similarly, with  $\frac{3}{16}$ -in.-diameter rods, the energy consumption was 50 watt-minutes;  $\frac{1}{4}$ -in. rods, 110 watt-minutes;  $\frac{5}{16}$ -in. rods, 180 watt-minutes. As the diameter of the rod increased, the energy consumption per weld went up very rapidly; for example, comparing  $\frac{3}{16}$ -in. and  $\frac{1}{4}$ -in. rods, nine times as much energy per weld was required in the latter case. This increase was due partly to the increased contact area and also to the large amount of cooling due to the jaws holding the metal. The current used in the case of the  $\frac{5}{16}$ -in. rods was about 2,000 amperes. Using copper rods, a current of 6,000 amperes was required, against 2,000 amperes for iron of the same diameter. The use of chokers to increase and diminish the welding current would considerably increase the energy consumption in welding, but, in any case, the current rushes in welders would not seriously affect pressure regulation in the average supply station, even if no regulating device were employed.

MR. A. E. MCKENZIE said that, about 2½ years ago, it was decided to increase the capacity of some superheaters, and the question of installing new superheater tubes was considered. The price of new tubes was so high that it was decided to lengthen the existing tubes by welding additional lengths. Twelve sample tubes (six scarf and six butt joints) were welded by the electrical resistance method, and on test the butt joints were found to be superior to the scarf joints, notwithstanding the greater surface of the latter. The result of the test justified the alteration of one boiler containing 40 tubes, which, after welding, were tested at 1,000 lb. per sq. in. Six months' satisfactory working of the experimental boiler warranted the change of three others, and, notwithstanding the strong criticism of the boiler makers and insurance companies, after two and a half years' work, not a single tube had given any trouble. Before making the welds, the tubes were slightly bevelled inside and outside at the butt; the burr was thrown up on the outside, although scarcely noticeable.

MR. W. CRAMP said the process of resistance welding appeared to be better than anything arc welding could produce. The portability of oxy-acetylene or oxy-hydrogen welding appliances was a great point, and, notwithstanding the author's suggestions, a direct-current machine should have a wide scope. Instead of a motor-transformer, a cheap form of homopolar machine run at a high speed might be successfully employed. If, using the same values of current and time, joints were made by (1) direct current, and (2) alternating current, would there be any difference in the results? The energy required for welding different sections of wire would depend very much upon the heat capacity of the section, and this effect would undoubtedly account for a portion of the increased energy consumption referred to by Dr. Marchant.

MR. K. M. FAYE-HANSEN said that in some cases the secondary of the transformer consisted of more than one turn, also some firms used copper laminations instead of a copper casting. Electrically, the casting was as good as the laminations, and it certainly provided a much better mechanical job.

MR. R. G. CUNLIFFE gave a description of a rail welding process for use on traction rails exceeding 10 sq. in. in cross-section. In this system, six special bridging plates were electrically welded so as to connect each fish-plate to the rails efficiently. The Chicago Railroad Co. employed the system with much success.

MR. J. FRITH wished to know whether in using the author's apparatus the back portion of the chain link did not short-circuit the portion to be welded. No mention had been made of the constant-current welding machine due to Dr. Rosenberg.

DR. E. ROSENBERG asked for further figures in connection with the tensile strength values. There was very little difference in the various methods according to the average value, but it was of considerable importance to know what the lowest value was.

MR. W. POLLARD DIGBY (communicated) said there was too much of a tendency to regard the tensile test as everything in regard to welding. They ought to consider other properties. The change in the microstructure of the metal welded was all-important. The mechanical engineer had failed to have recourse to the metallurgist. Each weld showed under the microscope such characteristics that it was possible for the metallurgist to say from a sample of the steel what method of welding had been employed. One thing was essential to resistance welds, that the resistance weld should receive adequate working while the metal was still plastic. If this were not done, one found, on cutting up a large bar welded by the resistance method, two distinct classes of fractures. The outer metal, near the extruded portion, had a decidedly splintered fracture; the inner area had a decidedly crystalline fracture with relatively low elongation, and showed under the microscope a slight tendency to overheating. Another property common to all welds in a greater or less degree was that of oxidation. Resistance welds shared with acetylene welds the least susceptibility to this. All the arc welds, on the other hand, which had come through his hands, had shown a marked tendency to oxidation. Each welding process had its own field of application. Many welding processes, not least among them that described by the author, were of great commercial success and general utility. At the same time they must really cease to place this excessive emphasis on tensile strength, and consider instead the fact that while tensile strength might remain high, the other mechanical properties might be affected, and not least, corrosion might be facilitated.

MR. L. W. SCHUSTER (communicated) said that the most interesting feature of the subject dealt with in the paper was the effect on the metal due to the welding. In the case of the acetylene welding of cracks and grooving of boiler plates, local hardening of the metal appeared to take place; great difficulty was encountered in obtaining a satisfactory weld, and the cracks were always liable to extend. It would appear that this would equally be the case in the event of its being practicable to adapt electric welding for repair

work of this nature. The cutting of plates by the acetylene blow-pipe flame seemed to have the same hardening effect, although in the case of steel pipes being out in this manner for receiving branches and the branches being afterwards welded by the acetylene process on to the pipes, the results appeared to be satisfactory, but it might perhaps be safer to anneal afterwards. In the case of the electrical welding of flanges to pipes, the results did not appear to have come up to expectation.

The AUTHOR, in reply, said that aluminium welds were extensively made in connection with rim work in the Birmingham district. Regarding the chain link question, a certain amount of current did go round the back of the link, but not enough to make it unbearably hot to the fingers; even in small links the economy of the process was so pronounced that this loss of energy was never considered of importance. Some firms used copper stampings for the secondary, but by far the majority used a copper casting.

### The Institute of Metals.

THE annual general meeting of the Institute of Metals was held in London on March 11th, when the new president delivered his inaugural address. On the following day a number of papers were read. One on "Metal-Filament Lamps," contributed by Mr. Alexander Siemens, summarises the history of the use of metal filaments in glow lamps, and states that the first lamp to have actually drawn-metal wire as its filament was the tantalum lamp, manufactured by Siemens & Halske, Berlin. They also succeeded in drawing an alloy of tungsten and nickel, but before that process was perfected, the General Electric Co., of Schenectady, patented a process to make pure tungsten ductile, which is described in the paper.

Mr. Arnold Philip (Admiralty Chemist) dealt with "The Corrosion of Distilling Condenser Tubes."

A paper by Dr. G. H. Bailey deals with the action of water and salt solutions on aluminium. From an examination of the experimental evidence, he draws the following conclusions:—That aluminium of high purity is less readily acted upon than that of lower purity, and that the presence of sodium and copper in the metal increases the rapidity of corrosion. Well-annealed metal is also more resistant to corrosion than unannealed metal. In general the corrosion of aluminium is a process of oxidation; metal exposed for several months to water or salt solutions from which the dissolved air had been expelled, underwent no corrosion whatever. The normal course of corrosion (excluding the action of acids and alkalis) is thus a transformation of aluminium into alumina, which separates out as a flocculent precipitate without any of the aluminium passing into solution.

Mr. O. F. Hudson discussed the microstructure of German silver, and Mr. G. H. Gulliver read a paper on "The Quantitative Effect of Rapid Cooling upon the Constitution of Binary Alloys." The importance of the subject is due to the fact that the constitution of a cast alloy cooled at ordinary rates lies between that of the very slowly-cooled and that of the very quickly-cooled mixture, so that its limits of variation with change in the rate of cooling can now be specified.

A paper was read by Messrs. H. S. Primrose and J. S. Glen Primrose, on "Practical Heat Treatment of Admiralty Gun-metal." They find that even in the absence of blow-holes, which constitute the commonest source of unsoundness, cast gun-metal behaves unsatisfactorily under hydraulic tests due to the presence of microscopical pores formed between two constituents of widely-different properties. The most marked improvement was found to be produced by annealing the bars for half-an-hour at a temperature of 700° C., as the physical tests showed lower results both above and below this critical point.

The report of Council showed that the membership amounted to 614, an increase of 28. The balance to the credit of the Institute at June 30th, 1912, was £548, in addition to the balance in the research fund and various minor assets.

### Recent Developments in the Street Lighting of Manchester.

By S. L. PEARCE, M.I.E.E., and H. A. RATCLIFF, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester, February 25th, and London, March 6th, 1913.)

THIS paper is principally a record of the work undertaken, the results obtained, and the numerous tests and experiments upon which the satisfactory completion of the work depended.

The first installation of arc lighting in Manchester was carried out in the early part of 1897. A number of 500-watt "open-type" arc lamps of the short-hour double-carbon type, suspended about 22 ft. above the ground, were erected. On October 27th, 1897, the City Council approved a report of the Electricity Committee recommending that all tramway routes be lighted by arc lamps; and in the following year application was made to the Local Government Board, and sanction subsequently received, for the borrowing of £75,000 for street-lighting purposes. The work has not been carried out, though at one period it was the distinct desire of the Corporation that the main thoroughfares should be so illuminated.

In 1904, the original "open-type" arcs were superseded by 600-watt and 900-watt lamps of the single-enclosure type, suspended some 18 ft. 6 in. from the ground, and burning 100 hours without re-trimming.

At or about that time a limited number of intensified gas lamps had been placed on the streets of Manchester; comparative results

obtained showed that the cost of a minimum horizontal illumination of 0.26 foot-candle per lamp per hour was 0.37d. for the 600-watt arcs, and 1.21d. for the intensified gas. The running cost per 1,000 C.P.-hours was similarly 0.75d. for the arcs, and 1.98d. for the intensified gas.

The year 1906 marked the beginning of the supersession of the single-enclosure type of lamp by magazine flame arc, which was completed by the end of 1911.

That the amount of electric street lighting is ridiculously small, is due to the fact that up to a very recent date the Gas Committee of the Corporation has been the street-lighting authority. On October 2nd, 1912, the City Council placed the control of the lighting of the streets under the authority of a Street Lighting Committee, and it is hoped that impartial consideration will be accorded in the future to the rival illuminants.

Arising out of a proposal to extend the high-pressure gas lighting system, the City Council, on February 1st, 1911, authorised a scheme of competition between the two rival illuminants. No restrictions were placed on either department; each was to do its best.

This paper is particularly concerned with the comparative results of Princess Street and Portland Street, which may be regarded as typical examples of modern street lighting by high-pressure gas lamps and high-candle-power flame arcs respectively.

Four Keith high-pressure lamps were suspended in Princess Street at the same height above the roadway as the arc lamps, namely 27 ft. 6 in. The distance between the lamps averaged 106 ft. 6 in. Each lamp contained three inverted burners, and clear globes were used. At normal pressure each burner was rated at 1,500 C.P., or a total of 4,500 C.P. for the complete lamp; but the maximum candle-power obtained was only about half this figure. As originally installed, the lamps were fitted with traversing and lowering gears; but these were apparently not successful, as the lamps were at a later date fixed permanently in position. The flexible gas supply tubing was also replaced by rigid galvanised gas barrel.

Princess Street is 60 ft. wide, and as the lamps were on an average only 106 ft. 6 in. apart, the resulting illumination was very good, and far superior to any previous example of high-pressure gas lighting in Manchester. Presumably in order to improve still further the maximum illuminating effect, but certainly not the uniform distribution of the light, the lamps have been lowered about a foot.

The central-suspension system was chosen for the lighting of Portland Street, and certain predetermined "units" of light were erected at such calculated distances apart as to give the maximum illumination for the least capital expenditure.

In addition to low initial costs, the central lighting system has the following advantages, which appear to outweigh certain known disadvantages:—

(a) The distributing mains can all be kept to one side of the street.

(b) No separate lighting standards are required on the street pavements, with consequent advantage to pedestrian traffic.

(c) A more even illumination is obtained; in other words, the ratio of maximum to minimum illumination is less than with side lighting for a given amount of electrical power employed.

The traffic in Portland Street is of a very dense character. It was therefore deemed advisable to aim for a high standard of minimum illumination, viz., something of the order of 0.5 foot-candle.

The length of Portland Street is 1,751 ft., and its width 66 ft. Sixteen 550-watt lamps, working four in series on the 200-volt mains, have been erected; the distance between lamps varies from 114 ft. to 124 ft.

Eight of the 16 lamps are run on an all-night circuit, and the remaining eight are switched off at 11 p.m. The switching "on" and "off" is automatically controlled by time switches.

With six exceptions the arc lamps were suspended 28 ft. above the level of the street by means of two wrought-iron straps, from two steel wires of  $\frac{1}{8}$  in. diameter, placed 14 in. apart, one above the other in a vertical plane (see fig. 1). Under these conditions the swinging of the span wires is largely counteracted.

The lamps are fixtures, and all trimming has to be done from a tower wagon.

From the street level to a height of some 8 ft., galvanised steel tubing is run up the building walls. The service branch cables drawn through the tubing then enter a connecting box, and from the latter a heavily sheathed 7/18 s.w.g. twin vulcanised india-rubber cable is fastened to the upper part of the walls with raw-hide cleats, and is then carried across the span wires to the lamps by means of pigskin suspenders. The lamps are of the magazine type, and the actual hours of burning average 70; but it is usual to allow only 65.

The first results obtained were not considered altogether satisfactory. Shadows and concentric rings were practically eliminated by the use of slightly opalescent outer globes, but the efficiency of the lamps was impaired to a very appreciable extent, and the distribution of light was rather worse than before.

It is apparent, from an inspection of the polar curves (fig. 2), that neither the clear nor the opalescent outer globes were suited to the conditions.

The height of the lamps was lowered from 28 ft. to 27 ft. 6 in., to mask certain shadows of the trolley-wires.

Whilst the lamps were undoubtedly giving their rated candle-power, yet, owing to the particular design of the outer opalescent globes and spinnings, practically all the rays from the horizontal to the 18° angle below the horizontal were entirely blotted out. It was decided to modify the construction of the spinnings, lowering the arc a distance of  $\frac{1}{8}$  in., and to use another type of outer globe in which there was less interference with the direct trans-

mission of the light rays in the neighbourhood of  $20^\circ$  below the horizontal (fig. 8). The alterations resulted in a substantial increase in the candle-power emitted between the angles of  $10^\circ$  and  $20^\circ$ , the maximum ray attaining 3,600 C.P. at  $23^\circ$ .

In the early part of 1912 the Manchester Corporation called in Mr. Jacques Abady and Mr. Haydn Harrison to report on the two systems of street illumination as carried out in Princess Street and Portland Street respectively. The reports of these gentlemen have already appeared in the technical Press.\*

In order that the comparison between the various schemes of lighting might be both definite and reliable, and also to enable the best results to be obtained from the arc lamps, a very considerable amount of photometric testing was necessary. This work was in progress for over twelve months, and many thousands of readings were taken during that period.

All the testing was done in the streets at night with the lamps burning under normal conditions.

The photometer used was a modification of an instrument constructed by Messrs. Alexander Wright & Co. The photometer head is of the Simmance and Abady flicker type. This photometer measures the actual light flux density of the incident ray, from which values for candle-power and the intensity of illumination on vertical or horizontal planes can readily be calculated. The complete apparatus

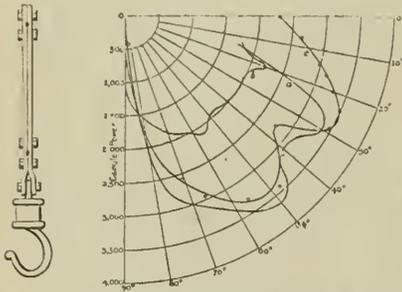


FIG. 1. a and b, with original globes and spinings; a, outer globes clear; b, outer globes opalescent; c, with clear globes of the type now used.

FIG. 2.—POLAR CURVES FOR 550-WATT LAMPS.

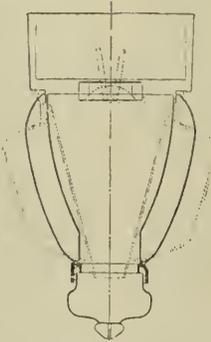


FIG. 3.—INNER AND OUTER GLOBES NOW USED. ORIGINAL SHOWN DOTTED.

is mounted on a special cart, by means of which it can be wheeled about as required. Owing to numerous structural alterations, and for no other reasons, it was not conveniently possible to arrange the photometer for taking readings at a less distance than 5 ft. from the ground.

Many of the measurements have, for purposes of comparison, been reduced to their corresponding values on a horizontal plane 3 ft. 3 in. above the ground.

Two 6-volt Osram lamps were used alternatively in the photometer as sub-standards of luminous intensity, thus providing a check on the measurements. The lamps were supplied from a 20 ampere-hour accumulator, burning when the discharge curve of voltage was practically horizontal.

In addition to photometer measurements, a few observations were also taken with a luminometer.

The results of the numerous photometric tests are given graphically in the paper. The results of street photometric tests are very frequently questioned, and gas authorities invariably dispute their accuracy. A consistently maintained degree of accuracy within a limit of 5 per cent. is all that is necessary for ordinary street work, and is recognised as sufficiently close by most of the authorities on photometric work. As all the curves obtained were plotted from the "means" of numerous readings taken with every necessary precaution, it may be reasonably assumed that the limit of possible error did not exceed 5 per cent., and, in many cases, was probably less.

The gas lamps give a much steadier light than the arc lamps, but their candle-power varies very considerably from day to day. The candle-power of a particular lamp may fall at least 50 per cent. before the mantles are renewed, unless it is arranged to change only one mantle at a time, thus spreading the complete change over a fairly long period.

The candle-power of the arc lamps may vary quite appreciably within a few minutes, but provided that the same make of carbons is used the average candle-power at any particular angle will not change to any extent from day to day, if the line voltage is reasonably constant.

A very important feature directly affecting the comfort of the general public is the absence or otherwise of glare. In this respect, the 3-burner high-pressure gas lamps have an advantage over the flame arc lamps with clear inner and outer globes. The use of clear outer globes with flame arc lamps is in fact hardly advisable from the point of view of scientific lighting.

Two notable features in Princess Street are the comparative softness of the shadows of objects cast on the ground and the absence of a pronounced dark horizontal zone in line with the reflectors. The first result is undoubtedly due in a great measure to the fairly large triple light source, which has the effect of shading off the edges of shadows; and the absence of a dark zone in line with the reflectors is no doubt due partly to the fact that the source of light is well below the reflector, and partly to the reflection from the inner surface of the large globes.

The shadows cast by the flame arc lamps when burning with clear inner and outer globes are very intense, and there is no appreciable shading of the edges; consequently, it is possible to confuse shadows with actual objects. The smallness of the light source, or, in other words, the high intrinsic brilliance, and the fact that the arc is well up under the reflector is no doubt the cause of the objectionable horizontal dark zone noticeable in cases where reflectors are used.

(To be concluded.)

#### DISCUSSION IN LONDON.

MR. A. H. SEABROOK, in opening the discussion, said that if the London electrical engineers had had such records as those contained in the paper, 18 months ago, they would not have been troubled by competitors to the extent that they were. The figures given were conclusive. He quite agreed with the centrally-hung lamps, but did not understand the absence of lowering gear, which was a great convenience. In the case of the Oxford Street lamps, lowering gear had superseded the use of the tower wagon, and it had paid for itself in 18 months in labour saved. It was essential to use good carbons, arc lighting being the best possible advertisement for electric lighting; the authors' figure of carbon cost, 2d. per lamp per hour, was a good one, which he (the speaker) had not found it advisable to reduce. The fixed costs of £61 per kW. connected for lighting was a good covering figure; the estimated 70 per cent. use of lighting connection (allowed in calculating the fixed costs) seemed high. In fixing cost it should be remembered that the load was largely a non-peak one; he asked whether the figures of cost were price charged or actual cost.

Mr. HAYDN HARRISON said a great deal of the work covered by the paper had been also carried out in London, but the results had not previously been published as in this case. High-pressure gas was shown to be out of court, but it was only fair to mention that the pressure was lower in Manchester than in London, and the results not so good. But a higher pressure was impossible in Manchester on account of leakage, and even with the increased pressure electricity was the better of the two. The success of the Manchester arc lighting was due to the care taken with the installation; indiscriminate arc lighting had done more harm than good. Dr. Bloch, who was an authority on the matter, gave 255 C.P. per cu. ft. of high-pressure gas as a practical figure, and reliable tests in this country gave 27 C.P.; the claim to 50 C.P. was excessive, but the lower figures might possibly be exceeded. The Manchester street illumination suffered from the black buildings, and at the time of the test a lamp opposite a new building appeared to be the best, and would have been judged the best by the average observer, which showed the necessity of photometry. He believed the intrinsic brilliancy of the H.P.-gas lamps in Regent Street was far higher than that of the arc lamps adopted in Manchester, and a great deal higher than for the arc with an obscuring globe.

PROF. SCHWARTZ said one of the great difficulties in street photometry was the large range of illumination which had to be measured: a photometer, such as that used by the authors, was liable to introduce errors due to its construction. The metre height above ground proposed for outdoor photometric measurements, was an inconvenient one, and he thought  $1\frac{1}{2}$  metres, or approximately the height of the eye, would be better. Tests taken by his assistants confirmed the results in the paper, and the great variation in illumination of high-pressure gas lamps. He congratulated the authors on the absence of glare; this was cheaply obtained at the cost of a little light.

MR. FRANK BAILEY thought it might be cheaper for the Manchester authorities to clean the buildings, and save energy now used in obtaining the minimum illumination. The City of London E.L. Co. had published all the principal results obtained from its experiments in street lighting, which covered much the same ground as the authors. Judging by his experience the authors had secured some curious results from dioptric globes; the latter were not easy to design, and in his own case, a special mould had to be provided before the glass-maker would make them. The treatment of the arc lamp globes at Manchester destroyed the skin of the glass, which it was difficult to preserve even in the normal state. He could not agree that arcs would not burn as steadily as gas lamps and strongly advocated further experiments with dioptric globes which would remedy such a defect.

MR. K. EDGECUMBE said the metre height for photometric measurements had been adopted as a standard by the Germans. He thought the authors might explain a little more definitely what they meant by horizontal illumination. Illumination had nothing to do with ground surface; the figures given were presumably calculated illumination of the area covered—not necessarily Portland Street. He, however, thought the illumination should take into account the conditions due to the buildings, such as reflection, &c.

PROF. J. T. MORRIS asked whether the effect of the fog on the gas mantles was due to carbon getting in with the air, depositing on the mantle and diminishing the C.P. It was regrettable that the gas lamps were not working at their highest efficiency, but high-pressure gas lamps did not give their supposed candle-power; a falling off of 25 per cent., and in some cases of 50 per cent., being

\* ELECTRICAL REVIEW, November 1st, 1912, page 693.

found. His own experiments confirmed the great reduction in c.p. shown by the authors. He asked whether the authors had measurements to prove the superior penetration of the arc lamps in fog, as he knew of cases where gas had been adopted owing to the statements as to the latter being superior. In looking into the question of costs, to find the direction of possible improvements, he found in the case of the arc lighting that energy cost 60-65 per cent., trimming and maintenance 7-8 per cent., and carbons 28-30 per cent., of the total, while in the case of the gas lamps, gas accounted for 80 per cent., trimming and maintenance 13 per cent., and mantles 7 per cent. of the total. It had to be remembered that the 7 per cent. was for mantles giving only half their candle-power, and if the latter were increased the life would be shortened.

Mr. Dow said the nearly horizontal rays caused the glare, but they were wanted to give even illumination; the authors' globe appeared, if anything, to intensify the glare. He questioned whether any form of diffusing globe would greatly affect the illumination curve. The ideal curve could be obtained with the metal lamp; with flame arcs the light fell straight down, and the problem was to take some of it and redirect it rather than to smother it. He did not consider the colour effect would be appreciable with the order of illumination used at Manchester.

Mr. A. P. TROTTER, in a communication, said the two rivals seemed to have had in view copious illumination, uniformity of distribution, and economy; if these were their objects they had both succeeded admirably. The difference between the illumination of the two streets, and between the uniformity of distribution, was imperceptible without a photometer, and the price was in favour of electricity. Until this experiment was made Manchester was, and in most of its other streets still was, the worst lighted of our great cities. Other street lighting authorities who might examine the results described, should not assume that a capital expenditure of £1,500 per mile of street, or £250 per mile per annum, was necessary for streets having the traffic of Princess Street, or even of Portland Street, after 7 p.m. The grading of the lighting to suit the requirements of the traffic in different streets, and the hours during which that traffic existed, were necessary factors in economy, unless a spectacular display was desirable for the purpose of making a town look attractive and gay. The whole of the illumination measurements might have been made with one of four or five direct-reading instruments, either at 3 ft. 3 in., or actually on the ground, with no calculations whatever. In street lighting one need not worry about the Purkinje effect, it did not begin appreciably to alter the relative brightness of red and green until the illumination had been reduced to about 0.025 ft.-candle. The authors said that their tests demonstrated a rather objectionable feature of dioptric globes, namely, the strongly-defined optical centre. But a dioptric shade generally meant one which, by the use of calculated planes and curves, so distributed the rays of light that a certain predetermined effect was produced. It was necessary to assume an initial distribution within the shade, and this implied a focus or optical centre. Dioptric shades were offered for street lighting in which no intelligence seemed to have been used in the design, and well-designed shades were so unintelligently used as to defeat the intended effect altogether. With a fixed focus arc there should be no difficulty in setting the shade as the inventor or designer intended. In 1879 he thought that uniform illumination was desirable in street lighting, but now he considered a street was more usefully lighted when the ratio of maximum to minimum was 15, or even greater. When half the lights were switched off in Portland Street, after 11 p.m., the street was excellently lighted. The graded frosting of the outer globes in Portland Street, no doubt, contributed largely to the uniformity of the lighting which had been achieved, but it was like regulating the speed of a steam engine by a brake instead of by the steam admission. There were two good features in the gas lighted Princess Street, which were well known to electrical engineers, but which had not been adopted in Portland Street. The gas lamps were surrounded by large clear globes. The large size might be necessary on account of the intense heat, but they looked well. While the maximum candle-powers were about the same, the glare looking straight at the arcs was greater in his opinion than with the gas lamps. The lesser glare of the gas seemed to be due to the use of a white reflector. If large white reflectors were used with the arcs the glare would be reduced, although the reflectors would be of little use in the sense of reflectors.

Mr. S. L. PEARCE, in replying, pointed out that there was no power to attach to buildings in Manchester, and although consent to the fixing of rosettes was obtained, the fixing of winches was objected to. The cost given in the appendix included nothing for profit, but it was ample, and some items, having nothing to do with street lighting, might be omitted. The business lighting load in Manchester was a high percentage of the total, and he did not think the 70 per cent. referred to by Mr. Seabrook was too high. The standard of illumination was high, but he considered that it could be fully maintained all night with advantage. He could not recall any very detailed information having been published in regard to the lighting in the City of London; Mr. Bailey had a preference for dioptric globes, while in Manchester they preferred graded globes, and did not find their life shortened by the treatment given. In regard to candle-power per cb. ft., he was under the impression that leading gas authorities did not claim more than 40 c.p. at the present time.

Mr. RATCLIFF, who also briefly replied, said the horizontal illumination they had in mind was the impressed light, not reflected light. Careful observation had confirmed the superiority of the arc lamps in a fog.

## DISCUSSION AT MANCHESTER.

DR. E. ROSENBERG said that, seeing Moyley Street and Portland Street, one had the clear impression that there was competition between the Gas and Electricity Committees. In both systems there was by no means an absence of glare, and one was quite as bad as the other. It was as if the illumination problem was in its infancy, and nothing was known about illuminating streets and houses. In Manchester one could see the lamps but not the motor-cars. He considered the photometer was used too much, as it only showed what the eye saw.

Mr. ALDERMAN WALKER said that the paper would have the effect of making electrical authorities assert themselves more in this matter. Regarding foggy weather, in Portland Street with its lamps spaced a greater distance apart than the gas lamps in Princess Street the lighting was infinitely better, under the actual conditions. He asked the authors if they had taken into account the quantity of low-pressure gas used as a by-pass for the high-pressure gas. In Westminster, he understood, it worked out at about 18. per lamp per annum.

Mr. H. R. BURNETT said the figures given for trimming and maintenance were remarkably low and required a little explanation. The cost per mile of street per annum was given as £251; it should be remembered that this figure did not include any capital charges, and was only for the lamps to 14 p.m. If the capital charges were added the cost of this lighting amounted to £500 per mile of street. He thought 5 ft.-candle was too high a minimum illumination. If the main streets were lighted to this standard the illumination of the side streets running into them must be raised also. The figure of 8½ per cent. on capital charges appeared to be inadequate.

Mr. A. ANGOLD said he did not think the raising of the fittings in produced all the improvement, the change from one globe to another had a lot to do with it. He explained how the globe had the effect of diffusing a light and boosting the light up at the angles of 15° and 20°. The glass, although clear, had considerable reflecting power; the beam thrown by the inner globe was on the 20° line, and that from the outer globe along the 15° line. About the question of glare from the full line globes shown in fig. 3, this would not be very noticeable if looked at anywhere from 35° upwards to the horizontal, because of the fact that so much light was coming from the surface of the globe. The graded frosting was a very good idea, but he did not think it would be permanently satisfactory, because all frosted globes tended to take up dirt, and the frosting spoiled the effect of reflection along the 30° line.

DR. T. Z. ZITTELL said that it was only recently that the design of arc-lamp globes had been given serious attention, and an endeavour made to design them scientifically. He asked whether any special notice was taken of the state of the globes when the tests were made; experiments had shown that a great difference could be found in candle-power figures when taken with clean and dirty globes.

Mr. E. H. HOLLINGSWORTH said he had had to abandon arc lamps in favour of metallic-filament lighting, principally for the reasons mentioned by Mr. Burnett. In the old days arc lamps had to be placed 80 yards apart, and the lighting was very unsatisfactory midway between the lamps; metal-filament lamps of 200 c.p. were now fixed on each tramway standard, and the lighting was very satisfactory.

Mr. H. T. WILKINSON did not think that the system of overhead suspension was used in England as much as it should be. On the Continent it was used much more freely. He could not understand why anyone trying to do his best should choose such an unsuitable street as Portland Street.

Mr. A. A. KOPPEL said the arc lamps in Portland Street were too brilliant; they might be useful for advertising purposes, but were unsuitable for street lighting. Yellow flame arc lamps should not be used for street lighting. For equal distribution of light and for reducing the dark shadows complained of by the authors, three 200-watt metal-filament lamps in a single fitting would be more suitable. It would be worth the experiment to have units of 3,000 to 4,000 c.p. at 100 ft. from the ground, with special reflectors, and suitably spaced.

Mr. R. G. CUNLIFFE said that, walking fairly often amongst the streets mentioned, anyone watching the lighting effects had been able to notice very quick differences in the shades, and often at close intervals, places which had been in shade had later on been well illuminated. Looking towards the gas lamps, and then up Portland Street, there was very little difference to the eye, whatever the photometer might show. Dr. Rosenberg referred to the question of glare, but those who had to drive in these streets spoke very highly of the illumination as against the side lighting. In Piccadilly, on the island platforms the centre lights were gas lamps with single mantles, which were very brilliant, but the glare was very objectionable to the people on the top of the trams.

Mr. A. WILKINSON was of the opinion that the new type of globe used had a fixed focal point, and in fitting these globes to the spinnings, care must be used; if in drawing up the net wires one side were pulled tighter than the opposite side, the globe would be canted out of the centre line. This would alter the angle at which the light rays struck the inner surface of the globe, the resulting effect being to deflect the rays on one side upwards, and on the opposite side downwards; and as the 10° to 80° rays were entirely reflected ones, it was important that they should not be distorted. If possible globes should be made with necks, having a more mechanical support than nets. With the type of lamp used in Portland Street, the carbons were fed alternately to the right and left of the vertical centre line of the lamp and its globe; thus the arc was burning out of centre some ½ in., the shadow of the lower finial was projected on the ground in an eccentric manner relative to the centre line of the lamp and ground, and on the arc changing over to the incoming carbons, the shadow was projected on to the

other side of the centre line. As this change took place every five hours, it was a difficult matter to design a reflector which would blot it out entirely.

Mr. P. P. WHEELWRIGHT said that in these days when main streets were very much more like railway tracks than roads, the more spent to good advantage on the lighting of streets, the safer were the roads. The colour of the flame arc was attractive to the public, and in the streets of Lancashire towns lighting was a valuable asset. In Blackburn people came from all the villages around for shopping, and the more attractive the streets were made, the more they would come.

Mr. JACKSON, referring to the low-pressure gas used for the by-pass, said it was a curious fact that gas people always did neglect this point. In some cases it worked out to 10s. per lamp per annum. To compete with high-pressure gas lighting by metallic-filament lamps would result in failure, and the only way to attain complete success was by using flame arc lamps. The maintenance charge given in the paper, not only with regard to the electric lighting, but also the gas, 0.5d. per lamp, worked out at 150 lamps per man; no one man could look after 150 flame arc lamps. A figure of 2s. 2d. per lamp per annum was quoted for the maintenance charges for gas lamps—in the case of ordinary gas lamps he calculated 17s. per lamp, and in street gas lamps the gas people charged 30s. per lamp per annum, but he thought those charges should be increased by at least 50 per cent.

Mr. S. L. PEARCE, in reply, said with regard to Dr. Rosenberg's remarks, that there was not a very high value of illumination in Portland Street, and at present he did not consider that they had carried out their experiments to a final conclusion in regard to getting over the glare. They were not satisfied that the best results had yet been obtained. He thought there was nothing included for the gas used for the by-pass in the figures which were returned by the gas department. The maintenance cost was borne out in practice, probably because Portland Street was very near Dickinson Street station, and consequently very little time was lost in going to and fro. He did not agree with Mr. Burnett and other speakers that there was too high a standard of lighting in Portland Street, and that it was too expensive. Those who resided in Manchester knew how extremely difficult the traffic was, especially between 4.30 and 6.30 in the evening. A most valuable report which had recently been issued by the tramways department, referred to the loss of the tramways due to drawing up on account of the congestion of the streets in the central area. This was possibly due to the fact that the illumination in the important thoroughfares was very poor, and the tramway traffic was often held up for this cause also. It seemed to him that the tramway authorities would very much reduce the energy consumption per car-mile if the illumination in the streets of Manchester was improved. He was surprised to hear Mr. Burnett's remark that on lower standards of illumination metallic-filament lamps were cheaper than flame arcs. For street lighting the tendency all over the kingdom to-day was for higher candle-power, and therefore the tendency would be to go in for flame arc lamps instead of metallic-filament lamps. In reply to Mr. Jackson, there was no doubt that the gas figures had all been based on laboratory tests, and they would not differ under certain perfect conditions it was possible to get 60 c.p. per cb. ft. of gas per hr., but the figure had been used in a somewhat unwarrantable fashion. Only lately Mr. Frank Goodenough had reduced this figure from 60 to 40. He thought it absurd, even assuming that a single mantle gave 1,500 c.p., to assert that 4,500 c.p. was obtained from three mantles in the same lamp, as there must be some masking effect.

Mr. RATCLIFF, in reply to Mr. Angold's remarks regarding the 20° ray of light, said the tests did show that they got something of that sort, and also they got a beam of light at a lower angle which was utilised in another direction by means of the globes. It was the beam of light at the lower angle which the eye saw, and they tried to remedy it by using a special globe and got two advantages—it cut off the light they did not want, and the deflection improved the distribution in the direction where it was required. The gas lamps were cleaned for all the tests, and the electric lamp globes on the average were fairly clean. There was not any apparent difference between the illumination in Portland Street and Mosley Street, as the order of illumination was only about 0.5 to 0.4. These results were actually confirmed by the independent experts.

- 5,565. "Ignition apparatus." O. SCHLICKE. (Convention date, March 5th, 1912, Germany.) March 3rd. (Complete.)
- 5,511. "Regulation of dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD., and N. SHUTTLEWORTH. March 5th.
- 5,521. "Electric signal transmitters." G. H. GATWAY. March 4th.
- 5,542. "Vapour electric devices." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 4th.
- 5,562. "Telephone receiving apparatus." R. HOPKINS. March 5th.
- 5,563. "Electrically-operated winding gear for clocks and the like." L. J. ARON and C. H. HARRISON. March 5th.
- 5,551. "Arrangement for starting groups of electrical machines consisting of a synchronous and an asynchronous machine connected in cascade with it." W. P. THOMPSON. (Allgemeine Constructionen Electricque de Charleroi, Belgium.) (Addition to 7195/12.) March 5th. (Complete.)
- 5,593. "Electric arc lamps." W. R. RIPPINGS. March 5th.
- 5,594. "Anti-vibration supports for incandescent electric lamps." A. BOON and H. T. WILKINSON. March 5th.
- 5,510. "Method of and apparatus for starting the operation of an electric furnace for producing metallic powders." M. U. SCHOOR. (Convention date, March 8th, 1912, France.) March 5th. (Complete.)
- 5,523. "Electric fuse plugs." BRITISH THOMSON-HOUSTON CO. (Allgemeine Electricitäts Ges., Germany.) March 5th.
- 5,529. "Continuous-current reducing brake connection with regulation by resistances in parallel with the motor armature." ALGEMEINE ELECTRICITÄTS GES. (Convention date, March 5th, 1912, Germany.) March 5th. (Complete.)
- 5,532. "Distributor for electric ignition in internal-combustion engines." R. BOSCH (firm of). (Addition to 9,840/11. Convention date, April 12th, 1912, Germany.) March 5th. (Complete.)
- 5,557. "Electric signalling systems." SIR A. T. DAWSON and G. T. BUCKHAM. March 5th.
- 5,544. "Control or actuation of clocks and other indicating and recording mechanism by wireless or other waves." E. V. GRATZ. March 5th. (Complete.)
- 5,545. "Electric storage system." C. F. KETTERING. (Divided application on 3,794/12, February, 1912. Convention date, May 22nd, 1911, United States.) March 5th. (Complete.)
- 5,546. "Automatic electric switches." H. C. E. BOUTARD. (Convention date, March 6th, 1912, Denmark.) March 5th. (Complete.)
- 5,549. "Methods of detecting high-frequency oscillations." E. C. YOUNG. March 5th.
- 5,568. "Gas-detecting apparatus for portable electric hand-lamps." G. J. RALPHE. March 6th.
- 5,579. "Emergency magnetic and spring cut-off device." B. T. PHILLIPS and D. J. PHILLIPS. March 6th.
- 5,593. "Device for indicating failure of an electric lamp." H. H. CHAPMAN, E. J. DEANE and F. M. BARTON. March 6th.
- 5,599. "Electrical signs for advertising purposes." A. L. PRECOE. March 6th.
- 5,526. "Electrical annunciators." BRITISH L. M. ERICSSON MANUFACTURING CO., LTD., and A. G. ROEGERS. March 6th. (Complete.)
- 5,577. "Electrical advertising signs, devices or the like." L. MARTIN and G. NIXEY. March 6th.
- 5,544. "Secondary batteries or accumulators." F. J. WOOD. March 6th.
- 5,546. "Electric pocket lamp with compass." ELECTROMCHANISCHE INDUSTRIE G.m.b.H. (Convention date, November 22nd, 1912, Germany.) March 6th. (Complete.)
- 5,548. "Electrical order-transmitting systems and the like." E. A. GRAHAM and W. J. RICEYTS. March 6th. (Complete.)
- 5,553. "Machine telephone switching systems." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) March 6th.
- 5,554. "Telephone exchange systems." WESTERN ELECTRIC CO., LTD. (Western Electric Co., Belgium.) March 6th. (Complete.)
- 5,562. "Protective devices for electric circuits." E. E. F. CREIGHTON. (Convention date, May 2nd, 1912, United States.) March 6th. (Complete.)
- 5,726. "Electric meters." G. NORTH. March 7th.
- 5,727. "Alternating-current electric meters." G. NORTH and T. W. ROSE. March 7th.
- 5,734. "Electric registering devices." BRITISH THOMSON-HOUSTON CO., LTD. (Allgemeine Electricitäts Ges., Germany.) March 7th.
- 5,735. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 7th.
- 5,745. "Brush and spark plug cleaner." E. SWINNEY. March 8th.
- 5,748. "Potential regulators for over-compounding or level-compounding on alternating-current systems." A. M. TAYLOR. March 8th.
- 5,763. "Method of electrically governing the speed of engines at sea." A. W. FITZIAN. March 8th.
- 5,792. "Circuit controller." W. MORRISON. (Convention date, January 15th, 1913, United States.) March 8th. (Complete.)
- 5,802. "Telephone receiver supports." F. S. MAXWELL. March 8th. (Complete.)
- 5,805. "Telegraphic transmitter." W. S. STEELLS and REBESI, LTD. March 8th.
- 5,830. "Voltage regulation of alternating-current circuits." H. M. TAYLOR, R. H. SCOTSON and E. COX-WALSEE. March 8th.

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- ELECTRICALLY-OPERATED DOORS. G. KORYTOWSKI. 8,786. February 14th.
- APPARATUS FOR TRANSMITTING AUTOMATICALLY TO A DISTANCE INDICATIONS OF THE OPERATIVE POSITIONS OF DEVICES. A. G. BLOXAM. (RUSSISCHE AKT.-GES. L. M. ERICSSON & Co.) 8,742. February 14th.
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- DYNAMO-ELECTRIC MACHINES OF THE HOMOPOLAR TYPE. BRITISH THOMSON-HOUSTON CO. (NOCCEGGIATO). 4,187. February 19th.
- SOCKETS OR BASES OF TROUBLE-POLES FOR ELECTRIC TRACTION SYSTEMS. E. M. MURTO and J. E. P. CONSTRUCTION CO. 4,264. February 20th.
- REGULATION OF THE SPEED OF ELECTRICALLY-DRIVEN RING-SPINNING MACHINES. J. KEMMENECH. 4,590. February 23rd. (Addition to 1911. Addition to No. 4,140 of 1912.)
- BRUSH HOLDERS FOR DYNAMO-ELECTRIC GENERATORS OR ELECTRIC MOTORS. Morgan Crucible Co. and J. E. GRANT. 4,592. February 23rd.
- 5,285. "Electrically-heated apparatus." E. C. R. MARKS. (Landers, Frary & Clark, United States.) March 3rd. (Complete.)
- 5,290. "Ignition of internal-combustion engines." J. E. WILKS. March 3rd. (Complete.)
- 5,295. "Systems and apparatus for electrically controlling a group of railway switches or signals." A. E. ALEXANDER. (Union Switch and Signal Co., United States.) March 3rd. (Complete.)
- 5,307. "Electrical resonance apparatus." H. W. HANDCOCK, A. H. DYRES and W. DUNDELL. (Divided application on 6,716, 1912, March 19th.) March 3rd.
- 5,521. "Actuating devices for circuit closures." G. D. YOUNG. (Convention date, March 29th, 1912, United States.) March 3rd. (Complete.)
- 5,852. "Electro-magnetically controlled perforating apparatus." B. HOLDATRENKOW. (Addition to 14,658, 1911. Convention date, March 16th, 1912, France.) March 3rd. (Complete.)

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

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## POWER SUPPLY ON THE RAND.

THE description given elsewhere in this issue of the huge undertaking which has been developed on the Rand will be read with interest by all who desire to make themselves acquainted with the methods adopted for the supply of electrical energy on the grand scale; it is by far the largest of its kind in the British Empire, and has few rivals in the world in point of magnitude and output, though the distance over which the energy is transmitted is not great. It is noteworthy that so high a pressure as 80,000 volts has been adopted for transmission over 35 miles, though the rule generally accepted as to the appropriate voltage—a rough rule, it is true, but fairly well conformed to—would have given only half this pressure. Probably the exceptionally favourable condition of a dry climate, and the known fact that lines insulated for pressures over 50,000 volts are less liable to trouble from lightning than lines at lower voltage, had a good deal to do with the choice, which has been completely justified by the result.

While we have in this country no undertaking comparable in magnitude with the Rand power supply, it does not follow that we have nothing to learn from the work that has been done by the company's engineers, who, although beset with exceptional difficulties of transport, labour, &c., have triumphed over all obstacles, and have adopted methods which in several respects deserve our careful study. The arrangement of the boiler house in bays at right angles to the engine room, brought about by the adoption of the turbine, and the employment of transformers coupled directly to the terminals of the generators, were prominent features of the practice introduced by Messrs. Merz and McLellan in connection with the Tyneside electricity supply, the only undertaking in this country which appears to resemble that of the Rand at all closely, and the high compliments paid to the Merz-Price system of protection of mains by the author of the paper further emphasise the association of ideas embodied in both schemes. The system of boiler draught employed, however, is an entirely new feature: the difference between this and the ordinary induced-draught system is not apparently very great, yet it suffices to effect a very marked improvement in the results obtained, and Mr. Hadley's claim that the chimneys are "absolutely smokeless" will be noted with interest by engineers who suffer under—or should we say violate?—the local by-laws in this respect. Further details regarding this part of the plant would be welcome.

Perhaps the most remarkable feature of the working of the plant is the enormous output, which will, at no distant date, be about 2,000,000 units a day, or nearly five times as much as our largest railway output. This, too, is given at the extraordinary load factor of 70 per cent. and upwards—a figure to make a central-station engineer's mouth water. Under these circumstances, the price of 525d. per unit, as Mr. Highfield pointed out, at first appears somewhat high; but when we make due allowance for the high capital and running costs on the Rand, and the fact that this is the maximum price, we may fairly assume that the actual price is equivalent to not more than 4d. in this country. In fact, it comes within measurable distance of the condition foretold by Dr. de Ferranti, when electricity for all purposes will cost only 4d. per unit, and we shall have generating stations here far larger than those on the Rand.

It is exceedingly significant that the owners even of large mines have found it expedient to scrap their own plant, and to take their supply of power from the company's mains.

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION.

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The same process is in progress here, but far more slowly; the relative cost of electricity is still much greater here than on the Rand, and manufacturers have not at command that ready flow of capital which stimulates enterprise and enables great economies to be effected by drastic changes, where it is available.

The extended use of compressed air, supplied in bulk on an unprecedented scale, is another feature peculiar to this unique undertaking. Although a great part of the air supply is derived from electrically-driven compressors, the intervention of this non-electrical medium can hardly be pleasing to the electrical engineer who loves his calling; but obviously it must be accepted, at any rate until electrical rock drills and other mining machinery have reached a more advanced stage of evolution.

The one consideration which we cannot but regard with deep regret is the fact that so large a proportion of the plant employed was built by foreign hands. The circumstances which led to this unfortunate result are known to our readers, and we need not further comment on them, but seeing that the turbo-alternator and the turbo-compressor were developed almost wholly by Sir Charles Parsons and his staff, it seems a great pity that this work should have gone abroad. For this the engineers were not responsible; their part of the work reflects the greatest credit upon them, and we congratulate them, as well as the managing director, Mr. A. E. Hadley, upon the successful accomplishment of a gigantic task.

## THE STATE AND THE ENGINEER.

In these days, when the development of engineering—in all its branches—is progressing with ever-increasing rapidity from one vast scheme successfully carried out to another of even more ambitious character, to be equally successfully accomplished in its turn, it would be well if attention could be brought to bear on the whole broad question of this development.

The one object of engineering is the more efficient working of the world; and, of course, this is attained by perfecting, so far as is reasonably practicable (to quote the words of the Home Office), the efficient working of communities, towns, and countries, which are the world's component parts. This is true, to a certain extent, of all professions, but particularly so of engineering.

Is development taking place along right lines? Is there any continuity of policy or purpose in the carrying-out of the great enterprises of the present time? The question of development along this or that line is almost always a matter of circumstances and individual judgment. The result of this is that the second question must be answered in the negative.

That being so, we naturally ask ourselves what can be done to improve matters? The *Canadian Engineer*, in its issue of January 23rd, 1913, contains some interesting articles bearing on the subject. Mr. T. Chase Casgrain, chairman of the International Joint Commission, some time ago offered two prizes for the best essays on "The Formation of a National Engineering Service." The essays which obtained the first and second prizes are printed in the issue above-mentioned. The first, by "Evolu," is entitled "A National Board of Engineering Control"; and the second, by "Observer," is called "The Organisation of a Corps of Civil Engineers for Public Works Services in the Dominion of Canada."

The first essay concerns itself almost entirely with the development of the natural resources of Canada through the instrumentality of the Board of Control. Railways, harbours, docks, ports, canals, irrigation, water power, surveying, and architecture, are all brought within the scope of the suggested Board, and the fundamental idea and method of working of the Board are expounded in a lucid manner deserving of careful attention.

"Observer" makes a general survey of public engineering departments throughout the British Empire and the United States, after considering which, he outlines a scheme for the Canadian public works service. This is also a very thoughtful essay, in that it bears evidence of much investigation of detail.

In the first essay, "Evolu" suggests a Board of five directors, responsible to Parliament, and appointed for an unlimited period, with retiring pensions after a specified number of years. Each director on being appointed would hand a formal signed and undated resignation to the Governor-General in Council, so that only Parliament could remove any director from his position; the Governor-General would fill in the date of resignation when it was decided by Parliament. Vacancies would be filled by the Board itself, either by promotion or appointment. Under the Board would come, with their staffs, the auditing engineer, the chief engineer of railways (we are taking the order in which they appear in a table given in the essay), the chief engineer of marine service, the chief engineer of harbours, the chief architect, the chief engineer of surveys, the chief engineer of canals and water service, and the secretary.

The auditing engineer would be responsible for the important work of collecting and tabulating information. This would indeed be a boon, and would probably do more than any other single thing to secure constant progress and to avoid the recurrent commission of the same mistakes. Now that Mr. Edgecombe is again President of the Incorporated Municipal Electrical Association, we may hear more of the information bureau which he suggested in his former presidential address, delivered at Kingston-on-Thames in 1906. The notion was turned down by the Council because they thought it beyond the scope of the Association, but it is a work that someone ought to do, and "Evolu" suggests what he calls the auditing engineer, with a technical librarian to assist him.

Much time, energy, and money are wasted, when tenders are invited for various schemes, by letting each tendering firm prepare and submit its own design. Designing, under the scheme, would be carried out by the Board's engineers, thus avoiding the loss incidental to the preparation of half-a-dozen or more designs, only one of which can be accepted, while all have to be paid for, directly or indirectly, by the buyers as a whole. Power actually to carry out the work by direct labour is suggested, but we do not think this is advisable or necessary. The Board should be a Board of Control—a *Direktion*, to use the German word, for which we have no equivalent—and not a Board of Works.

If this idea were carried out, engineering would be co-ordinated as the law is co-ordinated now. There would be uniformity of direction and continuity of purpose, and an entire absence of that haphazard working and that lack of coherence which are too often observable under present conditions. Heaven forbid that engineering should become as inelastic and difficult to set in operation as the law, but the idea is right.

From the idea of a Board of Control, it does not seem to us a long distance to a greater organisation of engineering as a whole, but we must reserve the further development of this conception for another article.

Whether the scheme, as outlined, will ever receive the sanction of the Canadian Parliament, or whether it will ever be brought before them at all, are matters which lie on the knees of the gods. It is obvious, as the *Canadian Engineer* points out, that appointments would be more likely to be made upon a strict basis of experience and ability, unaffected by political considerations. If this were done in Governmental matters, we should have public work carried on with something approaching the economy and efficiency of a private business undertaking. With proper care, the performance of some private undertakings might even be surpassed.

The notion has much to recommend it, and we hope that it will receive due public attention on both sides of the Atlantic Ocean.

### Celluloid Regulations.

A LETTER which appears in our "Correspondence" pages to-day serves to emphasise the need that exists nowadays for manufacturers and traders to be on the alert to prevent regulations which are drafted for the public good operating with needless hardship upon the interests of industry and trade. Remembering the grave fire risks that may attend the uncontrolled storage of celluloid and celluloid goods, everybody will agree that the time is fully ripe for better pre-

cautions to be introduced; and better precautions can only be enforced generally by means of regulations which receive the sanction of the Legislature. But those who draft such regulations are in danger of being influenced more by humane desires than by knowledge of, or regard for, industries which may be quite unnecessarily, and may be inadvertently, placed at a serious disadvantage; if the regulations are of too sweeping a character they may militate against the public interests as well as against those of private parties. There may be room for a little more considerate drafting without the main intentions concerning the lessening of fire risks being in the least degree defeated. The L.C.C. General Powers Bill, if allowed to pass in its present form, will enable the Council to enforce regulations for all premises in the county in which celluloid and other inflammable substances are kept for sale in quantities exceeding 10 lb. in weight. There is also a clause in the City of London Bill defining as a "celluloid shop" any premises whereon the aggregate celluloid kept "handled or otherwise dealt with (otherwise than for the purpose of being manufactured or employed in or subjected to any process of manufacture)" at any one time exceeds 10 lb. in weight. A celluloid shop has to be licensed and inspected and otherwise subjected to specified conditions. It hardly needs pointing out that this will involve every retail or wholesale accumulator dealer, and numerous traders in hardware and other goods! Unfortunately, it is too late for the battery makers or any other section of the electrical industry to take direct collective action in opposition, but the way is open for strong action to be taken through the medium of those who have already lodged petitions, and are sure to be heard. We draw attention to this matter, hoping that those sections of our trade which are likely to be adversely affected without sufficient reason will co-operate with Mr. Brooke, the railway companies, Chambers of Commerce and others, in order to ensure that the final wording of the clauses shall be fully effective, without being a needless handicap to trade and industry. It is expected that the second reading of the Bills will take place on Monday, 31st inst., and they will then go to the Local Legislation Committee, where they will probably be discussed on or about April 15th, when opposing petitions and arguments by counsel will be heard. It will be understood, therefore, that those who mean to take action must do so at once.

#### The E.T.B.I.

ON Monday next the annual meeting of the Electrical Trades Benevolent Institution takes place at the Institution of Electrical Engineers, with Mr. E. Gareke in the chair. The annual report to December, 1912, which will then come up for adoption, after expressing regret at the loss of a colleague and liberal supporter in Sir J. Irving Courtenay, shows that the income for the year was less than in 1911, as that was an exceptional year, inasmuch as there was a legacy received, as well as the balance of the Olympia 1905 Exhibition proceeds. A donation of £250 from the B.E.A.M.A. is, however, among the receipts for 1912. The total income for the year was £954, as compared with £1,101 for 1911, but it is important, as evidence of the wider interest taken in the Institution, that there was a marked increase in the number of persons subscribing, as well as in the amount of subscriptions; the latter is now more than four times the total of the preceding year, while the ordinary donations are also considerably more. The result of the year's work is a net income of £754, £150 of which has been placed on deposit at the bank, and £569 invested in Canadian  $3\frac{1}{2}$  per cent. registered stock, bringing the total of the invested funds to £3,968.

The report contains a regret—not that so few electrical men have died during the year—but that so far only one legacy has fallen to the fund. By way of comparison with other institutions, it is mentioned that one such benefited in 1911 to the extent of over £18,000. Perhaps the youthfulness of our organisation is responsible for this difference, or it may be that those who have the wherewithal to bequeath good round sums and have the mind to do it too, do not die; or, again, that those who have the mind to do so, and have shown a real interest in

the progress of the movement, have not the wherewithal to do it if they do die. But whichever way it be, we are hopeful that the timely hint of the Committee will carry effective weight with those of maturer years who have been fortunate enough to accumulate enough and to spare, and will also be borne in mind by more youthful spirits who may draft their wills, if only in hope of future ability, in such a manner that the secretary 10, 20 or 30 years hence, will be able in his own advancing years to say nice things about them and the benefit that their generosity has brought to the Electrical Trades Benevolent Institution, enabling it to grant pensions to many who were little more than beginners in the industry when the fund was first launched. The rules introduced in 1912 and the creation of a class of "members" have produced satisfactory effects, and at the end of 1912 there were 30 life members and 78 ordinary members. Efforts are being made, as some of our readers in London know, to stimulate interest among employes by means of entertainments, and during the current year this movement may be carried forward in a number of other centres. We hope that it will meet with success. The appointment of collectors in individual firms to receive members' subscriptions by instalments, in addition to being a convenience, will also answer the same useful purpose of popularising the fund and its objects. The life assurance scheme already referred to in our pages is intended to appeal particularly to juniors. The grants made from the fund during the year numbered eight, aggregating £71, but these figures do not convey any idea of the amount of investigation of circumstances that fell to the lot of the committee, nor do they indicate the real value of the Institution. In addition to meeting such temporary needs, the great work of those responsible lies in building up resources in preparation for the happy day when it will be possible to grant pensions. The annual dinner takes place next month, and we hope that our readers will do their utmost on this occasion—under a magnificent lead from Mr. George Sutton, a present-day leader in the industry—and add to the fund such an amount as will worthily represent the prevailing very active state of the electrical trade. It might be interesting for the guidance of would-be donors and legators if the committee were to say approximately what figure it has in mind—if any—as being required before the pension day can dawn.

#### Striking Companies in Turkey.

ALTHOUGH the difficulties to be referred to may have been overcome by the present time, it is yet of some interest to learn how two foreign companies in Turkish towns, far from the seat of the war, have been treated by the municipal authorities and the native population. In the first place, according to the Beyrout correspondent of a German newspaper, the Belgian Société de Tramways et Eclairage Electrique suspended the lighting system in Damascus because the municipal authorities were in arrears to a large amount in the payments to the company, and put off the company from day to day with an allusion to the empty coffers. Thereupon a large crowd attacked the company's administrative premises for two days in succession, smashed the windows, and fired revolvers without, however, the authorities taking any serious action against the demonstrators. Several tramcars were also entirely destroyed, whilst the windows of others were broken. The second case refers to the Beyrout Gas Co., which, at the time of the correspondent's letter, had already suspended working for three weeks on the alleged ground of the scarcity of coal, the imports of which have been rendered difficult through the war. In reality, however, the Municipal Council owed the company a large sum for street lighting, which the latter was unable to collect. Not only so, but the native population has diverted large quantities of gas, and the authorities have done nothing to bring the thieves to book. The whole of the city, with the exception of a few streets where electric lighting has been temporarily introduced, has been in complete darkness at night, and the police authorities have issued an order advising the use of lanterns by persons who go out after 8 o'clock in the evening.

**COST AND EFFICIENCY OF DISPLAY LIGHTING.**

By L. CROUCH.

In connection with the articles on "Ornamental Street-Lighting Poles" (ELECTRICAL REVIEW, March 22nd and July 19th, 1912), particularly as applied to "display" lighting in main business streets, various critics have urged the high cost of installing and operating such systems. However, the best proof of the pudding is well known, and the fact remains that the type of display standards, and the system of street lighting described in these earlier articles, continue to find increasing application in American cities. Nor do we find any digestive difficulties after the pudding has been eaten! The systems continue—as they commenced—to give every satisfaction, and practically every city which has adopted display lighting continues rapidly to extend its installation. There are, at present, three or four hundred towns in the States and Canada employing rolled metal and concrete standards, carrying tungsten lamps in diffusing ball globes, for the lighting of their main thoroughfares.

The cost of display systems is, in America, generally divided between property owners and the city authorities in a varying proportion, but, in many cases, the supply station has borne a large fraction of the expenditure. Owing to the advantage of brilliant frontage illumination in shopping districts, there is rarely any difficulty in collecting the major part of its cost from business proprietors, and, in a few American cities, the total cost is commuted to a tax against the properties as a permanent improvement. In the case of promenades and parks, &c., the local authority must, of course, bear the whole cost of the scheme, this being then purely for the public benefit.

A certain amount of specific cost data (both as regards installation and maintenance) was presented in the July 19th, 1912, issue of this journal, and readers will doubtless be interested in the following supplementary figures referring to some more recent installations in various American cities.\* Only those cases are here considered for which fairly complete data are available as to the exact nature of the equipment.

It is obviously impossible to prepare cost data which shall be universally applicable, since local conditions and the design of standard adopted are, of course, very variable. The following costs, however, may be regarded as representative for one of a number of 5-light ornamental standards of the type illustrated in figs. 1-6, p. 479, 1912:—

Pole ... ..	£7 0 0
Lamps and sockets ... ..	1 2 6
Globes ... ..	0 16 0
Erecting and wiring post and concrete foundations ... ..	1 12 0
65-ft. supply cable (lead, jute and steel) ... ..	3 5 0
Laying cable ... ..	7 16 0
<b>Total ... ..</b>	<b>£21 11 6</b>

The labour costs assume that the cable has to be laid below an existing concrete sidewalk, and all the items should be somewhat lower in this country.

Turning to particular cases, the data summarised in Table I show the conditions and results in a number of recent American installations. A cheap but very effective system, which has been adopted in residential quarters in Toronto (Ont.), provides light wooden poles along the inner edge of sidewalks. Each pole (which carries supply wires on insulators near its top) is provided with a cast-iron lantern containing a 150-watt tungsten lamp, screened by an 8 in. x 8 in. Alba-glass cylinder. The illumination provided is economical, novel and sufficient for residential needs.

The data in Table II refer to illumination measurements made at 3 ft. above ground level in the line joining adjacent 5 x 100-watt tungsten standards in Indianapolis.

\* Actual day and night photographs and more complete particulars of these installations are to be found in the *Southern Electrician*, pp. 448 et seq., 1912.

Finally, the figures in Table III refer to the energy expenditure per linear foot and per square foot, and the average foot-candles horizontal illumination provided in

TABLE I.—AMERICAN "DISPLAY" LIGHTING INSTALLATIONS.

Town.	Seattle (University Campus).	Minneapolis.	Hamilton.	Pine Bluff.	Atlanta (N.Y.).	Chicago.
Type of standard	Reinforced concrete cr. a-n-ced	Iron	Iron	Simple iron pipe.	Orna-mental iron	Reinforced concrete, bronze ornaments
No. of standards in use.	78	—	—	150	102	691
No. of lamps per standard.	1	5	5	4	5	1
Spacing of standards.	—	100	ca. 60	—	65	—
Watts per lamp.	100	100	100	100	4 of 60 1 of 100	490*
Capital cost per standard.	£7 14s.	£88	£16	£1 10s.	£22‡	£16 8s.†
Operating cost per standard per annum.‡	—	£12	£2 8s. per foot fr. ntage.	£7 4s.	—	—

\* In this case, 74 ampere series Jandus lamps (490 watts, 1,000 hor. c.p.) are used; tungsten lamps are employed in all other cases mentioned.  
 † Including proportion of central station equipment, posts, lamps and globes complete, erecting, supervision and tools.  
 ‡ Bare pole, £21 18s.; foundations, &c., £1 4s.; ornament, lamps, globes, transformers, &c., £3 8s.; total labour (students), 7s.; castings made in College foundry.  
 § £18 for poles, £10 for distributing system.  
 ¶ Including attendance, maintenance and electricity supply.

typical "display" street-lighting systems in four prominent American cities. For comparison are included corresponding data derived from Bloch's measurements in Berlin streets lighted by A.C. and D.C. arcs.

TABLE II.—ILLUMINATION DATA.

Feet from post.	Foot-candles illumination (3-ft. level). Crystal roughed inside globes.	Alba glass ball globes.
0 ... ..	0'34	1'40
5 ... ..	0'28	1'05
10 ... ..	0'18	0'50
15 ... ..	0'10	0'21
20 ... ..	0'06	0'12
30 ... ..	0'03	0'06
40 ... ..	0'02	0'04

Obviously—as would be expected—the best modern systems of arc lighting are more efficient, from the illuminating standpoint, than the ornamental tungsten schemes considered above, but the American display standards (which are also applicable and have already been applied to magnetite and Jandus flame arcs), provide an effective display illumination which can be achieved by no other system. The point—which has been indubitably made in American installations—is that the end justifies the means.

So recently as two or three years ago, ornamental or display lighting was regarded in the States as an expensive luxury which would probably be adopted only by private individuals or for the external lighting of public buildings.

TABLE III.—ENERGY EXPENDITURE AND AVERAGE ILLUMINATION.

	Watts per linear foot.	Watts per square foot.	Average horizontal foot-candles.
Dayton (Ohio) ... ..	8'71	0'173	0'092
Indianapolis ... ..	12'8	0'211	0'179
Toronto (Ont.) ... ..	9'85	0'235	0'175
Buffalo (N.Y.) ... ..	5'68	0'095	0'093
Ordinary D.C. arcs (Friedrichstrasse) ... ..	8'4	0'116	0'57
D.C. Flame arcs (Potsdamer Platz) ... ..	7'5	0'111	1'57
Ditto (Alsenbrücke) ... ..	6'1	0'218	1'55
A.C. Flame arcs (Hardenbergstrasse) ... ..	8'96	0'055	0'32

It was certainly not expected that the system would be employed to light entire business sections of large cities. This is almost exactly the point of view at present adopted in this country. Pavement display lighting standards have been already installed by a number of progressive business firms and hotels and, to a limited extent, by public authorities for public buildings. Surely it is reasonable to anticipate that, at no distant date, the proprietors or tenants of whole shopping areas will co-operate to provide display lighting for the whole of their main frontages. Artificial light is cheap enough in these days, and the cost of its provision

would be more than covered by the increased popularity and prosperity of the business districts providing it in pleasing profusion. After the business areas would follow promenades and the better-class residential quarters, particularly in holiday resorts.

Undoubtedly the whole proposition offers important possibilities to business men generally (and hence to the whole community), to manufacturers and contractors, and to central-station engineers. There is involved no question as to the relative merits of gas and electric light. What is required is display illumination along certain lines, and, in providing this, the relative positions of gas and electricity remain as in ordinary domestic or street lighting. The most favourable field for the development of the new system in this country is in those provincial towns which are to-day behind the times. In large cities, which have already adopted other costly lighting schemes, no change can at present be hoped for, except as a result of purely private enterprise.

## CO-OPERATION BETWEEN PRIVATE AND PUBLIC SUPPLY SYSTEMS.

[COMMUNICATED.]

At the present day the keynote of industrial progress is the elimination of waste products and the development of such products as marketable commodities or by-products of the main operation.

It is only comparatively recently that emphasis has been laid upon this side of engineering activity, and it is therefore hardly to be wondered at that, so far, the full value of research in this direction has not been appreciated. There is always a tendency on the part of manufacturers, whether large or small, to look after the interests of the moment and to leave the larger affairs which may culminate many years hence to look after themselves. Hence, such subjects as the conservation of the world's supply of energy are often regarded as a matter of academical interest only. When, however, it can be shown that such conservation in reality means pounds, shillings and pence at the present day, the matter assumes a live interest.

It is from this point of view that we propose to treat the relative position of the large centralised power plant and the groups of independent systems which are to be found in the areas served by a centralised supply. It is immaterial at the present stage to discuss whether these independent plants consist of steam engines with mechanical power transmissions, gas engine plants, or miniature electric power transmissions. The point to note is that in a given area we have a large centralised power supply, of which full use is not made, as evidenced by the existence of private plants. Is the proper relative attitude of these two sections that of competition or of co-operation?

In the United States, especially in the large cities, geographical disposition has proceeded in the vertical rather than in the horizontal direction. In other words, as the city has grown, more storeys have been added instead of more streets built. Hence, in comparatively small areas, we have great density of industrial operations and a correspondingly sharp conflict between centralised systems of power supply and private plants operating building blocks. The outcome of this is that the question of co-operation or competition has reached a very acute stage in America, and our contemporary, the *Engineering Magazine*, publishes in its January issue an interesting article, by Mr. Percival R. Moses, on "Practical Co-operation between Central Station and Isolated Plant." We propose to deal with this article more as an indication of the line of thought which is being actively pursued in America than to rigorously examine the arguments in detail, inasmuch as in this country we are not confronted with the large office block problem so much as with that of the congested manufacturers' district, and hence the problem is somewhat different in detail.

Broadly speaking, however, the British problem follows somewhat similar lines. The British manufacturer is now

becoming alive to the importance of utilising his waste products, using the term in its broadest sense. In the blast furnace, for example, he is no longer content to allow the waste gases, in a highly-heated condition, to pass away to the atmosphere. He utilises both the heat and the chemical constituents in power and heating in conjunction with the rest of his plant. He eliminates frictional waste by scrapping complicated mechanical transmissions in favour of a private electrical plant, and in connection with this plant he does not seek to maintain an expensive independent staff, but endeavours, so far as possible, to utilise men who can also be employed on other duties. If the works process is one which can be kept going evenly and continuously for a long number of hours per day and throughout the year without fluctuations, the manufacturer has reached, so far as his power production problem is concerned, a point of efficiency which it will take the central station supply a very long time to beat.

It is, however, precisely at this point where the private plants in a good many cases fail, because, owing to the requirements of manufacturing processes, the constant and regular demand on the power plant cannot be maintained. In other words, the private plant is at one instant overloaded, while at another time it is working at considerable inefficiency, owing to little or no load being placed upon it. Here, then, is the opportunity for the equalising effect of the large diversity factor of the public supply system, and it is here where co-operation can, with the greatest advantage, take place between the small power station and the large system. If we regard the large power system as a means of transferring super-abundant power available at one point to another point where there is a super-abundant demand, and the generating station itself as a species of storage reservoir capable of giving the necessary balancing action, we have what may be claimed as a practically new ideal of the co-operation of public and private supply, and yet one which it is practically certain will become more and more realised as time goes on.

This idea is by no means chimerical, nor should it be dismissed without careful consideration. The time is even now ripe for, at any rate, the first steps to be taken in the direction of such co-operation, because the centralised power supply systems are finding that as they widen their area the cost of transmission from a central point is becoming a more and more serious item. Even at the present day, cases are not wanting where, in preference to extending the capacity of an existing generating station to meet increased needs, further generating stations are being built at various points on the supply system, these generating stations working together and transferring energy from one to the other point as required. A still further step has been taken in the erection of such supply stations actually adjacent to industrial works, and deriving from them the necessary power to drive the electrical plant. If this process is extended, the final step is easily reached of having an extensive, and yet cheap, because not too bulky, transmission system, when one or two large power stations act as centralised or buffer supplies of power and a large number of smaller plants belonging to private manufacturers take energy from, or feed into, the common system, according to their individual requirements at any time. The importance of this on the cost of transmission is very great, because under competition conditions, in which the central station is trying to oust all individual plants in its area, the mains must be of sufficient size and capacity to carry all the power necessary over all the area without undue loss in transmission from the central point, while if co-operation is adopted, a large number of widely scattered sources of energy feed into the distributing system at many points, and hence the sum distance of transmission from the point of generation to the point of application over the whole area and throughout the whole year is less than if all the power had to be developed at one point, and therefore the cost of the transmission system taken as a whole will be less.

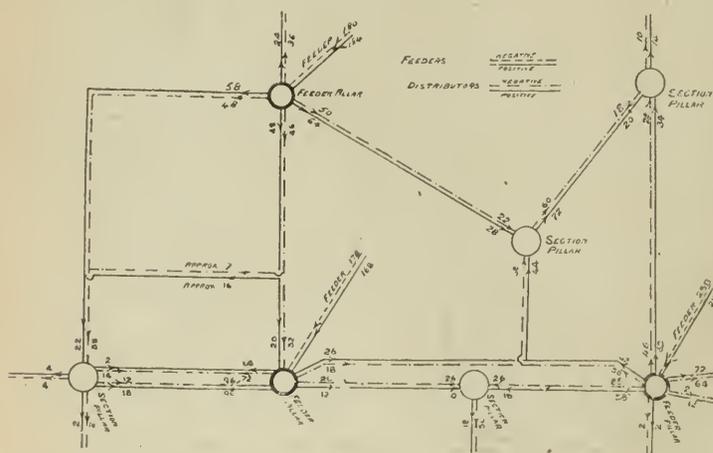
There is yet another point which bears upon the matter. In the central station, as pointed out by Mr. Moses, the by-product of the condensed steam from the engine or turbine, that is to say, the heat abstracted from the steam by condensing, either passes away to a river in the circulating

water, or is dissipated into the air by means of cooling towers, whereas in a large number of industrial processes the exhaust steam from the engine can be utilised in auxiliary service, such as heating buildings, warming die vats, &c. Where the private plant is of a modern description and of decent size, the value of such auxiliary services goes a long way to compensate for the fractional increase in efficiency due to the larger sizes of units used in the central power house, more especially when losses in transmission are taken into account. Further, the central station staff is occupied solely in producing the one thing, electric power; in the private plant, the staff is often used more efficiently because its labour and salary are distributed not only over the electrical production, but also over other manufacturing processes as well. These points all tend towards the realisation of an increasing overall efficiency if co-operation can be substituted for competition, and there is no doubt that in the future much more will be made of this point than has apparently been the case in the past. It would be well, therefore, if means could be found for the discussion in an impartial and business-like manner between the owners of private plants and the engineers of large public companies for the purpose of instituting a real attempt to secure co-operation, more especially in the large industrial districts, with a view to joining forces as far as ever possible to minimise industrial waste.

## A METHOD OF TAKING LOAD TESTS ON MAINS.

By J. B. MORGAN, A.M.I.E.E.

WHEN a distribution network has been laid down a few years and begins to get fairly loaded up, it is, of course, desirable to know exactly how the load is distributed among the various cables radiating from a feeder or section pillar.



Various devices have been brought forward from time to time to enable such records to be taken, but to those mains engineers who make liberal use of section pillars as well as feeder pillars, if they will only go to a little trouble from the start, a handy means of carrying out such load tests is always available. The only trouble to be taken is that of standardising on a certain length or type of switch fuse.

In the particular town I am interested in, not only are we liberally supplied with feeder pillars, but at all important street junctions we are using section pillars in place of the usual three or four-way disconnecting box, and our switch fuses are all of one particular make. The method of procedure was as follows:—

A switch pillar was fitted up in the test room and known currents were passed through a fuse; the fall of potential in millivolts between top and bottom of the fuse at various loads was taken after giving sufficient time at each different

step to obtain normal temperature. A curve was then plotted from the readings thus obtained.

On a single copper wire fuse mounted under working conditions the millivolt drop was found to be as follows:—

No. 16 s.w.g.		No. 18 s.w.g.		No. 20 s.w.g.	
Load.	Drop.	Load.	Drop.	Load.	Drop.
2 amperes	3.3 MV.	2 amperes	5.5 MV.	2 amperes	10.2 MV.
4 "	6.5 "	4 "	11.6 "	4 "	20.0 "
6 "	9.7 "	6 "	18.0 "	6 "	30.2 "
8 "	13.0 "	8 "	24.0 "	8 "	40.4 "
10 "	16.4 "	10 "	30.2 "	10 "	50.4 "
20 "	32.6 "	20 "	61.0 "	12 "	61.5 "
30 "	49.2 "	30 "	101.0 "	14 "	72.4 "
40 "	68.0 "	40 "	160.0 "	16 "	83.1 "
50 "	91.9 "	—	—	18 "	93.3 "
60 "	121.8 "	—	—	20 "	106.0 "

It will be seen from these figures that even when the fuses are working with small loads a good deflection is obtained.

This was done for each size of fuse wire in use, and from the curves obtained it is now possible to go to any pillar, take the millivolt drop across the fuses, note the size of fuse wire, and a reference to the curve gives at once the current passing, and also, as we are D.C., the direction of the current, whether into or out from the bus-bar.

It has been found in practice that such a series of readings is wonderfully accurate. In recent tests the sum of the currents ascertained to be passing through the fuses along the various distributors agreed not only with the measured current passing through the feeder fuse, but also within 2 per cent. to 5 per cent. with the feeder ammeter readings on the station switchboard.

It will easily be seen that millivolt readings like these can be taken very quickly, as it is sufficient to press the contacts of the voltmeter leads on the binding screws of the fuse, making it possible to take a complete set of readings at one feeder pillar in a very few minutes, and without disturbing cables and fuses.

From these figures a diagrammatic map of the mains can be made which will not only show the total load on the cables, but also will enable one to see where out-of-balance occurs. It also shows which mains are feeding or are being fed at interconnecting points, and it enables the mains engineer to work out a scheme whereby, in the event of having to run with each feeder supplying an isolated network, he can see how the distributors require grouping, so that each feeder takes up its proper share of the station output.

In taking the test for curves, and also the first records at the pillars, it is advisable to start with new fuses, as it will readily be seen that a deteriorated fuse will give a greater millivolt drop for the same load.

This test is also helpful in detecting a loose fuse contact or a deteriorated fuse at any time after having obtained an average of readings for the different distributors and feeders on good fuses.

A diagram is appended showing how such results can be plotted out, and the arrows show whether the mains are receiving current from, or are feeding into, the bus-bar in the pillar.

**Insulated Aluminium Cables.**—The British Aluminium Co., Ltd., inform us that the Paris Omnibus Co. have just placed an important contract for armoured aluminium cables for tramway feeder networks. The cables will have cross-sections up to 1,000 mm.<sup>2</sup> (155 sq. in.), and are for a pressure of 500 volts. The order comprises some 300 tons of metal, and is expected to show an economy of 8 to 10 per cent. as compared with the cost of copper cables. Including cables already installed of a net weight in aluminium of about 300 tons, this company's system now has in service or on order insulated cables employing a total of 600 tons of aluminium.

## A MARCONI TRAINING SCHOOL.

As a natural result of the rapid extension of wireless telegraphy the demand for trained operators has outrun the supply, and Marconi's Wireless Telegraph Co., Ltd., has been hard put to it to secure a sufficient number of them to take charge of the numerous installations which it is fitting on board ship, and in foreign countries. When the company entered into possession of its palatial headquarters in the Strand, in May last year, it set apart



FIG. 1.—WIRELESS TELEGRAPH TRAINING SCHOOL AT MARCONI HOUSE.

space on the top floor of Marconi House for a school for the training of wireless operators, with accommodation for 60 students at day and evening classes, and already 130 of the students have passed the Postmaster-General's examination since the opening of the school, and have obtained employment in the company's service. The classes proved so popular that the space available was taxed to the utmost soon after the school was opened, and it became urgently necessary to provide increased accommodation; the school was, therefore, transferred to the basement, where room was found for 125 students, and when we paid it a visit last week the space was fully occupied. We give herewith a view of the room in which lectures are given in the theory of wireless telegraphy by experts; a number of the students are also engaged in transmitting and receiving messages in the Morse code. We illustrate also the instrument room, which is equipped with a 5-kw., a 1-kw., and a 1½-kw. set of apparatus, of the standard types made by the company; here the students are taught to operate Marconi apparatus of the type installed on board ship, and to carry out repairs and adjustments.

Students attending the day classes have generally had some experience with land lines or cables, and are able to acquire a work-

until he obtains the Postmaster-General's certificate and joins the staff of the company, when the total amount of the fees paid by him is refunded.

The arrangements made for the instruction of the neophytes appear to be very effective, and being trained with apparatus identical with that which they will handle after leaving the school, they can confidently proceed to take up their appointments without fear of finding themselves at sea, in a double sense.

The company is anxious to extend the benefits of the training to the Territorial Force, Cadet Corps, the Church Lads' Brigade and the Boy Scouts, and therefore not only will the *Wireless World* contain a series of special articles on the subject for their benefit, starting with the April number of the new magazine (the successor of the *Marcomgraph*, as already mentioned in our pages), and running for 12 months, but examinations will be held at suitable centres and valuable prizes will be offered, as well as certificates of proficiency in connection with the portable field apparatus. The company or troop which furnishes the largest percentage of certificated members will receive a complete set of Marconi field telegraph apparatus. Further, free tuition in the working of the system will be given at the London School to the Boy Scouts on two evenings a week, which should enable the boys, after about three months, to pass the examination for proficiency which will be held.

The company is to be congratulated not only upon the manner in which it has provided for the supply of operators, but also upon this generous offer, which is certain to evoke a hearty response, and will result in disseminating a practical working knowledge of wireless telegraphy over a wide area—besides adding one more to the many "badges" which reward the industry of the Boy Scout who is no slacker.

## SOME DIFFICULTIES WITH TRAMCAR MOTORS.

THE majority of troubles which are found on traction motors can be traced to comparatively simple causes. In one case, for example, it was noticed that a motor was exceptionally hot when the car was run, and at first it was thought that there was some defect in the design or construction of the motor, to which the attention of the manufacturers would have to be drawn. Examination, however, showed that both of the bolts on one of the field magnets in the top half of the motor case had slacked off, with the result that the magnet had been dropped slightly in position, and its pole face was rubbing

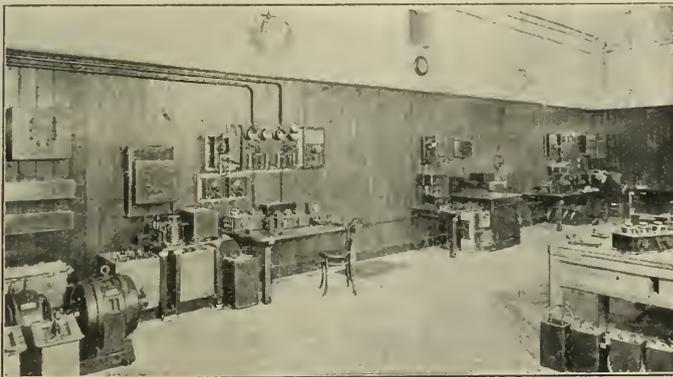
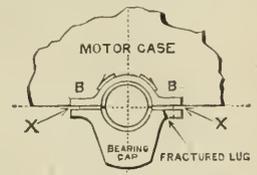


FIG. 2.—INSTRUMENT ROOM AT MARCONI HOUSE.

ing knowledge of the Marconi system in a couple of months; whilst they are learners they receive pay at the rate of 17s. 6d. a week, and after obtaining the Postmaster-General's certificate of proficiency and passing the examination set by the company's instructor, they are drafted into the service of the company. The commencing salary of a wireless telegraphist is £1 a week and all found on board ship, with an annual increment of 2s. 6d. per week to a maximum of 30s. per week. On promotion to the rank of senior telegraphist, the commencing salary is 35s. a week and all found on board ship—f.o.b., so to speak—with an annual increment of 5s. per week to a maximum of 55s. Promotions are made to higher grades when vacancies occur, according to seniority. Candidates for admission as pupils in the evening classes have to be between 19 and 24 years of age, and must have had previous business experience; the classes are held on three evenings a week, from 7.30 to 10 p.m. Each pupil pays a fee of 2s. 6d. a week



The faces marked x should meet when bolted up at b.

FIG. 1.

against the armature. The field-magnet bolts which had been used were of the round-headed type, and the only inference which could be come to was that when the motor had been fitted, and the nuts had apparently been tightened, the bolts had been turned round with the nuts, with the result that they were not tightened up properly. It was, of course, a mistake to use round-headed bolts of this description for such a purpose, as it is difficult to prevent the bolt itself from turning, and all that can be done with this class of field-magnet bolt is to exercise very great care to see that the bolt does not turn, and to use a good make of lock washer. Wherever possible, however, square-headed bolts should be used.

Another cause of failure was discovered some little time after a car motor had been overhauled and fitted with new bearing bushes. After a short run in service, it was found that a bearing cap was broken, and that the armature had

dropped on the field magnets, and the car was taken back to the depot for inspection. It was then seen that the new bearing bushes were slightly larger in diameter than was requisite, and consequently when the bearing cap was bolted up, the lug face did not bear against the motor face. The position will be understood by reference to the illustration in fig. 1. If the bearing bush had been of the right external diameter, the faces of the bearing-cap lugs would have met the corresponding surfaces provided on the motor case, but the result of a gap left in this way was that the lugs of the cap, which was a casting, were in tension, and when they were subjected to the strain of the motor and the vibration on the road, they sheared, as shown in the sketch. Thus a considerable amount of trouble was caused by what was apparently an altogether unimportant detail, but the attention of the turner was drawn to the defect in order to secure the system from further trouble due to this cause.

Another difficulty which may be mentioned was of such a nature that at first the superintendent was thrown upon the wrong scent altogether, and it was not until a considerable amount of investigation had taken place that the true cause of the trouble was identified. It was noted on inspecting a car after returning from service that the motor case on the car had been rubbing slightly on the stone sets between the track. Usually this occurs when there are some high sets somewhere along the track, or else when the wheel tires are being run at less than the minimum thickness. It was found that although the tires were worn, they were still larger than the minimum diameter. An investigation of the track throughout the whole route, where the car had been in service, showed that it was in quite good condition, without any stone sets projecting unduly from the surface of the permanent way. Investigation was, therefore, thrown back on the car itself, and after a considerable amount of search it was discovered that there were no rubber shock absorbers under the axle-box springs, and, partly due to this cause, the springs themselves had closed up for about  $\frac{1}{2}$  in. These shock absorbers consisted of rubber washers about 1 in. thick when they were not under compression, and the combined effect of their absence, together with the closing-up of the springs and the wear on the tires which had taken place, had reduced the motor clearance to such an extent that the motor casing had rubbed on the crown sets of the track. The fitting of shock absorbers under the axle-box springs, together with the introduction of new springs of standard length, gave sufficient room to the motors to enable the full mileage to be got out of the tires before they had to be renewed.

In another case a hot armature bearing occurred on a car motor which had just been overhauled, and when the bearing was taken down in order to discover the cause of the trouble, it was found that this bearing had not received any lubrication, and it therefore fired and seized. The bearing bush had been fitted with a slot through which a felt pad pressed on the journal, and supplied the lubricant, and on the bearing cap was provision for a dowel pin fitting into a hole in the bush in order to ensure that the lubricating slot was in the proper position. In this particular case, however, the dowel pin had come out during the overhaul of the motor, and, unfortunately, when the motor was put into position again, the absence of the dowel pin was not noticed. Hence when the car was running in service the bearing bush turned owing to the absence of the pin, and in turning displaced the pad, interrupting the supply of lubricant and causing the hot bearing.

These few instances are typical of a good many others which might be narrated, showing the importance of the proper upkeep and repair of a tramway system.

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**Gateshead Tramways.**—The Gateshead and District Electric Tramways Co. is just starting a service of motor-buses as adjuncts to the tramways. The first section will be between Low Fell and Chester-le-Street, so that passengers will be able to travel from Gateshead by car to Low Fell, and thence by bus to Chester-le-Street, a distance of 8½ miles, for a 6d. fare. Another route will link up Heworth tramway terminus with the Usworth and Washington district. The chassis of the buses have been built by Messrs. Straker & Squire, and the bodies by the Immisch Co.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Notice of Opening of Roads.

I understand that under Clause 61 of the new Bill promoted by the Metropolitan Water Board, the promoters are seeking to obtain powers to force any local authority or gas, electric light or water company to give them three days' notice before opening up any roads in their area.

The Battersea Borough Council are endeavouring to get the reference to local authorities omitted, but I have yet to hear that anyone is moving on behalf of the companies.

The electric light companies are already sufficiently burdened in this respect, having to give notice to the local authority and the gas company. One would not mind so much if the local authorities and the gas companies were compelled to return the compliment, but they are not.

Is it not worth while even now for the companies to follow the example of the Battersea Borough Council and endeavour to get the reference to themselves omitted, or failing this, to get a corresponding obligation imposed upon the Water Board?

M. Farrer.

Twickenham Electricity Supply,  
March 18th, 1913.

### Regulations Regarding Celluloid.

There are points in the London County Council General Powers Bill and the City of London Celluloid Regulations Bill which should receive the attention of traders, on account of the probable effects of them if they are allowed to be passed. If these Bills which propose to deal with the London area are passed, no doubt similar legislation will be promoted all over the country, and it is therefore imperative that Members of Parliament should be approached by traders to call their attention to the effect such legislation would have in handicapping shopkeepers and warehousemen, who are already suffering from heavy taxation, and some of whom are hardly able to make a reasonable livelihood, and if they were to be subjected to further harassing regulations would have to close down.

Neither the London County Council nor the City of London Corporation have the slightest case for asking for regulations for the storage of celluloid. The fact is that the fire at Moor Lane, where they were manufacturing articles out of celluloid, has caused the County Council and the Corporation to promote hasty and immature Bills. The manipulation of celluloid is one thing, and the storage is another, and we must fight to the best of our ability to have the storage clauses cut out of the Bill altogether.

The Bills ask Parliament to grant practically unlimited powers to members of these two corporate bodies, most of whom have no knowledge of the trade, and who may, with the best intentions, so use their powers as to destroy the trade without any necessity at all.

The regulations are left entirely to the discretion of the County Council or the City Corporation, and on behalf of the trade I most strongly object to its being left to any such body to create restrictions which are wholly unnecessary, the nature of which is not foreshadowed in any way, and which, if unreasonably made, must seriously hamper a very important industry and business.

Traders are at present suffering from a sufficiency, to say the least, of inspection and inspectors, and from the dead charges created by recent legislation; now a new attempt at creating a fresh army of inspectors is found in these two Bills, and it is both desirable and necessary for the trade to oppose them.

I have been examining the reports for the last seven years of the Chief of the London Fire Brigade, and find that out of a total of 21,726 fires, only 10 were in any way affected by celluloid, and in almost every case it was in connection with celluloid film. Large quantities of celluloid have been sold and stored in shops and warehouses for the last 35 years, and the record is singularly clean. For every one death due to celluloid, according to the firemaster's

reports above referred to, there were 90 recorded due to children playing with matches, beside a host due to children playing with fire; yet our County Council and City Corporation do not take any notice of that, but from sentimental reasons they promote Bills of which the preamble, so far as it relates to the matters aforesaid, is unfounded and incorrect, and incapable of proof.

If any traders want any further particulars, I shall be only too happy to supply them.

**The British Xylonite Co., Ltd.**  
THOS. R. BROOKE, *Commercial Manager.*

Hale End, London, *March 19th, 1913.*

[We refer to this matter in a leaderette.—EDS. ELEC. REV.]

#### Convassing Councillors.

With reference to the recent meeting of the Bermondsey Borough Council, at which our tender for 170 Metrolamp lamps was formally accepted, our attention has been drawn to a complaint made by one of the members relative to councillors being canvassed at their homes by the representatives of competing arc-lamp makers.

We wish to make it quite clear that the remarks in question have no reference to our firm, as we have never approached any of the members of the Council in connection with this contract, all our communications with the Council being made through the borough electrical engineer.

**Johnson & Phillips, Ltd.,**  
ST. J. SHEPPARD, *Director.*

Charlton, *March 18th, 1913.*

#### Morse Signalling on Submarine Cables.

Referring to my letter and cable slip of March 7th, 1913, may I beg sufficient space in your valuable paper to inform Mr. E. Raymond-Barker, and others interested, that I did most successfully, and without any difficulty whatsoever, convert these inverse currents into Morse dots and dashes in the manner suggested, and they might have been relayed with ease.

P. O'Neil.

London, E.C., *March 18th, 1913.*

#### The "Load-Factor" Question.

In reply to "Consumer," for the purposes of determining a charge for energy, the time element may be the total number of hours during which current is available, viz., 8,760 for an ordinary year for most public supplies.

Few figures can be so misleading as that of load-factor.

It is quite easy to show that a poor load-factor can be profitably supplied at a very low rate; it does not always follow that a high load-factor can be supplied at a low rate.

A domestic refrigerating plant will probably have a very low load-factor, but it can be quoted at a low price because it will only be used in the summer time, and only a very small percentage of the energy it uses will be delivered at times of any peak load.

The load-factor of a barber's brush is not high, but it is quite desirable business on account of its abnormal diversity. Again, cooking offers an "all-the-year-round" load with summer maximum, and can be quoted at lower rates than heating, if that is considered desirable. This is, perhaps, the best case for the load factor.

A case came under my notice a while ago, in which one customer was taking two classes of load of about equal demand, from 8 a.m. to midnight all the year round. The normal load factor was really over 30 per cent., but for a few weeks in the winter time the two loads overlap for an hour or a trifle more. Academically, this overlapping halves the load factor, because it doubles the maximum demand. It is one of those many cases in which a load factor is of small commercial significance in deciding the price to be quoted.

Probably no system of charging for all loads will ever be so sound and equitable as by two rates over stated periods—unless Dr. Ferranti's dream materialises, when, I suppose,

load curves will be like a saw edge, and units fetch about £1 per 1,000. The cost of the meters militates against the general adoption of this scheme, but having determined what must be the "guarded" or high-price period, it will not be difficult to determine approximately what percentage of the total units delivered to any customer will be generated within that "guarded period." For this percentage, the "average price obtained" should at least be charged, and for the remainder a small margin above "running costs" as separated from "standing charges."

The price charged inside the "guarded period" can gradually advance as the percentage increasingly preponderates up to a maximum price per unit. From these figures a flat rate can be quoted.

**Reginald W. Klitz,**  
*Chief Assistant Electrical Engineer.*

Wimbledon Electricity Supply,  
*March 20th, 1913.*

#### The Electro-Harmonic Society.

I think if the letter in your issue of the 21st were allowed to pass without comment, a very wrong impression would get abroad. I can personally assure you that a very large number indeed of the members of the Electro-Harmonic Society have a strong objection to the practice of not smoking on Ladies' Nights; this feeling is not confined to the members, but is shared by the ladies as well. I think that no one could have any objection to smoking being permitted, say, after the interval. Your correspondent's remarks about drinkers seem to be quite out of place.

Referring to your foot-note to the letter in your issue of the 7th inst., the fact that you have not heard any complaints from *Members* of the Society must be due to the fact that you are so busy attending to the artistes and the programme. The subject is often broached in the room, and I can give you a lengthy list of people who would like to see the present practice changed.

If the Committee do not wish to make the alteration, they might at least remove temptation from us in the shape of matches and fairy lamps, which are always placed on the tables!

F. R. C. Rouse.

London, N.W., *March 20th, 1913.*

[It is not for us to dictate to the Committee. The "Ladies' Nights" are not "Bohemian" Concerts, and if members and ladies find difficulty in refraining from indulgence in the fragrant weed, we can only suggest that the temptation be removed. We may add that our meeting with members is not confined to the King's Hall.—EDS. ELEC. REV.]

#### Small Electrical Undertakings.

In regard to your North Yorks. note on p. 171, the Dales are much further forward than even your notice would indicate. Some five years ago, the Askrigg works were started to supply Askrigg, a village of 400 inhabitants: the following year the Keeth and Hawes schemes were undertaken, with populations of 400 and 800 respectively. Grassington was finished just after Askrigg: two years ago, the Aysgarth scheme was undertaken, while Middleham was similarly provided for three years ago.

Bainbridge, a little village of less than 250 inhabitants, has its own plant supplying at 6d. per unit, and looks like paying. I may say the schemes vary from 500 volts A.C. to 50 volts D.C., and are worked from ancient water wheels, turbines and up-to-date producer gas plants.

Ernest Burton.

Askrigg, *March 20th, 1913.*

#### Heavy-Service Lampholders and Adapters.

Re "Sales Superintendent's" and "Engineer's" remarks about lampholders, this lampholder is badly required here, and, so far, the manufacturers have nothing that will stand 5 amperes for any length of time without

breaking down. The old form of lampholder with the springs sweated or brazed to the pins at the top, and the base of contact to the leads, would carry 5 amperes without injury. The lampholders of to-day are very inferior in this particular. I am sure that any suppliers of a suitable 5-ampere capacity B.C. lampholder would get a huge demand not only here, but all over the country, owing to the increasing system of charging by contract, &c., and registering the domestic light and power consumption through only one meter.

C. J. Stonier,  
Sales Superintendent.

Dundee Electricity Supply,  
March 30th, 1913.

## LEGAL.

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD., v.  
J. SALOMON & CO

MR. JUSTICE BANKES on Tuesday, March 18th, in the King's Bench Division, had before him for further consideration the case in which the plaintiffs sued defendants, leather dealers, of Weston Street, Bermondsey, to recover £1,880 5s. 1d., for electricity supplied to the defendants' factory at Mina Road, Old Kent Road, S.E., from June, 1908, to November, 1911. The plaintiffs' case was that through the reading of the final figure of the total shown on the meter dial as a decimal instead of a unit, the defendants had, in error, only been charged one-tenth of the proper amount. The matter was reported in our issue of March 7th. The jury had found in answer to questions left to them, that the plaintiffs at the end of each quarter by the quarterly accounts rendered, represented to the defendants that the quantity of power consumed was materially less than the amount actually consumed, but that the plaintiffs did not intend that the defendants should act upon such representations, that the defendants acted upon such representations, that the meter supplied by the plaintiffs was a suitable one, that the plaintiffs' servants were negligent in reading the meter, that the plaintiffs kept the meter in proper order for correctly registering the value of the supply, and that the defendants by reasonable care could have ascertained that they were using much more power than they were being charged for.

MR. ATKIN, K.C., counsel for the plaintiffs, said that his Lordship would not be further troubled with the case. The plaintiffs abated £150 off the claim, and there would be judgment for the plaintiffs for £1,730 5s. 6d., with costs. Certain money in Court would be paid out in part satisfaction.

MR. JUSTICE BANKES, in assenting, said: I am very glad to hear that.

BRITISH ECONOMICAL LAMP CO., LTD., v. THE EMPIRE, MILE  
END, LTD., AND A. BERNSTEIN.

ON March 19th, the reserved judgment was delivered of the King's Bench Divisional Court, composed of Justices A. T. Lawrence and Lush, in this case, which had been argued before their Lordships on February 14th. The plaintiff company appealed against a decision by Sir Forrest Fulton, the Recorder, at the Mayor's Court last year. The plaintiff company had proceeded to recover certain lamps at the theatre, or their value, and damages for their alleged detention. They had been let to the theatre tenants, and the landlord had entered on account of the non-payment of the rent. The plaintiffs claimed the lamps, but the Recorder held that the bulbs were fixtures, and had entered judgment for the defendant, the lessor.

For the appellant company, Mr. Geo. Wallace, K.C., had argued that the glass bulbs were not part of the house, and Mr. Rankin had submitted an argument in support of the Recorder's decision.

The judgment of Mr. Justice Lawrence (read by Mr. Justice Lush) was to the effect that the appeal must be dismissed, with costs. The action was brought to recover the electric lamps, or their value, and damages for their detention. The owners of the theatre re-entered for non-payment of the rent, and had been in possession a month or more before the plaintiffs made their claim. The lamps were affixed to the brackets by the bayonet attachment in common use for the purpose. The plaintiff company let the lamps out on hire to the late tenants of the theatre, and at the Mayor's Court the Recorder had held that the lamps were trade fixtures, and had given judgment for the defendant. The plaintiffs' appeal was against this decision, and they had to consider if the plaintiffs had shown a cause of action. In his opinion they had not done so. They claimed the right to enter the theatre and remove the lamps. The plaintiffs had their remedy against the person to whom they let the lamps. He thought the case did not involve any examination of the various decisions as to fixtures. In his judgment the plaintiffs failed, because they had shown no cause of action. The lamps were affixed to the brackets, and he knew of no duty on the part of the defendant to disconnect them and return them to the plaintiff company. He thought, therefore, the appeal must be dismissed with costs.

MR. JUSTICE LUSH, in his judgment, pointed out that the defendant was the lessor of the theatre, and he had re-entered for non-payment of the rent. The Recorder had held that the lamps were trade fixtures, and had given judgment against the plaintiffs, but he (Mr. Justice Lush) did not agree with that view. He agreed, however, that the plaintiffs had shown no cause of action, and he agreed that the appeal must be dismissed with costs.

The appeal was accordingly dismissed with costs. Leave was granted appellants to appeal further.

MR. GEO. WALLACE, K.C., smilingly observed that "the decision they really wanted they had not got."

BATTERSEA BOROUGH COUNCIL v. THE COUNTY OF LONDON  
ELECTRIC SUPPLY CO., LTD.

IN the Chancery Division, on Tuesday, this case was mentioned on a motion by the plaintiffs for an interlocutory injunction restraining the defendant company from breaking up the Council's streets in order to lay their mains.

MR. HUGHES, K.C. (for the plaintiffs), explained that the action raised a very important question upon a point of law under the London Electric Supply Act of 1908, but it was quite impossible for him to proceed with his motion that day, as the defendant company had just filed an affidavit, which he had not had an opportunity of considering. Counsel asked his Lordship to fix a convenient day early next term, as the matter was very urgent.

SIR ALFRED CRIPPS, K.C. (for the defendant company), agreed that the question was one of law and that it was important, but said that his view was that it had already been decided in his favour in a case tried by Mr. Justice Parker (now Lord Parker). It was a case in which the defendant company had to give certain notices, which had been done. If those notices were objected to, they had, in the company's view, to go before the Board of Trade. The company were quite willing to go before the Board of Trade, admitting that they were unable to proceed without the consent of that body. They refused, however, to give any undertaking pending the hearing of this motion.

MR. HUGHES: They claim to break up our streets and lay their mains through our streets. Whether they are right or wrong, it is an important matter for the Council.

His Lordship fixed Monday, April 7th, for the hearing of the motion, subject to any case part-heard.

HALL, BAYLISS & CO., LTD., v. BODDAM.

THIS action, heard at Clerkenwell County Court last week, was a claim by plaintiffs, a firm of manufacturers, against Col. Boddam, an electrical specialist, of Old Jewry, E.C., for £6 1s. 9d., as the half cost, as agreed, of making an electric water heater, carrying out tests, and advising. Defendant counterclaimed for £20. Plaintiffs, he set up, verbally agreed to make an electric water heater according to plans and specification to the value of £20, in return for 21 days' option to purchase the patent. Defendant complained that the heater was not of proper material or manufacture. Plaintiffs, he alleged, did not carry out their contract, and he claimed as damages the £20 agreed to be paid for the option.

At the close of the hearing, his HONOUR held that plaintiffs were entitled to recover on the claim for £5 16s. 6d. With regard to the counterclaim, that was a whole misconception. One man could not say that another one must exercise an option. That was not the meaning of giving an option. The person to whom it was given had the right to say, "I am not going to exercise it," and because of his refusal the other side could not come upon him for damage unless the man promised to pay damages in the event of failure to exercise the option. Therefore, the judgment must be for plaintiffs on the claim and counterclaim.

POSTMASTER-GENERAL v. DUBLIN CORPORATION.

IN the Chancery Division, on 17th inst., in the matter of the above action, it was stated that difficulties had arisen between the parties as to the carrying out of certain telephone works which were then in course of execution. After hearing the argument, the Master of the Rolls directed an injunction to issue until further order, restraining the Corporation from interfering with, or in any way obstructing, the plaintiff in the laying of an underground telephone line and the provision of manholes along Baggot Street, Merrion Street, and Nassau Street, as shown by the plan furnished to the defendants by the plaintiff, the plaintiff undertaking to abide by any order of the Court. The question of costs was reserved.

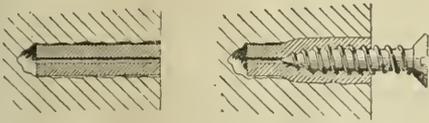
**Burnham (Somerset).**—With reference to the electric lighting scheme proposed by Dr. J. A. Purves, of Exeter, the U.D.C. has asked him, if he saw no real prospect of being able to form a company to carry out the scheme, whether he would agree to stand aside so that the Council could negotiate with others. Dr. Purves had previously written to the Council promising that Burnham should be attended to now that a company had been floated, but as the time in which the company had to be registered had really expired, he asked the Council to grant another four months in which to enable him to get the company registered. At the Council meeting it was explained that Dr. Purves had until August 8th to complete the matter.

## BUSINESS NOTES.

**Catalogues and Lists.**—THE BRITISH ALUMINIUM CO., 109, Queen Victoria Street, London, E.C.—Three new illustrated circulars, one relating to aluminium collector bows, a second concerning aluminium light railway feeders, and the third, sundry aluminium fittings.

MESSRS. DRENNAN, GLOVER & COOPER, Corn Exchange Buildings, Hanging Ditch, Manchester.—Catalogue "J," of 56 pages, containing a large amount of tabulated data and prices, relating to their resistance materials, including "Nichrome" resistance wire, which is widely used for domestic electric heating devices, and "Nichrome II," which is the successful outcome of several years' work to produce a wire which can be run permanently at 2,000° F. Owing to its slightly higher cost, the restriction of its use at present to mere severe conditions, such as laboratory furnaces, soldering irons, grills, hot-plates, &c., is suggested. The other materials included in the list are Climax nickel, Advance, Therlo, Yankee silver, German silver, and ferro-nickel.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Blomfield Street, London Wall, London, E.C.—Circular No. 76 giving particulars and prices of a new patent plug for use with the Henley wiring system, for fixing their patent "Link" clips, saddles and protective covering to plaster, brick, marble, slate, stone, &c. It is believed that the plug will fill a long-felt want for many purposes.



HENLEY'S NEW PATENT PLUG.

The hole made for the plug is only a little larger in diameter than the screw that fits it. Satisfactory tests made at the works showing the strength of pull required to remove the plugs from plaster and brick respectively, are published in the list.

MESSRS. SIMPLEX CONDUITS, LTD., London and Birmingham.—1913 edition of their pocket catalogue (84 pp.) of conduits and conduit accessories, distribution boards and watertight fittings. Very compactly arranged, and with numerous illustrations and price information, the present edition contains practically the whole of the matter covered by sections "T," "D," "U" and "M" of their general catalogue in a condensed form, and bound in handy size for contractors' convenience on the job. One or two new designs of conduit fittings have been added. These include back outlet bends and tees, which are



SIMPLEX SHORT-ARM TEE.

intended for screwed conduit installations, and have heavy cast covers, to serve as a drawing point where a branch is taken off at right angles to the main run of conduit.

MESSRS. CAMELL LAIRD & CO., LTD., Cyclops Steel and Iron Works, Sheffield.—"Catalogue of Tool Steel" (about 90 pages, bound). Particulars of their high-speed steels, mining tool steels, special steel for coal-cutting machines, shear steels, water-hardening steel, non-tempering steel, nickel and automobile steels, sections of tool and spring steel, and other productions, are included, and a number of pages give weights, equations, gauges, and so on, in tabular form.

THE CENTURY ELECTRIC CO., St. Louis, U.S.A.—16-page illustrated pamphlet respecting "Invincible" split phase motors.

THE BRUSH ELECTRICAL ENGINEERING CO., LTD., Loughborough.—40-page book of pictures showing their various types of electric cars for tramway and light railway service, their designs for colonial and foreign cities predominating. A number of pages are devoted to Peckham truck illustrations.

**Shopping Week.**—At the Ashton-under-Lyne shopping festival last week, MESSRS. EATON & CO., of Old Street, were awarded a 2nd prize for their show of electrical goods.

**Belgium.**—La Société des Ateliers Electrochimiques is the name of a new concern which has just been formed in Brussels with a capital of £3,000.

**Book Notices.**—"Journal of the Western Society of Engineers." Vol. XVIII, No. 1, January, 1913. Chicago: The Society. Price 50 cents.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXII, No. 3, March, 1913. New York: The Institute. Price \$1.00.

"Journal of the American Institute of Architects." Vol. I, No. 3, March, 1913. Washington: The Institute. Price 50 cents. "La Fixation des Unités par Voie Legislative." By R. de Baillehache. 1913. Paris: A. Colin.

**Tale of a Lamp.**—We have received a story regarding a 16-watt, 250-volt Gram drawn-wire lamp which inadvertently found its way to an ashbin, from which it was taken in the usual way to the refuse cart, and from the latter, also in the usual way, to the refuse heap at a destructor worked by an electric supply company, in the neighbourhood of Blackpool. But it survived, once more in the usual way, being rescued, clothed in its carton by a workman, in a nick of time almost like a "brand from the burning" though it hadn't really reached the fire. Of course, after all that has gone before, it is surprising that the said workman was surprised to find it intact—everybody ought to have known what would happen! However, the end of the story is that the rescued lamp is burning "happily for ever afterwards," shall we say, in the house of the charge engineer.

**Trade Announcements.**—It is announced that the business lately carried on by MESSRS. T. E. SMITH & CO. LTD., Keighley, is being continued by Mr. J. H. Smith, under the style of the Smith Electrical Co., Ltd., at 7, Cavendish Street, Keighley.

THE ELECTRICITY SUPPLY CO. FOR SPAIN, LTD., have removed to Dunster House, Mincing Lane and 12, Mark Lane, E.C.

**France.**—The *Financial News* publishes news from Brussels to the effect that a Franco-Belgian syndicate, composed of the Ateliers de Constructions Electriques du Nord et de l'Est, the Banque de Bruxelles and the Banque d'Empain, intend to establish new iron smelting works near Dunkirk.

**C.T.S. Rubber Gloves.**—Mr. R. Nelson, Electrical Inspector of Mines, was recently reported to have said at an inquest that he did not like to see insulating gloves in use, presumably because when these have become worn or damaged, they become more dangerous than no gloves at all. To meet this difficulty the ST. HELENS CABLE AND RUBBER CO., LTD., of Warrington, applied a thin sheathing of leather to the face of their rubber gloves, which protected the rubber, but was not wholly satisfactory, the company, therefore, have made a further improvement, by devising a method of covering the gloves on the palm and fingers with their patent cab-tire sheathing, already well known in connection with their C.T.S. cables. We understand that this combination, which has been provisionally protected, appears to fulfil all the requirements of high insulation, long wearing power, flexibility and convenience in use.

**Bankruptcy Proceedings.**—CHARLES SPENCER NORTHOTE, electrical engineer, 67, Stanthorpe Road, Streatham, London.—The adjourned public examination of the above-named debtor was held at the Court House, Wandsworth, last week. The Official Receiver said he had no further questions to ask, and debtor, having read the shorthand notes of his previous examination, and answered the formal questions of the Registrar, was allowed to pass, the examination being concluded.

FRANCIS HASTINGS MEDHURST (deceased), engineer, Victoria Street, S.W.—First and final dividend of 2½d. in the £, payable April 8th, at the offices of Elles, Salaman & Co., 1 and 2, Bucklersbury, E.C.

**Liquidation.**—DOLTER ELECTRIC TRACTION, LTD.—A meeting is called for April 23rd at Austin Friars House, Austin Friars, E.C., to hear an account of the winding up from the liquidator, Mr. W. S. Ogle.

**Meter Approved.**—The Board of Trade has approved of the Ferranti A.C. meter type C (single-phase two wire) deposited by Messrs. Ferranti, Ltd., in November, 1911.

## LIGHTING and POWER NOTES.

**Algeria.**—A central electric lighting station is to be established in the little town of Gurgotville.

**Argentina.**—The Hydro-Electric Co., of Tucuman, has made an offer to the municipality of that city to undertake the street illumination at a figure showing a reduction of 12 per cent. on the actual amount now paid to the Cia. Electrica del Norte. If the proposal of the Hydro-Electric Co. is accepted it would mean a reduction in the public lighting bill of \$1,200 a month.

The province of Buenos Aires Electricity Co. is arranging to give a day service in Azul. This company is erecting a station at Ramos Mejia, the building is now nearly finished, and the machinery will shortly arrive. It is also extending to the suburb of Caseros, where a sub-station is to be erected, current being taken in bulk from the Compania Alemana; the land for this station has already been purchased and plans prepared. In Villa Ballester a new sub-station is being built which will be supplied from the San Martin station.—*Review of the River Plate.*

**Australia.**—According to the *Australian Mining Standard*, some little time ago Mr. Forbes Mackay, the Sydney city electrical engineer, brought forward a proposal to construct an underground storage battery, which, with auxiliary plant, cables, &c., was estimated to cost £52,500. This battery was to provide for the expected load of 1914. Eleven tenders were received for the work, none of which complied with the general conditions specified, and the lowest entailed an expenditure of £63,000. The increased cost was due to the general increase in prices since the proposal was first considered, and the engineer

recommended, and the Council agreed, to drop the proposal for the present. Additional power is required, however, and tenders are to be invited for a 5,000-kw. turbo-generator.

**Barnes.**—The electrical engineer has been instructed to report whether special arrangements could be made with shopkeepers who use arc lamps for outside shop window lighting; and also upon the question of reducing the charges to consumers and for public lighting. The £1,000 standing to the credit of the undertaking is to be put aside as reserve.

**Bromley (Kent).**—The Electricity Co. has submitted to the T.C. terms for public lighting, viz., 1,009 single 60-watt lights at £1 5s. 6d. each per annum, and 46 240-watt lamps at £6 each, a ten years' contract being asked for owing to the cost of converting the lamps.

**Bury.**—At a meeting of the Electricity Committee, the electrical engineer (Mr. S. J. Watson) reported that he had been approached by representatives of the Peel Spinning and Manufacturing Co., with regard to a supply of electricity, which the company would require for power purposes when it had carried out the contemplated extensions to its mill. The Committee confirmed the terms offered by the engineer.

**Canada.**—The Calgary Power Co., owing to the rapid extension of the city, has decided to develop another of its water powers at Kanamaskis Falls, 2 miles above the present Horse Shoe Falls plant, at a cost estimated to be \$1,000,000.

The Western Canada Power Co., of British Columbia, will shortly have 100,000 h.p. developed on the Stave River. The second installation of the company's plant is near completion, and a large contract for a minimum of 12,000, and a maximum of 40,000 h.p., has been entered into with the British Columbia Electric Railway Co. from this second installation.

It is stated that fresh proposals are being made for utilising the tidal movement in the Bay of Fundy, between New Brunswick and Nova Scotia, in the generation of electricity for supply in Eastern Canada. Our correspondent says a site has been chosen for the project, and a reservoir is to be constructed between an island and the mainland, where from 50 to 70 ft. tides are found.

The Hon. Adam Beck, of hydro-electric power fame, is said to be investigating the possibilities of the H.T. direct-current system for Canadian transmission work.

**Caton.**—The ratepayers have decided to form a company to install electric light. For many years the village, which is practically a suburb of Lancaster, has been supplied by gas from the works of Story Bros., Ltd., Queen's Mill. They have arranged to substitute electric power for gas, and left the villagers to their own resources. Most of the capital required has already been subscribed, a gratifying feature being the interest taken in the scheme by the inhabitants.

**Chester.**—The Electricity Committee has decided to recommend the T.C. to sanction an extension of the electricity works as suggested by the electrical engineer, at a cost of £11,550.

**Clacton-on-Sea.**—The U.D.C. has applied to the L.G.B. for a loan of £6,000 for extensions to plant and buildings at the electricity works.

**Doncaster.**—The Electricity and Tramways Committee has decided to recommend an extension of the electricity works, at an estimated cost of £12,500.

**Dover.**—The Electricity Committee has had under consideration a report from the electrical engineer on the relative costs of automatic and hand control of the street lamps. He estimates that when the present conversion is completed, the average cost for the next three years for controlling and maintaining the lamps, exclusive of renewals, will amount to £290 per annum, also that if time switches were fitted to all the posts excepting those on the route of the lamps controlled from the works, and were incandescent lamps substituted for the arcs, the cost would only amount to £77 per annum; and if £13 were allowed for expenditure on repairs to the clocks, there would be a clear saving of £200 per annum. The cost of 325 time switches (the actual number required to meet present requirements) would amount to £528, and it is suggested that the cost should be spread over three years by means of a suspense account, although if only two years were allowed, the ultimate saving would seem to justify the increased cost of £64 per annum for the next two years. The Committee has approved and adopted the report, and has decided to spread payment over a period of three years as suggested.

**Duffield (near Derby).**—At the annual meeting of the parishioners a resolution was passed approving of the proposals of the Corporation of Derby to extend its electric lighting and power system to Duffield, provided that the mains are laid underground where so required by the Parish Council.

**Dufftown (Banff).**—At a meeting of the T.C. it was reported that Mr. Barker, Nairn, had been engaged to give a report on a lighting scheme for the burgh with coal gas, and Mr. McLeod, Clyde Valley Electric Power Co., Glasgow, to give a report on an electric scheme, the fee of the former being 8 guineas inclusive, and that of the latter £20 and expenses.

**Dungarvan.**—The B. of T. has informed the Urban Council that if it wishes to obtain powers for the electric lighting of the town, it will have to consider applying for a provisional order, as the Board has no power to grant licences for this purpose.

**Ealing.**—The electrical engineer has been authorised to purchase 50 electric heating irons, which will be let out on hire to consumers at a charge of 1s. per quarter, additional to the charge for current consumed.

**Eton.**—A statement to the B. of G. regarding the adoption of electricity for lighting and cooking, instead of gas, at the workhouse, showed that for the previous year gas for lighting and cooking, with rent of stoves, repairs to mantles, burners, &c., and 20½ tons of coal, cost £228. During the past year the cost of electricity, rent of meters, lamp renewals, part cost of new range and of installation, and 10½ tons of coal, amounted to £78, a saving of £150. The master of the workhouse testified to the improved conditions of lighting, atmosphere, &c., since the introduction of electricity.

**Glasgow.**—The date has been fixed for the exhibition of appliances for power, heating, cooking and lighting under the auspices of the Glasgow Corporation, at from October 23rd to November 15th. It is expected that there will be a large entry by manufacturers and contractors.

**Gloucester.**—The Council has adopted a scheme recommended by the electrical engineer, under which private consumers will have the option of taking a supply of electricity at the ordinary rates, or for an annual payment equal to 12½ per cent. upon the rateable value of their premises, and 1d. per unit for all electricity consumed. The tender of Messrs. Ruscoe, of Hyde, amounting to £195, was accepted for supplying and fixing mechanical stokers for two of the boilers at the electricity works.

**Greenock.**—At the annual meeting of the T.C. on the 18th inst., Treasurer Williamson announced that the agreement with the Port Glasgow power users was now completed. Ship-builders and engineers had felt some difficulty with the 30 years' undertaking, but the speaker gave the assurance that no better terms could be given at a later stage by Greenock Corporation for power. It was reported that for the last four weeks the supply of electricity showed an increase of 116,968 units over the same period of 1912—an increase of nearly 11 per cent.

The B. of T. has sanctioned the borrowing of a further sum of £30,000 by the Corporation for the electricity department, to cover expenditure to be incurred in connection with the extension to Port Glasgow.

**Grimsby.**—In connection with the proposed purchase of turbine plant for the electricity department, it has been decided to revise the application to the L.G.B. from £8,650 to £9,300, in order to carry out certain additional work.

**Ham (Surrey).**—At a meeting of the U.D.C. on March 20th, the clerk reported that he had prepared an agreement with the Twickenham and Teddington Electricity Supply Co. for supplying electricity to the district, but owing to trouble with the B. of T. nothing definite had been decided.

**Harrogate.**—The C.C. has decided to have the electric light installed at the police court premises, and the T.C. has decided to contribute £20 towards the cost.

**Haydock.**—The B. of T. has revoked the 1905 electric light order.

**Hayward's Heath.**—The application of the Mid-Sussex Electric Light and Power Co. for a prov. order for electric supply, formed the subject of a B. of T. inquiry last week. It was stated that the company intended to supply Hayward's Heath, Lindfield and the urban part of Cuckfield, and the only opposition was as to the site of the generating station, which had been acquired from the U.D.C., and which was 200 yds. from the nearest house.

**Heysham.**—An application was made to the Morecambe T.C. last week to apply for powers to supply electricity in the Heysham Urban Council district, which immediately adjoins the west end of Morecambe. The leading property owners and occupiers signed the request, which was heartily received by the Morecambe Corporation.

**Hindley.**—The U.D.C. has approved a draft agreement with the Lancs. Electric Power Co., and has forwarded it to the B. of T. for its approval before completing it.

**Hornsey.**—The income of the electricity undertaking for the year ending March, 1914, is put at £23,350, as against an estimated expenditure of £22,629. In the discussion which occurred upon this estimate, Councillor Double urged that, as there was a balance of £6,000 on the undertaking, and a sum of £4,000 was sufficient for working capital, a reduction in the price of current supplied should be made to consumers. Application is to be made to the L.G.B. for sanction to borrow £3,000 for services.

**Hoylelake and West Kirby.**—At a meeting of the U.D.C., the chairman of the Finance Committee presented the annual financial statement, which showed that the electricity undertaking had done very well, the approximate profit for the year being about £450. It was stated that the Committee had under consideration a further extension of the machinery in order to cope with any further development the district might make.

**India.**—The Madras Corporation has proposed to raise a loan for various improvements, including electric lighting. The electric lighting will occasion expenditure of about 10 lakhs of rupees, but of this sum only 3 lakhs have been budgeted for the financial year of 1913-14. The Corporation is to be congratulated on having determined on the electric lighting of the city. Private

citizens of all classes have provided themselves with this form of illuminant; the most insignificant bazaars are now to be seen lit with electricity, and it is about time that the Madras streets followed the example. When the electric lighting is an accomplished fact, or even before that time, the levying of the maximum lighting tax will doubtless become a necessity and will not be grudged.

It is now confidently expected that the Simla hydro-electric scheme—the main details of which have been given in these notes, will be ready for opening early in May next.

**TATA SCHEME.**—Our contemporary, *Indian Industries and Power*, recently reviewed the position of the constructional work on the Tata hydro-electric scheme. The initial scheme provided for some 30,000 H.P., but the completion of the three reservoirs, Lonavla, Walhwa, and Sherwata will cable some 60,000 H.P. to be supplied. The Sherwata dam is an extension of the original scheme and has just been commenced. Work is being actively carried on in connection with the dams, power house, pipe line and transmissions; it is expected that the hydro-electric plant will be in operation in a year's time, as the superstructure and machinery foundations of both power house and receiving station are under construction.

At the Bombay end, preparations are being made by the mills to utilise the power, and nearly all the motors and transformers required are said to be on order, while half the underground supply cables on the island of Bombay have been laid. Contracts have been entered into to supply 30 cotton mills and three flour mills, the smallest installation being of 250 H.P.

**Inverness.**—The North of Scotland E.L. and P. Co. has secured its first municipal lighting contract; the Market Hall is to be electrically lighted, the cost being given as 7d. per hour as against 9d. per hour charged for gas at present.

**Keighley.**—The T.C. last week considered the proposed arrangement for supplying the Bingley Urban Council with electricity in bulk for a term of 10 years certain, and the arrangement to continue thereafter from year to year until determined by either party giving 12 months' written notice to the other. The terms in brief provide for a fixed annual payment to the Corporation of £400 to £600, according to the amount of energy supplied, and for a charge of 3d. per B. of T. unit. After a long discussion, the arrangement was confirmed. Mr. H. Webber, borough electrical engineer, was appointed permanently as tramways manager.

**London.**—**BERMONDSEY.**—Application is to be made to the L.C.C. for sanction to, and the advance of, loans of £500 for meters and £1,000 for services.

**HAMMERSMITH.**—In a report to the B.C., the Finance Committee chairman states that the net surplus in the accounts of the electricity undertaking for the current year is estimated at £7,578, and he is of opinion that a sum of £3,340, part thereof, being equivalent to the produce of a penny rate, should be allocated to the relief of the general rate for the ensuing year.

Messrs. Walter Scott & Middleton have applied for a supply of electricity for driving their machinery in connection with the widening of the L. & N.W. Railway at Willesden Junction; also for the use of a 150-H.P. motor, and offering to pay a minimum of £250 per annum for current used, £65 per annum for the hire of the motor and £50 towards the Council's cost of laying on the supply. The Council has agreed to the above offer, and a supply is to be given at the flat rate of 1d. per unit.

**FULHAM.**—An expenditure of £1,100 has been authorised for converting the remaining 121 rectified arc lamps in the borough to metallic-filament cluster lighting. This alteration, it is stated, may be expected to result in a further reduction in the number of units consumed and chargeable to public lighting of £8,483 per annum, which is equivalent to an annual saving of £345. An additional expenditure of £210 has also been authorised for converting 100 gas lamps, which are on the lines of mains already laid in the side streets of the borough, to incandescent electric lamps.

**ST. PANCRAS.**—An agreement is to be entered into with the London Housing Society for a supply of current to its residences in Judd Street for lighting, heating and cooking purposes, upon payment by it direct, of an annual charge in advance, of £11 per kW. and 3d. per unit for all current supplied by meter. This is upon the condition that no gas is used by the society in any of the buildings. In assessing the kW. upon which payment would be made, the engineer estimated that 70 per cent. of the lamps in lighting at one and the same time could be considered as the maximum. The Electricity Committee reports having had under consideration the question of an undercharge which occurred in the accounts rendered for electric current supplied to the Railway Clearing House. In the year 1907, the Committee states, the voltage of the supply was changed from 110 volts to 220 volts, and at the Railway Clearing House three of the four 110-volt meters were replaced by 220-volt meters. In regard to the fourth meter, which was allowed to remain at 110 volts, inasmuch as it was one of special size and cost, the meter reading book was marked to be subject to a multiplying constant of two in making out the account. The reading of this meter for the quarter following was duly multiplied, and the account properly rendered, but the constant was subsequently omitted from the book, and, as a result, the current at 220 volts passing through this 110-volt meter was since then only charged at half its value. The total undercharge until the error was discovered amounted to £747. This sum, after negotiation, was settled in full. Arrangements were then made, the Committee continued, for a thorough and complete investigation of the meters in use, and it had been ascertained that the only other case of an error having occurred was in respect of a 220-volt meter which was con-

needed to a 110-volt supply. This was responsible for an undercharge of £31, which had also been paid in full. The district auditor, in his remarks upon these errors, says that, in his opinion "there is no reason whatever for supposing that the consumer was aware of the mistake. The substitution of metallic-filament lamps and the conversion to 220-volt current might easily have been regarded as sufficient explanation of the variation in charge. There are at present a number of 220-volt meters in use for measuring 110-volt current. In regard to them an efficient system has been instituted to obviate any risk of overlooking the constant, multiplier-cards of distinctive colour being used."

**Luton.**—It is stated that in all probability the profits of the electricity department will be absorbed by the proposed expenditure on house services, purchase of meters, &c. The question of installing new plant during the year, at an approximate cost of £20,000, is under consideration. In connection with the lease of the Corporation tramways, which expired on February 21st last, Messrs. Balfour, Beattie & Co., Ltd., the lessees, have now asked for a considerable reduction in the price of energy. The company suggested that the price should be for the first 200,000 units per annum, 14d. per unit; for any quantity exceeding 200,000 units per annum, 1d. per unit. If this alternative was accepted, the company stated that it would be prepared to give the Council an option to determine the lease at any time upon 12 months' notice. Being of the opinion that it would be an advantage to have the power of determining the lease during the next 10 years, the Committee decided to agree to the proposal, subject to a fuel clause.

**New Zealand.**—Until recently the water of the Waipori River, which supplied the hydro-electric plant at Dunedin, was conveyed in an ordinary open flume. The risk and expense attached to its use led the Corporation to tunnel through a hill, some 4,440 ft., and in January last the water was diverted to the new course. The immediate result was to give the city an additional 1,000 H.P., making 4,000; two more generators are being installed, which will bring this up to 6,000 H.P., and it will be possible to develop an additional 4,000 H.P. in the future. The tunnel has an advantage over the open flume in that it can be used as a pipe line, supplying direct to the Pelton wheels and avoiding waste of excess water as heretofore. The tunnel, a new weir, and conduit have cost £39,752.

**Oldham.**—The B. of G. has decided to have electric lighting and telephones installed at the Workhouse.

Some time ago the Electricity Committee decided to install plant for supplying H.T. energy, and at a recent meeting of the Committee it was reported that there was not space available at the Greenhill station for the erection of the necessary switch-board, the engineer suggesting an extension on the eastern side fronting Churchill Street. This was agreed to by the Committee.

**Peterborough.**—The T.C. has discussed the extensions of the electricity works, for which a loan has been agreed upon. The city electrical engineer is to prepare a specification for a 500-kw. turbo-generator and two Lancashire boilers. The engineer was also instructed to make inquiries as to the value of various mechanical stokers and to report.

**Rhosllanerchrugog.**—The local Traders' Association has taken up the question of a supply of electricity for the district. A supply could be obtained from Wrexham by means of the tramway wires, this being considered the cheaper method, but the Association has decided to make further inquiries as to the possibility of current being generated in the town.

**Southampton.**—A letter has been received from Itchen U.D.C. with reference to the Council's schemes for supplying current, to the effect that the District Council favoured the proposal for a bulk supply on a six-years' contract. It is estimated that there will be a gross profit on the electricity undertaking for the year ending March, 1914, of £21,057, which, after deducting interest on redemption charges and special expenditure, will leave £1,379 available for appropriation.

**Stirling.**—At a meeting of the Lighting Committee it was reported that the capital account of the electric light undertaking was overdrawn to the extent of £115. It was recommended that £1,000, the balance of a sum authorised, be borrowed, and the T.C. has agreed to this. Recently the Committee met at the works and inspected the plant.

**Swansea.**—The question of increasing the contribution of the electricity department to the rates, was recently discussed by the E.L. Committee, and it was agreed to give one-third of the net profit for this purpose. It was pointed out that increased financial charges would have to be met shortly; that the reserve fund had not reached the 10 per cent. limit; that it would probably be necessary to pay for meters and street lighting out of revenue, to which the borough treasurer demurred; also that the price of gas was being reduced, all excellent reasons for retaining any available surplus in the undertaking.

**Theale (Somerset).**—There is every prospect of this village being supplied with electricity from Wedmore, where a scheme has been carried out. Prominent residents have taken up the matter, and the proposal has been favourably received.

**Troon (Ayrshire).**—The T.C. has under consideration the question of an electric lighting scheme for the borough.

**Truro.**—At the recent inquiry into the schemes promoted by the Corporation and the Truro Gas Co. for the electric lighting of Truro, counsel for the Corporation said the company was asking the B. of T. to ignore the Corporation—an unprecedented step. The Mayor of Truro gave evidence, and said the citizens were also against power being given to the gas company. Dr. Purves, of Exeter, said Truro was an exceedingly good field for the establishment of an electricity works. The capital expenditure he placed at £8,000. This, at 4 per cent, together with sinking fund, could be paid off at the rate of £520 annually for 25 years. To show the extent to which it was expected electric light would be taken up, Dr. Purves stated that Lauceston, with a population of 4,500, had 3,700 lamps connected at the end of the first year, and Paignton, with a population of 10,000, had 6,000 lamps. Councillor Lodge stated that all the population of Truro wanted electric light, and 95 per cent, would prefer it in the hands of the Corporation.

**Tynemouth.**—At a meeting of the T.C. on the 19th inst., Alderman Irvin announced the Electricity Committee's intention to reduce the tariff for lighting. He said that the works had done so well during the last two or three years that they had practically wiped out their deficit. Mr. Gregg added that the feeling of the Committee was that even a further reduction in the price of energy for illumination purposes might be made next year.

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## TRAMWAY and RAILWAY NOTES.

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**Bingley.**—The U.D.C. has been recommended to make an offer to the Bradford Corporation to obtain a provisional order for a tramway from Ling Bob, Wilsden, to the Bradford city boundary, and to lease the tramway to the Corporation upon certain conditions; and also to accept the terms suggested by the Shipley Council as the consideration for its consent to the junction of the proposed Bingley tramway with the Shipley tramway at Nab Wood.

**Birmingham.**—The City Tramways Committee has decided to improve the service by the introduction of more vehicles. At present 511 cars are in use, but to meet the requirements of traffic by extension of lines and also during the busy hours of the early morning and evening, it has become necessary to provide additional rolling stock. As a first instalment 40 more cars are to be purchased, some of which will be used on the Hagley Road route when the line is opened. The others will be utilised to increase the existing services in the city. Land has been purchased for the widening of Warwick Road and Stratford Road, and the work of laying the track, &c., will be carried out in the course of the summer. This work comprises the extension of the Stratford Road tramways from College Road to Hall Green, and also the completion of the line along Warwick Road.

**Blackpool.**—A petition signed by 2,000 ratepayers has been presented to the Tramways Committee calling for penny fares on the Promenade during the summer. The Committee has deferred consideration of the matter until it goes into the estimates for the ensuing year.

**Bolton.**—Despite the unfavourable weather which prevailed during the greater part of the day, the Corporation tramcars were extensively patronised on Good Friday, the receipts being about £100 in excess of the previous year's.

**Bradford.**—The Lord Mayor, on Monday, opened the extension of the tramway between Wyke and Bailiff Bridge, which provides a through connection between Bradford and Brighouse, thus making the second two-town connection in which Bradford is concerned. The new line opens up possibilities of an eventual through connection between Bradford and Huddersfield. The length of the new line is 1 mile 338 yd.; it is partly within the Bradford city boundary, partly in the Rural District of Hipperholme, and partly in the Halifax Rural District, and has been constructed on the Dawson & Foster patent reinforced system, at a cost of £22,000, which includes the special treatment of the road. It brings the total length of track now operated by the Corporation to 103 miles 1,096 yd., the capital expenditure being approximately £995,000. The Lord Mayor, accompanied by members of the City Council, officials and public men, travelled to the site in a gaily decorated car. The Mayor of Brighouse and other officials of that town were also present, and attended the subsequent luncheon at the Bradford Town Hall.

**Bury.**—The Tramways Committee at a recent meeting decided to continue the experiment of running tramcars to and fro on the Heywood Street route for a further period of one month.

**Doncaster.**—The extension of tramway at Bentley, which has been carried out at a cost of £3,750 by Mr. J. W. Pearce, of Morecambe, was formally opened for traffic last week, after an inspection by the B. of T. Inspector.

**Edinburgh.**—At a meeting of the T.C. the Tramway Committee, on a proposal to take over the undertaking of the Colinton Tramway Co., asked power to negotiate with the company, the Edinburgh and District Tramway Co., the War Department and other parties interested. The convener of the Committee advised that the Council should wait till next meeting, when it would have before it the printed report from the town clerk on the whole matter. This was agreed to.

**Glasgow.**—As reported in the REVIEW recently, Glasgow Corporation gave limited powers to two committees to make general inquiries in connection with a proposal to erect a new bridge over the River Clyde in Glasgow, to relieve the congestion caused largely by the conveyance of tramway traffic in the centre of the city, and also to construct a dividing bridge lower down the river. A deputation has now been appointed to visit cities in which bridges suitable to Glasgow's requirements may be seen.

**Hull.**—The tramway employes are agitating for the reinstatement of a driver recently dismissed on account of a collision, and a general strike is threatened.

**Leeds.**—The people of the Farnley district, which is served by the railless traction system, are up in arms against the service, which they say is inefficient. They have ceased to grumble about the cars tearing up the roads, racking the passengers' nerves and splashing mud on people and buildings, have had a public meeting, which was addressed by the members for the district on the City Council, and have obtained 865 signatures to a petition asking for a better service. The proposals, which were put before the Tramways Committee by a deputation last week, include an increase in the number of cars, facilities for interchange of workmen's tickets both ways in case of breakdowns of the cars (which, it is alleged, are frequent), overlapping stages, a system of queues, and the provision of a waiting room at Moor Top.

**Leicester.**—The Corporation has initiated a service of pay-as-you-enter cars.

**Liverpool.**—A problem which is being considered by the Corporation Tramways Committee is to quicken the service of cars in the more congested parts of the city. At the present the Pierhead is the terminus for the majority of the cars, but the greater number of the passengers carried do not complete the journey to the landing stage, the cars both to and from the Pierhead and the business part of the city being comparatively empty, while considerable congestion exists in the city itself. A proposal has been brought forward to abolish in many cases the journey to the Pierhead, and return the cars more quickly through the town, which would have the effect of saving the present waste, and, at the same time, relieve the congestion by allowing a quicker service of cars on the various routes. Various proposals have also been suggested, with a view to avoiding duplication on the suburban routes, and it is also urged that the number of first-class cars is excessive, having regard to their returns.

**London.**—Last week trial runs were made over the recently electrified East London Railway, and the complete service is expected to be running on Monday next.

**New Zealand.**—The B.C. of New Plymouth has decided to take a poll of the ratepayers on a proposal to borrow £55,000 for the purpose of constructing electric tramways on the overhead system.

**South Africa.**—The Bloemfontein Corporation has now decided to proceed immediately with a railless traction system for the city at an approximate cost of £80,000.

**Wallasey.**—The Tramways Committee has recommended the Council to rescind the extension of the penny stages made 12 months ago, and to revert to the shorter stages.

**Wath (Yorks.).**—A ratepayers' meeting was held last week, which had been called by the chairman of the local Council with a view to obtaining the support of the ratepayers in the Council's opposition to the Mexborough and Swinton Tramways Co.'s Parliamentary Bill. The chairman explained that the opposition had arisen because the Mexborough and Swinton scheme did not embrace a wide enough area; the Wath Council desired the opinion of the ratepayers as to whether it would not be more to its advantage to attempt to run its own scheme of railless cars, instead of allowing the Mexborough and Swinton Co. to have a monopoly for 31 years, as was proposed in the Bill. The meeting decided to agree with the Council's opposition, and asked the Council to combine with neighbouring Councils for the establishment of a system of tramways under public control.

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## TELEGRAPH and TELEPHONE NOTES.

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**Australia.**—The application of the Marconi Co. for permission to inspect the wireless stations of the Commonwealth Government, in connection with the action for infringement of patents which is being brought against the Government by the company, was granted by the Federal High Court last week.

A full automatic service is to be established at Perth, W.A., and in Melbourne. The same course will be followed in other important centres when the present switchboards have to be replaced.

There are now eight wireless stations at work in Australia, of which six have been constructed by the Government staff under Mr. Baskill. Ten more should be completed by June 30th next.—*Australian Mining Standard*.

**Imperial Wireless System.**—Two actions against *Le Matin* by Mr. H. Samuel, the Postmaster-General, and Sir Rufus Isaacs, the Attorney-General, were before the Court of King's Bench, presided over by Mr. Justice Darling, on the 19th inst. The actions arose out of an article published in the *Matin* on February 14th, in which allegations were made as to the conduct of the plaintiffs in relation to the Marconi contract. The *Matin* having published a full apology, the two plaintiffs only desired the opportunity of making a public statement in the witness box as to their position.

Sir Edward Carson, K.C., M.P., who appeared for the plaintiffs, said that the statement complained of was this:—"Mr. Leo Maxse, the eminent editor of the 'National Review,' protested vehemently against the way in which this agreement had been concluded. He imputed that Mr. Herbert Samuel, the Postmaster-General, whose idea it was to enter into the negotiations with the company, had entered into an arrangement with Sir Rufus Isaacs, the Attorney-General, and brother of Mr. Godfrey Isaacs." It was an absolute falsehood, said Sir Edward, to say it was Mr. Herbert Samuel's idea to enter into negotiations with the Marconi Co. The Attorney-General had never had anything to do with it. It had been alleged that they had bought Marconi shares at an average price of about 50 fr., at which the shares were quoted before the opening of the negotiations with the Government, and had resold them at a profit rising to as much as 200 fr. a share, according as the negotiations enabled it to be foreseen that the contract would be concluded. Neither of them ever bought shares in the company either in their own name or any other name, nor did anyone buy shares for them, nor were they ever interested in any option or syndicate, or in any transaction whatever in relation to the shares of the company. There were other Marconi companies. The American company was an independent company, which could have no interest in the contract at all. That company erected stations in America, and had no interest in the English company, although the English company had shares in it. The American company, subsequently to the tender, proceeded to raise capital, having bought out certain interests in America and made other arrangements which rendered an extension of capital necessary. Even the suggestion of the issue of shares did not come until some weeks after the tender of the English company had been accepted, but the Attorney-General, having heard of the American company and these shares, bought 10,000 shares at the market price premium. At the time the Attorney-General bought the shares, the British company's shares were at the very highest figure they had reached, so that any suggestion that the purchase of the American shares had anything to do with the price of these shares was entirely out of the question. He sold some of them, and amongst others he sold 1,000 to Mr. Lloyd George and another 1,000 to the Master of Elibank, believing them to be a good investment. The Attorney-General had 6,400 shares, and at the present price was a loser upon the transaction by about £1,000 to £1,500.

Mr. Herbert Samuel, the Postmaster-General, then went into the witness box, and, in answer to Mr. F. E. Smith, K.C., he corroborated the statement of counsel; he said the course pursued was absolutely in accordance with all previous precedents relating to Post Office contracts.

Sir Rufus Isaacs also entered the witness box and stated that he never had anything to do with the negotiations for the contract and never knew of the negotiations until just a few days before the announcement was made on March 8th, 1912. He never bought a share in the Marconi Co., either before or after, or at any time. He had never held a share, or had any interest in a share, nor had he ever had an interest in an option or syndicate, either in his own name or anybody else's name. He never heard of the shares, or of the constitution of the company in America, until his brother returned about April 8th or 9th of last year. He then heard that the American company were issuing shares to raise new capital to carry out special arrangements that had been made for the purchase of the assets of a competing company—the United Wireless Co.—which had gone into liquidation in America, and also some important contracts which had been made with the Western Union Cable Co. He bought 10,000 of the shares at the market price, but previously he satisfied himself that they had no interest with the British Government. His purchase in the American company had nothing to do with raising the price of the shares. He sold 1,000 of his shares to Mr. Lloyd George and 1,000 to the Master of Elibank, who were great personal friends of his. He would not have gone into it unless he had been satisfied that it had nothing to do with the Marconi Co. He sold 3,570 shares, and that sale averaged a profit which eventually brought the whole transaction to his having 6,430 left out of the 10,000. The net result of the transaction was that he had made a loss of about £1,100 or £1,200 if he sold the shares at the present prices.

Mr. Campbell, K.C., appearing for *Le Matin*, described the circumstances under which the article complained of was written, and said that the moment the attention of his clients was called to it, they met it with an immediate apology and explanation.

Judgment was accordingly entered for the plaintiffs with an indemnity for their costs.

The Select Committee on the Marconi contract met on Thursday last week, and selected Sir Albert Spicer as chairman. The Committee met again on Monday, in private, and on Tuesday Sir Rufus

Isaacs, the Attorney-General, was examined regarding his purchase of American Marconi shares. His evidence was given in minute detail, but in substance was the same as that given in the libel action against *Le Matin*. The examination was continued on Thursday.

In reply to questions in the House of Commons, Mr. H. Samuel stated that the American Marconi Co. had no interest at all in the British Marconi Co., but that the British Co. had a large interest in the American Co. He explained that there was no similarity between the case of Mr. J. E. Taylor and that of the Attorney-General and the Chancellor of the Exchequer, and that the reduction in rank of Mr. Taylor would not be reconsidered.

**India.**—The wireless telegraph station at Lahore has just been opened, and the new station at Bombay will be ready very shortly.—*Indian Engineering*.

**Telephone Employés.**—The eighth annual conference of the Amalgamated Society of Telephone Employés was held in Glasgow last week; 70 delegates were present, representing 10,000 employés. The outgoing president, Mr. O. Preston, stated that if a plebiscite of male members of the staff were taken, the vote would undoubtedly be in favour of a return to the old order of things.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" to-day.

**VICTORIA.**—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" to-day.

April 15th.—1,020,000 arc lamp carbons, 26,900 carbon-filament incandescent lamps, and bare hard-drawn copper cables, for the Melbourne City Council. See "Official Notices" to-day.

**SYDNEY.**—May 12th. Fibre conduit for the City Council. May 26th.—Meters and glazed stoneware bridges. July 7th.—Arc lamp carbons. Specifications 108. 6d. for each section, from City Electrical Engineer's Department.—*Australian Mining Standard*.

**Ayr.**—Corporation tramways. Tenders for work in connection with Hawk Hill extension—permanent way construction, road widening, &c. Mr. J. Young, engineer, Town Buildings, Ayr.

**Belgium.**—March 29th. Municipal authorities of Ixelles-lez-Bruxelles. Armoured cables necessary for the low-tension distribution service.

**Blackpool.**—High and low-tension cables and transformer switch pillars. See "Official Notices" March 14th.

**Buenos Ayres.**—April 15th. Supply of motors, cables, dynamos and other accessories for motive power. Oficina de la Direccion General de Minas, Geologia e Hidrologia, Buenos Ayres.

**Chorley.**—Board of Guardians. Tenders for a complete telephone installation for the workhouse.

**Croydon.**—March 31st. Stores for a year, for the Corporation Electricity Department. See "Official Notices" Feb. 21st

**Douglas (Isle of Man).**—March 31st. About 190 tons of good steam coal for the Corporation tramways department. Mr. A. Robertson, Town Clerk.

**Dundee.**—April 4th. E.H.T. switchgear and transformers, for the Corporation. See "Official Notices" to-day.

The Corporation electricity department invites tenders for the supply of steel sashes and frames, and for the supply and erection of opening casements, for extensions at Carolina Port generating station. Mr. H. Richardson, general manager and engineer.

**Edinburgh.**—Electric lighting for the new Veterinary College buildings at Summerhall. Mr. D. M'Arthy, architect, 25, Frederick Street, Edinburgh. Deposit two guineas, returnable.

March 31st.—Coal for the Corporation electricity supply department for 3 or 12 months. Engineer's Office, Dewar Place.

**France.**—The electrical department of the French State Railways has just invited tenders for the supply of eight underground electric cables to transmit three-phase 15,000-volt current between the Nord power station in Paris and the sub-station at La Garenne.

April 5th.—The Bureaux du Service Electrique (Second Division of the French State Railways in Paris (43, Rue de Rome) are inviting tenders for the supply of the switchboards required on the alternating side at the transformer station at the Champs de Mars, Paris.

**Glasgow.**—The Tramways Sub-Committee on Works and Stores of the T.C. is inviting offers required under the annual contracts. Mr. James Dalrymple, general manager, Headquarters, Bath Street.

**Hornsey.**—March 31st. Natural draught cooling tower for the T.C. electricity works. See "Official Notices" March 14th.

**Italy.**—The Azienda Elettrica Municipale, of Rome, has just invited tenders for the supply of about 350 km. of copper conductors required in connection with the electric transmission installation between Castelmadama and Rome.

**Keighley.**—(a) Foundation work for a 2,000-kw. turbo-alternator and condensing plant at the electricity works; (b) rolled steel joists in connection with the above. Drawings and specifications obtainable from Mr. H. Webber, Borough Electrical Engineer, Coney Lane, Keighley.

**Limerick.**—April 10th. Stores and materials for a year, for the Borough electricity department. See "Official Notices" to-day.

**Lisnaskea (Co. Fermanagh).**—April 14th. Gas engine and suction gas plant, dynamo and booster, battery, wood poles, overhead mains, &c., and switchboard, for the Lisnaskea Electric Light Co., Ltd. See "Official Notices" to-day.

**London.**—L.C.C.—April 3rd. Reconstruction and re-winding of seventeen 300-kw. synchronous motor-generators and three 500-kw. induction motor-generators. See "Official Notices" March 14th.

April 2nd.—Electrical installation at the Avery Hill Hostels, Eltham, S.E. See "Official Notices" March 21st.

**BATTERSEA.**—April 1st. Coal for a year, for the B.C. Electricity Department. See "Official Notices" March 14th.

**LEWISHAM.**—March 31st. Guardians. Wiring and fittings for 500 lights at the workhouse, and 500 lights at the infirmary, in High Street, Lewisham, S.E. Specifications at Union Offices, 394, High Street.

**Manchester.**—April 1st. Electric fittings and wires, &c., for a year, for the Lancs. and Yorks Railway Co. Mr. Waring, Stores Department, Osborne Street, Manchester.

April 15th.—Tramways Committee. Tenders for roofing over of avenues at the Hyde Road car works, Manchester. Mr. J. M. McElroy, General Manager.

**Maryborough.**—April 9th. 1,120-amp.-hour accumulator, for the District Asylum. See "Official Notices" to-day.

**Peterborough.**—March 31st. 1,023 yards of cable, for the Corporation. See "Official Notices" March 21st.

**Salford.**—March 31st. Stores, &c., for the Corporation Electricity Department. See "Official Notices" March 21st.

April 10th.—Extra-high-tension switchgear, for the Corporation. See "Official Notices" to-day.

**Shanghai.**—April 3rd. Extra-high-tension and low-tension switchgear for sub-stations. See "Official Notices" March 14th.

**Spain.**—The municipal authorities of Epila (province of Zaragoza) have just invited tenders for the concession for the electric lighting of the town during a period of 15 years.

**Stalybridge.**—4,500 yards E.H.T. three-core lead-covered cable. See "Official Notices" March 14th.

**West Ham.**—April 3rd. Electric light installation at the new workshops, Aldersbrook Road, Wanstead, for the Guardians. See "Official Notices" to-day.

**Wigan.**—March 31st. Materials and stores for the Corporation Light and Tramways Departments. See "Official Notices" March 14th.

**York.**—April 5th. The Board of Guardians is prepared to receive tenders for (1) a dug well round an existing bore hole, an additional cast-iron liner down the bore hole, a deep well pump for 5,000 gallons per hour, and two small centrifugal pumps and electric motors; and (2) water-softening plant (without heat) dealing with 5,000 gallons per hour. Tenders to the Clerk (Mr. George Sykes), Union Offices, Museum Street, York.

## CLOSED.

**Ashton-under-Lyne.**—The Electricity Committee has provisionally accepted the tender of Messrs. Switchgear & Cowans, Ltd., for high-tension switchgear to specification.

**Atherton.**—The U.D.C. has accepted the tender of Messrs. Manchell, Barratt & Co. for two transformers.

**Bristol.**—The Docks Committee has accepted the tender of Buchanan & Curwen for the electric light installation at Bathurst and Prince's sheds.

**Burnley.**—The Guardians, on March 20th, entered into their half-yearly contracts. These included one for electrical requirements with Messrs. Simpson Bros.

**Chesterfield.**—The T.C. has accepted the tender of the British Westinghouse Co., Ltd., for a 500-kw. rotary converter, speed 600 R.P.M., and a 500-K.V.A. transformer, at £1,461.

**Australia.**—According to the *Australian Mining Standard*, the following contracts have been placed:—

**HOBART.**—Postmaster-General's Department:—

46 chains cable, 260 pairs, £125.—B.I. and Helsby Cables, Ltd.  
118 chains cable, 208 pairs, £285; 61 chains cable, 160 pairs, £311.—Australian Metal Co., Ltd.

**VICTORIAN RAILWAYS.** Electrical equipment of Melbourne suburban system. (This matter has already been mentioned in the ELECTRICAL REVIEW):—

Power station, buildings, boiler house equipment and other plant—deposit, £5,455 10s.—£258,230.—Babcock & Wilcox, Ltd.  
Equipment of suburban stations—deposit, £1,200—at rates.—Sicmens Bros. Dynamo Works, Ltd.  
Turbo-alternators and transformers—deposit, £9,756—£122,235.—C. A. Parsons & Co.  
Train equipment's—deposit, £16,901—£676,180.—General Electric Co. (U.S.A.).

**NEW SOUTH WALES.**—Public Works Department. Building works:—

Construction of electric lifts, Registrar-General's new building, £2,035.—Standard Waygood, Ltd.  
Railway and tramway construction works.—100 tons of fishbolts for 80-lb. rails, £15 per ton.—H. W. Cameron & Co., Sydney.

**SYDNEY.**—Municipal Council:—

Maximum demand indicators, £308.—W. G. Watson & Co.  
Transformers, £1,239.—Australian General Electric Co.

**Clacton-on-Sea.**—The U.D.C. has accepted the tender of the Consolidated Diesel Co., Ltd., for an engine and accessories and switchboard, at £4,840, and a Crompton dynamo, at £710; and that of Messrs. Johnson & Phillips, Ltd., for cables for extensions, at £56.

**France.**—The adjudications on the tenders returnable on March 11th, for telephone cables (in three lots) for the Post and Telegraph Department, Paris, have resulted in the rejection of all the offers made, owing to them exceeding the price limit previously fixed. The lowest tender for lot 1 (10,000 metres of copper cable and 28-pairs of silk and cotton-bound conductors) was 1,900 fr. per kilometre, by M. Grammont. The lowest tender for lot 2 for similar requirements, was 1,885 fr. by Messrs. Geoffrey & Delore, the India-Rubber, Gutta-Percha and Telegraph Works Co.'s tender being 1,925 fr. per kilometre. For lot 3 (15,000 metres and 14 pairs), the lowest tender was that of the Tréfileries du Havre, 1,210 fr.

The tenders invited for the same date, for extensible commutator telephone tables, were also rejected for the same reasons. The lowest tender was that of the Société des Ouvriers en Instruments de Précision, 50,126 fr. for two lots, the Thomson-Houston quotation being 52,700 fr. for two lots.

**Germany.**—Messrs. Heh. Riecke & Co., of Kassel, have submitted the lowest tender to the Prussian State Railway authorities of Munster for the supply and erection of five 80-ton electrically-operated cranes.

**Glasgow.**—The T.C.'s Tramways Committee on Works and Stores has recommended acceptance of the following offers:—

Porcelain insulators.—Bullers, Ltd.  
Copper bonds.—R. R. Todd.  
Winding armature coils.—Manchester Armature Coil Co.  
Winding commutators.—Mavor & Coulson.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government departments named:—

### ADMIRALTY: CONTRACT BRANCH.

Bell, bell fittings, gongs, &c.—Hawkers, Ltd.; India-Rubber, Gutta-Percha, &c., Co., Ltd.; McGeoch & Co., Ltd.; Mechan & Sons, Ltd.; Player and Mitchell, Reid Bros., Engineers, Ltd.; Spagnolotti, Ltd.  
Brackets, pendants, &c.—Evered & Co., Ltd.; Edison & Swan, &c., Co., Ltd.; Gabriel & Co.; General Electric Co., Ltd.; Mechan & Sons, Ltd.; W. McGeoch & Co., Ltd.; Player & Mitchell, Ltd.; David Shanks and Co., Ltd.; Spagnolotti, Ltd.  
Lampholders and insulators for.—Edison & Swan, &c., Co., Ltd.; General Electric Co., Ltd.; W. McGeoch & Co., Ltd.  
Incandescent lamps.—British Union Lamp Works, Ltd.; British Thomson-Houston Co., Ltd.; Crayssico, Ltd.; Edison & Swan, &c., Co., Ltd.; General Electric Co., Ltd.; Rugby Lamp Co., Ltd.; Pope's Electric Lamp Co., Ltd.

### WAR OFFICE.

Electric dry cells.—Atlas Carbon and Battery Co., Ltd.; Siemens Bros. and Co., Ltd.  
Installation of electric light, officers' houses, Tidworth.—Malcolm and Allan, Ltd.

### INDIA OFFICE: STORE DEPARTMENT.

Pipettes, &c.—Chloride Electrical Storage Co.

### CROWN AGENTS FOR THE COLONIES.

Cable.—W. T. Henley's Telegraph Works Co., Ltd.  
Dynamo sets.—Britannia Engineering Co., Ltd.  
Switchboard meter equipments.—Western Electric Co.

### POST OFFICE.

Protective apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; International Electric Co.  
Telegraphic apparatus.—B.I. and Helsby Cables, Ltd.  
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; British Insulated and Helsby Cables, Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Crystalac Manufacturing Co., Ltd.; Edison and Swan United E.L. Co., Ltd.; General Electric Co., Ltd.; International Electric Co.; London Electric Wire Co. and Smiths, Ltd.; Siemens Bros. & Co., Ltd.; Spagnolotti, Ltd.; Western Electric Co., Ltd.  
Telephonic cable.—B.I. and Helsby Cables, Ltd.; Johnson & Phillips, Ltd.  
Stoneware ducts.—Albion Clay Co., Ltd.  
New wireless station, Malin Head.—Robert Colhoun.  
Power plant and wiring at Malin Head wireless telegraph station.—Westminster Engineering Co., Ltd.  
Steel masts at Valencia wireless telegraph station.—Marconi's Wireless Telegraph Co., Ltd.  
Telephone exchange equipment, Leith; alterations and additions, Mayfair Exchange, London; Information desks and alterations, City and Central Exchanges, London.—Western Electric Co., Ltd.  
Telephone exchange equipment, Barnsley and Helensburgh.—Peel-Conner Telephone Works, Ltd.

**Herne Bay.**—The U.D.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, for an installation of electric fire alarms, at £27 a year, for five years.

**Hornsey.**—The tender of the Reason Manufacturing Co., Ltd., for electrolytic meters for the ensuing year, has been accepted by the Council.

Messrs. Chamberlain & Hookham, Ltd., have also obtained a contract for meters from the B.C.

**Huddersfield.**—The Electricity Committee has accepted the following tenders:—

- Mark Brook.—New chimney at electricity works.
- H. Brook & Co.—Tanks.

**Hford.**—The U.D.C. has accepted the following tenders for coal for the electricity works:—

- Bradbury, Son & Co., Ltd.—2,000 tons of Gedling small peas, 14s. 6d. per ton.
- E. Foster & Co.—7,000 tons of libleck medium peas, 15s. 6d. per ton, and 1,000 tons of Tamworth double-acreoned nuts, at 10s. 2d. per ton.

The Education Committee has accepted the tender of Messrs. Ellis & Ward, Ltd., for the electric light installation at South Park Schools, at £157.

**London.**—HAMMERSMITH.—As the result of tests made of propellant meters recently tendered for, the tender of Messrs. Chamberlain & Hookham was recommended for acceptance.

The tenders received for arc lamp carbons were:—

Electrical Engineering and Equipment Co., Ltd.	(accepted) £137
Ship Carbons .. .. .	149
W. Geipel & Co. .. .. .	148
J. G. Wilson .. .. .	153
Siemens Bros. Dynamo Works, Ltd. .. .. .	154
H. G. Mayer & Co. .. .. .	170
Elan Electrical Co. .. .. .	178
General Electric Co., Ltd. .. .. .	188
Crompton & Co., Ltd. .. .. .	207

\* Net; others less 2½ per cent.

**BATTERSEA.**—The B.C. has accepted the following tenders for annual supplies to the Electricity Department:—

- Carbon lamps.—British Thomson-Houston Co., Ltd.
- Oils.—Price's Co., Ltd.
- Turbine oil.—A. Duckham & Co., Ltd.
- Bitumen.—Callender's Cable and Construction Co., Ltd.
- Compound.—Dussek Bitumen Co.
- Engine room stores and ironmongery, &c.—Pryke & Palmer.
- Packings.—R. Meldam.

**PULHAM.**—The B.C. has accepted the following tenders for annual supplies:—

- Carbon brushes.—W. Geipel & Co.
- House out-ends and service boxes.—B.I. and Helsby Cables, Ltd.; Sykes and Sugden.
- Glass globes.—City Glass Co.
- Electrical goods.—British Thomson-Houston Co., Ltd; Siemens Bros. Dynamo Works; W. T. Henley's Telegraph Works Co., Ltd.
- Carbons.—Sloan Electrical Co. (for about seven months only).
- Frames and covers.—W. T. Henley's Telegraph Works Co., Ltd.

**EALING.**—At an estimated cost of £130, with an additional £15 for foundation work and fitting, Messrs. Weir, Ltd., are to be requested to provide at the electricity works, a Weir boiler feed pump to take the place of the two small ones which have been working for nearly twenty years and are now almost unfit for further service.

**STOKE NEWINGTON.**—The tender of the London Electron Works Co., Ltd., has been accepted for the purchase and removal of old tinned material and galvanised iron, &c., from the Stoke Newington destructor for three years, at £1 10s. per ton for tinned material, and 12s. 6d. for the iron, &c.

**BERMONDSEY.**—The B.C. has accepted tenders by the following firms:—

- Reason Manufacturing Co.—Time switches and demand indicators.
- E. H. Cripps.—Meter boards.
- Stern, Smeuborn Oil Co., and W. B. Dink & Co.—Engine oils.
- Thos. Wragg & Co., Ltd.—Conduits and troughing.
- Sykes & Sugden, Ltd.—Street frames and covers, &c.
- Chamberlain & Hookham, Ltd.—Meters, fuses and time switches.
- General Electric Co., Ltd.—Cut-outs, &c.
- Union Cable Co., Ltd.—Paper cable, lead-covered.
- Liverpool Electric Cable Co., Ltd.—Rubber cable.
- C. Macintosh & Co., Ltd.—Lead-covered rubber cable.
- Siemens Bros. & Co., Ltd.—Lead-covered cable.
- Craig, Sharp, Ltd.—Joining material.

**Manchester.**—The B. of G. has placed a contract with Messrs. Anderson, Ltd., Salford, for installing electric light at Crumpsall Workhouse.

**New Zealand.**—Messrs. Hick-Diesel Oil Engines, Ltd., have received the following Colonial orders for their oil engines:—

- To Aroha Borough Council, N.Z.—One of 240 h.p.
- Corporation of Thames, N.Z.—Two of 160 h.p.

**Norwich.**—The T.C. has accepted the tender of Messrs. Alexander Wilson, of Aberdeen, for a two-cylinder electric motor-driven air compressor for New Mills power station, at £421.

**Salford.**—The Education Committee has accepted the tender of Messrs. Willoughby & Wilcox for installing the electric light at the technical laboratories and workshops, at £40; and that of Messrs. Davenport, Sparrow & Co. for similar work at the juvenile employment bureau.

**York.**—The Cable Accessories Co., Ltd., have secured the contract for supplying brackets and fittings for lighting the streets of the city.

**Southend-on-Sea.**—The T.C. has accepted the following tenders:—

- Edgar Allen & Co., Ltd.—30 in. galvanized iron tongue for tramways, £50.
- Worthington & Co.—Poles, brackets, trolley wire, seat on pillars and bands, £801.
- Mr. D. H. Rose.—Gun-metal overhead line material, £41.
- Alton & Co.—Steam pipes, £95, and exhaust pipes, £76.
- Hopkinson & Co.—Steam valves, £76.
- Glentfield & Kennedy.—Exhaust valves, £23.

The British "Niagara" Boiler Co., Ltd., has secured from the Corporation a contract for two 25,000 lb. capacity boilers, complete with Niagause stokers, superheaters and forced draught fan equipment, also Green's economisers and other work.

**FORTHCOMING EVENTS.**

**Manchester Electro-Harmonic Society.**—Friday, March 28th. At the Albion Hotel, Manchester. Last concert of the season.

**Association of Mining Electrical Engineers (South Wales Branch—Western Section).**—Baurday, March 29th. At 7.30 p.m. in the Grammar School, Swansea. Lecture on "Turbine Engines, their Construction, Installation and Maintenance," by Mr. A. L. Ohlson.

(South Wales Branch—Eastern Section).—Saturday, March 29th. At 5 p.m. at the Carlton Cafe, Cardiff. Discussion on paper on "The Speed Control of Three-phase Motors," by Mr. S. Blmons.

**Institution of Electrical Engineers (Scottish Section).**—Annual general meeting postponed from April 8th to April 15th.

(Newcastle Section).—Monday, March 31st. At 7.30 p.m. at the Armstrong College, Newcastle. Paper on "Telephonic Development," by Mr. J. R. Andrews.

(Manchester Section).—Tuesday, April 1st. At 7.30 p.m. at the University, Manchester. Paper on "Self-synchronising Machines," by Dr. E. Rosenberg.

**Association of Electrical Station Engineers (Glasgow Branch).**—Wednesday, April 2nd. At 7.45 p.m. Meeting at the Y.M.C.A., Bothwell Street, Glasgow.

**Electro-Harmonic Society.**—Friday, April 4th. Kieg's Hall, Holborn Restaurant. Last smoker of the season.

**Salford Technical and Engineering Society.**—Saturday, April 5th. At 7 p.m. at the Royal Technical Institute, Salford. Paper on "Modern Gas Engines," by Mr. K. Cox.

**THE ELECTRICAL ENGINEERS (LONDON DIVISION).**

Commanding Officer—Lieut.-Col. H. M. LEAF.

The following orders have been issued:—

- Friday, March 28th.—"D" Company. Company training, 7 to 10 p.m.
- Saturday, March 29th.—Headquarters will be opened from 10 a.m. till 12 noon for regimental business only.
- Monday, March 31st.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.
- Tuesday, April 1st.—"B" Company. Company training, 7 to 10 p.m.
- Thursday, April 3rd.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.
- Friday, April 4th.—"D" Company. Company training, 7 to 10 p.m.
- Saturday, April 5th.—Headquarters will be opened for regimental business from 10 a.m. till noon.

(Signed) J. H. S. PHILLIPS, Major.  
For Officer commanding L.E.E.

**NOTES.**

**The L.C.C. Highways Committee.**—The members of the new Highways Committee (which, as our readers know, took after the electric tramway system) will be as under:—

Cotton, H. E. A.	Kenard, Cpt. A.C.H.	Scott, A. H.
Evans, B. B.	Lidiard, H.	Squires, W. J.
Goodrich, A. O.	Monk Bretton, Lord	Ward, Henry
Gordon, H. H.	Prestige, J. T.	White, Sir Edward
Hume, G. H.	Rawson, A. C.	Yeo, A. W.
Hunt, William		

**Electric Motor-Vehicle Construction in the United States.**—The Edison Electric Vehicle Co., of America, is the name of a new concern which has just been formed at Lawrence, Mass., to manufacture industrial motor-vehicles of the electric type. The vehicles will all be fitted with Edison batteries.

**Rugby Engineering Society Conversazione.**—The third Conversazione held under the auspices of the Rugby Engineering Society took place on the evening of the 14th inst. in the Co-operative Hall, Rugby. This function is held about every two years, and is one of the most successful and interesting displays of the results of engineering progress and scientific research in the Midlands. The large hall was used for the display of exhibits, and of the two smaller halls attached, one was reserved for a lecture and demonstration theatre—there being during the evening continuous demonstrations of the Pathscope, by the courtesy of the Pathscope Co., interspersed with two very interesting lectures: one by Mr. E. B. Wedmore, entitled "Infinity," which, in spite of the awe-inspiring title, thanks to the wit and humour of the lecturer, was much enjoyed by a numerous and appreciative audience. The second lecture was by Mr. F. A. Haigh, on "Coloured Photography," in which a demonstration was given with suitable examples of this interesting development of the art. The second small hall was reserved for refreshments, and a most instructive and enjoyable evening was spent by some 400 members and their friends, a continuous programme of music being provided in the main hall throughout the evening by Mr. Dudley's orchestra. The Marconi Co. sent down a complete wireless installation, with one of their engineers to demonstrate the working of the equipment. There was an excellent demonstration of the X-rays, with specimen photographs, &c. Messrs. Alfred Herbert, Ltd., of Coventry, gave a practical demonstration of the photostat, using mercury lamps. Mr. Robert W. Paul, of London, exhibited a comprehensive collection of electrical instruments, and the Cambridge Scientific Instrument Co. sent a very comprehensive exhibit of their specialities. One of the most popular demonstrations was that of the effect of rotary alternating magnetic fields, by means of apparatus kindly loaned by Dr. Sumpner, of Birmingham, and many other very interesting exhibits were shown. Great credit is due to the Committee responsible for the arrangements, and particularly to the joint hon. secretaries, Messrs. R. G. Hosking and J. M. Ferguson, for having so successfully organised a conversazione which, on its social, as well as its scientific side, it would be difficult to surpass.

**Strike at Barrow.**—There has recently been a strike of Corporation employés in progress at Barrow-in-Furness. Although most of the workmen in nearly all departments went out on strike, the whole of the men in the electricity department, with the exception of two or three casual labourers, who were interfered with while at work, remained loyal, in spite of desperate efforts on the part of the Labour Party and agitators to get them to go out on strike. As a result, there was no interference of any sort with the electricity supply, and a number of Mr. Burnett's staff assisted at the gasworks, which, for some days, were largely run by the officials from the various departments. The gas supply was maintained at a reduced pressure, but none of the gas street lamps were lit. Fortunately, however, most of the main thoroughfares are lighted by electricity, and the fact that the electricity supply was maintained, of course, made the inconvenience caused by the strike very much less than it would otherwise have been. Under ordinary circumstances there is a keen but friendly rivalry between the electricity and gas departments, but, in the present instance, the former co-operated with and assisted the gas department in every possible way in the fight against their "common enemy—the labour agitator."

Later information received just as we go to press states that the strike still continues. A few of the men have returned to work, and the places of some have been filled. The gas supply is being maintained at reduced pressure by volunteers, but none of the gas street lamps are yet lit.

**Copper.**—Messrs. H. R. Merton's mid-monthly statistical circular, which is now to hand, shows a drop, during the fortnight ending March 15th, of 1,034 tons in visible supplies. This includes 932 tons withdrawn from English ports. Dutch stocks (also included) are up 850 tons, and Hamburg stocks 125 tons. Deliveries, at 24,379 for the fortnight, will, if continued at the same rate, show a fairly brisk trade on the month. North America's contribution is high, Spain's very low, Chile shipments average, and Australian the same. The world's supply figures for the end of February again show an increase (1,172 tons), though not so large as the preceding one. At 99,273 tons they stand higher than they have done since 1911. Stock in American producers' hands on February 28th, however, was 100 tons less than on January 30th, the increase in world's supplies, therefore, depending on the increase in Dutch and German stocks. Without these the European supplies are 2,009 tons down for the half-month, and the combined visible supply lost 2,452 tons during February.

**Charge of Receiving.**—At the London Sessions on 17th inst. Abraham Viner, a rubber dealer of Walworth, was charged with receiving six magnetos belonging to the Bosch Magneto Co. According to the *Morning Advertiser's* report, complaints were made that the company's consignments of magnetos to Australia arrived short of the proper number, paving stones of about the same weight having been substituted. There was no direct evidence to show when the cases were tampered with, but investigations led to the discovery that the prisoner had disposed of six of the magnetos at much below cost price. The accused was found guilty of receiving one magneto, and he was remanded in custody until April 10th, when the judge will give his decision.

**The Batti-Wallahs.**—The eighth annual dinner of the Batti-Wallahs' Society was held on Saturday, March 15th. The toast of "The King" constituted the toast list, and Mr. Collis, the retiring President, who took the chair, pointed out that there was no necessity for him to make a speech, since all he could say about

the Society was to be found in the menu-programme and the Batti-Wallahs' *Journal*, the second number of which was published in time for distribution at the dinner. We understand that Mr. Robinson, the entertainment secretary, displayed originality in stage-managing the whole affair. The menu took the shape of a uniform cap and inside there were amusing illustrations depicting the seven ages in the life of an electrical engineer. Mrs. J. Corneille, Mr. Martin Muir, Miss Ada Fox, Mr. Olley Oakley, Mr. Ernest Pike and Mr. Louis Nikola entertained the guests. During the course of the evening Mr. J. Snow Huddleston, the President for the ensuing year, who had a previous appointment, called in, and, in response to a general request, gave a short speech. We are informed that "there was a record attendance, in spite of the unavoidable clashing of dates."

**A Glasgow Electrical Exhibition.**—The Glasgow Corporation Electricity Department is organising an Electrical Exhibition (incorporating engineering and machinery) to be held from Thursday, October 23rd, to Saturday, November 15th, inclusive. An official preliminary circular, issued by the general manager (Mr. James M. Freer, 38, Bath Street, Glasgow), states that the scope of the exhibition will embrace lighting, heating and power, and a special section will be devoted to appliances for domestic purposes. Careful attention will be given to a section illustrating electrical applications to light railways, mining, textile, and every branch of manufacture. "The exhibition will afford a unique opportunity to engineering and machinery manufacturers to exhibit their specialities in conjunction with electric power appliances. The management will make special endeavours to bring the exhibition to the notice of likely users of electrical equipment in all parts of Scotland and the North of Ireland." The complete prospectus will be circulated a few weeks hence.

**Association of Electrical Station Engineers.**—A meeting was held recently at the Mechanics' Institute, Bradford; 16 gentlemen were present, and these included representatives from Colne, Dewsbury and Keighley, as well as Bradford. It was unanimously agreed that a branch of the A.E.S.E. be formed for Bradford and district. An hon. secretary was appointed, and it was decided to form a committee of 12. A number was elected from those gentlemen present, and a few vacancies were left to be filled by representatives of other districts around Bradford, who, it is hoped, will attend at the next meeting.

It was proposed that when the A.E.S.E. gets into working order, a magazine be published and sent to members. It was also proposed that the A.E.S.E. become incorporated.

All the gentlemen present promised to make application for membership at once if they had not already done so, and to do their best to obtain members; those from outlying districts promised to canvass the particular districts from which they came.

The next meeting was provisionally arranged for April 16th, and it is hoped that there will be a larger attendance.

A meeting was held at the Amalgamated Society of Engineers' premises, Mount Pleasant, Liverpool, on Thursday last. There was a representative attendance, and it was unanimously resolved that a branch be formed for Liverpool district and the Cheshire side of the Mersey. Mr. A. Chas. Black was elected hon. secretary, with Mr. F. A. Taylor hon. assistant secretary, and a committee of seven was appointed for the time being. It was resolved that the next meeting be held in about two weeks' time.

**Alleged Fraud.**—On 19th inst., at Marlborough Street Police Court, Horace Gustave Ménage, 31, described as an electrical engineer, living in Junction Road, Upper Holloway, was charged with obtaining on divers dates between November, 1912, and January, 1913, with intent to defraud, a quantity of electrical accessories of the value of £21 8s. 11d. from Walter James Spencer and others of the Sun Electrical Co., 118, Charing Cross Road, W.C.

According to a report in the *Morning Advertiser*, Mr. R. T. Smith, who prosecuted, said that the prisoner in 1902 entered into an agreement with the Telephone Instalment System Co., Ltd., of High Holborn, and by the terms of it he was forbidden to order any goods for that firm unless their printed forms, duly signed by the manager, managing director, or the secretary, were used. It was alleged that the accused disregarded this arrangement, and ordered goods from the Sun Electrical Co., representing that they were required by the Telephone Instalment System Co. In this way he obtained goods of the value of £21 8s. 11d., which he appeared to have applied to his own use. Mr. Smith said he also proposed, in addition, to charge the prisoner with forgery, he having altered a genuine order and made an addition to it.

Mr. R. Bos, managing director of the Telephone Instalment System Co., said that by the agreement entered into with his company the prisoner was to manage the electrical department, and was to have a third of the profits of that department over and above the cost of the work. He was not allowed to order goods for them unless the printed forms of the company, signed by the manager, managing director, or secretary, were used. The goods referred to in the charge had not been ordered by them. The business of the company was to supply telephones on the instalment system, and also to carry out work in connection with telephones.

Mr. Denman, on the application of Mr. Lewis, remanded the prisoner, allowing bail in two sureties of £30 each, or in one in the sum of £60.

**Edison Battery Car for Glasgow E.L. Department.**—The electrically propelled motor-van which the Electricity Committee of the Corporation has purchased has a load capacity of 1 ton, and is equipped with an Edison storage battery. The energy cost for a run of 40 miles is said to be less than 1d. a mile.

(Continued on page 527.)

## POWER SUPPLY ON THE RAND.

On Thursday, March 13th, a paper was read before the Institution of Electrical Engineers on this subject, by Mr. A. E. Hadley, M.I.E.E., managing director of the Victoria Falls and Transvaal Power Co., Ltd., which was formed at the end of 1906, with the object of supplying power in South Africa and Rhodesia and of acquiring the concessional rights to develop the Victoria Falls. We give below an abstract of the paper, together with reproductions of the lantern slides, for the use of which we are indebted to the courtesy of the author.



FIG. 1.—EXTERIOR OF ROSHERVILLE GENERATING STATION.

Under the original proposal a supply to the Rand was to be given partly by transmitting power from the Victoria Falls, 700 miles distant, and partly by steam generating stations located on the reef. The author became associated with the company shortly after its formation, and after its

original proposal had been modified through giving up the plan to supply part of the requirements of the Rand with power from the Falls.

The great demand for power on the Witwatersrand has arisen through the extraordinarily successful development of the gold mines on the reef, which, although only discovered in 1886, now produce 33 per cent. of the world's output of gold. Further, it is estimated by the leaders of the gold-mining industry that the work of raising gold will still be in progress on the Rand 100 years hence.

Turning for a moment to the history of electric power on the Rand, a few details will be of interest. Siemens and Halske were the first to obtain a concession in 1894, and formed the Rand Central Electric Works, Ltd., in 1895, which had a plant aggregating 3,200 kw. capacity in 1906.



FIG. 2.—ENGINE ROOM AT ROSHERVILLE POWER STATION.

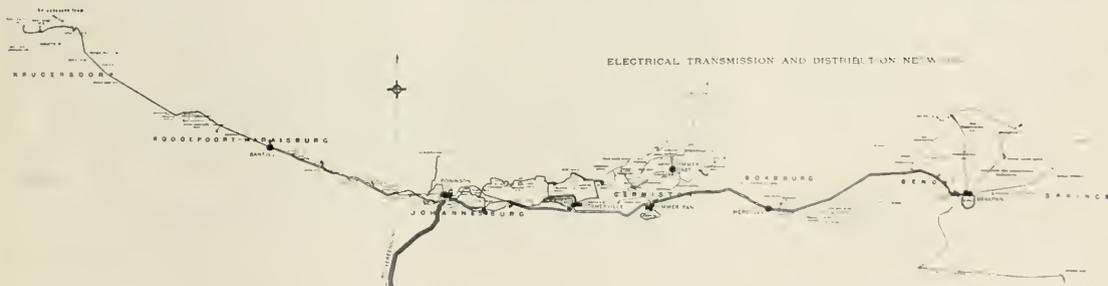


FIG. 3.—GENERAL PLAN OF NETWORK OF THE VICTORIA FALLS AND TRANSSVAAL POWER CO.

Another concession was obtained by the Simmer & Jack mine in 1897, from which the General Electric Power Co. was established in 1903 with plant having a capacity of 2,500 kw. In 1905 Messrs. Lewis & Marks, having in view the possibility of supplying the Rand from their coal-fields at Vereeniging, 35 miles south, commenced obtaining wayleaves for a pole line, while certain European manufacturing companies sent out representatives to report on the prospects.

The Victoria Falls Co. ultimately took over the two existing supply companies in 1907, and purchased the Vereeniging wayleaves from Messrs. Lewis & Marks, at the same time entering into an agreement with them for the right to establish a power station at Vereeniging. In 1907, pending the installation of modern plant, a supply totalling 4,000 kw. was given from the existing steam stations which had been purchased.

As soon as it was appreciated that a cheap power supply was available the mining groups entered into contracts with

the company, and the demands for power have since increased so quickly that it has throughout been the greatest difficulty

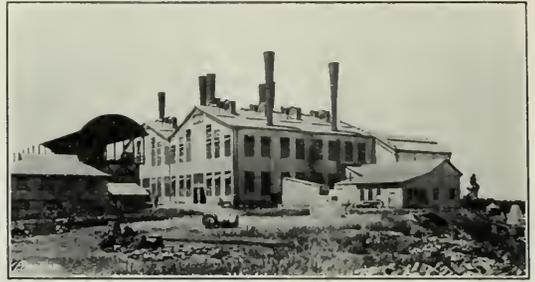


FIG. 4.—EXTERIOR OF GENERATING STATION AT SIMMER PAN.

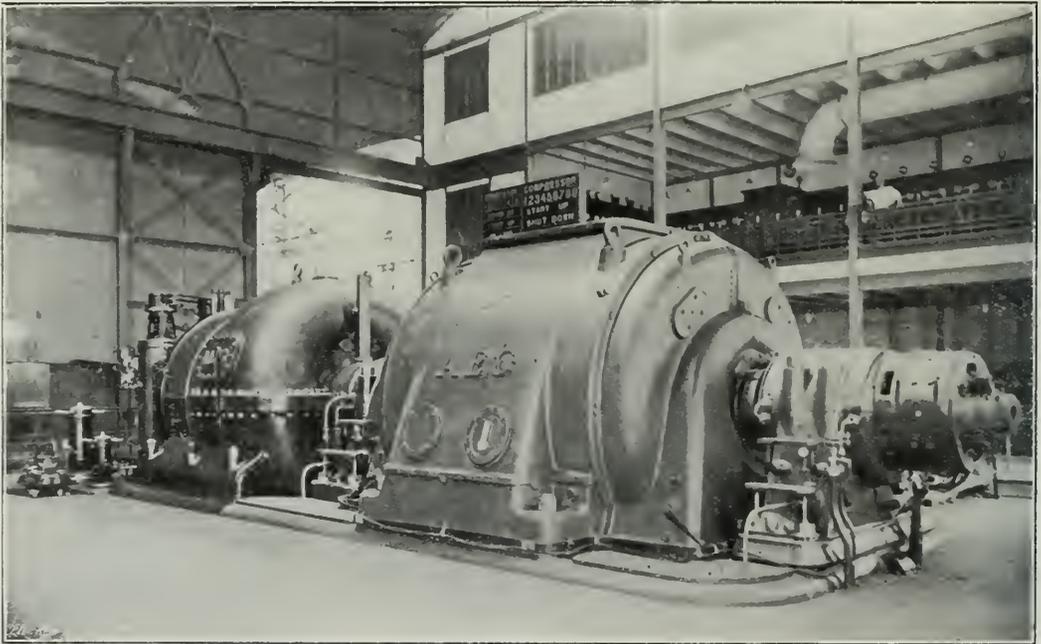


FIG. 5.—TURBO-GENERATOR OF 12,000 K.V.A.

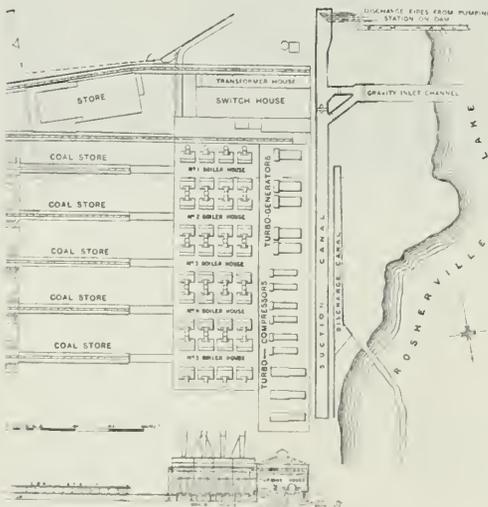


FIG. 6.—PLAN OF ROSHERVILLE POWER STATION.

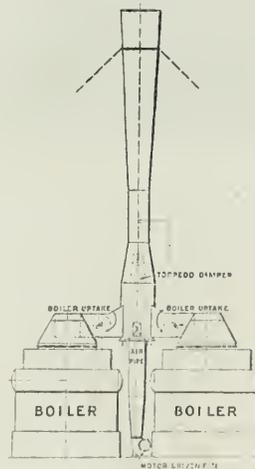


FIG. 7.—PRATT SYSTEM OF BOILER DRAUGHT.

for the company to raise capital and install plant rapidly enough to satisfy the demand.

In 1908 the largest group of mines, viz., that controlled by the Rand Mines, Ltd., and Messrs. Eckstein & Co., decided to change over their mines to electric driving. In addition to the supply of electricity to this group of mines, the conditions called for the supply of compressed air for working the rock drills.

The peak load of the combined undertaking has reached 88,000 kw., and the sales average 1,350,000 units per day.

These figures include the sales of compressed air to 10 mines. The air units represent practically the same amount of energy as if these 10 mines had converted their compressors to electric drive and purchased electricity. When the further

The supply is furnished to all mining consumers at 2,100 volts and 525 volts. The necessary step-down transformers

Name of station.	Total capacity of electric generating plant installed.	Steam driven air compressors installed.	Extensions in progress.
Brakpan ...	Two 3,000 kw. sets	—	—
Simmerpan ...	Six 3,000 - kw. sets	—	—
Rosherville ...	Five 10,000-kw. sets	Six 3,500-kw. machines	Three 7,000-kw. steam - driven air compressors
Vereeniging ...	Four 10,000-kw. sets	—	—
Extensions in 1913.	—	—	Two 10,000-kw. sets
—	114,000 kw.	21,000 kw.	41,000 kw.

Total capacity of plant installed and in progress, 176,000 kw.

demands for power which have already been notified are met by the plant now on order, the sales will reach 2,000,000 units daily. The monthly load factor, based on the hour of maximum output, varies from 70 to 74 per cent.

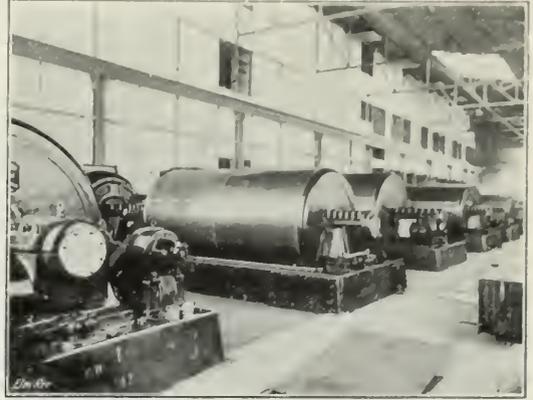


FIG. 8.—AIR COMPRESSORS AT ROBINSON CENTRAL DEEP.

and switchgear are provided by the power company, while the consumer supplies the sub-station building and pays the

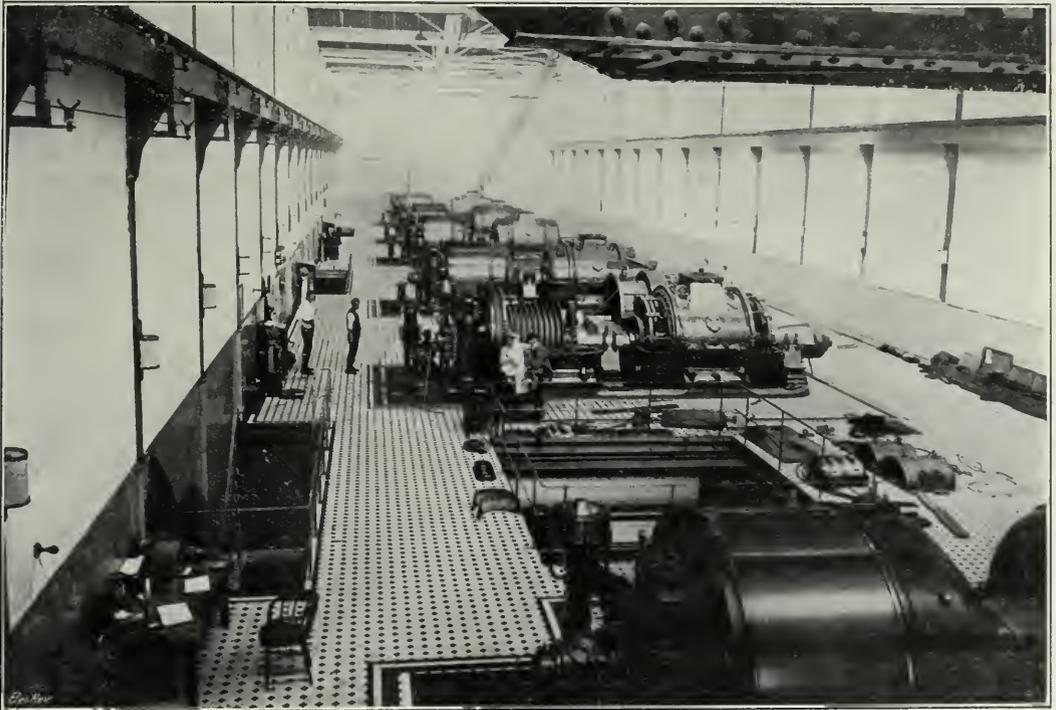


FIG. 9.—INTERIOR OF SIMMER PAN GENERATING STATION.

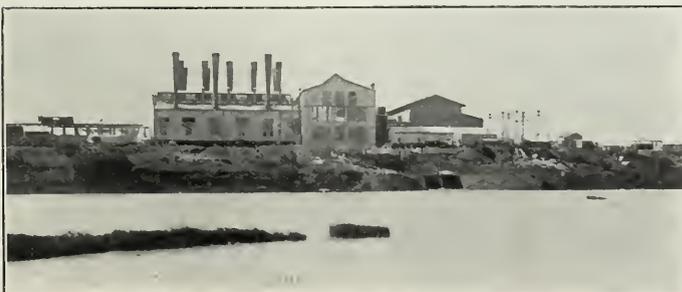


FIG. 10.—EXTERIOR OF GENERATING STATION AT VEREENIGING.

power company a sum equal to 2 per cent. of the power bill to cover the losses in the step-down transformers.

The standard price in mining contracts covering not less than 12 years is 0.525d. per unit, as long as the monthly load-factor is above 70 per cent., the load-factor being based on the hour of maximum consumption. This price is subject to periodical revision depending upon the cost of production, and further, a participation with the consumers in the profits of the business after a due return has been paid on capital is also provided for. In case of failure of supply the consumers are

entitled to a payment from the power company of 7s. per hour for each 100-kw. put out of commission.

The introduction of these prices on the Rand has reduced the cost of power to the mines by 40 per cent., and has reduced the cost of production of gold by an amount varying from 6d. to 1s. per ton of ore milled. It has further resulted in considerable saving of capital expenditure on

20,000-volt distribution line. Where the load is most dense the transmission system consists of two rows of towers, each arranged to carry two circuits (fig. 19, p. 521).

The 40,000-volt transmission system is fed at Brakpan, Simmer Pan, Rosherville, and at Robinson Central, where the supply from the Vereeniging station joins the reef. In addition to these distribution stations the transmission lines pass through two further distributing centres at Hercules to the east and Bantjes to the west. From these six points distribution networks, laid out as ring mains, supply the various substations on the mines. The three eastern distribution stations supply the system through 10,000-volt overhead lines. The central portion of the area is served by an underground 20,000-volt cable system.

The Vereeniging station is connected to the Rand by an 80,000-volt line approximately 35 miles long, terminating at the Robinson Central distribution station, where the pressure is transformed to either 40,000 or 20,000 volts, these pressures being also coupled together through transformers aggregating 16,000 K.V.A.

All transmission and distribution circuits, with the exception of the long-distance 80,000-volt lines, are equipped with the Merz - Price balanced relay system for automatic switch control, without which a reliable supply on the ring-main system could not have been given, and the more expensive radial type of network would have been necessitated.

This balanced relay system is also employed for the protection of all transformers and for the large generators. The pilot wires for operating this system on the 40,000-volt transmission lines are combined with telephone circuits in a lead-covered cable suspended overhead, while on all distribution networks (both overhead and underground) combined pilot and telephone cables are laid underground.

A special feature of the lay-out of the telephone system is

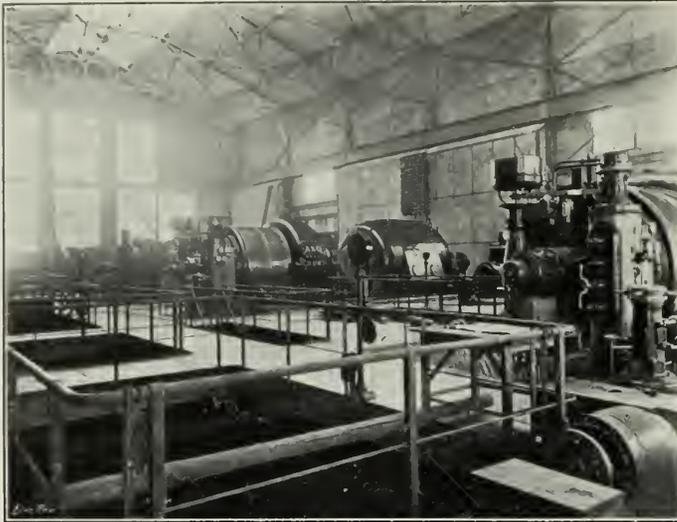


FIG. 11.—ENGINE ROOM AT VEREENIGING.

plant, which in the case of a new mine may amount to £100,000.

The area over which a power supply has to be given lies within a strip about two miles broad and stretching 50 miles from east to west. The total power used by the mines at the present time is estimated at about 400,000 H.P.

Power plants aggregating nearly 180,000 kw. have been installed in, or are under construction for, the stations enumerated in the table on page 521. They are set out in the order in which they were built.

At Robinson Central air station there are also six electrically-driven air compressors, each of 3,500 - kw. capacity.

At all stations steam turbo-electric generating sets are employed, and produce three-phase energy at 50 cycles. Step-up transformers raise the generator pressure to 40,000, 20,000, or 10,000 volts, and their interposition gives additional security to the machines against pressure rises. This method, in which the generator voltage is optional, gives the further advantage of enabling the stators to be constructed with bar winding having one bar per slot.

The main system of transmission (shown in fig. 3) is effected by means of 40,000-volt overhead lines stretching practically the whole length of the reef. At the present time, however, the western extremity is working as a

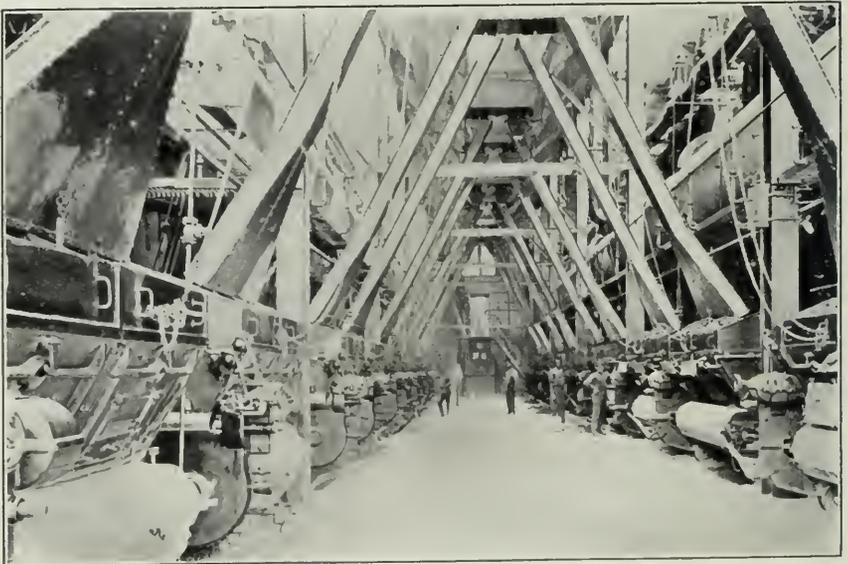


FIG. 12.—BARCOCK & WILCOX BOILERS (MARINE TYPE) AT VEREENIGING.

the arrangement whereby the control of all switching and the control and regulation of load, voltage, power factor, and other operating conditions, are in the hands of the control department.

One control engineer or load dispatcher is responsible for all routine switching and linking carried out at any point

on the electrical system during his shift, and under the regulations no switching can be carried out without his consent. The load dispatcher, as soon as any switching has been carried out, adjusts a large diagram in the control room so that it shows every connection on the system (fig. 17, p. 524).

When the contract with the Rand Mines, Ltd., was concluded the site for the station was selected at the Rosherville Dam, which is the largest lake on the Rand. This station will shortly have a capacity of nearly 100,000 kw. of plant installed. After the new extensions are completed the turbine room will be 150 ft. long and 75 ft. wide, and there

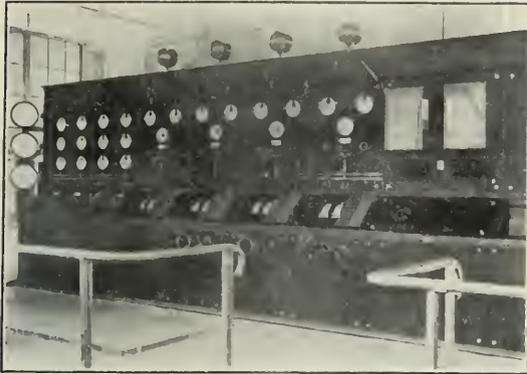


FIG. 13.—CONTROL BOARD, VEREENIGING POWER STATION.

will be five right-angle boiler bays, each containing eight boilers. The general lay-out is shown in fig. 6, p. 520.

The coal-storage arrangements are very complete, the coal being discharged from a height of 14 ft. through the floors of 40-ton railway trucks into outside storage bunkers, under which coal conveyors are arranged. The whole structure is open, as roofing is unnecessary, owing to the favourable climatic conditions.

The conveyors, each capable of dealing with 40 tons of coal per hour, run in tunnels under the external coal store, and are fed with coal by gravity through shoots from the coal pile above. These conveyors are kept running practically continuously, allowing the internal coal bunkers in



FIG. 15.—BUS-BAR GALLERY.

the boiler house to be of small capacity. An automatic tip is fitted over the bunkers, which tips the conveyor buckets when the coal in any particular bunker has fallen below a certain level. Weighing machines are installed in the conveyor tunnels, and the coal is weighed as it passes in the conveyor buckets.

The ashes are discharged from the rear of the stokers into hand trucks in the basement, where natives push the loaded trucks out and attach them to a motor-operated rope haulage leading to the ash dump. The question of removing these ashes by suction is at present under consideration.

The class of coal burnt at this and other Rand stations is

mostly the small coal from the collieries in the Middelburg district 60 miles distant, mixed with a proportion of the dull produced by the coal-cutters. The coal has an average calorific value of about 11,000 B.T.H.U. per lb.

The large percentage of ash, viz., 18 to 25 per cent. of the coal, and the high load factor at which the plant is operated, necessitated a combination of boiler, superheater and economiser that would give the highest possible efficiency; the high cost of white labour, and the inefficiency of that of the native, also required that the plant should be mechanically operated.

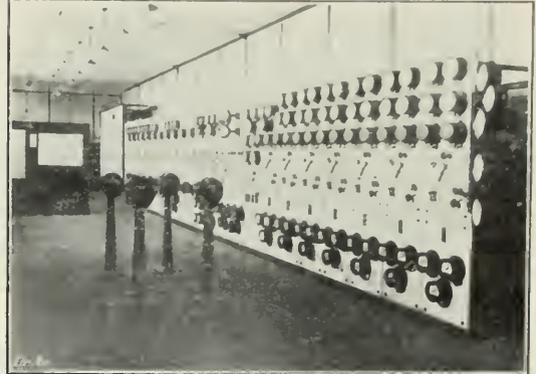


FIG. 14.—CONTROL BOARD, SIMMER PAN POWER STATION.

In view of these considerations, and the great cost of constructional work in South Africa, the injector system of induced draught (fig. 7) originally devised by Mr. Prat has been adopted in all the power stations. The system has been found to give the utmost satisfaction.

In the lay-out employed, adjacent boiler units are connected to a common ejector chimney, the top of which is 90 ft. above the boiler-house floor. An electrically-driven rotary fan, capable of developing 75 h.p., blows cold air through the ejector situated in the chimney, thereby pro-



FIG. 16.—SWITCH GALLERY.

ducing the necessary suction in the flues, and a draught of about 1 in. is usually employed.

With this arrangement great flexibility in the boiler house is obtained, and by the use of a torpedo-shaped damper in the air pipe regulating the pressure of the air jet, the duty of the boiler unit can be easily regulated to suit fluctuations in the load. The plant is absolutely smokeless, and it is difficult by looking at the ejector chimneys from outside the station to tell which boilers are at work.

The boiler unit selected is the Babcock & Wilcox marine type, fitted with chain-grate stokers, each having an integral superheater and economiser. The boilers are arranged in

two rows in each boiler house, with a central and common firing floor (fig. 12, p. 522). Each boiler has a rated capacity of 32,000 lb. of steam per hour at a pressure of 220 lb.

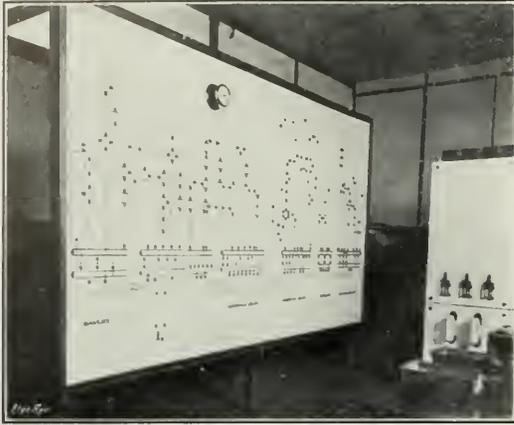


FIG. 17.—LOAD DISPATCHER'S DIAGRAM.

with a temperature of feed water of 100° F., and is capable of producing 38,000 lb. of steam without undue forcing. The heating surface of the boiler is 5,520 sq. ft., of the superheater 1,720 sq. ft., and of the economiser 2,200 sq. ft. A six-hour test on one of the boiler units gave a combined efficiency of boiler, superheater, and economiser, of 80 per cent.

The turbine room (fig. 2) at present contains five turbo-generators each of 12,000 K.V.A. (fig. 5), and six steam compressors each having an input of 3,500 KW.; three more steam compressors each taking 7,030 KW. are also being installed. The turbines are of the A.E.G.-Curtis horizontal type, having one high-pressure wheel with three rims of blades. The admission pressure at the intake nozzles is brought down from 220 lb. at a temperature of 300°—350° C. to about 20 lb. with a superheat of about 20° C. In the low-pressure portion of the turbine, the steam is expanded through 12 stages. Both hand and motor regulation of the speed are arranged for. The total weight of a 12,000-K.V.A. turbine set, including condenser and pumps, is 370 tons.

The stators of each of the six-pole generators are bar wound, having one bar per slot. The machines running at 1,000 R.P.M. produce 50-cycle three-phase energy at 5,000 volts, which is stepped up to either 10,000, 20,000, or 40,000 volts, by transformers directly connected with the stator terminals.

The rotor coils are lined with metal casings before being attached to the rotor by dovetailed grooves and wedges. The rotor carries a ventilating fan at each end. The frequent dust storms in South Africa charge the air with heavy particles which might prove dangerous in the ventilation of the machines, consequently each machine is provided with an air filter having an effective surface of fireproof

cloth of 8,000 sq. ft. Each turbine set is provided with a direct-driven exciter, while a stand-by supply is also available from a motor-generator and battery.

The condensers have a cooling surface of 17,750 sq. ft.; each set has a centrifugal circulating pump of about 663,000 gallons per hour capacity, and a centrifugal air pump, both connected on one shaft and driven direct by a steam turbine. The exhaust from the auxiliary turbine is taken to the middle stage of the main turbine, where the remaining energy in the steam is utilised down to the vacuum of the condenser.

The water for the condensers and compressor jackets is taken from the lake through a channel excavated along the front of the station, and is discharged into a second canal placed alongside the intake; this canal delivers the warm water to the lake at a point as far from the intake as possible. Under normal conditions of water levels the intake water flows by gravity into the service canal, but in order to deal with periods when the water in the lake may be low, a pumping station has been erected half-way along the dam wall at the deepest part of the lake.

The boiler feed pumps are of the turbine-driven centrifugal type, and are installed in the turbine room. With the exception of certain electrically-driven bearing-cooling pumps, all auxiliaries are turbine-driven.

The generator transformers are connected by cables to their corresponding generators, and are each of 12,500-K.V.A.

capacity. Where larger transformers have been required, as for the last two sets at Vereeniging, two transformers for each machine have been installed. The transformers at Rosherville are of the shell type and water-cooled, the windings nearest the terminals being specially insulated to withstand between adjacent turns a pressure of 25,000 volts for 5 minutes. A test pressure of 160,000 volts was applied to the whole of the windings. The weight of each transformer complete, without oil, is 50 tons; the oil itself weighs 21 tons.

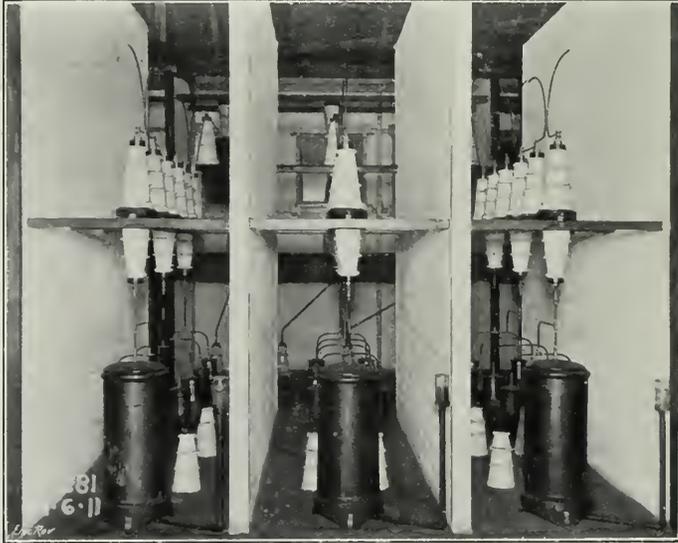


FIG. 18.—LIGHTNING ARRESTERS AT ROSHERVILLE.

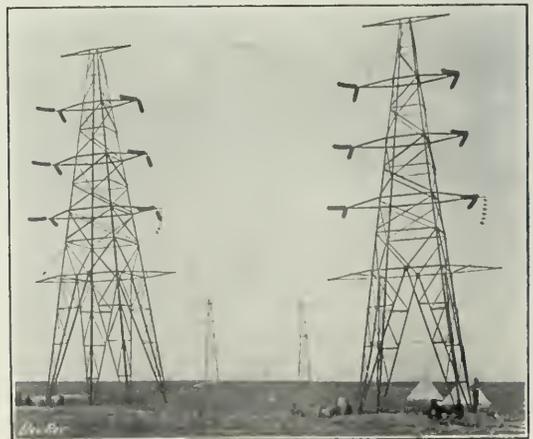


FIG. 19.—DOUBLE TOWER LINE AT 80,000 VOLTS, AND CONSTRUCTION CAMP.

The steam turbo-compressors at Rosherville are similar to the motor-driven compressors at Robinson Central, and are each designed to deal with 22,000 cu. ft. of free air per minute with an outlet pressure of 9 atmospheres (absolute). The power required on the shaft is, roughly, 3,500 kw. In the case of electrically-driven sets at Robinson Central each unit is divided into two halves on separate shafts, each motor having a capacity of about 2,000 K.V.A., and being designed to operate at full load at a leading power factor of 85 per cent. The sets run at 3,000 r.p.m. The steam-driven compressors are arranged in two sections on the same shaft, with an intercooler between them. The cooling water required for the jackets of the compressor and intercooler amounts to about 40,000 gallons per hour. The air leaves the compressor at a temperature of about 70° C.

Between the compressor and the pipe line an automatic non-return valve is fitted, which allows a compressor to drop out to atmosphere when its pressure falls below that of the air system.

By the use of the rotary compressors the air entering the pipe system is kept entirely free from oil and other impurities liable to be introduced into the air system when piston compressors are employed. The speed regulation of the steam turbo-compressors is automatically controlled by the pressure in the air pipes. The regulation of the electrically-driven compressors at Robinson Central is effected by throttling the intake. The weight of a turbine-driven compressor, condenser, and pumps is 180 tons.

The switchgear is laid out in a building at the southern end of the station, and the step-up transformers are in cubicles arranged along the outer side of the switch-house. The last-mentioned is constructed with four floors: the upper floor contains the lightning-arrester gear, the third floor the bus-bars, the second floor the 40,000 and 20,000-volt oil switches, whilst the lower floor is occupied with cableways and pipe passages. Duplicate bus-bars are installed for both the 40,000 and 20,000-volt systems, the various oil switches being provided with knife selector switches to connect to either bus-bar. The 40,000 and 20,000-volt systems are connected together through coupling transformers. The switches consist of three single-phase coupled switches operated from a remote-control board (see figs. 13-16).

Since the Rosherville station came into commercial service, troubles have been experienced owing to failures of switches on short-circuit. When the Brakpan and Simmerpan stations were started to supply the 40,000-volt transmission and also the 10,000-volt local lines, their total capacity was 24,000 kw., and no trouble was experienced when a short-

Dynamos running at a high speed have a low internal reactance. The step-down transformers in the present case were designed with a low reactance to give good regulation, so that probably the total reactance in circuit on a short-circuit was about 7 or 8 per cent. The momentary rush of energy on short-circuit could therefore reach the tremendous proportions of 500,000—700,000 kw. No oil switch, as at present designed, could interrupt this rush of power unassisted. The intensely hot gases formed by the arc, after



FIG. 21.—OVERHEAD LINE AT 40,000 VOLTS.

rising through the oil, come into contact with the air and cause an explosion, which, more often than not, is productive of a switch failure.

About the time that this trouble became apparent on the Rand, exactly the same difficulty was being experienced on stations of similar large output in America, and the problem was vigorously tackled over there. Many methods have been tried at Niagara, Chicago, and other places, and it has become generally recognised that it is necessary to insert additional reactances in order to limit the rush of energy on short-circuit. In certain cases this precaution has proved entirely satisfactory. In others additional methods for assisting the oil switch have been necessary; such as (1) sectionalising the system on to separate bus-bars and limiting the amount of machinery that would be affected by one short-circuit; (2) the placing of two switches in series timed so that one opens first and inserts a non-inductive resistance, the circuit being actually broken by the second switch; (3) the use of a special type of switch having two moving systems, one of which first introduces reactances, and the other then breaks the circuit.

These methods have been tried on the Rand. The earthing of the neutral through a resistance has proved most valuable, as more than 90 per cent. of the faults start as faults to earth. At Rosherville and Vereeniging reactances having a value of about 6 per cent. have been installed between the dynamos and the step-up transformers. The latest practice is to design both generators and transformers required for power service with large internal reactances.

At Vereeniging and at the Rand end of the 80,000-volt line two systems of switching have been installed. On the first two Vereeniging machines two switches are employed in series, one introducing a non-inductive resistance; while on the last two machines, both of which have not yet been put into service, a two-movement reactance switch is being

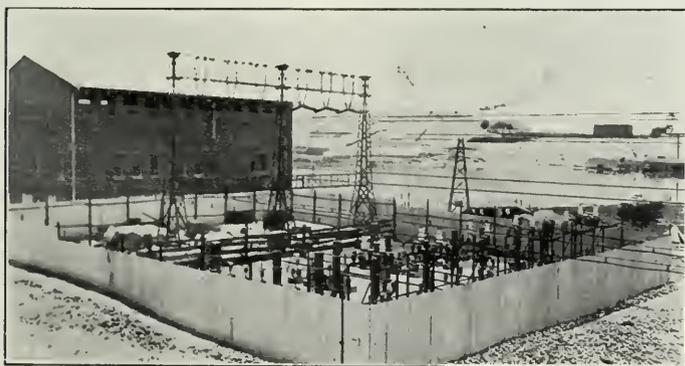


FIG. 20.—LIGHTNING ARRESTERS, &C., AT END OF 80,000-VOLT LINE.

circuit occurred on the system. When, by the addition of Rosherville, the system grew to 60,000 and 70,000-kw. capacity, switch breakdowns occurred, conclusively proving that no apparatus was available which could be relied upon to interrupt the immense rush of current occurring on short-circuit.

Some serious line interruptions have in the past been caused by the wilful throwing of bare wires over the lines. When this form of short-circuit has occurred near a power station, apparatus has usually been lost.



## NOTES.

(Continued from page 518.)

**Institution and Lecture Notes.**—**CONCRETE INSTITUTE.**—On Thursday, March 13th, a paper was read by Mr. H. C. Johnson, on "The Strength of Cement; Results of Tests on 15 different Brands used in Paste, Mortar and Concrete."

**INSTITUTION OF ELECTRICAL ENGINEERS (WESTERN SECTION).**—The annual meeting of the Section was held on March 10th, at the South Wales Engineers' Institute, Cardiff, Mr. W. A. Chamen presiding. The chairman reviewed at length the work carried out by the Section since its inauguration in March last year, and expressed gratification at the increase in the roll of membership. He congratulated the Section upon its new chairman (Mr. H. Faraday Proctor), and its vice-chairman (Mr. D. E. Roberts, Cardiff). The chairman announced that Mr. Arthur Ellis, Cardiff, had had to resign his seat. The following were elected on the Committee:—Messrs. H. D. Munro, A. J. Newman, E. G. Okell, A. B. Randall, Prof. D. Robertson, W. A. Scott, F. Tremain. After the general meeting, a discussion on Mr. Sydney F. Walker's paper on the use of "High-tension Continuous Current on the Thury System in Mines," was held. Owing to the absence of the author through ill-health, the secretary (Mr. Sidney B. Haslam) read an abstract on his behalf, and after further remarks from the chairman, the discussion was adjourned until a special meeting to be held on April 14th, in Cardiff.

**(YORKSHIRE SECTION).**—On Wednesday, an informal paper by Mr. Thos. Roles on "Electric Heating and Cooking" was read at Sheffield. A discussion followed.

**ROYAL INSTITUTION.**—The following arrangements are announced:—

*Fridays.*—

April 4th, at 9 p.m.—"The Spectroscope in Organic Chemistry," by Dr. J. J. Dobbie, F.R.S.

April 18th, at 9 p.m.—"Applications of Polarised Light (with experiments)," by Dr. T. Martin Lowry, F.R.S.

May 23rd, at 9 p.m.—"The Secret of the Permanent Magnet," by Prof. S. P. Thompson, F.R.S.

June 6th, at 9 p.m.—"Reflection and Refraction of Light as Concealing and Revealing Factors in Sub-Aquatic Life," by Dr. Francis Ward.

*Thursday Afternoon Lectures.*

May 22nd and 29th and June 5th, at 3 o'clock.—Three lectures by Prof. W. J. Pope, F.R.S., on "Recent Chemical Advances: (1) Molecular Architecture; (2) Chemistry in Space; (3) The Structure of Crystals"—experimentally illustrated.

*Saturday Lectures.*

May 10th and 17th.—Two lectures by Mr. H. A. Humphrey on "Humphrey Internal-Combustion Pumps."

May 24th, 31st, and June 7th.—Three "Tyndall" lectures by Prof. E. Rutherford on "Radioactivity": (1) The Alpha Rays and their Connection with the Transformations; (2) The Origin of the Beta and Gamma Rays and the Connection Between Them; (3) The Radio-Active State of the Earth and Atmosphere.

**Electric Stoves for Canada.**—H.M. Trade Commissioner for Canada reports that a firm in Winnipeg is desirous of getting into communication with United Kingdom manufacturers of electric stoves who may wish to do business in Winnipeg and the surrounding districts.—*Board of Trade Journal.*

**New Hydro-Electric Works in Italy.**—Several important schemes are proposed to be carried out in the near future. In the first place, a Government concession is shortly to be granted to the Società per le Forze Idrauliche della Sila, which is an investigation company formed by the Banca Commerciale, the Italian Southern Railway, the Società Meridionale di Elettricità, and the Société Franco-Suisse of Geneva. The concession relates to the construction of dams and hydro-electric works in the Sila mountain range, where there are heavy rainfalls, followed by periods of drought, so that the water falls very irregularly. It is proposed to construct four dams eventually, of which two are to be built at first, and the total power available is estimated at 150,000 H.P. As, however, no demand exists for such a large amount of power in this thinly populated district, which has few industries, the company intends first to proceed with plant of 50,000 H.P., and the energy will be used partly for the local production of carbide of calcium and partly for distribution over Calabria, Basilicata, and a portion of Apulia, by means of a network about 200 miles in length. The capital required for this provisional scheme ranges from £1,600,000 to £2,000,000, and it will be raised by the four promoting companies previously mentioned. A feature of the scheme is that by the adoption of a suitably arranged hydraulic system it will be possible to protect the districts at the foot of the mountain from drought on the one hand, and inundations on the other. A second project refers to Sardinia, where a hydro-electric proposal is also associated with an improvement in the agricultural land. It is intended to dam the River Tirso, and a yield of 15,000 H.P. is expected. The power is to be utilised in the local mines, and the water will be also used for the purposes of irrigation. The expenditure will be defrayed partly by the State and partly by other interests. A third scheme is that of the Società Ligure Toscana di Elettricità, of Lezhorn, which is erecting a new power station of 15,000 H.P. on the Serchio River, in the Ligurian Apennines. The supply will be

extended to Pistola and Florence, and the cost of the new station is to be provided for by raising the company a capital from £450,000 to £640,000.

**The Siemens Smoker.**—The King's Hall at the Holborn Restaurant was well filled on Wednesday, March 19th, on the occasion of the Siemens smoking concert to which we made preliminary reference in our issue of February 28th. Mr. Alexander Siemens was in the chair and gave words of welcome to the very large number of friends of the Siemens companies who were privileged to enjoy the excellent entertainment and to partake of the hospitality which had been prepared. The artistes were as follows: Miss Annie Bartle, soprano; Miss Olive Fox, comedienne at the piano; Mr. Ivor Walters, tenor; Mr. Thomas Howell, baritone; Mr. Olly Oakley, banjoist; Mr. Bromley Carter, humorist; Mr. Will Edwards, humorist; Mr. Ernest Hastings, musical sketches; Mr. Jock Walker, Scotch humorist. Mr. Mansell Stevens was accompanist, and Mr. George Lakeman acted as musical director. Mr. Harry Gooding's Imperial Orchestra played a number of selections from 7.30 until 8 o'clock, and also during the interval. The event was declared by all to have been a huge success.

**Parliamentary.**—**ELECTRIC LIGHT PLANT CONTRACT.**—In the House of Commons, March 17th, Mr. Touche asked the representative of the First Commissioner of Works to state where the contract for the equipment of the British Legation in Peking with electric generating plant, ice-making plant and other things was placed, and if he would state the amount of the contract and whether it was given to a German firm. Mr. Benn replied that the contract in question was placed amongst British firms, with Messrs. Siemens Bros. & Co., Ltd., of Caxton House, Westminster. The amount of the contract was £11,572 10s.—Further questioned by Mr. Touche as to whether the hon. member was aware that Messrs. Siemens Bros. was a purely German firm, Mr. Benn said that on the contrary, the firm was a British one.

**SECOND READINGS.**—In the House of Commons on March 17th, the following were read a second time:—Chesterfield Corporation Railless Traction Bill, and Cleveland and Durham County Electric Power Bill.

**I.E.E. Students' Electric Dinner.**—The informal Electric Dinner held by the I.E.E. Students last Friday evening, in the West Room of Trinity House, was an unprecedented success. The attendance numbered nearly 60, the West Room being packed to its utmost capacity. Among the toasts may be mentioned those of "Electric Cooking" and "Point-Five Juice." The former was proposed in a very breezy speech by Mr. S. M. Hills (the author of a recent Students' Section paper on "Electrical Heating and Cooking Apparatus"), and Mr. C. H. Smith, of Marylebone, responded in a more technical vein. The latter was proposed by Mr. G. W. P. Page, and received a humorous response by Mr. J. Mould. Between the toasts Messrs. S. G. Killingback, R. E. Dickinson, W. V. Zolmer, and H. K. Whitehorn contributed items to the musical programme with much success. On the whole, the chairman, Mr. J. C. Rennie, is to be heartily congratulated upon the great success which attended the first All-Electric Dinner of the I.E.E. Students.

**South America.**—According to *La Electricidad*, of Buenos Ayres, activity in electric enterprise is very great in all that section of South America. The municipality of Anchorena, in the province of San Luis, has decided to establish an electric lighting service. The civic authorities of La Paz, in the province of Entre Rios, are similarly disposed, and the Comision de Fomento, of Carcarana, in the province of San Lorenzo, was considering tenders for the installation of an electric light and power service on March 8th, while in the province of Buenos Ayres the authorities of Pilar have begun the preliminaries for the introduction of the modern illuminant, and the installation at Trenque Lauquen is expected to be completed in the course of a month or two. A start has also been made with the installation at Pico. As will already have been seen from our "Contracts Open" column, in the Federal capital the Minas, Geologia and Hidrologia Department of the Ministry of Agriculture is inviting tenders for motors, cables, dynamo and accessories for a power installation. Furthermore, according to the same journal, Herr Mauro Herlitzka, of the firm of the same name, has returned to South America, having secured capital for new and important electrical schemes.

**Appointments Vacant.**—Meter tester-repairer (30s.), and switchboard attendant (25s.), for the Harrow Electric Light and Power Co., Ltd.; arc lamp trimmer, jointer and meter fixer, for the Stoke-on-Trent Corporation; charge engineer for the Burgh Electricity Department, Paisley; mains superintendent for the Islington B.C. Electricity Department (£200). See our advertisement pages in this issue.

**Illuminating Engineering.**—An exhibition of the latest improvements in electric illumination and other devices was held in Newcastle-on-Tyne on 17th inst., having been organised by the BRITISH THOMSON-HOUSTON Co., of Rugby. The object of the show, as described by Mr. H. C. Wheat, the company's illuminating engineer, was to illustrate the fact that many existing installations are deficient and lacking in hygienic principles, and that a common failure to get better results is due to the fact that so few persons understand the proper method of utilising reflectors. Demonstrations were given to show the increased efficiency obtained by the proper use of reflectors. In the evening Mr. Wheat delivered a lecture on "Illuminating Engineering," which was illustrated by lantern slides.

**Inquiry.**—A correspondent inquires for the makers of a substitute for slate known as "Sindanyo Asbestos Wood."

**Annual Dinner.**—The fifth annual Staff Dinner of the South Metropolitan Electric Light and Power Co., Ltd., was held on 19th inst. at the Trafalgar Hotel, East Greenwich, the chair being taken by the managing director and engineer-in-chief, Mr. Henry W. Bowden. After the usual toasts of "The King" and "The Company" had been duly honoured, and the chairman had given a brief *resumé* of the year's work of the company, the evening was concluded with a social programme and whist drive.

**Fatality.**—A correspondent states that George Cochran, electrical engine-man, at Calderbank Colliery, Uddingston, who took great delight in having flowers and plants in his engine house, was setting a window box in position, when he fell over a stair-rail and was killed.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—There was quite a lengthy discussion at the Carlisle Town Council meeting, when the proposal to fix the salary of a successor to MR. S. T. ALLEN, the electrical engineer (who goes to Wolverhampton), at £500, he to be debarred from private practice and from taking pupils, was forward. There were two amendments moved by parties who thought the amount too large for a commencing salary, £350 and £400 being favoured. The original recommendation was a unanimous one on the part of the Electric Lighting Committee, but the Council meeting was markedly divided on the amendments, there being 10 in favour of £400 and 15 against. Eventually the recommendation was adopted. In the course of the discussion, high praise was given to Mr. Allen for the manner in which he had brought the undertaking from a non-paying to a paying condition by reason of his great business aptitude and engineering skill. The speaker said that had they been a private undertaking, they would not have let him go without offering him £1,000 per annum. His salary of £600 had only been a commencing one and he had been promised a long way beyond that figure. With the exception of the appointment of the Town Clerk, this was the most intricate appointment of the City.

The *Australian Mining Standard* says that MR. W. H. VINCENT, who has been electrical engineer in the works branch of the Home Affairs Department, Melbourne, at £350 a year, has been appointed chief electrical engineer to the Brisbane Electric Light Co., at £600 a year.

MR. E. G. BAKER, mains assistant to the Tynemouth undertaking, has been appointed to a similar position with the Motherwell Corporation.

The Stoke Newington B.C. has approved of the salary of MR. S. HANN, electrical engineer, being advanced by £20. Councillor Lavey said that the electricity department was increasing by leaps and bounds. Mr. Hann had saved the Council much money since it had dispensed with the services of the consulting engineer.

On the occasion of his departure to take up a position at Swansea, MR. J. A. SOMERVILLE, for five years on the staff of the Lewes and District Electric Supply Co., has been presented by his colleagues with a case of pipes.

A recommendation by the Electricity Committee of the Norwich T.C. to increase the salary of the city electrical engineer, MR. F. M. LONG, from £600 to £700 per annum, has been referred to the General Purposes Committee.

The Gloucester City Council has increased the salary of its electrical engineer, MR. F. H. COBSON, from £350 to £400 per annum, and granted him permission to take one pupil.

MR. J. A. MCKINNEY has left the Cleveland and Durham Electric Power, Ltd., to take up an appointment as relief shift engineer on the Kent Electric Power Co.

**Tramway Officials.**—MR. THOS. RIDYARD, for six years with the Manchester Corporation tramways department, has been appointed rolling stock superintendent to the Liverpool Corporation tramways at a commencing salary of £350 a year.

Amongst a large number of increases to Corporation officials at Manchester, sanctioned at a meeting of the City Council last week, were the following:—Tramways department—Mr. J. Wood, financial superintendent, £475 to £500 (maximum); Mr. J. T. Oakes, traffic superintendent, £450 to £475 (maximum £500); Mr. F. A. Mitcheson, accountant, £375 to £400 (maximum); Mr. G. R. Blackburn, rolling stock superintendent, £350 to £370 (maximum £400); Mr. T. Ridyard, car works manager, £250 to £270 (maximum £300); Mr. R. Beattie, chief claims clerk, £325 to £350 (maximum); Mr. T. G. King, stores superintendent, £250 to £275 (maximum £300); Mr. H. Jackson, chief clerk, traffic department, £240 to £250 (maximum); Mr. J. W. Hewitt, cashier, £225 to £245 (maximum £300); Mr. W. Grey, chief clerk, general office, £220 to £235 (maximum £250); Mr. C. H. Pepper, assistant accountant, £205 to £220 (maximum £250). The following advances were made in the electricity department:—Mr. L. H. Marlor, installation inspector, £220 to £235; Mr. F. R. Radcliffe, chief rental clerk, £215 to £225; Mr. E. J. Constable, assistant resident engineer, city stations, £200 to £220; Mr. L. R. Lee,

mains engineer, £450 to £475; Mr. H. A. Ratcliff, head of testing department, Polygon, £300 to £325; and Mr. E. Bolton, substations engineer, £350 to £375.

The Keighley Town Council last week appointed MR. H. WEBBER, the borough electrical engineer, to be tramways manager, to date from October 15th last, at a salary of £100 a year. Great praise was expressed concerning Mr. Webber's work in the tramways department since his appointment as temporary manager last October. One member objected to the appointment on the ground that the result of Mr. Webber's occupying the dual position could not have a good result.

**General.**—The *American Electrical Review and Western Electrician* states that the Franklin Institute, Philadelphia, acting through its Committee on Science and the Arts, has recently awarded the Elliott Cresson gold medal, the highest honour in the gift of the Institute, to the following: C. P. Steinmetz, Schenectady, in recognition of successful application of analytical method to the solution of numerous problems of first practical importance in the field of electrical engineering; Emile Berliner, Washington, in recognition of important contributions to telephony and to the science and art of sound-reproduction; Isham Randolph, Chicago, in recognition of distinguished achievement in the field of civil engineering; John William Strutt, Baron Rayleigh, in recognition of extended researches of signal importance in physical science; Sir William Ramsay, in recognition of numerous discoveries of far-reaching importance in the science of chemistry; Emil Fischer, Berlin, in recognition of numerous contributions of fundamental importance to the science of organic and biological chemistry.

The *Australian Mining Standard* for February 15th stated that MR. W. FITZPATRICK, chairman of the Victorian Railways Commissioners, was about to leave for Europe and America to study the newest electrical railway systems, giving special attention to points bearing on that part of the electrification of the Melbourne railways that has not yet been authorised by Parliament—the new electrical signalling apparatus for ensuring the proper control of the electric train service. Mr. Fitzpatrick will probably be away from the State for about five months. The Commissioners have also decided to send MR. E. BLAZEY, the superintendent of goods train service, and MR. F. C. CALCUTT, chief engineer of signals, on a tour of inspection relative to electrification of railways, the main point of their inquiries being the latest and most effective systems of signalling. They will leave on March 11th, and will visit England, France and America, Mr. Fitzpatrick leaving on April 8th.

Our American namesake says it is announced that the Edison Electric Illuminating Co., of Boston, has arranged to retain the services of MR. ARTHUR WRIGHT, of London, in a general advisory capacity.

MR. ANTHONY G. LYSTER has been taken into partnership with Sir J. Wolfe Barry, Mr. G. E. Wilson Crutwell and Mr. K. A. Wolfe Barry as Sir John Wolfe Barry & Partners, 2, Queen Anne's Gate, S.W.

At Bradford Parish Church on Thursday, last week, MR. JOE DYSON, principal of the firm of Messrs. J. Dyson & Co., electrical engineers, Bradford, was married to Miss Winifred Muff, youngest daughter of Mr. John Muff, the chairman of the Bradford Board of Guardians.

At the Star Hotel, Cudworth, Yorks., last week, a presentation of a marble clock and ornaments, appropriately inscribed, was made to MR. WM. WALKER, who is leaving the post of electrician at the Grimethorpe Colliery, Cudworth, to take up a position at Pendlebury Collieries, near Manchester. A presentation of a silver breakfast cruet was made to Mrs. Walker. A pleasant musical and social evening was spent.

MR. E. H. FIELD, of the staff of Messrs. Crompton & Co., Ltd., Arc Works, Chelmsford, has been presented, on his marriage, with a marble clock by the members of the staff at the works.

MESSRS. HEAP & DIGBY announce that they have removed from 28, Victoria Street, Westminster, S.W., to 48, Westminster Palace Gardens, Victoria Street, S.W.

## CITY NOTES.

### British Insulated and Helsby Cables, Ltd.

PRESIDING over the annual meeting of this company, which was held at Liverpool on March 17th, DR. E. K. MUSPRATT stated that the profit for the year amounted to £218,394, compared with £188,258 for the previous year, showing an increase of £30,136. The result was most satisfactory, particularly in view of the fact that during the year the company's operations were considerably hampered by the coal strike. During the previous year £44,416 was expended on increased plant and machinery, and the results had amply justified the course taken. The sale of the Liverpool works to the Automatic Telephone Co. had been completed, and the holding they now had in that company was likely to prove a valuable asset in the future. It was expected now that the Government had taken over the telephone system of the country, that a considerable demand would arise for the extension of telephone work generally, and they could with confidence look forward to getting a fair share of that work. With

regard to the profit and loss account, when they added the balance brought forward from 1911, they had available for all purposes £282,045, which had been dealt with as shown in the report. The balance available for distribution was £101,230. The directors recommended a further dividend of 6s. per share, making, with the interim dividend already paid, a total distribution for the year of 10 per cent., leaving a balance to carry forward of £74,230, which was an increase on last year's "carry forward" of £10,580. The sum of £5,000 had again been placed to the debenture stock redemption fund, and this could be looked upon as an addition to ordinary reserve. On referring to the balance-sheet it would be seen that after crediting the amount received from the sale of plant at the Liverpool works, and debiting the amounts expended during the year at their Prescott and Helsby factories, the amount now stood at £619,489, compared with £641,876 last year. In this connection the directors were following the policy of judiciously extending the company's manufacturing plant in accordance with the demand, and the directors thought that returned the best profit obtainable. In last year's balance-sheet the amount against the item of patents and goodwill stood at £71,500. The directors had decided to further reduce this amount by taking from profit and loss £36,500, leaving the amount standing in the balance-sheet under this heading at £35,000. At one time patents and goodwill stood at £251,672. If business continued good, it was the directors' wish to extinguish this item altogether. The value of stock and work in progress had increased by £65,838. This was partly due to the increased price of raw materials as well as to the increased volume of manufactures in progress. The sum under the head of sundry debtors had been increased by £106,148 for similar reasons. With regard to investments, this account, after writing off £8,500, now stood at £614,077, as against £552,193 last year. The position had, however, improved during the past year, owing to the fact that though they had obtained £120,000 ordinary £1 shares in the Automatic Telephone Co., their investment account had only increased during the past 12 months by £61,881. With regard to the Midland Electric Corporation for Power Distribution, Ltd., in which the company had a very substantial interest, a further marked improvement had taken place, the net revenue account for the past year, after paying debenture interest, having increased from £2,500 to £12,843. The present issue of Midland Electric Corporation debentures would fall due in June next, and it was proposed to re-issue these, together with a further amount, so as to provide a substantial sum for future extensions of that company's operations, necessitated by the growing demands for electric energy in that district. Their company (the British Insulated) originally guaranteed the present issue of the Midland Co.'s debentures as to capital and interest, and it was proposed by the directors, in order to facilitate the present issue and to obtain as low a rate of interest as possible, that the company continue the same guarantee with regard to the new issue. As, however, the Midland Co.'s profits had been continually improving, and were sufficient to cover the interest on the whole of the proposed increase of new debentures, it was not contemplated that this further guarantee would, in effect, cost the company anything. With regard to the Electric Supply Co., of Victoria, the other company in which they were particularly interested, he was pleased to report a further considerable improvement in the position. The British Insulated Co. had credits at various banks, principally abroad, of over £14,000, as against an overdraft on their own bankers at home of over £73,000.

The report and accounts were adopted, and a resolution authorising the payment of the dividend was passed.

Mr. J. Carlton Scott and Mr. J. S. Harwood Banner were re-elected to the board.

**Montana Power Co.**—Quarterly dividends of 1 per cent. on the common stock and of 1½ per cent. on the preferred stock have been declared.

**Consolidated Cities Light, Power and Traction Co.**—A first quarterly dividend of ½ per cent. on the common stock is announced.

**Tramways and Light Railways Estates Co., Ltd.**—The total revenue for 1912 was £735. A dividend of 2½ per cent. is paid, and £262 carried forward.

**Prospectus.**—*Mississippi River Power Co.*—The list is to close on March 27th in an offer of \$3,000,000 first mortgage 5 per cent. 40-year gold bonds at \$91 per bond of \$500.

**Shawinigan Water and Power Co.**—Dividend 1½ per cent. for the quarter ending March 31st on the Common stock.

**Great Northern Telegraph Co., Ltd., of Denmark.**—At the general meeting, which will be held at Copenhagen on April 26th, the board will propose to pay a total dividend and bonus of 20 per cent. for the year 1912, including the 5 per cent. already paid, and to transfer to the reserve and pension funds the usual amounts besides an extraordinary endowment once for all to the last-mentioned fund.

**Jarrow and District Electric Traction Co., Ltd.**—The report for 1912, as abstracted in a financial daily, states that the accounts show an available sum, after providing for debenture interest and placing £700 to renewals account, of £2,867. A dividend of 2 per cent. is to be paid, £1,025 put to depreciation and reserve account, and £843 carried forward.

**Mexico Tramways Co.**—The directors have declared a dividend of 1½ per cent.

### Salisbury Electric Light and Supply Co., Ltd.

The directors' report for 1912 which was adopted at the meeting held on March 11th, says that the generating plant has been sufficient to meet the output, and the whole of the plant is in thorough working order and capable of dealing with a considerably increased demand. The profit on the year's working, including £419 brought forward, amounts to £6,796, and after paying £1,290 interest on debentures and an interim dividend at the rate of 1 per cent. for the half-year, amounting to £709, there remains a balance of £4,804. The directors recommend that a further dividend at the rate of 8 per cent. for the half-year be paid, making, with the interim dividend, 6 per cent. for the year, and that £2,400 be carried to reserve, leaving £1,004 to be carried forward.

Mr. W. M. HAMMICK presided at the annual meeting, and in moving the adoption of the report, he said that not only were they paying the same dividend as last year, but they were carrying forward £1,004, instead of £449. The auditors drew attention to the insufficiency of the reserve fund, and they were catching up yearly to the point that the auditors thought should be attained in this respect. The coal contract was only 1s. 7d. a ton more than in the previous year, but the consumption had been reduced, the bill being only £65 more. The water supply had been better, but the floods had not assisted them at all, as when the river was in flood they did not get the value of their turbine, as they did when the water was moderately high. The sale of current was very good. The working expenses of 1911 and 1912 were practically the same.

Mr. GUPPER seconded, and the report was adopted.

Thanks were voted to the staff, special mention being made to the services of Mr. A. R. Randall, the engineer and manager, Mr. Godwin, and Mr. Bankin.

**Newmarket Electric Light Co., Ltd.**—The directors' report for 1912 states that the equivalent of 772 33-watt lamps have been connected to the mains, making the total 27,811 lamps. Applications for a further 430 lamps have been received this year. The whole of the works have been maintained in perfect working order. The profit, added to £10 brought forward, amounts to £2,569, which, after providing for debenture and other interest, £715 leaves a balance of £1,824. The directors recommend a dividend of 4 per cent.; that £700 be carried to reserve for renewal of plant, and that the balance be carried forward. The directors record the death last year of the chairman, Mr. J. Garrod. Mr. F. E. Gripper was elected chairman in his place for the remainder of the year, and Mr. F. W. Cobb, of Cheveley, was elected a director in place of the late Mr. Garrod. The meeting was held on March 17th.

**Clyde Valley Electrical Power Co.**—The half-yearly meeting was held in Glasgow, Dr. J. MacKenzie presiding. The chairman moved the adoption of the accounts, which (according to the *Scotsman*), showed a net profit of £24,718 for the six months ending December, 1912, together with £3,647 brought forward, making a disposable balance of £28,365. He stated that the board had decided to transfer the sum of £12,500 to contingency fund for depreciation, &c., bringing this fund up to the total of £56,600, and to carry forward £15,865. The company's business continued to show steady progress, and the number of new contracts recently closed and in course of negotiation justified the expectation that this progress will be maintained. Contracts for supply showed an increase of 5,000 H.P. during the half-year. The report and accounts were adopted. The meeting authorised the issue of the remaining £300,000 of capital in the form of 30,000 6 per cent. cumulative preference shares of £10 each.

**Stock Exchange Notices.**—The Committee have ordered the undermentioned to be quoted in the Official List:—

British Columbia Telephone Co., Ltd.—10,000 6 per cent. cumulative preference shares of \$100 each, fully paid (Nos. 1 to 10,000).  
Compania Hidro-Elctrica de Tucuman.—£300,000 5 per cent. first mortgage debentures of £100 each (Nos. 1 to 3,000).

**Wemyss and District Tramways Co., Ltd.**—The board have under consideration doubling certain portions of the track with the view of expediting the service to Kirkcaldy. In their annual report the directors note that the profits for the year, together with the balance brought forward, after providing interest on debenture stock, and writing £1,000 off account for betterment of the undertaking, amounts to £3,643. The dividends are 6 per cent. on the preference and two dividends of 3 per cent. on the ordinary shares.

**Gandy Belt Manufacturing Co., Ltd.**—The profit for 1912 was £18,273, plus £1,542 brought forward. The dividend for the year is 10 per cent., and £1,584 is carried forward.

**Fairbairn, Lawson, Combe, Barbour, Ltd.**—The profit for 1912 was £33,269, as compared with £38,075 for 1911. The dividend for the year is 5 per cent., as compared with 7½ per cent. for 1911; £22,745 is carried forward, as compared with £47,136.

**Isle of Wight Electric Light and Power Co., Ltd.**—The net profits for 1912, including £2,115 brought forward, was £16,286. The *Financier* states that a dividend of 2 per cent. on the ordinary shares is proposed, adding £3,500 to renewals and £1,000 to the reserve, carrying forward £2,800.

**Mexican Light and Power Co., Ltd.**—Dividend 1 per cent. on the ordinary shares, and 3½ per cent. for the six months ended April 30th on the preference shares.

### Guildford Electricity Supply Co., Ltd.

THE directors' report for 1912 again records very satisfactory progress, the gross receipts being £10,069, as compared with £8,679 for 1911, showing an increased revenue of £1,389. There is a balance on the revenue account of £3,705 (after crediting depreciation fund account with £1,280), as compared with a balance of £3,303 (after crediting depreciation fund account with £1,000) on the revenue account for 1911. After making due provision for debenture interest, dividend on preference shares, &c., and the placing of £500 to the credit of reserve fund account, the net revenue account shows a balance of £1,075 for distribution. Out of this sum the directors recommend the payment of a dividend at the rate of 5 per cent., less tax, for the past year, on the ordinary share capital which will absorb £731, thereby leaving a balance of £344 to be carried forward. The following table shows the progress of the business:—

Year.	No. of connections.	Total revenue.	Total costs.	Gross profit.
1909	744	£7,490	£3,198	£4,292
1910	807	7,885	3,441	4,444
1911	874	8,679	4,876	4,303
1912	929	10,069	5,114	4,955

The above progress has made it necessary to enlarge the company's works, and for this purpose the freehold land and buildings situate between the company's works and the premises of Messrs. Dennis Bros., Ltd., have been purchased. A new engine room is now in course of erection, which will accommodate a further 1,100 H.P. of generating plant, of which 550 H.P. is now being installed.

	1912.	1911.
Units sold—Lighting .. .. .	331,930	295,990
Power and heating .. .. .	437,896	256,515
<b>Total .. .. .</b>	<b>769,826</b>	<b>552,445</b>
H.P. of motors connected .. .. .	753	553
Total number of connections .. .. .	869	874

### County of Durham Electrical Power Distribution Co., Ltd.

THE annual general meeting was held in Newcastle-on-Tyne on 19th inst., Dr. J. T. Merz presiding.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., p. 445), said the progress of the company had been very slow in the past year, very largely due to the interruptions of trade that took place. The increase of connections with the company's system had been 11,000 H.P., in respect to which the current year ought to reap the benefit. It was satisfactory to know that the increase had been more than in former years. The profit was only £7,000 more than in the preceding year, but they had written £813 off their manufacturing plant, and £850 off their connections for house services, and their lighting load had gone up considerably. The capital expenditure had been only trifling, £2,277; but this was due to the fact that the Durham Co. had sold to the Newcastle-on-Tyne Supply Co. £45,000 worth of mains. The company was not in a position to raise money easily, and therefore it depended largely upon the financing of its sister Supply Co., the company which took it over and promoted it seven or eight years ago: so the £45,000 raised in the way mentioned had been spent in the extension of the business in other directions. A Birmingham shareholder had written a letter expressing dissatisfaction with the progress of the company. The shareholder wrote, in effect, that it seemed clear either that the cost of the original installation was needlessly extravagant, or that the rates at which they supplied current were entirely unprofitable, or that their organisation for increasing the sale of current was defective; also that it was difficult to avoid the impression that all three were the cause, and he suggested that it was time either to reorganise the board of management, or the capital, or both. Well, he was glad to answer those questions. In regard to the prices charged by the company, they were slightly more than the prices charged by the Newcastle Supply Co. and the Newcastle Co. was supposed to be the most successful company of its kind in the kingdom, and he might perhaps, add that as a power company it was the only company that had met with some considerable success. Therefore it could not be a matter of prices. As to the management, the company was entirely in the hands of the staff and directors of the Newcastle Co., with one exception, and that was a gentleman who was capable of criticising and watching the affairs of the company, so there could be no complaint as to the management of the company. As to the company being overburdened with capital, he might give a little explanation of the real position. Their company was originally started 12 years ago, and it was carried on for some years before the Newcastle Supply took it over and bought the shares, or, rather, retained some and offered the others to the public, together with a larger amount of capital that was issued. At that time there was a great boom in electricity concerns, and many promoters and irresponsible persons rushed into the field and promised to get electric stations and electric supply organisations in order to supply customers very cheaply. The result was that the company started in that district without any statutory powers whatever, merely through private connections, and supplied current at unreasonably low prices. These prices were certainly 25 per cent. lower than they should have been with the result that the company was prevented from entering into contracts for any large amount of electricity at any high figures. Had those prices been only 25 per cent. more for the

first five or six years their company would have made a considerable sum of money. In addition to this the company had been saddled with a considerable amount of unnecessary capital. That capital had been spent on plant that had become obsolete, and had to be renewed. Again, the company included in its area several communities such as Sunderland and South Shields, which, out of pure sentiment, had chosen to supply their own electricity at a much greater cost than they could have got it from the company. That, however, could not now be helped. What they were now aiming at was to try and increase the load, and that could only be done by progressing on the lines which they had followed so far. He thought they would see that all this criticism as to overloading of capital, or low prices, or failure of the management, could be discredited. The management was the same as that of the Newcastle company, a successful company, the capital could not be altered, and the prices could not be raised. The only way of getting out of the difficulty was to increase their load, and this they were trying to do.

SIR LINDSAY WOOD seconded the report, which was carried, and the retiring directors were re-elected.

### Newcastle-on-Tyne Electric Supply Co., Ltd.

THE annual meeting was held in Newcastle on 19th inst., Dr. J. T. Merz presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 440), said that the connections to the company's system at the end of the year amounted to 174,327 H.P., showing the large increase of 22,700 H.P. over the previous year. The capital expended in the 12 months had been £167,081. In former years he had stated that the amount of capital spent in proportion to horse-power connected would go down, but that statement was not quite correct so far as last year was concerned. If they took the capital expended, £167,000, they would find that it represented about 7 guineas per additional H.P. connected. In former years he had said the latter sum might come down to 5 guineas or £5. This required some explanation. The capital they were now spending, and had spent for some years, and notably last year, was not spent entirely in reaching consumers. The company had now a new department in its business, of which he had spoken on former occasions, but it had been very largely developed in the course of last year, and would be still more largely developed in the future. This was receiving supplies of electrical current from waste-heat stations situated near the coal mines themselves. This was a development of what had been called the waste-heat industry. Electrical current was now generated by the company in connection with coalowners at the mines, and especially where coke ovens existed. This waste heat and gas could not be used except on the spot, and, therefore, instead of bringing their fuel in that shape to their works, they went with their works to the fuel. They had now two classes of industrial concerns connected with them. First, there was the larger class of consumers who used electrical current for their own purposes, and, in the second place, they had those who produced waste heat and gas, which the company received on the spot and converted into electricity, usually in partnership with the coalowners. Therefore, the capital they now spent on mains was not only the capital spent on reaching consumers, but also capital spent upon mains by which they could conduct electricity made in various outlying places, where, to a large extent, it was of no use, into the centre of their distributing system. These mains belonged to the company, and were a valuable asset. They were a link for bringing electricity from outlying places, and for supplying consumers on the way. For these mains they had received a considerable sum—£22,500—which was really a repayment of profit. If they had not got that sum, they would have had to recoup themselves probably in the terms which they would have charged. This £22,500 was not brought into the profit and loss account, and did not ostensibly appear in the balance-sheet. Dr. Merz referred the shareholders to statement No. 8 in the accounts—investments—and said those investments in former years stood at a higher figure than at present—£73,000. If they compared this amount with that of last year, they would find that the figure was now £22,500 less, this sum having been taken off and utilised as an amount to discount the value of that asset, which had been written down by £22,500. If they took this figure from the amount spent in reaching new consumers, they would find that the capital spent per horse-power was £5 7s. 3d., which was coming near the figure he had mentioned in former years. The business of the company, continued Dr. Merz, had been materially interfered with and hampered by the coal strike. It was impossible to say how much the coal strike cost the company, partly in reduced output, in the cancellation of coal contracts, having to pay more for their coal, also in purchasing coal in the market at high prices in order to prevent any chance of stoppage, and lastly, in the deterioration of the large stock of coal which they held. The amount written off the coal stock was £1,419. That was in the shape of deterioration, but was not mentioned as deterioration in the report. The net profit of the company had increased by £2,600. They had now 22 motor-cars which stood on the books at £1,300, or less than £200 per car. They had spent £723 in replenishing these cars, and that sum had come out of revenue. The sum of £2,845 had been spent in making connections to dwelling houses, this being, of course, new business. Dr. Merz mentioned that, in regard to waste heat, the company benefited to the extent of an equivalent of about 70,000 tons of coal, which, he said, was a very large item. They might want to know how they got the £167,000 which they had spent out of capital. First of all, they took £28,400 out of the cash they had in hand, then they recalled loans which were standing out, and repaid those

owing to them, and the difference gave them £36,754. They afterwards borrowed from the bank £100,580, making up the total to £165,751. Of that sum, £3,500 had been spent on stations and the mains of the company, and £45,000 was paid over to the Durham company in purchase of mains in their district. These mains were laid down by the Durham company, and paid for by it, but the Durham company allowed the Newcastle company to use the mains, and they formed a large portion of the mains by which the latter company got the waste heat current. They could be used for supplying electricity and for bringing electricity from other places. These mains formed a link in the company's circle, and it was better that the Newcastle company should own the whole circle. The Durham company paid them rent, which gave the Newcastle company a return on the capital. The Durham company was the largest customer of the Newcastle company, which was anxious that the Durham company should increase its business as much as possible.

SIR LINDSAY WOOD, Bart., seconded the adoption of the report, which was carried.

Dividends at the rate of 5 per cent. on the preference shares and at the rate of 5 per cent. on the ordinary shares, were declared.

The CHAIRMAN then drew attention to the question of directors' fees. He said that the subject had not been dealt with for 11 years, when the dimensions of the company were less than one-fifth what they now were. Three years ago he had mentioned that the matter would be brought up at the next meeting, but when that meeting came the question was postponed for various reasons.

MR. N. H. MARTIN moved that the remuneration of the directors for the past year be £1,500, and that that sum be their annual remuneration until it is altered by a general meeting.

### South London Electric Supply Corporation, Ltd.

THE annual meeting was held on March 18th at the Cannon Street Hotel, E.C., Mr. J. Atherton presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 411), said he thought they would agree that the results of the year's working had been very satisfactory, the lamps added to the circuits during the year being the equivalent of 22,585 35-watt lamps; this was the largest increase they had had since the year 1908. The total lamp connections at the end of the year amounted to 273,306 (since increased to over 286,000), and he was glad to say that nearly 40 per cent. of this increase was due to new lighting connections. As he pointed out last year, they then hoped that the influence of the metal-filament lamp in depressing their lighting revenue had been overcome, and he was pleased to say that their expectation had been realised. The power side of the company's business had also made very satisfactory progress during the year, and nearly 650 H.P. of additional motors had been connected to the mains, bringing the total up to 4,600 H.P., and the units sold for power were again practically equal to the units sold for lighting. The result of these additional connections was an increase in the units sold of 520,631, and the total units sold for the year amounted to 5,000,118, as compared with 1,479,487 in the previous year, or an increase of 116 per cent., and the revenue obtained had been increased by nearly £4,000. In regard to the costs of production, these had increased by £1,587, and the gross profit had risen by £2,321, as against a rise in the previous year of £1,774. The largest increase in expenditure had been for coal, due to the abnormal price which this was now commanding, and which constituted a heavy tax upon all industry. Adding together all the items of expenditure under the revenue account, the sum total was £20,859, which worked out at the very satisfactory figure of 1d. per unit sold, as compared with 1'03d. in the previous year, this result being again one of the best obtained by any of the companies supplying electricity in the metropolis. Last year he told them that after very careful consideration they had decided to install a further 2,000-kw. turbine, and to change the system of generation from single-phase to two-phase, and they then hoped that this work would have been completed by the early part of last September. The coal strike and other labour troubles, however, completely upset their calculations, and they had to give their contractors an extension of time, and the plant was not completed until the latter part of November, so that although practically the whole of the capital expenditure for the new turbo-alternator, cables, switch-gear and other apparatus for the change over to the two-phase system was included in the capital account, it had not been productive of any revenue during the year. The capital expenditure during the year amounted to £17,312 principally incurred for the new turbine and the change over to the two-phase system. This change was made in the early part of the present year, and he was more than pleased to say that the resulting business was satisfactory. The new machinery was running well, and the change had been effected without the supply to any consumer being interrupted. Their sales department continued to grow apace, and as the accommodation in the offices at the works had become insufficient, they had decided to open central show-rooms in one of the main thoroughfares in their area of supply. The total amount available for distribution was £28,472, and out of this sum they had provided £6,000 for depreciation on plant and machinery. The item of £2,574 for renewals represented principally the value of the first generating set installed in the works, and this had been disposed of to make room for the new 2,000-kw. turbo-alternator. After providing for debenture interest and other interest accrued, &c., there remained to be carried to the general balance-sheet the sum of £15,183, out of which the board recommended a dividend on the ordinary shares at the rate of 5½ per cent. per annum, an increase of one-half per cent. over the preceding

year and in view of the enhanced price of coal and other difficulties with which they had to contend during the year, they thought the shareholders would agree that this was a very satisfactory result.

MR. R. A. BUSH, a shareholder, seconded the motion.

MR. HOOT congratulated the shareholders upon the satisfactory progress which the company had made since its inception. Now that the board had adopted the two-phase system they could, he said, enter more widely into the field of competing for power on the very best terms, and he believed that the company was only in its infancy in that respect. There were a great many large factories in the area which hitherto they had not been able to tackle, and they might safely leave the development in the hands of the directors and the capable manager, Mr. Sprunt.

The CHAIRMAN, in reply to questions, said the debenture issue was made at 99 per cent. As to an interim dividend the board thought such a policy inadvisable at the present time.

The report was adopted.

### Evered & Co., Ltd.

THE directors report that the trading for 1912 resulted, after the provision of £1,110 for debenture interest and £176 for income-tax, in a net profit of £13,256, plus £2,090 brought forward, making £15,346 to be dealt with. They recommend a dividend of 5 per cent., free of income-tax (£8,537), put to writing off plant, £2,500, and propose to carry forward £4,309.

The increase in the turnover reported during the previous year has been continued, and has reached a total which has not been approached for some years past, enabling the whole of the works to be kept fully going during the past financial year. Stocks of raw material at the works have been taken on the same fixed basis as in former years, and, therefore, very considerably below cost or market value. All part-manufactured and finished stock has been brought into account at the figures obtaining in the beginning of the year, since when large advances in cost of manufacture have occurred, and in the opinion of the managing directors the actual value of the stock at to-day's market prices is distinctly in excess of the amount at which it appears in the balance-sheet. But, in view of the uncertain position of the metal market, such action appears to the board to be wise. Machinery and plant, in addition to the writing off above proposed, have been maintained and renewed, and are in fully efficient condition. The depreciation of buildings has been provided for by the lease redemption policies mentioned in the last report.

The meeting will be held at Drury Lane offices on Monday.

**Kettlewell Electricity Supply Co., Ltd.**—A meeting of the shareholders of this company, which has recently been formed in connection with one of the West Yorkshire village schemes for generating energy by means of local water power, was held last week, when it was reported that the scheme was making satisfactory progress, and the directors hoped to be able to declare a dividend in due course. Messrs. O. Robinson (chairman), J. H. Coates (vice-chairman), L. Gaunt, Walsh, J. Raw, W. L. Carradice, and T. Inman were elected directors, and Mr. W. P. Inman, secretary.

**Liverpool District Lighting Co., Ltd.**—Mr. Charles McLaren presided over the annual meeting of this company, and in proposing the adoption of the accounts, he stated that during the year the company had increased their sales of electricity by over 50,000 units, and had added 3,515 lamps to the supply system. The extra profit, however, had been nearly all taken up in the increased cost of fuel and labour, and the extra expense incurred during the coal strike. The company were now making a business of hiring electric heating and cooking apparatus, and it was expected that the increased revenue from this source would make the figures for 1913 even better than for the preceding year. The increase in consumers necessitated increased capital expenditure for laying mains, and more plant would be required during the coming winter to meet the increased demand. Mr. Holbroek Gaskell, who seconded, pointed out that for the first 2½ months of 1913 the company was progressing more rapidly than in 1912. The report was adopted.

**Hadfield's Steel Foundry Co., Ltd.**—At the annual meeting on 17th inst., Sir R. Hadfield said that he hoped we should have nothing like conscription in this country to interfere with industry. It would be a great mistake to have men withdrawn from productive employment. The *Times* reports that in reply to a shareholder, Sir Robert said that while Hadfields were not likely to try anything venturesome, "they were going to launch out a bit."

**Winnipeg Electric Railway Co.**—The report for 1912 states (says the *Times*) that the gross earnings were \$3,765,384, as compared with \$3,829,749. The net earnings were \$1,761,236, as compared with \$1,928,782. After providing for the percentage on earnings accrued the city and interest on bonds, the directors declared four quarterly dividends, amounting to \$720,000, leaving a surplus of \$174,463, which has been transferred to the credit of profit and loss account, making a total credit to that account at December 31st of \$2,091,236.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended February 2<sup>nd</sup>, 1913, amounted to 730,198, compared with 658,948 units in the corresponding four weeks of 1912.

### British L. M. Ericsson Manufacturing Co., Ltd.

The directors' report for the year ended December 31st, 1912, states that the net profit amounts to £18,563. The directors recommend that after payment of 6 per cent. to the preference shareholders, the balance of £13,941 be appropriated as follows:—Dividend of 8 per cent. (free of income-tax) to the ordinary shareholders, requiring £8,001, carrying forward £5,940.

The annual meeting was held on March 19th, at the Memorial Hall, Farringdon Street, E.C., Mr. W. M. CROWE, chairman and managing director, presided, and in proposing the adoption of the above report, he said that although that was the tenth annual meeting of the company, it was the first time that the directors had had the pleasure of meeting with the shareholders. Formerly the company was a private one, held practically by two shareholders—the National Telephone Co., and Messrs. Ericsson, of Stockholm. Therefore, the annual meeting was more of a form than a reality. He thought they would agree with the directors that the result of the year's working had been exceedingly good, and particularly so was that the case when they remembered that in common with other manufacturing concerns they had had a good deal to contend with. Early last year they had a series of strikes, including the coal strike, and the price of raw material went up considerably, and wages also rose. Coal was a commodity that they used a great deal of, and they had to pay some 65 per cent. more for it last year than in 1911. Then they had been burdened with extra taxation. The National Insurance Act cost them many hundreds a year. Then, again, their chief customer in this country—the Postmaster-General—had not put through so many orders in 1912 as he did in 1911. It would be remembered that in 1911, he had in prospect the taking over of the business of the National Telephone Co., and he, therefore, put in hand enormous supplies of material, and that company and other telephone manufacturers in the country put as much work through during that year as they could, and, consequently, they made big profits. He was glad to say that 1913 had started well, and should matters go on as they were at present, they hoped to meet the shareholders this time next year with as good, if not better, results than they showed that day. One thing was certain, and that was that there was any amount of work to be done in this country in telephones. When they compared this country with other go-ahead countries, they found that we were very far behind in telephones. If they took representative towns in the United States of America and some of the countries of Europe and compared them with towns in this country, it was found that we had a long way to go before we were equal with those other countries. London, for instance, had a telephone for every 35 inhabitants. New York had one for every 12; Chicago one for every 9; Washington one for every 6. If they went to Stockholm they found there that they had a telephone for every 5 inhabitants, and in Copenhagen there was one for every 12. Turning to our own country, as he had said, London had one for every 35 inhabitants; Birmingham had one for every 72; Liverpool one for every 40; Manchester one for every 47, and the other towns were in a like state. It would, therefore, be seen that before England was on equal terms with the countries he had mentioned, telephone manufacturers would have a great deal of work put through their hands. He was glad to say that the Postmaster-General and the officials under him realised this state of affairs, and they were tackling the matter in a businesslike way. They hope, therefore, that before many years were over they would be equal with the most advanced countries in respect to telephones. One thing he regretted, and particularly for the sake of their own company, and that was that the Postmaster-General had decided to continue the policy of the National Telephone Co. in withdrawing the hand micro-telephone from use in this country. That was a small instrument with the receiver and the transmitter combined. While we were removing this instrument, other countries were installing it. France, for instance, within the past six months had made the hand micro-telephone the standard for the country, and their friends in Stockholm had given large orders for the instrument. Turning to the accounts it would be seen that no amount was put aside for reserves, but during the year the amount written off for depreciation was within a few pounds of £10,000. The directors considered that that amount was ample and even generous under that head, and he believed that the shareholders would agree with them. It was especially ample when it was known that during the partnership of Messrs. Ericsson and the National Telephone Co. depreciation was written off at a very high rate indeed. An agreement existed between those two concerns which provided that after depreciation was written off every penny was profit which would be divided, therefore there was no reason for the heading "reserves"—the depreciation was at such a high rate that it served the purpose of depreciation and reserve. It would be remembered that before the issue of the prospectus last year, a valuation was made of the assets at the Beeston factory, and they were put down at £116,786, and that was after sufficient allowance had been made for depreciation. Those assets stood in the books at the company at £86,674, so that there was a reserve of £30,000, which did not appear in the account. It was the intention of the directors immediately they found it convenient to do so, to build up a reserve, in addition to continuing the present rates of depreciation. It must also be remembered that the fixed assets, the machinery, power plant, &c., had been kept up to the highest standard of efficiency out of revenue. Again, although the company had a valuable goodwill, and had valuable patents, having a right to all the patents taken out by Messrs. Ericsson, of Stockholm,

no amount stood in the books for them. It would, therefore, be seen that the company had not a penny of water in its capital. Turning to the balance-sheet, it would be seen that the cash in hand amounted to £68,000, which was £18,000 more than would be required to pay off the whole debenture issue, and to that had to be added the value of the stocks, which gave them a total of £111,300, or more than enough to cover the whole preference issue, and that was without touching the fixed assets, amounting to £96,600. The stocks in hand were practically all made under firm orders, and were, therefore, as good as liquid cash. The other liquid asset, sundry debtors £26,000, was £7,700 more than was necessary to pay off sundry creditors, and the amount of bad debts during last year was only £20. The fixed assets had increased considerably since 1911, the reason being that during last year an addition was made to the factory in the shape of warehouses, stores, and a testing department. The amount carried forward was practically sufficient to pay the preference dividend for 1913, therefore, taking everything into account, he thought it would be agreed that the security of the shareholders and the debenture-holders, and the position of the company generally, were about as good as could be wished for.

Mr. HAROLD SANDS seconded the motion, and the report was adopted.

### Hove Electric Lighting Co., Ltd.

THE annual meeting was held on March 19th at Salisbury House, E.C., Mr. Carleton F. Tuftnell presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 442), said that the capital expenditure during the year had amounted to £1,300, the principal item being £889 for extension of mains. The gross revenue had increased from £24,840 to £25,220, and the expenditure from £10,383 to £10,590, the profit carried to net revenue being £14,630, as compared with £14,457 in 1911. That was a small increase, but it was satisfactory in that last year they had to announce a reduction of profits to the extent of nearly £1,000 in comparison with the then previous year. The units sold in 1912 amounted to 1,169,003, as compared with 1,139,328 in 1911—a very satisfactory increase. Taking into the account the balance brought forward from 1911, and deducting the dividends paid on the preference and ordinary shares and also making provision for debenture interest accrued, there remained a surplus of £9,283, and as the outcome of the year's working, they again recommended the payment of a dividend at the rate of 10 per cent. per annum, making 9 per cent. for the year. They would, perhaps, expect him to say something with reference to the notice received from the Hove Corporation of their intention to exercise the option of purchasing the company's undertaking. The notice stated that the purchase was to be by way of repayment of the legitimate capital expenditure of the company, which was one of the two alternatives open for selection by the Corporation. Immediately on receiving the notice the directors thought it was only right to inform the shareholders, and this they did by a circular letter on December 3rd last. The Hove Corporation had lodged a Bill in Parliament for the purpose of enabling them to raise the necessary money for the purchase, and it was a condition of the Bill that until the transfer was actually effected by the payment of the purchase money the company would carry on the undertaking for the benefit of the shareholders. They must all regret the contemplated purchase, as the business had been a satisfactory one from the very start. He would again like to compliment the staff, both in London and Hove, upon the efficiency of their work, and to assure them how thoroughly the directors appreciated their efforts.

COL. H. WOOD seconded the motion.

Mr. SCRASE asked whether the board had formed any view as to what the ordinary shareholders were likely to receive as a result of the purchase of the company?

The CHAIRMAN said that according to the terms of the notice the Hove Corporation would pay them the actual capital expenditure, which, up to the present time, was £176,279. Of course they could not tell what further capital expenditure might be necessary during the present year, nor could they tell what the accrued profits might be which would come back to the shareholders.

Mr. F. R. REEVES, the managing director, remarked that in addition to the capital expenditure there was the investment reserve fund, which also belonged to the ordinary shareholders, and if they put those two amounts together and deducted the debentures, the debenture stock, and preference shares, which did not share in the surplus assets, they would be able to see pretty clearly what the result was likely to be. A great deal depended upon the view the Hove Corporation might take of the capital expenditure account. If they accepted the audited figures then they would know where they were, but they might dispute some of the items, which of course would bring an uncertain element into the figures.

The CHAIRMAN said he might say that they did not anticipate that there would be any dispute over the matter at all.

The report was adopted.

**Empresas Electricas Asociadas.**—The directors have declared a dividend of 1½ per cent. for the last quarter of 1912.

**Electrical Distribution of Yorkshire, Ltd.**—An extraordinary meeting was held at Leeds on 18th inst. Mr. R. W. Wickham presided. The resolution already passed increasing the capital, was approved.

### Metropolitan Electric Supply Co., Ltd.

Mr. W. HARRISON CRIPPS presided at this company's annual meeting on March 18th, at Winchester House, E.C.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 415), he said that the capital expenditure was this year £2,013,999, an increase of £111,000. Of this, £51,000 was what he might describe as a direct increase, and £62,800 was an indirect increase. The gross revenue for the year was £202,000, an increase of £19,500. The working expenses were £99,086, an increase of £11,000. After deducting the working expenses there was left to the credit of revenue account, before depreciation, £103,096. They had thought right to put £20,000 to depreciation, and that left £83,096. As regards the increase in the capital account for the year, this figure was the large amount of £114,101, but the amount of cash actually spent was only £51,298. That was expended, to a large extent, for the extension and consolidation of their western area. The difference of the two amounts arose from the amount then standing in the books, which represented the purchase of the Acton undertaking. What they did was to take over that undertaking for a period of 42 years, including all buildings, mains, plant, &c.—in fact, the whole thing, lock, stock and barrel. In exchange for the undertaking, they took over the obligation of the debt and sinking fund for the amount spent by the District Council, less that which they had already repaid, which practically represented the depreciation on the property during the years they held it. Therefore they became liable to pay interest and sinking fund on the unredeemed part of their loan, this loan amounting to £62,863. That item, being a capital charge, had to be shown in the capital account in a separate column. Turning to the revenue account, they would see that they had earned, roughly, an extra £19,000 (the largest increase in one year since parting with Marylebone), at only a working cost of £11,000, leaving £8,000 as a net increase. He trusted they would consider this satisfactory, especially when they remembered that in 1911 the increase of receipts was practically swallowed up by corresponding increase in cost. They could rest assured that the board, ably assisted by their officers, went very carefully into every item of expenditure. There were some items, however, such as coal and rates, over which they had no control, and these two items had both shown a serious increase in their expenses last year. They regarded the future of the company very hopefully, for although, during the current year, there must be a considerable increase in the cost of coal, they also thought that there would be a substantial increase in the revenue. He would again call their attention to the satisfactory condition of the reserve and depreciation fund, to which they had added £20,000, compared with an addition of £15,000 two years ago, and £17,000 last year. It now stood at the substantial total of nearly £300,000. This had been built up for the most part out of revenue, and had been gradually accumulating since the early days of the business. They must remember in considering this fund that all their plant was kept up in the highest state of working efficiency out of revenue, and further, that in their own case they had less than an average depreciation to provide for, because a large amount of the old and depreciated plant was entirely renewed out of the funds obtained from the compensation money paid by the London County Council in taking over their old Sardinia Street works, and nothing was at that time withdrawn from the depreciation fund. In considering the amount of dividend, they thought that, after providing a considerable extra sum for reserve, the shareholders were fairly entitled to some small immediate benefit for the successful working of the year. They still looked cheerfully forward to the future prospects of the company. The business had been steadily expanding, and during the past year the increase in connections was equivalent to 71,267 8-c.p. (30-watt) lamps, and they now had the largest amount of connected lamps in the history of the company, the total exceeding 1 million. The progress had not only been marked in a large further demand for power, but also for light. They would remember that the effect of the introduction of the metal-filament lamp five years ago showed itself in a marked falling off in the sale of light units. This reached its climax in 1910. In 1911 there were symptoms of recovery, and for the first time there was a tendency again to rise slightly. They considered that a most satisfactory feature in this year's report was that this rise had not only been confirmed, but considerably increased, amounting during the year to nearly half-a-million of units, or over 5 per cent. Another source to which they looked for an increased revenue was the gradually extending use of current for cooking. Its use for this purpose had been slow at first—partly owing to the inefficiency of the early cooking ranges, but chiefly to its advantages not being generally known. The London County Council during the past year had had a committee sitting with reference to the future electrical supply of London, and had courteously sought an interview with the collective representatives of some of the companies. They did not know what might be the outcome of it, but he felt sure that any co-operation which would be of mutual benefit both to suppliers and consumers, would be carefully considered. He had often been struck with the fact that many Londoners thought there must be something wrong with the present system of supply, and that they paid too much for their current. With improvements in production there was a tendency for many articles to cheapen, and this would probably apply to current as in other matters. In the meanwhile it was only fair to the electrical undertakings, whether companies or Councils, to say that the public were obtaining their supply of current at a cheaper rate than in almost any capital in the world, a fact which they would discover by a few months' residence in Paris, Berlin, or in any of the big American cities.

SIR JOHN PENDER seconded the resolution.

Mr. FISHER asked if in the conversation with the County Council any suggestion was made that the Acton undertaking should be excluded from any proposed taking over by the County Council.

Mr. HARROP thought the working expenses had increased out of proportion to the income, and whilst he admitted that they were making progress, he did not consider they were making progress fast enough. They had about as many lights now as when they had the Marylebone undertaking but whereas they paid 10 per cent. in those days, now they were only paying a miserable 4 per cent.

Mr. GURNEY asked if the capital value of the shares was increasing.

Mr. MOORE remarked that they had heard from the chairman that their men had worked well and did not grumble. Having had to do with workmen all his life, which was between 80 and 90 years, he felt they must be paying the men well or they would grumble.

The CHAIRMAN, in reply, said he was not present at the meeting with the County Council, but he understood that no details were discussed. As to Mr. Harrop, they could not talk of what one or another company was doing, unless they studied the history of the company. If they averaged what the shareholders had received over the life of the company, it would amount to considerably more than 1½ per cent. The company was getting as much of the business in Kingsway as others. The price of the company's shares was not in any way under the control of the board.

On the motion of Mr. F. LEVERTON HARRIS, seconded by the Hon. G. BIRKBECK LUBBOCK, the retiring directors were re-elected.

Mr. J. F. E. MULLETT proposed a vote of thanks to the chairman, board and the staff. He was glad to hear that they had an admirable staff of canvassers, which was all-important in these days of keen competition.

Mr. W. H. SKEL seconded the motion, which was carried unanimously.

### British Aluminium Co., Ltd.

The report of the directors, as abstracted in the *Financier*, states that the trading profit for 1912, together with interest and dividend on investments and deposits, and the revenue derived from Kinlochleven and Foyers estates, and transfer fees, is £194,823, plus £4,001 brought forward. Provision for income-tax, legal expenses, bad and doubtful debts, depreciation of investments and furniture, and proportion of profits payable to directors, has absorbed £17,420; prior lien debenture interest, £40,000; debenture stock service fund, £43,223; reserve for depreciation, £40,000; reserves account, £30,000, leaving £28,180. The directors recommend a dividend of 6 per cent. per annum, less income-tax, for the year on the preference share capital, requiring £17,974, leaving to be carried forward £10,206. The reserve account, including the sum of £30,000 added out of the profits of the year, amounts to £80,000. The investment of the balance of this fund will be made during the current year. The depreciation reserve account, including £40,000 set aside out of this year's profits, now stands at £100,000. The aluminium works at Vigeland, near Christiansand, Norway, previously controlled by the Anglo-Norwegian Aluminium Co., Ltd., have been purchased by this company. Part of the price has been paid, and the balance will be paid during the present year. These works, which will add considerably to the company's productive capacity, are now in full operation. The company has also acquired an interest in a works for the manufacture of alumina, to augment the supply from the works at Larné. The output and sales for the year were greater than in any previous year. The prices obtained were low, owing to the keen competition of the foreign producers, but prices for the present year show a material improvement. The demand for the metal continues to increase, and the sales made for the present year are encouraging.

### South Wales Electrical Power Distribution Co.—

The directors report that, although the operations of the year 1912 were somewhat seriously affected by the national coal strike, which caused a lessened demand for current and a considerable increase in the price of coal, the units sold showed an increase of 3,319,081 over 1911, and reached a total of 19,689,656. After payment of all working expenses and interest on prior lien debenture stock, and making due provision for depreciation of new plant, there remains a fairly substantial surplus, which, according to agreement, will be utilised in discharging the indebtedness to certain consumers of the Treforest Co. The application last year for a prov. lighting order for the district of Llantwit Fardre was successful, and a supply is now being given in that district. The application for a prov. order for the district of Bedwas and Machen Upper is not at present being proceeded with. The supply of current in the Caerphilly area is developing satisfactorily, and the acquisition of the prov. order has been fully justified.

**Australia.**—An Australian exchange states that the Northern Sydney Electric Light and Power Supply Corporation, Ltd. has increased its capital to £250,000 by the creation of 230,000 shares of £1 each. This company has been negotiating with the North Sydney Council for the supply of electricity, and is also in communication with other Councils in the northern suburb for a like purpose.

**Alldays & Onions Pneumatic Engineering Co., Ltd.**  
—The directors announce a dividend at the rate of 5 per cent. per annum.

MARKET QUOTATIONS.

STOCKS AND SHARES.

Tuesday Evening.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, March 26th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
Acid, Hydrochloric .. .. per cwt.	5/-	..
" Nitric .. .. .. "	22/-	..
" Oxalic .. .. .. per lb.	23d.	..
" Sulphuric .. .. .. per cwt.	5/6	..
Ammoniac Sal .. .. .. "	42/-	..
Ammonia, Mariate (large crystal) per ton	229 10	..
Bleaching powder .. .. .. "	46 5	..
Bisulphide of Carbon .. .. .. "	18	..
Borax .. .. .. "	17 10	..
Copper Sulphate .. .. .. "	23 15	..
Lead, Nitrate .. .. .. "	29 10	..
" White Sugar .. .. .. "	27 10	..
" Peroxide .. .. .. "	32	..
Methylated Spirit .. .. .. per gal.	2/6	..
Potassium, Bichromate, in casks .. .. .. "	84d.	..
Potash, Canstie (88/90 %) .. .. .. per ton	22 10	..
" Chlorate .. .. .. per lb.	34d.	..
" Perchlorate .. .. .. "	44d.	..
Potassium, Cyanide (98/100 %) .. .. .. (for mining purposes only)	74d.	..
Shellac .. .. .. per cwt.	85/-	..
Sulphate of Magnesia .. .. .. per ton	4 10	..
Sulphur, Sublimed Flowers .. .. .. "	46 10	..
" Recovered .. .. .. "	23 10	..
" Lump .. .. .. "	45	..
Soda, Canstie (white 70/72 %) .. .. .. "	10 6	..
" Chlorate .. .. .. per lb.	84d.	..
" Crystals .. .. .. per ton	28 5	..
Sodium Bichromate, casks .. .. .. per lb.	8d.	..
METALS, &c.		
Aluminium Ingots, in ton lots .. .. per ton	£95	..
" Wire, in ton lots .. .. .. "	112	..
" Sheet, in ton lots .. .. .. "	120	..
Babbitt's metal ingots .. .. .. "	£38 to £145	..
Brass (rolled metal 2" to 12" basis) per lb.	84d.	3d. dec.
" Tube (brazed) .. .. .. "	94d.	3d. dec.
" Wire, (solid drawn) .. .. .. "	83d.	3d. dec.
" Wire, basis .. .. .. "	84d.	3d. dec.
Copper Tubes (brazed) .. .. .. "	114d.	3d. dec.
" (solid drawn) .. .. .. "	108d.	3d. dec.
" Bars (best selected) .. .. .. per ton	483	..
" Sheet .. .. .. "	483	..
" Rod .. .. .. "	483	..
" (Electrolytic) Bars .. .. .. "	£29 15	..
" Sheets .. .. .. "	£26 10	..
" Rods .. .. .. "	75	..
" H.C. Wire per lb.	94d.	..
Ebonite Rod .. .. .. "	5/8	..
" Sheet .. .. .. "	4/9	..
German Silver Wire .. .. .. "	1/10	..
Gutta-percha, fine .. .. .. "	7/- to 8/-	..
India-rubber, Para fine .. .. .. "	3/10 1/2	1d. dec.
Iron Pig (Cleveland warrants) .. .. per ton	55 5	2/6 inc.
" Wire, galv. No. 8, P.O. qual. .. .. "	14	..
Lead, English Pig .. .. .. "	16 15	15s. inc.
Manganin Wire No. 28 .. .. .. per lb.	6/6	..
Mercury .. .. .. "	£7 10	..
Mica (in original cases) small .. .. per lb.	6d. to 8s.	..
" medium .. .. .. "	8/6 to 6/-	..
" large .. .. .. "	7/6 to 11/-	..
Nickel, sheet, wire, &c. .. .. .. "	3/6 to 4/6 nom.	..
Phosphor Bronze, plain castings .. .. per lb.	1/2 to 1/3 1/2	3d. dec.
" rolled bars & rods .. .. .. "	1/2	..
" rolled strip & sheet .. .. .. "	1/2 1/2	..
Platinum .. .. .. per oz.	185/-	..
Silicium Bronze Wire .. .. .. per lb.	11d.	..
Steel, Magnet, in bars .. .. .. per ton	455	..
Tin, Block (English) .. .. .. "	£217 to £218	1/1 inc.
" Wire, Nos. 1 to 16 .. .. .. per lb.	2/7	1d. dec.
White Anti-rusting Metals .. .. .. per ton	46 to £728	..
Zinc, Sh <sup>t</sup> (Vieille Montagne hnd.) .. .. "	£28 10	..

Quotations supplied by—

a G. Boor & Co.	/ Bolling & Lowe.
b The British Aluminium Co., Ltd.	/ Morris Ashby, Ltd.
c Thos. Bolton & Sons, Ltd.	/ Richard Johnson & Nephew, Ltd.
d Frederick Smith & Co.	/ W. T. Glover & Co., Ltd.
e F. Wiggins & Sons.	/ P. Ormiston & Sons
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	o Johnson, Matthey & Co., Ltd
g James & Shakspeare.	p W. F. Dennis & Co.
h Edward Till & Co.	

**Greenock and Port Glasgow Tramways Co., Ltd.**—The ordinary general meeting of the shareholders of the above company was held on March 18th, at Electrical Federation Offices, Kingsway, W.C., Mr. W. L. Madgen presiding. The proceedings were quite formal, the report being adopted on the motion of the Chairman, seconded by Mr. A. C. Miles, without any remarks.

**Continental.**—SWITZERLAND.—La Société Suisse pour l'Industrie Electrique, of Basle, for the last financial year shows a profit of £69,350, as compared with only £60,865 in the preceding 12 months. A dividend of 7 per cent. is being declared.

ITALY.—La Società Italiana Thomson-Houston, of Milan, is declaring a dividend of 6 per cent. for the last financial year.

HOLIDAY influences are still noticeable factors in the stock markets, and there was no great rush of fresh business for the Stock Exchange to cope with after the Easter recess. The situation abroad was read as more encouraging, and this pointed to the possibility of money becoming cheaper, so that to this extent conditions were to the good of markets. The wild weather of the week-end led to considerable damage to telephone and telegraph wires, but much of this had been repaired before the Stock Exchange resumed work on Tuesday morning.

The Underground Railway Companies should have been benefited at the expense of the steam lines by the roughness of the elements during the holidays. Judging by the traffic returns, however, people moved about at Easter-time with much the same freedom as usual. The Undergrounds, therefore, could not expect to receive more than their customary share of holiday traffic, and prices are a little duller, there being falls in Metropolitan and Districts. The Income Bonds of the Underground Electric Railways eased off to 92. No changes have taken place in Central London stocks, nor in those of the City and South London Railway, with the exception of a point fall in the City 4 per cent. Debenture stock. Metropolitan Electric Tramways First Debenture lost 1 1/2. London United Tramways Debenture has not picked up its drop of last week.

The market for London Electricity Supply shares is well-nigh stagnant. Last week there was one change, and this week ties with its predecessor in the number of fluctuations, a fall of 3/4 in South Metropolitan Preference, reducing the price to 22s. 6d. Now that the dividends are declared and paid, and the reports issued, it is contended that there is nothing much else to go for at present; and, with the summer in front of us, the electric lighting companies of London will fall into their usual jogtrot, without exciting interest or attention from the investor. There is still a little speculation latent in the City of London Ordinary shares; and if the clique which has been operating in them were to choose to run up the price, the manoeuvre could be executed without difficulty. In the provincial list, Bournemouth and Poole Second Preferences have hardened to 10 1/2.

The Latin-Canadian group has somewhat weakened. Recent new issues from companies operating in South America have been left largely in the hands of underwriters, and this seems to have acted as a kind of caution signal in the way of checking purchases of American—North, Central, and South—stocks of the utility class. An important newcomer this week is the offer of three million dollars 5 per cent. Gold Bonds at 91 by the Mississippi River Power Company. The Common shares fell back to 48, but have recovered a point or so, while the existing 5 per cent. Bonds are quoted in the Stock Exchange Official List at 89 1/2 to 91 1/2.

Brazilian Traction dropped 1 1/2 to 96 1/2, and the British Columbia Electric stocks are lower. Havana Fives fell 2 points, Rio Trams 1st Bonds and Sao Paulo 1st Debentures are both a little lower. Of the Mexican descriptions, there are falls in Mexico tramway and Mexican Light and Power Shares and Bonds. The chief drop this week, however, is one of 5 points in Shawinigan water, where vague, unconfirmed rumours of an impending issue of new capital continue to play their part in depressing the price of the shares. Montreal gave way apparently in sympathy. Demand has arisen for Cape Electric Trams, the price putting on 1/8 at 15s. On the other hand, La Platas are 3/8 easier.

The Barcelona Tramway Company has recently made, we understand, an issue of 5 per cent. Bonds at 90, carrying a bonus of 33 per cent. in common shares. According to our information, it is intended to made a public issue of these Bonds later in the year, when the times are more propitious, the present emission being a kind of underwriting which enables the company to secure money and support at the time it wants them. The nominal price of Barcelona shares in the market is about 40. Columbia Gas and Electric shares have dropped back to 13, and the rest of the stocks and shares in this utility group are, on the whole, in a depressed state for the time being.

The Telegraph market is very quiet. Direct United States Cable shares dropped to 7, and Eastern Telegraph 4 per cent. Debenture at 96 is a point down. Other issues, however, retain the rises which they secured last week. New York Telephone Bonds are firmer, and National Telephone Deferred stock hardened to 20 1/2 on a little speculative inquiry by those who expect that the residue of the money to be awarded will work out at something better than this.

A good deal of activity in Marconi's has for its net result a fall of 1/8 in the price of the Ordinary, and of 1/4 in the Preference. Whatever may be the ethical attitude which ought to be taken in respect of Cabinet Ministers' investments, the plain man will probably deplore the fact that highly placed officials should allow the least handle to be given to the suspicion that they should be speculating. And that American Marconi shares savoured strongly of a speculation there will be found few Stock Exchange men ready to deny.

The British Aluminium Company's report makes a fine showing, net profits having risen to £194,800, no less than £42,000 better than those for the corresponding period. Some such result had been expected, and advances in the company's stocks have been noticed here from time to time. This week there are improvements in the Ordinary and Preference shares. Brush Second Debenture lost 5 points, bringing the price down to 25. Manufacturing descriptions as a whole are very steady. Rubber shares eased off, but braced up again; the stationary condition of the market in the raw material is fatal to activity in the shares; probably the users of rubber appreciate it more than the Stock Exchange does.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

Table listing various electrical supply and power companies in England, including names, stock shares, dividends, and closing quotations.

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Table listing colonial and foreign electricity supply and power companies, including names, stock shares, dividends, and closing quotations.

TELEGRAPH AND TELEPHONE COMPANIES.

Table listing telegraph and telephone companies, including names, stock shares, dividends, and closing quotations.

\*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ \$s. In Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations Mar. 25th, Rise + or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations Mar. 25th, Rise + or Fall, Present Yield p.c. Lists various railway and tramway companies like Bath Trams, Metropolitan Railway, etc.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations Mar. 25th, Rise + or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations Mar. 25th, Rise + or Fall, Present Yield p.c. Lists international railway and tramway companies like Anglo-Arg. Trams, La Plata Elec. Trams, etc.

MANUFACTURING COMPANIES.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations Mar. 25th, Rise + or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations Mar. 25th, Rise + or Fall, Present Yield p.c. Lists manufacturing companies like Aron, Crompton & Co., etc.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING FEBRUARY, 1913.

The February returns of electrical business show a falling off in both the export and import sections as compared with the previous month, which is to some extent accounted for by the shorter period covered by the returns.

The exports from this country reached a total of £517,375, as compared with £576,523 in the previous month, and included nearly £170,000 worth of machinery and cable valued at £106,711.

The telegraphic and telephonic exports, although, in common with other things, showing some decrease on the January figures, reached very satisfactory totals.

Electrical imports were valued at £236,079, as against £252,167

in January; while the re-exports at £23,396, were about £5,000 down. The decrease in the imports total was mainly due to the falling off in cable, telegraphic and telephonic values, the other items of the imports showing but little variation in value as compared with the January returns.

Argentina was our best customer during the month, while India, New South Wales, Canada and Brazil were also prominent purchasers from this country.

As regards the imports, Germany, as usual, took the lion's share of the business, while the United States retained a large share of the remainder.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable, apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	2,016	332	144	39	...	190	2,199	32	18	...	583	367	5,919
Germany ...	1,733	210	8	...	514	489	1,947	...	2	3	2	48	4,956
Netherlands, Java & Dutch Indies ...	735	1,408	98	...	220	215	870	30	306	35	35	168	4,120
Belgium ...	487	262	39	70	273	...	1,400	347	11	60	1,190	...	4,142
France ...	607	133	3,233	40	30	273	10,107	92	12	83	3	3	14,645
Portugal ...	191	...	23	...	...	...	404	...	10	6	250	23	909
Spain, Canary Isles and Spanish N. Africa...	1,064	1,908	9	138	300	350	5,170	911	72	129	691	402	11,150
Switzerland, Italy and Austria-Hungary ...	301	270	203	62	69	14	2,423	...	7	256	43	1,680	5,328
Greece and Turkey ...	402	2,996	16	...	...	...	1,800	...	101	32	...	250	5,597
Channel Isles, Gibraltar, Malta and Cyprus...	239	38	73	44	...	36	375	950	1,450	...	19	658	3,882
U.S.A., Philippines and Cuba ...	807	15	524	...	64	286	317	...	11	10	2	1,103	3,139
Canada and Newfoundland ...	1,099	6,625	1,174	581	20	4,853	12,348	...	4,134	49	5,158	186	36,317
British West Indies and British Guiana ...	50	51	73	96	...	88	187	4	132	...	12	198	891
Mexico and Central America ...	91	...	26	...	34	...	160	59	...	...	12	83	465
Peru and Uruguay ...	454	...	137	58	...	12	484	...	1,339	20	44	1,264	3,812
Chile ...	591	106	307	57	...	17	7,564	927	678	...	278	4,543	15,068
Brazil ...	1,471	2,972	2,312	322	25	75	10,189	467	214	...	12,483	2,540	33,070
Argentina ...	3,823	26,426	379	1,628	90	526	15,284	2,617	3,296	238	7,643	624	62,571
Colombia, Venezuela, Ecuador and Bolivia...	...	28	5	...	...	...	598	...	7	4	...	390	1,032
Egypt, Tunis and Persia ...	607	286	46	39	11	44	1,308	56	55	...	493	18,148	21,093
British West Africa and Ascension ...	387	51	7	204	154	...	1,502	...	5	38	145	...	2,493
Rhodesia, O.R.C. and Transvaal ...	1,145	186	475	1,028	154	256	2,186	770	226	11	217	...	6,654
Cape of Good Hope ...	1,959	1,273	173	384	...	2	2,772	245	1,097	20	4,611	28	12,564
Natal ...	813	9,640	570	209	...	173	5,097	52	152	...	181	92	16,979
Zanzibar, Brit. E. Africa, Mauritius & Aden	82	394	16	126	...	...	461	44	7	...	8	593	1,731
Azores, Madeira and Portuguese Africa ...	565	262	37	51	...	136	1,044	4	85	...	138	10	2,332
French African Colonies and Madagascar ...	...	...	32	...	...	...	...	...	...	...	17	15,100	15,149
China and Siam ...	1,118	432	185	224	...	1,421	4,994	46	1,429	...	86	357	10,292
Japan and Korea ...	518	4,890	917	...	26	2,259	12,475	...	3,474	...	94	105	24,788
India ...	3,970	18,560	3,035	1,686	112	2,246	12,354	3,268	3,008	64	823	734	49,860
Ceylon ...	101	2,474	108	25	...	761	144	...	2	4	108	160	3,893
Straits Settlements, and Fed. Malay States	377	1,696	249	43	...	201	662	194	181	136	29	17,166	20,934
Hong Kong ...	245	154	372	267	...	...	697	...	408	...	21	80	2,244
West Australia ...	354	1,106	393	644	...	228	4,352	1,652	1,761	...	...	450	10,949
South Australia ...	643	906	115	367	23	684	1,407	...	...	...	...	...	4,145
Victoria ...	3,465	7,095	914	1,434	...	157	5,363	1,779	42	...	6,184	677	27,110
New South Wales ...	3,738	9,700	1,290	506	95	1,582	15,370	1,235	1,241	20	10,701	2,302	47,780
Queensland ...	68	516	123	401	...	162	1,644	...	46	72	22	...	3,054
Tasmania ...	167	14	7	95	...	...	60	...	77	...	377	275	1,072
New Zealand and Fiji Islands ...	2,350	3,293	578	1,014	...	1,038	5,305	436	209	4	499	514	15,240
<b>Total, £</b>	<b>38,862</b>	<b>106,711</b>	<b>18,425</b>	<b>11,882</b>	<b>2,214</b>	<b>18,774</b>	<b>153,113</b>	<b>16,220</b>	<b>25,308</b>	<b>1,294</b>	<b>53,234</b>	<b>71,338</b>	<b>517,375</b>

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	7	...	...	70	...	...	4,058	291	523	...	5,166	...	10,115
Germany ...	8,623	23,759	1,963	15,943	7,978	3,731	70,272	234	2,637	8,055	6,460	...	149,655
Holland ...	...	...	130	3,469	760	7	336	...	...	5	38	...	4,745
Belgium ...	779	1,309	149	239	84	...	2,196	10	361	258	5,256	...	10,641
France ...	591	...	646	1,340	369	622	768	100	269	3,691	1,328	...	9,724
Switzerland ...	257	332	156	38	26	136	820	12	...	56	735	...	2,568
Italy ...	521	4,703	...	...	...	...	108	...	...	...	200	...	5,532
Austria-Hungary ...	...	798	...	593	102	...	24	...	...	747	148	...	2,412
United States ...	5,508	765	865	130	870	55	10,458	21,251	3	...	441	...	40,346
Canada ...	28	...	15	...	...	...	40	...	...	...	...	...	83
<b>Total, £</b>	<b>16,314</b>	<b>31,666</b>	<b>3,924</b>	<b>21,822</b>	<b>10,189</b>	<b>4,551</b>	<b>89,080</b>	<b>21,898</b>	<b>3,790</b>	<b>12,815</b>	<b>19,772</b>	<b>...</b>	<b>235,821</b>

Additional imports: Spain, carbon, £258.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	8,396	204	...	4,391	481	...	8,859	...	446	524	95	...	23,396
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TOTAL EXPORTS: £517,375.

TOTAL RE-EXPORTS: £23,396.

TOTAL IMPORTS: £236,079.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

PROCEEDINGS OF INSTITUTIONS.

Power Supply on the Rand.

By A. E. HADLEY, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester, March 11th, and in London, March 13th, 1913. For the commencement of the paper see p. 519.)

The 80,000-volt pole line consists of two rows of lattice steel masts equipped with four circuits of stranded copper, each conductor having a section of 60 sq. mm., and carrying three earthed guard wires above the conductors. Every fourth mast (commonly called an "anchor mast," fig. 1) is of sufficient strength to take the full strain of the conductors in a lateral direction; and the three intermediate masts (fig. 2) are designed to take the strain due to wind

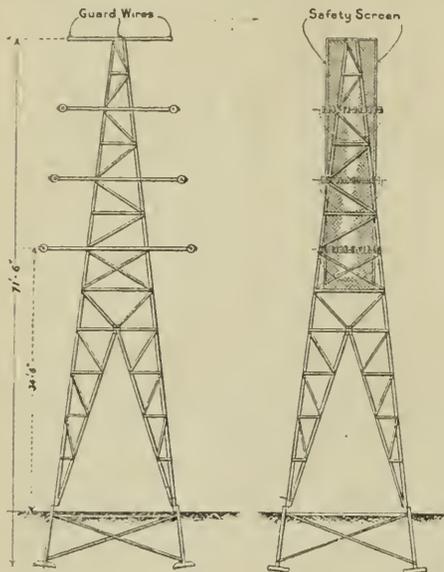


FIG. 1.

pressure in a direction transverse to the line. Extra anchor masts are also used whenever the line changes its direction, and at railway crossings. A special end tower (fig. 3) is used at the ends of the line.

The masts are normally spaced 500 ft. apart. The anchor masts have an overall height of 71 ft. 6 in., the lowest cross-arm being 34 ft. 6 in. from the ground. On these masts the conductors are placed

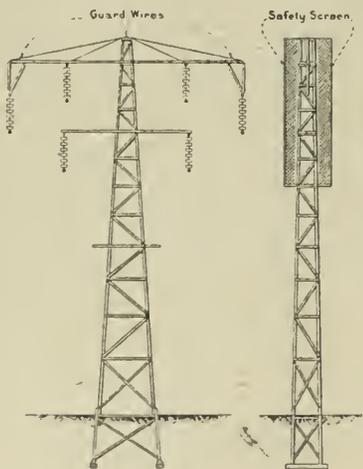


FIG. 2.

vertically above each other, separated by a distance of 9 ft. Each mast was required to deflect 1/4 in. at the top when subjected to a horizontal pull of 4 1/2 tons applied 44 ft. from the ground at an angle of 30° from the line direction.

The intermediate masts when carrying the weight of the insulators, conductors and guard wires, were required to give a temporary deflection at the top of 1 1/4 in. when subject to a horizontal pull of 35 cwt., applied 35 ft. from the ground and at right angles

to the line direction. The conductors on these masts are arranged three on each side, in the shape of an equilateral triangle having sides 8 ft. long. The lowest support for the conductors is 34 ft. 6 in. from the ground, and a 10-ft. sag is allowed, so that the lowest part of any conductor is never less than 24 ft. 6 in. from the ground. All masts are provided with a safety screen to prevent any possibility of men working on one circuit coming into contact with the circuit on the opposite side of the pole. This screen consists of a rectangular steel framework interlaced with galvanised steel wire netting.

The 80,000-volt insulators used are of the disk type, 10 in. in diameter, and connected six in series at each suspension and straining point. Before erection each insulator is subjected to a mechanical stress of 1 1/4 tons, and while in this condition is tested to 40,000 volts for five minutes.

The latest type of 40,000-volt transmission line is of a similar design, but pin insulators are employed on the intermediate lattice masts, and four disks are used in each string of insulators on the main towers which take the lateral strain.

All the 20,000-volt cables have circular conductors of 100 sq. mm. section, and are paper-insulated, lead-covered and armoured. Each cable is capable of transmitting about 7,000 k.v.a. The cable was specified to stand a test pressure at the factory of 50,000 volts, and a test pressure of 40,000 volts for 10 minutes after laying.

The atmospheric conditions on the Rand are in many ways abnormal. During the winter violent wind and dust storms are encountered, while for six months during the summer (from September to April) the reef is the centre of frequent and violent lightning storms accompanied by heavy rain and sometimes phenomenal hail. The Rand, which is the watershed of that part of South Africa, is probably about the worst district in the world for lightning, the altitude of Johannesburg being 5,760 ft. At this altitude the range of temperature is very large, and rapid changes in temperature occur, disturbing the atmospheric conditions.

The total number of lightning storms passing over different sections of the system during the last season (which lasted for 182 days) amounted to 199. Most careful daily records and observations are taken of all atmospheric disturbances, and these records show that lightning is encountered on an average on one out of every three days.

Every storm exerts some influence of greater or lesser severity upon the overhead system, but year by year the number of troubles caused have been largely reduced, so that interruptions to supply are now infrequent, and the loss of apparatus seldom takes place.

As a general rule the effect of lightning is brought about through an induced effect on the overhead lines, setting up a high-frequency surge. Experience goes to prove that the intensity

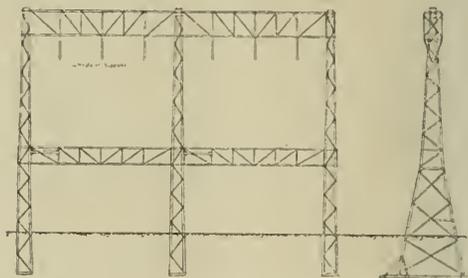


FIG. 3.

of the induced effect is in the majority of cases localised to some part of the transmission line, and only in the minority of cases does it reach the end of the line with its full severity. Further, it is quite a rare though not unknown occurrence for the line to be actually struck by lightning; and it is possible, though not determined, that this immunity may be the result of the earthed guard wires.

The means whereby the effects of lightning have been prevented in the great majority of cases from disturbing the system are mainly; (a) the employment of earthed overhead guard wires; (b) earthing the neutral of each separate section of the system; and (c) by careful selection and adjustment of lightning arresters to deal with the different conditions arising.

Experience has shown that the guard wire constitutes one of the most efficient systems of line protection, and contributes largely to successful operation during storms.

During the earlier lightning seasons the neutral of the system was not earthed, and unquestionably many interruptions and much loss of apparatus resulted from not employing this system. One of the troubles caused by lightning is occasioned by the arcing-over of insulators, which with an insulated system having considerable capacity to earth generally results in an intermittent arc to earth, thereby setting up dangerous surges in the system. These surges lead to cumulative trouble and cause discharges on the arresters of the other two phases, increasing in severity until finally a second flash-over takes place (generally at the arrester gear itself) and short-circuits the phases. By earthing the neutral through a resistance, any arc to earth is immediately isolated by the operation of the Merz-Price balanced relay system, and the arresters are not called upon to continue operating. A star-delta transformer is employed for earthing to avoid disturbance to telephones. Since the neutral of the system was earthed, it has been

found that in the majority of cases where an arc has occurred over a line insulator, the fault has been isolated so rapidly as to prevent damage to the insulator, and the line has been immediately put back into service by closing the switches.

At the time of the initial installation the aluminium arrester was not on the market, and in consequence, a complete system of horn arresters was connected up. The most careful records have since been kept of the operation and discharges occurring on these arresters. The number of pressure rises on each of the phases with an earthed neutral has been found to be equal.

The best combination of the number of horns, the spacing of arc gaps, and the amount of resistance to earth, had to be determined by experience and experiment.

During last season some aluminium arresters were installed, but no conclusive observations of their operations were obtained. This system, however, has been adopted for the protection of the 80,000-volt lines, as the experience on many systems in America has been largely in favour of this form of protection.

In order to show the operating efficiency, technical figures such as are regularly used by this company, rather than financial figures, are put forward in this paper.

As they participate in the profits, the consumers supplied by the company have at definite periods the right of access to the books in order to determine the cost of a unit of power.

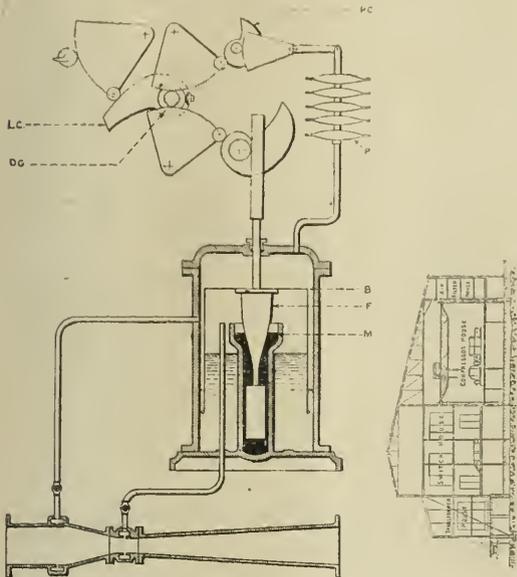


FIG. 4.—AIR METER.

The supervision of the power stations by the administration is based on weekly balance-sheets from each station, showing the efficiency of each process. The form in which these returns are made is based upon the underlying idea of energy, and all energy in whatever form it appears, whether as heat in the coal or in the steam, is expressed in the electrical engineer's unit, i.e., the kilowatt-hour, which proves far more convenient than using foot-pounds or thermal units for expressing energy. The energy value of each lb. of coal, usually expressed in B.T.H.U., is converted to kilowatt-hours by multiplying by 0.000293; thus, a coal of 11,300 B.T.H.U. per lb. has a value of 3.3 kw.-hours per lb.

The product of the number of lbs. of coal burnt per kw.-hour, and the energy value per lb. gives the coal energy required for each unit of electrical energy sent out; and the reciprocal of this multiplied by 100 gives the overall efficiency of the station. Thus, taking an average figure for Rosherville of 2½ lb. of coal per unit sent out, and 3.3 kw.-hours (11,300 B.T.H.U.) for the heat value of the coal per lb., the overall efficiency is 12 per cent.

In a similar manner the energy in the steam is calculated in kilowatt-hours from Mollier's steam tables. The boiler efficiency is the ratio of the kilowatt-hours in the steam (less the energy supplied from the hot well) to the kilowatt-hours in the coal. The efficiency of the engine room plant is expressed as the ratio of 1 kw.-hour of electrical output to the kilowatt-hours of available energy in the steam, i.e., to the total energy of the steam less the heat rejected to the condensers. The ratio of the available energy in the steam to the total energy in the steam gives a measure of the efficiency of the condensing process.

The balance-sheet and detailed report of the Rosherville station show how the returns of these efficiencies are regularly made. Similar returns are prepared for the other stations.

The compressed air required for the various mines had to be supplied at an average pressure of 100 lb. per sq. in. delivered on the property of each of the consumers. The initial demand involved a maximum load of about 30,000 kw.; but this has since been nearly doubled. All the advantages of centralisation of power production, such as the use of large units, saving in capital and operating diversely amongst the mines, spare plant, &c., apply to

this form of power supply. The system of centralising the compressor plant and transmitting by pipes was therefore adopted. The distance between the two extreme mines served by the air-pipe system is approximately 14 miles. The total length of pipe laid is 20 miles, varying in diameter from 24 in. to 9 in.

EFFICIENCY REPORT.—OPERATION DEPARTMENT. ROSHERVILLE STATION.

Two weeks ending October 23rd, 1912. No. 1 Account.—Boiler House

	This week. kw. hrs. kw.-hrs.	Last week. kw. hrs. kw.-hrs.	This week. kw. hrs. kw.-hrs.	Last week. kw. hrs. kw.-hrs.
To energy in coal used (per unit sent out) ...	870	860	655	653
Loss heat in hot-well ...			0.61	0.68
			5.94	5.85
Balance lost ...			2.76	2.75
<b>Total ...</b>	<b>870</b>	<b>860</b>	<b>870</b>	<b>860</b>

No. 2 Account.—Turbine House.

To energy in steam (from No. 1 Account) ...	655	653	By electric output	1.00	1.00
Less energy to cooling pond ...	4.59	4.57	Balance lost ...	0.96	0.96
Available energy ...	1.96	1.96	<b>Total ...</b>	<b>1.96</b>	<b>1.96</b>

	This week. Per cent.	Last week. Per cent.
Efficiencies—Boiler house ...	68.0	68.0
Condensing process ...	30.0	30.0
Turbine house ...	51.0	51.0
Overall ...	11.5	11.6
B.T.H.U. per watt-hour ...	29.7	29.3

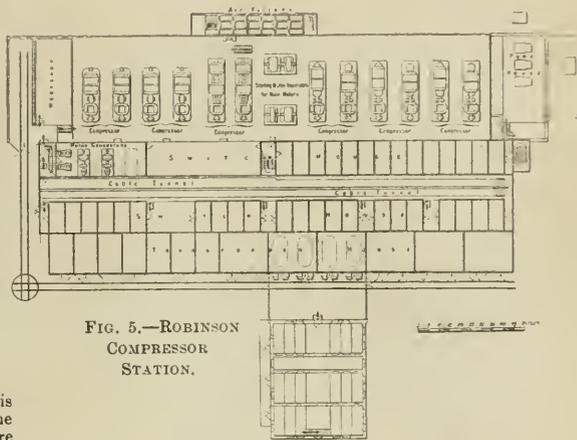


FIG. 5.—ROBINSON COMPRESSOR STATION.

Detailed Report. Operation Adjustment. Rosherville Station. Week ending October 23rd, 1912.

Item.	This week.	Last week.
<b>Output.</b>		
1. Units sent out ...	4,754,000	4,514,000
2. Units, per cent. of generated ...	94.20	94.00
<b>Coal.</b>		
3. Lb. per unit sent out ...	2.64	2.61
4. Calorific value ... B.T.H.U.	11,250	11,250
5. Energy per unit sent out kw.-hours	8.70	8.60
<b>Water.</b>		
6. Condensed water per unit sent out lb.	16.20	16.30
7. Make up, per cent. of evaporated ...	6.00	5.50
8. Hotwell temperature ... deg. C.	68	75
9. Energy in hotwell per unit kw.-hours	0.61	0.68
<b>Steam.</b>		
10. Pressure ... lb. per sq. in.	224	224
11. Temperature at machines deg. C.	297	296
12. Water evaporated per lb. of coal lb.	6.50	6.54
13. Energy in steam per unit kw.-hours	6.55	6.53
14. Vacuum per cent. ...	91.60	92.00
15. Energy to cooling pond per unit kw.-hrs.	4.59	4.57
<b>Ash.</b>		
16. Per cent ...	18.70	18.50

It was decided to install steam-driven rotary compressors at Rosherville Dam and to erect an electrically driven compressor station at Robinson Central Deep (fig. 5), a point six miles to the west, where a supply of water was available for cooling purposes, the two stations operating in parallel on a common trunk pipe system. The additional cost of two stations, as compared with one, was found to be more than offset by the saving in the cost of air

mains and by the beneficial influence on the power factor of the compressor motors at Robinson Central; these were designed to operate at a leading power factor of 85 per cent. at full load.

Six steam-driven rotary compressors have consequently been installed at Robsville, and six similar compressors, electrically driven, at Robinson Central, each compressor being rated at about 3,500 kw. input. The orders for these machines were distributed among the three firms who tendered, namely, the Allgemeine Elektrizitäts-Gesellschaft, Pokorney Wittkind, and Gutehoffnungshütte. These machines are the largest compressors yet constructed, 1,250-kw. capacity representing the construction limit previously reached. To meet the increase in the demand, three additional steam compressors, each rated at 7,000-kw., are under construction.

Before electrification, the mines obtained their compressed air supply by reciprocating steam-driven compressors at each mine. The agreement defined that the consumers should pay the same price for any given quantity of compressed air as they would have paid for the indicated steam energy necessary to enable their reciprocating compressors to produce this quantity of air, assuming that they bought this steam energy at the same rate per kilowatt-hour as they were paying for electrical energy for other purposes. This involved measuring the quantity of compressed air, which could be delivered for each 134 I.H.P.-hour (1 kw.-hour) developed in the cylinders of the consumers' reciprocating compressors.

The overall efficiency of the reciprocating mine compressors, on the average, was found to be 64½ per cent., so the commercial air unit was fixed at 0.641 of the quantity of air which would be compressed isothermally by the expenditure of 1 kw.-hour.

The tests of the compressors had to be conducted in South Africa, and as no meter existed then, and the usual methods of testing compressors were far from accurate, new methods had to be devised to determine a unit on which the purchase of power worth £250,000 a year for 20 years was to be based.

The measurement of the discharge from the compressors through orifices was decided upon. A master meter was designed by the Rand Mines, Ltd., and constructed by Messrs. Fraser & Chalmers, which was ultimately erected in an air-testing station. The orifices used in the compressor tests were compared with this master meter and their coefficients determined.

A general description of the principle of the Venturi meter adopted may be of interest. It has been agreed that the mean annual temperature on the Rand, 60° F., should be taken throughout, and similarly also the mean annual atmospheric pressure of 12.086 lb. per sq. in. was adopted.

Measurement of the weight of air by means of a Venturi tube is found by taking the drop in pressure across the throat, and the temperature and pressure at the point of supply, in accordance with the formula  $w = K(P_1 H / T_1^2)$ ; where  $K$  is a constant,  $H$  is the pressure-drop across the throat, and  $P_1$  and  $T_1$  are the pressure and temperature respectively at the point of supply.

The recording mechanism has to multiply continuously two variables, one dependent upon the weight of air passing, and the other on a function of the pressure of supply. The weight of air is measured by the drop of pressure across a Venturi tube (fig. 4) fixed in the pipe line. In the meter adopted the Venturi head is measured by means of an inverted bell  $B$ , sealed by oil, the movement of which is controlled by a specially shaped float  $F$  that enters and leaves a mercury bath  $M$ . This float is so shaped that the displacement of the bell corresponding to any Venturi head is proportional to the logarithm of the number of pounds of air passing at a given pressure and temperature. The arrangement is sensitive to a Venturi head of less than one 10,000th of a pound per square inch, and it will measure a Venturi head up to 0.85 lb. per square inch.

The pressure of delivery is measured by steel diaphragms  $P$ , and a displacement proportional to the logarithm of the required pressure function is obtained from them by means of a cam  $P.C.$  These two displacements, each proportional to the logarithm of one of the variables to be measured, are added together by means of a differential gear,  $D.G.$  This combined displacement is finally converted by means of a logarithmic cam  $L.C.$  into a displacement proportional to the power (kilowatts) in the pounds of air being delivered.

The meter is provided with direct-reading recording dials which are capable of being connected with a clock-driven shaft running at one revolution every two minutes. To avoid winding, the clock is driven by a small constant-speed air turbine. The guaranteed accuracy which has been maintained in operation is as follows:—Full load, within 1.5; half load, 1.75; one-tenth load, 2.25 per cent.

The meters were constructed by Messrs. George Kent, Ltd. The results of the operation of the air system have been observed over the 20 months since the supply was first put into commercial use, and have been very satisfactory.

It has been found that of the air units sent out 95 per cent. have been recorded at the consumers' meters, 3 per cent. have been lost in transmission, and 2 per cent. are unaccounted for. The monthly air load factor is at present 50 per cent.

The author wishes to express his thanks to Major the Hon. W. L. Bagot, D.S.O., the company's general manager in South Africa; Mr. Bernard Price, the chief engineer; Mr. G. M. Clark, the company's air engineer; Prof. Klingenberg, of Berlin; Mr. T. L. Hodgson, of Messrs. Kent, Ltd., and to the members of the staff who have kindly given their assistance in the preparation of this paper.

#### DISCUSSION IN LONDON.

MR. J. H. ROSENTHAL said that the arrangement of the boilers in bays at right angles to the engine room was first used at Carville, and had since been repeated in a large number of cases in all parts of the world. The allowance of 75 H.P. for the induced-draught fans was above the actual requirements for two boilers and looked

large, but it represented a very small percentage of the output. The barometric pressure on the Rand was low, and it would have been impossible to work this plant with chimneys in the ordinary way. Two boilers supplied 4,000 H.P., and the chimneys were of a peculiar shape. An advantage of the system was that the fan was not in the flue gases, and the special chimney gave a better efficiency than the ordinary type. The output of the plant was 1.19 kw. per sq. ft. of floor space—a record result; at Dunston the output was 1.12, and at Lot's Road 0.72 kw. In that climate the coal store need not be covered, as the coal did not suffer from exposure; the coal was handled entirely by mechanical means, white labour being costly and coloured labour unsuitable. The efficiency of 68 per cent., quoted in the paper, included all stand-by losses; the coal was of very inferior quality but very cheap.

MR. H. BRAZIL, referring to the guard wires, said he understood that in the original installations barbed wire was used; was it any better than plain wire? He asked what size were the star-delta transformers that were used to prevent disturbance to the telephones, what earthing resistance was used on the 10,000-volt system, and why the arresters were grouped as shown in the paper.

MR. A. P. TROTTER remarked that overhead construction was carried out in a different way in each country, local conditions being of the utmost importance. In this country stringent economy was necessary, as compared with the big job on the Rand. The spans were moderate compared with those used in America, and more in accordance with British practice. He was pleased to see the double line of poles and the ring main employed. He had always believed in the efficacy of the earth wire, especially when it was put above the line, and was glad to learn that it had proved successful. Barbed wire was not much better than plain. The clearance of 24½ ft. seemed to be large; in this country haycarts were the deciding factor—was there any need to go beyond 18 or 20 ft. on the Rand? The troubles due to surging which were cured by earthing the middle point only occurred on long lines.

MR. J. S. HIGHFIELD said it was important to realise what a very large expansion of electricity supply was in progress in all parts of the world. These big mines had found it best to drop their private installations, thus proving the case for long-distance transmissions. The views of twopence-halfpenny users of 50 H.P. on the subject of taking power from the mains here made him tired; the Rand would afford a useful argument to quote in such cases. The price of '525d. did not appear to be very low, in view of what was done here. He was interested in the co-operative scheme adopted on the Rand, under which the price was subject to variation; it was always difficult to fix the proper price in advance. It was essential to the consumer that the supplier should make a profit—otherwise the plant could not be kept up to date and extended, owing to the difficulty of raising capital. It was important that the earth wire should be above the line wires, and be of similar material, so as to last as long as the others, as it was a difficult wire to replace.

MR. A. JACOB disagreed with Mr. Trotter's remarks concerning the transmission lines, as he considered the American lines the more substantial. The sag of 10 ft. appeared to correspond with a factor of safety of 2 on the wire, whereas 5 was adopted in this country. The towers had extremely long arms, and if all the wires were cut on one side the arms would be subjected to an excessive stress. Comparing the cost of copper and aluminium for the 80,000-volt line, the ratio was 956 to 826, even when more rigid lines were used for aluminium, showing a marked saving in favour of the latter.

MR. DAVIS referred to the climatic difficulties and legislative restrictions met with in South Africa, and observed that the use of synchronous motors to drive the air-compressors would help the power factor. He dealt at some length with the control and operation of the air compressors, and the mode of transmitting the air.

MR. E. V. PANNELL remarked that, though there was no likelihood of such big schemes being carried out here, it should be remembered that such schemes were engineered from this country. He criticised the weakness of the towers in the event of a heavy side pull, and the small spread at the base, and asked whether concrete foundations were used; these sometimes cost 50 per cent. of the whole cost of the tower. The earth wire was useful in adding to the mechanical stability of the line.

MR. ARTHUR WRIGHT commented on the great success of the boiler house without tall chimneys, on the Prat system, and of the transmission of power by compressed air over long distances—two great experiments which had been completely successful. He believed that ultimately all the mains would be put underground, as that was the only way to overcome the trouble from lightning.

In reply, MR. HADLEY said that the figures for efficiency were not selected; they were ordinary working figures, obtained at a time when the cooling water was warm. The guard wires were always of galvanised steel without a hemp core; barbed wire had only been used to keep cattle off the masts. The clearance of 24½ ft. was provided to comply with the Government regulations, and was not really necessary except to prevent wires from being thrown over the line and to avoid the lashes of whips. The price of '525d. must be considered in connection with the purchasing power of money in South Africa, and was intended rather to fix a maximum than to represent the actual payment. The price was reviewed every year, and after a dividend of 6 per cent. had been paid, any surplus that remained was divided, ¼ to the supplier and ¾ to the consumer. The factor of safety of the line was calculated and tested to 5; each class of line was tested, and all the wires on one side were cut simultaneously, without twisting the towers. No trouble was met with from corona in dry weather. Legislation presented no difficulties; the Power Act was quite reasonable. His

saw no evidence of standardisation of towers in America. The guard wire had been given up in Central Colorado, owing to mechanical troubles. He saw no reason for putting the lines underground; the lightning grew less troublesome every year.

#### Röntgen Society.

At the meeting of the Röntgen Society, on March 4th, Dr. F. HOWARD HUMPHRIS read a paper on "The Rationale of the Static Current," in which he advocated a wider acceptance of this electrical mode among British electrotherapists. He considered the current to be replaceable by no other form of electricity, and, in particular, to produce mechanical effects which were unobtainable by other means. These effects were due to the diffusion of the current caused by its high voltage—running from 600,000 up to a million volts. In the course of the discussion Mr. R. M. STANESBY said that there were certain points of difference between the static current and the ordinary coil current which ought to be investigated. After 10 years' experience of working solely with static currents for X-ray production, he had had no effect of dermatitis, although he had not protected himself in any way. In reply to a question as to climatic conditions and their influence upon the static machine, Dr. Humphris said that the supposed dampness of the climate was, he thought, an overrated bugbear. He had practised for 10 years in a damper climate than this, where the relative humidity was always over 90, and also in the Southern States of America, where it was over 95, and had been successful. But in the English climate, if proper attention were paid to the machine, and due cleanliness observed, there would be little or no difficulty. If a static machine was out of condition on 1 per cent. of the days on which it was in use, he thought its owner was unfortunate. With regard to the use of the static machine as a means of X-ray production, 10 years ago in the United States it was generally believed that dermatitis could not be produced under such circumstances, but subsequently he went over to Paris and was there undeceived. Burns, and very bad burns, could be produced.

At the same meeting, Dr. H. Lewis Jones brought forward an interesting communication, the purpose of which was to amplify a previous address by Prof. Silvanus Thompson on the physiological effects produced by an alternating magnetic field. With the head inserted between the poles of a magnet, Prof. Thompson had been able to observe a faint, flickering illumination over the whole field of vision. Previous workers, however, had had negative results with experiments along similar lines, and this contradictoness Dr. Jones attributed to the differences in the duration of the induced currents which were set up. If the retina was to be stimulated, a current must have a much longer duration than was necessary for the motor and sensory nerves. He had ascertained from some experiments with the mechanical interrupter of Leduc, that the retina was unable to respond to electrical impulses of a briefer duration than  $\frac{1}{100}$ th of a second. In an apparatus in which everything was unchanged except the duration of the individual impulses, it was possible to regulate the retinal effect, and watch it come and go. The fluttering light—which, of course, was subjective—was observed at its maximum with waves of about one-fiftieth of a second, or longer; when much shorter than this, the retinal response died quite away, although the muscular twitching remained. The retina was very slow to respond to electrical stimulation, and would not respond at all to the short waves.

#### Physical Society.

At the meeting held on February 28th, a paper on the "Interference of Röntgen Radiation," by PROF. C. G. BARCKLA and MR. G. H. MARTYN, was read by PROF. BARCKLA.

The authors have made a preliminary investigation of the Röntgen radiation proceeding from a crystal of rock salt (which is of the simple cubical form) when a pencil of Röntgen radiation is incident in a direction nearly grazing one of the three sets of mutually perpendicular cleavage planes. Using a very narrow pencil of radiation, it was seen that the principal secondary pencil was one obeying the laws of reflection from the cleavage planes.

A diverging pencil of radiation was directed on to a crystal so that various portions were incident on the cleavage planes at different angles. The intensity of the reflected pencil varied periodically with varying angle of incidence, the maximum being separated by intervals corresponding to approximately equal increments in the value of  $\cos \theta$ , where  $\theta$  was the angle of incidence on the reflecting planes. Such a series of maxima may be explained by interference of the pencils reflected from equal spaced parallel planes, the maxima being spectra of various orders. The wavelength, calculated on the assumption that these are planes passing through corresponding portions of molecules in the planes of cleavage, and that a molecule is simply NaCl, is found to be  $0.6 \times 10^{-9}$  cm. This value agrees remarkably well with the value (between 1 and  $2 \times 10^{-9}$  cm.) calculated from the velocity of ejection of electrons by this X-radiation, taking this to behave as ultra-violet light of short wave-length.

A paper on "Alternating-Current Magnets" was read by PROF. E. WILSON.

It follows from the well-known law of pull of an electromagnet that if the magnetic field alternates between positive and negative values the pull is unidirectional and intermittent. Unless means are provided to reduce the consequent chattering and vibration, the

magnet is rendered useless. In the present experiments a phase-splitting device has been adopted, and consists in surrounding a portion of the pole-piece of the magnet with a short-circuited coil. The portion of the pole-piece so surrounded is sometimes said to be "shaded," and the coil referred to as a "shading" coil. The effect of this coil is to alter, not only the relative amplitudes but the phase of the magnetic fields passing through the shaded and unshaded portions of the pole-face. The magnet used in the experiments varies the length of its gap when in action, and the influence of the gap length upon this phase-displacement has been studied. When the resistance of the shading coil is such that the magnetic induction in over the whole face is substantially uniform and the gap closed, the phase-displacement is 72 electrical degrees ( $360^\circ = 1$  period). A gap length of 0.15 cm. reduces the phase-displacement to  $18^\circ$  and consequently the minimum or "hold-on" pull drops. This minimum or "hold-on" pull is, of course, smaller than the average, and has to be taken into consideration in the design of the magnet. The arrangement of the shading coil above described is very effective in preventing vibration and chattering when the magnet is closed, and renders the alternating-current magnet a practical success.

With constant alternating voltage impressed upon the magnetising coils of the magnet the net pull exerted diminishes rapidly at first as the gap length increases and tends to become more nearly constant. The R.M.S. amperes, on the other hand, steadily increase as the pull diminishes, owing to the increase in the gap length.

The observed net pull in the case of the magnet experimented upon is less than the calculated average pull, varying from 83 to 59 per cent, as the gap length varies from 0 to 1 cm. The frequency used was 50. The large displacement of phase only occurred when the air-gap was small, but it was only when the armature was actually in contact with the pole that it was required to abolish the chattering.

#### PAINTING CARS WITH ENAMEL BAKED ELECTRICALLY.

By the use of a baking enamel (instead of linseed oil paint or air-drying enamel) the Hudson and Manhattan Railroad Co. are able to get cars through the painting shops in two days, as compared with from 6 to 14 days required by the usual process. Baking enamel has been used for years past on automobile bodies and for finishing such parts of railway coaches as can easily be stored, but we believe this is the first case in which entire cars have been painted with this material. The success of the new method and the advantages which it offers to traction companies are so considerable, that we have no hesitation in presenting the following notes, abstracted from a more detailed article in the *Electric Railway Journal*.

The enamel used in this case is the ordinary varnish-pigment baking mixture, the hardening of which requires the evaporation of turpentine and the oxidation of residual oils, the action being assisted by fossil gum. Baking enamels are essentially the same as air-drying enamels, but, being dried artificially, they may contain ingredients which give a hard tough surface, and, since they can be applied in a very free-running state, they are economical in use, and the dried surface has an admirable gloss. Experience in the automobile industry appears to show little difference in durability between air-dried and baked enamels, but the latter have a better appearance, and are more economical and expeditious in use.

In the present connection, it is essential that the baking enamel used should dry completely during a single, short-period heating, so that each layer assumes its permanent state before the next coating is applied. This condition is not realised in air-drying enamels, hence the network of cracks which soon appears on the surface of the latter in service.

There are three successful methods of baking enamel on railway cars:—(1) Stove the whole car in a kiln of suitable size, repeating the stoving for each coat; (2) bake the priming and first coat of enamel at a moderate temperature and air-dry the subsequent varnish coats; (3) seal all outlets and bake the interior of the car by electric heaters.

The latter method is the first to be adopted as standard on any railway, and is that used by the Hudson & Manhattan Co. This company's cars run chiefly in subways, hence the external appearance of the vehicles is not studied, but paint is, of course, applied to keep the steel from rusting. In ordinary cases, however, the outside of cars must also be enamelled, and, to apply the present process, it is only necessary to partition off a space large enough to hold the car and heat this enclosure by five or six sets of electric car-heaters.

After prolonged experiments, the Hudson & Manhattan Co. have adopted the following practice:—The bulk of the old enamel is removed by hand-scraping, and a varnish remover is then carefully applied and followed by a cleaning with gasoline on cotton waste. The car is then heated to  $200^\circ$  F. (this temperature not affecting the wiring in the car), by the suspension of three extra sets of electric car-heaters from the hand rods. About 50 kw. is required to maintain this temperature in a 41 ft.  $\times$  8 ft. 10 in. car with monitor-deck roof. Current is controlled from outside the car in accordance with the readings of thermometers visible through the windows. During baking, the car doors and windows are closed, and ventilator apertures, &c., are covered with layers of newspapers held down by tar. When the car has been heated to

200° F. for 1 hour, it is allowed to cool to about 115° F. and the priming is applied and baked at 200° F. for 3 hours. The second and third coats are applied with the air in the car cooled to 70°—80° F. and are baked at 140° F. for 3 hours each. The last coat is baked at 130° F. for 3 hours. If, for any reason, the priming cannot be baked at 200° F., the first coat should be baked for 4 hours at 165° F. It is especially important that the procedure recommended for the application and baking of the priming be followed as closely as possible. The final appearance is at least equal to that given by the best grades of air-drying coach colours and rubbing varnishes. As a conservative estimate, the new method occupies only from 20 per cent. to 25 per cent. of the time required by ordinary systems; the percentage of the car equipment held idle for painting is correspondingly reduced and, in many cases, the coat of varnish which is annually given to surface cars, could be applied between rush hours.

First-class materials and labour must be used where enamel baking is practised, but any additional outlay under this heading is compensated by the reduced charges on idle equipment. By the above process, the cost of application of baking enamel is roughly equal to that of high-grade painting. The cost of painting the interior of a car, 41 ft. between bulkheads by 8 ft. 10 in. over sills, is as follows (average H. and M. Railway data):—

	White ceiling (400 sq. ft.).	Green sices.
Removing old paint † ... ..	28s. 10d.	62s.
Quarts of paint in each coat ...	1'5, 1'5, 2, 2	2'5, 2, 4, 2'5
Total cost of paint ... ..	26s. 6d.	41s. 6d.
Labour cost of painting ... ..	21s. 6d.	30s.
Labour cost of sanding between coats ... ..	5s. 6d.	12s.
<b>Total ... ..</b>	<b>82s. 4d.</b>	<b>146s.</b>

To these amounts must be added 4s. for connecting extra heaters and 15s. for energy at 0'3d. per kW.-hour, making a total cost of £12 7s. per car. The cost of materials is about half as great as where air-drying enamel is used, owing to the greater covering power of the baking enamel.

The wooden sashes on the H. and M. cars are treated as though they were of steel, except that the thoroughly hardened old paint is not removed before applying new enamel. When enamelling new or cleaned wood, an oil primer should be used; this need not be followed by more than two coats of baking enamel to secure excellent results.

Standard varnish removers can be used to remove baking enamel, but the special hardness of the latter makes the operation more difficult than usual.

	1910. Francs.	1911. Francs.	Inc. or dec. Francs.
<i>Steam engines, cranes, pumps, turbines, &amp;c.—</i>			
To Germany ... ..	1,596,000	1,873,000	+ 277,000
„ France ... ..	938,000	1,214,000	+ 276,000
„ Belgium ... ..	576,000	1,280,000	+ 704,000
„ Russia ... ..	1,121,000	1,128,000	+ 307,000
„ British India ... ..	208,000	441,000	+ 233,000
„ Japan ... ..	45,000	183,000	+ 138,000
„ Canada ... ..	—	100,000	+ 100,000
„ Other countries ... ..	1,670,000	1,164,000	— 506,000
<b>Total ... ..</b>	<b>6,154,000</b>	<b>7,683,000</b>	<b>+ 1,529,000</b>

	1910. Francs.	1911. Francs.	Inc. or dec. Francs.
<i>Gas, petrol, benzine, hot air, &amp;c., motors.—</i>			
To France ... ..	1,779,000	1,884,000	+ 105,000
„ Italy ... ..	1,529,000	1,425,000	— 104,000
„ Great Britain ... ..	710,000	1,161,000	+ 441,000
„ Russia ... ..	678,000	1,132,000	+ 454,000
„ Roumania ... ..	638,000	641,000	+ 3,000
„ Egypt ... ..	144,000	432,000	+ 288,000
„ Algeria and Tunis ... ..	46,000	281,000	+ 235,000
„ Argentina ... ..	158,000	168,000	+ 10,000
„ Australia ... ..	76,000	279,000	+ 203,000
„ Other countries ... ..	1,431,000	1,878,000	+ 447,000
<b>Total ... ..</b>	<b>7,189,000</b>	<b>9,271,000</b>	<b>+ 2,082,000</b>

	1910. Francs.	1911. Francs.	Inc. or dec. Francs.
<i>Electric meters.—</i>			
To Germany ... ..	40,000	106,000	+ 66,000
„ Austria-Hungary ... ..	57,000	131,000	+ 77,000
„ France ... ..	163,000	244,000	+ 81,000
„ Italy ... ..	203,000	207,000	+ 4,000
„ Other countries ... ..	128,000	174,000	+ 46,000
<b>Total ... ..</b>	<b>591,000</b>	<b>865,000</b>	<b>+ 274,000</b>

	1910. Francs.	1911. Francs.	Inc. or dec. Francs.
<i>Steam and electric locomotives.—</i>			
To France ... ..	83,000	1,093,000	+ 1,010,000
„ Serbia ... ..	—	109,000	+ 109,000
„ Dutch E. Indies ... ..	—	493,000	+ 493,000
„ Argentina ... ..	535,000	339,000	— 196,000
„ Other countries ... ..	414,000*	83,000	— 331,000
<b>Total ... ..</b>	<b>1,032,000</b>	<b>2,117,000</b>	<b>+ 1,085,000</b>

\* Norway, 300,000 francs.

NOTE.—25 francs = £1.

EXPORTS STATISTICS OF SWITZERLAND.

THE following figures showing the exports of electrical and similar machinery from Switzerland in 1911 are taken from the recently issued official trade statistics; the particulars for 1910 are added for purposes of comparison and notes of any increases or decreases are given:—

	1910. Francs.	1911. Francs.	Inc. or dec. Francs.
<i>Dynamo-electric machines and electric transformers of all kinds.—</i>			
To Germany ... ..	2,070,000	2,742,000	+ 672,000
„ Austria ... ..	897,000	767,000	— 130,000
„ France ... ..	3,108,000	4,675,000	+ 1,567,000
„ Italy ... ..	2,874,000	1,298,000	— 1,576,000
„ Belgium ... ..	342,000	1,036,000	+ 694,000
„ Great Britain ... ..	573,000	1,374,000	+ 801,000
„ Russia ... ..	997,000	1,306,000	+ 309,000
„ Spain ... ..	1,340,000	1,319,000	— 21,000
„ British India ... ..	78,000	253,000	+ 175,000
„ Mexico ... ..	38,000	156,000	+ 118,000
„ Brazil ... ..	179,000	627,000	+ 448,000
„ Argentina ... ..	523,000	730,000	+ 207,000
„ Other countries ... ..	2,647,000	1,765,000	— 882,000
<b>Total ... ..</b>	<b>15,666,000</b>	<b>18,048,000</b>	<b>+ 2,382,000</b>

	1910. Francs.	1911. Francs.	Inc. or dec. Francs.
<i>Hydraulic and wind motors.—</i>			
To Germany ... ..	950,000	1,342,000	+ 392,000
„ France ... ..	586,000	999,000	+ 413,000
„ Italy ... ..	943,000	549,000	— 394,000
„ Great Britain ... ..	403,000	352,000	— 51,000
„ Russia ... ..	267,000	263,000	— 4,000
„ Spain ... ..	295,000	385,000	+ 90,000
„ Japan ... ..	431,000	937,000	+ 506,000
„ Canada ... ..	66,000	566,000	+ 500,000
„ Mexico ... ..	650,000	180,000	— 470,000
„ Brazil ... ..	111,000	362,000	+ 251,000
„ Argentina ... ..	61,000	168,000	+ 107,000
„ Other countries ... ..	1,458,000	1,060,000	— 398,000
<b>Total ... ..</b>	<b>6,221,000</b>	<b>7,163,000</b>	<b>+ 942,000</b>

HYDRO-ELECTRIC WORKS ON THE MISSISSIPPI.

WHAT is described as the world's largest hydro-electric development will ultimately utilise over 300,000 H.P. from the River Mississippi, at Keokuk, Iowa, and is now practically half completed. From the *Southern Electrician* we draw the following particulars:—The concrete dam across the river is 4,619 ft. long, 53 ft. high, and 42 ft. and 29 ft. in width at its base and top respectively; it comprises 119 similar spans, carries a causeway along its top, and provides deep water navigation 65 miles up the river. Between the power house and the Iowa shore, a large lock (110 ft. wide and 40 ft. lift) and dry dock have been built. The power house is of concrete construction, is 1,718 × 133 ft. in plan, and 70 ft. high to the generator floor; from this floor to the roof pinnacle is 107 ft. 6 in. The building is set almost parallel to the river, and will ultimately contain 30 9,000-K.V.A. umbrella-type alternators; half this equipment is nearly ready for service. The turbines are of the Francis type, 16 ft. 2 in. in diameter at the 20 buckets, and each is placed in a scroll case (39 ft. diameter × 22 ft. high) fed by four intakes which—initially parallel—sweep round to supply the whole turbine periphery uniformly. The total load on each main thrust bearing is 246 tons, and the shaft is 25 in. in diameter. Rated at 32 ft. head (the actual head varying from 29 to 43 ft.), the turbines are of 86 per cent. efficiency when running at 57.7 R.P.M.

The three-phase alternators are rated at 9,000 K.V.A., 11,000 volts, 25 cycles, and have a full-load efficiency of 96.3 per cent., and 13 per cent. regulation at unity p.f.; each machine weighs 27.5 tons, and is provided with a brake to hasten shutting down; the armatures are 30 ft. 9 in. in external diameter. Excitation is by an unusual system; turbine-driven alternators (ultimately four in number), rated at 2,000 K.V.A., 460 volts, 25 cycles, feed three-phase bus-bars running the whole length of the generator room. Thence 100-kw. motor-generators, located in a gallery 8 ft. above the floor, excite each alternator at 250 volts. A reserve 440-volt bus-bar, excited through a 600-K.V.A. three-phase transformer from the main power circuit, is installed for each group of generators.

Duplicate bus-bars are installed on both high and low-tension systems, and all generators, transformers and lines have selector switches enabling connection to be made to either bus-bar. One L.T. bus-bar runs the whole length of the station, and will be used for

transfer and in emergency. The normal operating bus-bar has section switches and current limiting reactances. Each reactance is rated at 240 K.V.A., and comprises concrete cores wound with copper cable; total weight 12 tons. The generators and transformers feeding each outgoing line will be on a separate section of the bus-bar, but, ordinarily, the sections are paralleled through the reactances, and the emergency bus-bar unites the ends of the main bus-bar and forms a "ring." Except the L.T. bus-section switches, all switches are non-automatic and arranged so that trouble on one section opens its two section switches, reduces the generator voltage and leaves generators, transformers and lines connected together. One H.T. bus-bar is out into sections corresponding to the lines; the sections of the other can be paralleled if desired.

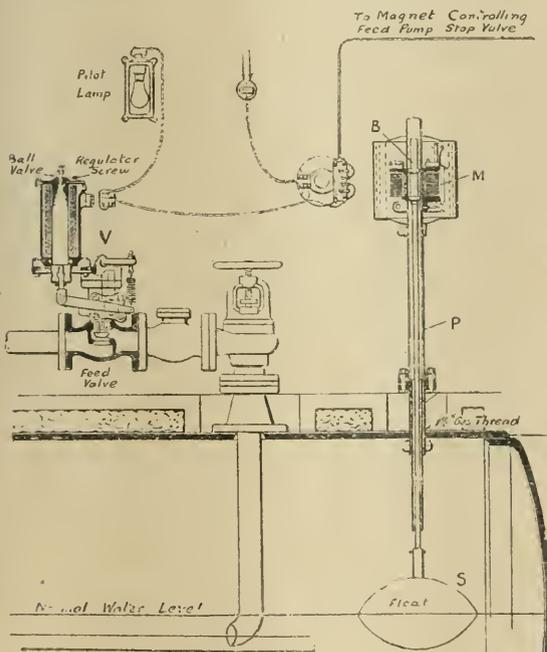
The three-phase transformers are rated at 9,000 K.V.A., 11,000/110,000 volts, and are connected delta low-tension and star high-tension, with neutral dead earthed; each occupies 8 x 16 ft. x 24 ft. total height, and containing 10,000 gallons of oil, weighs 103 tons complete. The H.T. bus-bars consist of 2 in. standard iron pipe, from which line connections are made with 1 1/2-in. copper pipe. The roof bushings give a safety factor, on line voltage, of 3 under rain and 4 under dry test. Rotary double-break air disconnecting switches are mounted 24 ft. between line phases and have 12-ft. arms.

The entire station is controlled from a switchboard room on the top floor, in the centre of the building, and complete telephonic communication is provided between every part of the building, the sub-stations and distributing points and the chief despatcher's desk and switchboard. An extensive oil-treating, storing and distributing system is installed, in addition to distinct water supplies for transformer cooling, fire protection and general station use.

Power is distributed locally at 11,000 volts, and through the populous country along the river at 110,000 volts. The 137-miles E.H.T. line to St. Louis comprises two 300,000-cm. copper circuits carried 10 ft. between phases in vertical planes on either side of 80-ft. steel towers placed 800 ft. apart. Anchor towers at 1-mile intervals will withstand breakage of all the line conductors and the 1/2-in. steel ground wire; other towers will withstand breakage of two wires. Steel conductors placed 24 ft. apart are used for the single spans over the Mississippi (twice) and Missouri (once). Seven-part suspension insulators are used (flash-over 440 KV. dry, 330 KV. wet).

**ELECTRIC CONTROL OF BOILER FEED.**

The accompanying illustration shows the essential features of an ingenious and practical electric water-level regulator for steam boilers. The equipment comprises a float S, an electromagnet M (mounted adjustably on a standpipe P on the boiler), and an



electromagnetically controlled feed valve V. The float has a guide rod, penetrating the standpipe P, and carrying an iron block B. The relative position of B and M is so adjusted that, when the water level in the boiler is normal, B lies above M, but as the water level sinks and the float descends, B practically closes the magnetic circuit of M and thus enables the latter to attract an

armature carrying a relay contact. An air brake on the valve magnet core provides for rapid opening and gradual closing of the feed valve, and an alarm signal is given in the event of current failure or of over-feeding.

As the stand-pipe is closed at the top, no stuffing-box is necessary, and the apparatus is, therefore, not liable to stick.

This apparatus is designed for operation on 110 or 220-volt circuits, and is made in sizes suitable for boilers having 3,000 or 5,500 sq. ft. heating surface. Where electric power is used for driving feed-pumps, chain grates, draught fans, &c., this regulator is very easily applied, and its use results in increased efficiency of steam raising and reduced liability to accident. The manufacturers are the Hannover-Maschinenbau A.G.—Elek. Abt. and E. u. M.

**FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.**

**AMENDMENTS.**

**NEW ZEALAND.**—The New Zealand Customs Authorities have issued the following decisions as to the duties to be levied on certain electrical and similar goods on importation; the duties in all cases are those levied on British goods under the Preferential Tariff:—

Nacho automatic signalling gear for electric tramway; telephone transmitters, mouthpieces, transmitter diaphragms and hand combinations; extension bells being telephone accessories; vulcanite nipples, claimed as electrical insulating material: 20 per cent. *ad val.*

**AUSTRALIA.**—The Australian Customs Authorities have decided that "telephone counters" are to be dutiable at the rate of 20 per cent. *ad val.* under the British preferential tariff.

**RUSSIA.**—The *Commercial Gazette* of St. Petersburg reports the introduction of a Bill authorising the Council of Ministers, on the suggestion of the Minister of Commerce in conjunction with the Minister of Finance, to permit the duty free importation of foreign products for their manufacture into finished articles or for final finishing, on condition that they are subsequently exported in the form of finished articles, within a time to be decided on by the Ministers under a separate application in each case, and provided that the products in no way circulate in the Russian market. The Minister of Finance will require the deposit of the amount of duty ordinarily payable, as guarantee for the manufacture and subsequent exportation of the finished articles.

**BRAZIL.**—The Brazilian Budget Law provides for the entry of certain goods at specially low rates of duty as follows:—Materials destined for the first public installation of light, power, and electric tramways, &c., when imported on the requisition of the Governments of the States or the municipalities (including the Federal District authorities) for works undertaken by them, are to pay 8 per cent. *ad val.* The reduced (*ad val.*) rates of duty resulting from the present law are to be calculated on the official values in cases where a fixed duty is assigned in the Customs tariff; as regards goods which are tariffed *ad val.*, the commercial value is to form the basis of assessment. In the case, however, of material for sanitary works, the duty is to be calculated on the commercial or invoice value of the goods.

**BELGIUM.**—The Customs authorities have issued a notice to the effect that time switches imported into Belgium are to be dutiable as apparatus which is classified in the tariff as follows:—

Of aluminium ... ..	40 fr. per 100 kg
" cast-iron ... ..	2 "
" wrought-iron or steel ... ..	4 "
" copper or any other material ... ..	12 "

**NEW PATENTS APPLIED FOR, 1913.**

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 5,836. "Electric fuse holders." ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD., and E. HOWELL. March 10th.
- 5,872. "Electrical alarm signalling apparatus for ordnance." F. KRUPP ART-GEA. (Convention date, April 22nd, 1912, Germany.) March 10th. (Complete.)
- 5,903. "Electrical sockets." SIMENS SCHUCKERTWERKE G.m.b.H. (Convention date, March 20th, 1912, Germany.) March 10th. (Complete.)
- 5,909. "Combined globe and reflector for incandescent lamps." E. WIDMER. March 10th.
- 5,926. "Electrical machines." F. NEWTON and NEWTON BROS. March 10th.
- 5,935. "Electric magnetic generator for self-lighting and vehicles." T. TANSSON. March 10th.
- 5,936. "Support for telephone registers or books." G. HAKER and H. HEIDORN. March 10th.
- 5,938. "Telegraphones." T. McKENNA. (C. K. FAYKAUSER, United States.) March 10th. (Complete.)
- 5,950. "Facsimile transmission electrically of drawing, handwriting and the like." T. N. ATKINSON and J. B. FRASER. March 10th.
- 5,961. "Systems of electrical distribution." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) March 10th.

- 5,995. "Magnetic compasses." KELVIN & JAMES WHITE, LTD., M. B. FIELD and D. RENNERT. March 11th.
- 6,028. "Electric lamp electrode holders." M. A. HERWIG. (Divided application on 15,927 of 1912, July 8th, 1912.) March 11th. (Complete.)
- 6,092. "Electrical water purifiers." A. H. VAN PELT. March 11th.
- 6,036. "Electrical conductors." ART. GEP. BROWN, BOVERI & CIE. (Convention date, March 18th, 1912, Germany.) March 11th. (Complete.)
- 6,040. "Means for indicating time by electrical impulse." A. WORT. March 11th.
- 6,066. "Tight and reversible case for electric accumulators or cells." F. SARLON. (Convention date, March 13th, 1912, France.) March 11th. (Complete.)
- 6,082. "Driving dynamo-electric magnets for lighting purposes on motors, motor-cycles or the like." W. G. FORRES. March 11th.
- 6,086. "Automatic electric alarm for railways." H. GARTSIDE. March 12th.
- 6,122. "Interrupters for electric circuits." A. PELLAK. (Convention date, March 20th, 1912, Germany.) March 12th. (Complete.)
- 6,136. "Methods of starting the arcs of electric furnaces." E. K. SCOTT. March 12th.
- 6,148. "Electric incandescence lamps." H. ZSCHOCKE. March 12th.
- 6,166. "Electric fuses." F. GRUNERAG. March 12th. (Complete.)
- 6,184. "Protecting devices for electric circuits." SIEMENS-SCHUCKERTWERKE G.M.B.H. (Convention date, March 12th, 1912, Germany.) March 12th. (Complete.)
- 6,109. "Device for automatically breaking and making electric contacts of the like at a predetermined moment." N. BENDIXEN and F. C. E. GOUDRUP. March 12th.
- 6,178. "Electrical connections." SOC. ANON. LE CARREON. (Convention date, December 2nd, 1912, France.) March 12th. (Complete.)
- 6,174. "Multiplex telegraphy." E. D. CATHEA. March 12th.
- 6,185. "Block-signalling and train-controlling systems." A. J. ALLARD. March 12th. (Complete.)
- 6,186. "Electric train signalling and controlling systems." A. J. ALLARD. March 12th. (Complete.)
- 6,192. "Wireless clock-synchronising apparatus." R. L. R. DES ORDONS. (Convention date, March 13th, 1912, Belgium.) March 12th. (Complete.)
- 6,222. "Electrically-heated flat-irons." S. LE FEVRE VAREL. March 13th.
- 6,223. "Instantaneous electrically operated water-heaters." S. LE FEVRE VAREL. March 13th.
- 6,226. "Rheostats for controlling electric motors and the like." P. S. SWAN. March 13th.
- 6,253. "Electrical candle-fittings." F. HODGSON. March 13th.
- 6,288. "Electric lampholders and the like." N. McLEAN. March 13th.
- 6,285. "Regulation of dynamo-electric machines." BRITISH THOMSON-HOUSTON Co., LTD. (Compagnie Francaise Thomson-Houston, France.) March 13th.
- 6,292. "Telegraph and other signalling and the like apparatus." H. O. A. JENSEN. (Divided application on 18,985, August 19th, 1912.) March 13th. (Complete.)
- 6,296. "Combined ears or clips and anobors for electric trolley wires for tramways and the like." March 14th.
- 6,306. "Electrostatic separators." J. KRAUS and E. OFFEN. (Convention date, March 14th, 1912, Germany.) March 14th. (Complete.)
- 6,369. "Telephone exchange systems." D. H. KENNEDY and J. W. TURNER. March 14th.
- 6,371. "Construction of rheostat." L. MILLER. March 14th.
- 6,375. "Electric transformers." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) March 14th.
- 6,387. "Manufacture of plastic and elastic compositions, artificial filaments, films coatings, and the like products." L. LILIENTHAL. (Convention date, February 19th, 1913, Austria.) March 14th. (Complete.)
- 6,388. "Process of and apparatus for separating ores and metals by means of electricity." N. L. MELGAREN. March 14th. (Complete.)
- 6,408. "Portable electric safety lamps." P. WOLF. March 14th. (Complete.)
- 6,410. "Means for and method of changing the frequency of alternating currents." A. M. TAYLOR. (Addition to 8,853, 1911.) March 14th.
- 6,421. "Process or method of and means for operating upon earthenware, and chiefly in the production of electric insulators and the like." H. L. DOUGLON and H. MORRIS. March 15th.
- 6,442. "Secondary batteries." W. S. NAYLOR and CHLORIDE ELECTRICAL STORAGE Co., LTD. March 15th.
- 6,461. "High-frequency alternators." HON. SIR C. A. PARSONS. March 15th.
- 6,462. "Secondary electric batteries." B. HEAP and CHLORIDE ELECTRICAL STORAGE Co., LTD. March 15th.
- 6,465. "Selectors especially for use with automatic telephone exchanges." G. A. BRUNLANDER. (Convention date, March 22nd, 1912, Sweden.) March 15th. (Complete.)
- 6,479. "Transmitters for use in wireless telegraphy." J. SAHULEA. (Convention date, March 26th, 1912, Austria.) March 15th. (Complete.)
- ELECTRIC SWITCHES AND THE CONDUCTION CONNECTIONS THEREOF. H. C. Sheldo (Saschische Gruppenwechschaltger. Ges.) 30,021. December 31st. (Divided application on No. 8,590 of 1912, February 13th.)
- FIRE-ALARM. M. Moloney. 4,777. February 26th. (August 3rd, 1911.)
- MINERS' ELECTRIC LAMPS. C. H. Worsnop. 4,983. February 28th.
- HOLDERS FOR ELECTRIC CANDLE LAMPS. C. C. Regnart. 5,560. March 5th.
- TELEGRAPHY. S. G. Brown. 6,275. March 13th.
- ELECTRIC SIGNAL FOR USE ON LOCOMOTIVES. R. G. J. Wightman. 6,555. March 16th.
- ELECTRIC RADIATOR. J. Slater & Co. (Engineers), Ltd., and C. R. Allensby. 6,964. March 20th.
- CLUTCHES OPERATED BY ELECTROMAGNETIC COILS. G. Richards. 7,928. April 2nd.
- MEMORANDUM PAD FOR USE WITH TABLE TELEPHONE INSTRUMENTS. J. G. Hay. 8,695. April 12th.
- TELEPHONE EXCHANGE SYSTEMS. M. L. Johnson. 8,997. April 16th.
- IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES WITH A SYMMETRICAL ARRANGEMENT OF CYLINDERS. M. C. Brendel. 10,130. April 23rd. (Addition to No. 6,567 of 1912.)
- CLUTCHES AND DRIVING MECHANISM PARTICULARLY ADAPTED AS SLOW MOTION GEARS FOR THE OPERATION OF STARTING DEVICES FOR ELECTRIC MOTORS. J. H. Wellisroff and H. T. Boothroyd, Ltd. 10,366. May 1st.
- PROTECTIVE DEVICES FOR ELECTRIC DISTRIBUTION SYSTEMS. British Thomson-Houston Co. and E. B. Wedmore. 10,545. May 3rd.
- ELECTRODES FOR ARC LAMPS. British Thomson-Houston Co. (General Electric Co.) 11,792. May 17th.
- MAGNETIC WATER-LEVEL INDICATOR FOR STEAM BOILERS. F. W. Montgomery. 16,483. July 5th. (August 14th, 1911.)
- ELECTRIC SAFETY FUSES. L. Kovacs. 19,218. August 22nd.
- DEVICE FOR CONTROLLING ELECTRIC CIRCUITS IN A DETERMINED ORDER. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 20,914. September 18th.
- ELECTRIC SHOCK PROTECTOR FOR UMBRELLAS. I. H. Weinberg, G. Schreiner and F. Buetzer. 21,162. September 17th.
- ELECTRODES FOR GALVANIC CELLS. Bernhard Electricitäts Werke Akt.-Ges. 21,739. September 25th. (September 25th, 1911.)
- ELECTRIC ARC LAMP SPECIALLY APPLICABLE FOR CINEMATOGRAPHIC OR OTHER PROJECTIONS. E. Siron. 26,886. November 22nd.
- ELECTRIC SWITCHBOARDS. C. A. Vandertell and A. H. Midgley. 27,501. November 29th.
- TELEPHONE RECEIVERS. J. Schiessler. 27,969. December 4th. (Divided application on No. 4,407 of 1912, February 21st.)
- METHOD AND MEANS FOR PROTECTING ELECTRIC ACCUMULATORS FROM FLOODING BY SEA WATER. H. Wehrli. 28,519. December 10th. (March 26th, 1912.)
- ELECTRICALLY CONTROLLING GUNS ON SHIPS AND ASHORE, STEERING GEAR ON SHIPS, SWING BRIDGES, HYDRAULIC ACCUMULATORS, CRANES, CAPSTANS AND THE LIKE. A. Martin, H. Jackson, A. J. Campbell, T. B. Campbell and W. Campbell. 1,901. January 24th.
- IGNITION IN INTERNAL-COMBUSTION ENGINES. J. E. Wilks. 8,404. February 10th.
- TELEPHONE SYSTEMS AND APPARATUS THEREFOR. E. A. Mellinger. 4,179. February 19th.
- APPARATUS FOR REPRODUCING UNDEULATING CURRENTS. J. Schiessler. 4,407. February 21st. (Convention date and Patent of Addition not granted.)
- ELECTRIC CONDUITS. H. H. Longbottom and T. Fairar. 4,426. February 22nd.
- ALTERNATING-CURRENT DYNAMO-ELECTRIC GENERATORS. Akt.-Ges. Brown, Boveri & Cie. 4,460. February 22nd. (February 22nd, 1911.)
- ELECTRIC LAMPS FOR ILLUMINATING MUSIC AND THE LIKE. O. Hawkes and P. T. Cockrell. 4,818. February 26th.
- MEANS FOR LEADING ELECTRIC OR OTHER POWER INTO REVOLVING STRUCTURES. R. H. S. Bacon and F. W. H. Shepherd. 5,336. March 2nd. (Cognate application No. 8,443 of 1912.)
- ELECTROLISERS AND THE LIKE. Peyton & Peyton, Ltd., and H. B. Bond. 5,467. March 5th.
- DYNAMOS. A. A. Price. 5,981. March 9th.
- PROTECTIVE DEVICES FOR ELECTRIC DISTRIBUTION SYSTEMS. British Thomson-Houston Co., Ltd., and E. B. Wedmore. 8,569. April 11th.
- DEVICE FOR SECURING SHADES AND THE LIKE ON ELECTRIC LAMPHOOLDERS. W. J. Instan and A. Holt. 9,302. April 19th.
- ELECTRIC CIRCUIT INTERRUPTERS. J. Bijur. 9,426. April 20th.
- WORKING SUBMARINE CABLES. J. Gott. 10,534. March 8rd. (March 18th, 1912.)
- ELECTRIC LIGHTING AND REFLECTORS AND SCREENS THEREFOR, ESPECIALLY APPLICABLE FOR FOOTLIGHTS OR MEANS FOR LIGHTING STAGES OF THEATRES OR THE LIKE PURPOSES. A. W. Beutell and J. A. Manners-Smith. 14,722. June 2th.
- ARC LIGHT ELECTRODES. British Thomson-Houston Co. (General Electric Co.) 15,483. July 2nd.
- ELECTRICAL TRANSFORMERS. Siemens Schuckertwerke Ges. 15,647. July 4th. (July 4th, 1911.)
- ELECTRIC RETORT FURNACES. J. Bally. 16,041. July 9th. (July 11th, 1911.)
- PREPAYMENT METER FOR USE IN THE DISTRIBUTION OF ELECTRICITY. Allgemeine Electricitäts Ges. 16,194. July 10th. (July 10th, 1911.)
- ELECTRIC STRIKING GEAR. H. Campiche. 17,779. July 81st. (August 1st, 1911.)
- WATERTIGHT BOTTLES AND THE LIKE. E. A. Grsham. 19,557. August 27th.
- ELECTRIC DRIVING MECHANISM FOR CLOCKS. F. H. Walker. 20,666. September 5th.
- REFILLABLE ELECTRIC FUSE. A. F. Damm. 21,240. September 18th.
- POLYPHASE ALTERNATING ELECTRIC CURRENT COMMUTATOR MOTORS. Siemens Schuckertwerke Ges. 21,471. September 20th. (September 22nd, 1911.)
- MEANS FOR SUSPENDING ARC LAMPS. G. Schanzlenbach & Co. Ges. 22,549. October 8rd. (May 21st, 1912.)
- DRIVING MECHANISM OF MAGNETO IGNITION MACHINES HAVING OSCILLATING ARMATURES. Firm of Robert Bosch. 29,046. October 9th. (May 3rd, 1912.)
- ELECTRIC CUT-OUTS. Veist and Haeflner Akt.-Ges. 23,514. October 15th. (November 2nd, 1911.)
- DYNAMOS. C. L. Bredden and H. E. Moore. 25,866. November 5th.
- MAGNETIC COMPASSES. Kelvin & James White, Ltd., and J. T. Bottomley. 26,338. November 16th.
- MEANS FOR REDUCING THE DURATION OF SPARKS PRODUCED BY MAGNETO-ELECTRIC GENERATORS. P. Mascow. 27,094. November 25th. (January 25th, 1912.)
- MEANS FOR THE PROTECTION OF ELECTRIC ACCUMULATORS FROM FLOODING BY SEA WATER. W. Wehrli. 28,520. December 10th. (March 25th, 1912.)

## PUBLISHED SPECIFICATIONS.

### 1912.

- BRUSH HOLDERS FOR DYNAMO-ELECTRIC MACHINES. Pintsch's Electric Manufacturing Co. and C. H. Vidal. 15,471. July 2nd.
- METHOD OF ENABLING SPEECH-TRANSMITTING INSTRUMENTS COMPRISING MICROPHONES TO BE WORKED WHEN CONNECTED IN PARALLEL. R. Goldschmidt. 15,915. July 8th.
- SECRET INTERCOMMUNICATION TELEPHONE SYSTEMS. Telefonfabrik Akt.-Ges. vorm. J. Berliner. 16,084. July 9th. (December 22nd, 1911.)
- REGULATING SWITCH. F. C. Curtis. 16,933. July 20th.
- COVERING OF ELECTRIC CONDUCTORS WITH PLASTIC MATERIAL. W. S. Smith and A. D. Schuter. 22,534. October 8rd. (Addition to No. 16,642 of 1911.)
- SPRING-MOUNTED FOOTSTEP BEARING FOR ELECTRICITY METERS. Koring and Mathieson Akt.-Ges. 27,775. December 8rd. (March 15th, 1912.)
- APPARATUS FOR ELECTRO-OSMOSE. Ges. für Elektro-Osmose and H. Illig. 29,826. December 21th. (Addition to 725 of 1912.)

### 1913.

- RECEIVER FOR SUBMARINE SIGNALLING. Signal Gesellschaft. 2,184. January 27th. (November 30th, 1912.)
- MANUFACTURE OF CHROME-ALUM BY ELECTROLYSIS. H. Chaudrat. 1,639. January 20th. (January 24th, 1912.)

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

# THE ELECTRICAL REVIEW.

Vol. LXXII.

APRIL 4, 1913.

No. 1,815.

## ELECTRICAL REVIEW.

## MINISTERS AND MARCONI.

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It is a long while since any controversy has arisen in political and commercial circles arousing such intense interest as the incidents which during the last few days have involved the conjunction in the public Press of the words at the head of this article. Ministers are never without their enemies. The name of Marconi we use, of course, in an impersonal sense. It is representative of a great enterprise, and great enterprises must have their rivals, or would-be rivals. The evidence which was begun in the libel action against *Le Matin*, and continued before the Parliamentary Committee, may have afforded some satisfaction to enemies, but has also afforded considerable disappointment to the friends of both.

The contract for the links of the wireless chain was made by the Post Office after considerable discussion and negotiation. The officials of the Department have maintained, with a tenacity which is entitled to commendation, that the terms of the contract were advantageous to the State. Whether or not the terms were the best that could be obtained, or even if the best that could be obtained from that particular contractor should have been entered into, it is not now the time to consider.

The contract, in fact, contained some exceptional conditions, and we think it probable that these exceptional conditions mainly exercised the public mind in so far as the public mind is exercised about such undertakings. The contract having been provisionally agreed to by the Government, was subject to the ratification of Parliament. Such ratification was expected promptly, as the managing director of the company remarked in a letter upon which we commented in our issue of January 24th, 1913. By both parties to the contract it is to be feared that the confirmation of Parliament was regarded rather as a matter of form than otherwise. If that be so, it was an error of judgment which was to precede many others. Until ratified by Parliament, the contract was not complete, and when it came up for ratification, it became evident that it would be necessary to have it fully considered by a Select Committee. This resulted very largely from the criticisms in the Press, which seemed to emanate principally from political opponents of the Government. Much of the criticism, even in quarters which have been called influential, was based on compounds of inaccuracies and inferences. That an important organisation could acquire an influence of its own was not recognised, and the influence which the Marconi Co. unquestionably did exercise was attributed to the relationship existing between its managing director and one of the principal members of the Government. Continuing for some time it was clearly hinted in the Press, and more definitely stated in clubs and places where they talk, that some Ministers had made money out of Marconis. This general talk was formulated by the Attorney-General in the House of Commons in October, and specifically denied on

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,**  
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his own behalf and that of other Ministers according to formula. This was probably the crowning mistake of the series, because it is to be feared that friends and foes alike regarded the denial as general, and omitted to notice the specific nature of the formula. In consequence, there was surprise and disappointment at the evidence in the *Le Malin* case, which showed that whilst leaving British Marconis severely alone, the Attorney-General had dealt in American Marconis, and that he was joined in those dealings by the Chancellor of the Exchequer and the Chief Whip. The distinction between the two companies, the nature of an investment, and the limitations on Ministerial thrift, have formed the substance of much evidence before the Select Committee without, we think, very material benefit. Fine distinctions of this sort seldom reach the popular mind. To the man in the street, Marconis are Marconis, and the geographical prefix is comparatively unimportant.

The exact method of reaching a conclusion may not be scientifically or judicially correct, but the man in the street will unquestionably be right in his conclusion that such action on the part of the Attorney-General, the Chancellor of the Exchequer, and the Chief Whip was singularly ill-advised. The contract had to come before Parliament. The chief law officer might have to advise, the Controller of the Purse would certainly have to exercise some discretion in such a matter, and the Chief Whip would possibly be required to exercise his functions in obtaining the presence of the necessary majority of members. No reasonable individual would suggest that they would be in any way influenced by their personal interests in carrying out their respective duties, but the fact that their interests were possibly antagonistic to their duties would seriously impair their efficiency. Whatever the distinction between the particular companies concerned, no difference exists on the part of the individual managing their affairs. The investment was prompted by the Attorney-General's brother, who had "made himself responsible for" a large issue of shares of the American company, and it was the same brother and no other who was responsible for the negotiation of the contract with the British company. The practical objection is found in the fact that in consequence of the circumstances which had arisen, the Attorney-General, who is presumed to be the most able adviser at the disposal of the Government, was compelled to ask that he should be excused from advising as to the power of the company to withdraw from the contract.

The drawbacks attending the position of the Chancellor of the Exchequer are less direct, but to the public even more important. Amongst much inaccurate statement and unreasonable inference, the writer in the *National Review* made a perfectly reasonable reference to the South Sea Bubble in connection with the Marconi companies. In connection with company promotion, it is quite common to follow one success with another, making subsidiaries upon geographical or other lines, sometimes without much reason, except that the public are ready to absorb that particular brand of share. In the case of Marconis, the geographical company is quite a reasonable branch to pursue, but the flotation on the London market of the American company at the time, and under the circumstances concerned, must be regarded as being prompted by, and should be judged according to, the methods of the company promoter. It would be improper to describe the American company as a bubble company. We do not think it would be improper to describe its introduction on the London Exchange as an inflated flotation. The participation of the Chancellor of the Exchequer in such a deal is very much to be regretted, if only for its possible effect on the investor or dabbler who, hearing of the fact, might conclude that "if it is good enough for the Chancellor of the Exchequer, it is good enough for me." The lack of worldly wisdom evinced by both the Attorney-General and Mr. Lloyd George must be regarded as one of the most remarkable features disclosed by the recent controversy. The Attorney-General was so astonished as to answer: "Good heavens! No!" when asked if the surprise telegram from a celebrated man were not a familiar feature of company promotion. The Chancellor of the Exchequer persisted in the

description of his purchase of shares in a new company, with no dividend record, at an extravagant premium, as an "investment." We presume it is due to his more businesslike experience that we are able to congratulate Mr. Samuel, as we do, on having refrained from drawing fine distinctions, and on adopting the better policy of leaving the whole family severely alone.

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## ELECTRIC HEATING AND COOKING.

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IN view of the importance which already attaches to the subject named above, and which, we firmly believe, is but the merest shadow of that which it will eventually acquire, we make no apology for including in this issue an article on electric cooking apparatus, together with a report of the discussion on the subject by the Yorkshire Local Section of the Institution of Electrical Engineers. Mr. Roles, whose remarks in opening the discussion took the form rather of a paper than of a mere introduction, was clearly effervescing with information on electric cooking, derived from actual experience and observation, and could have said a great deal more if circumstances had permitted. We trust that he will find an opportunity to supplement his interesting comments on the construction of the apparatus employed for heating and cooking purposes, for it is precisely such information as this that is most urgently needed by the manufacturers, to enable them to eliminate defects and errors and to improve their products to the highest pitch of reliability and efficiency.

That many mistakes have been made in the design of the earlier forms of cooking stoves and utensils is common knowledge; but probably few were aware that the effectiveness of electric heating apparatus could be so materially influenced by small changes in construction as Mr. Roles stated. We speak of effectiveness rather than of efficiency in this connection, because of necessity, technically speaking, the efficiency of an electric heating device must be very nearly 100 per cent.; the whole of the electrical energy must be converted into heat energy in one form or another, with the possible exception of an inappreciable amount of electrical radiation. But it is evident that the mode by which that heat energy is communicated to the surroundings of the heating apparatus may have a very important effect upon the effectiveness of the apparatus as a means of imparting warmth to the person or of maintaining the temperature of a room. We are, therefore, led to make the suggestion that the whole question is one which ought to be subjected to exhaustive investigation with a view to ascertaining beyond doubt the best type of apparatus for the performance of given functions, such as heating a room, warming an air supply, and so on.

In the ordinary course, such questions as these are left to be settled by the slow and tedious process of evolution and survival of the fittest, at immense cost to the industry and the public; by the application of scientific method they could be solved in a few months, or even weeks, at a cost trifling in comparison with the resulting benefit. The same applies to cooking apparatus. Although so great progress has been made in the development of this branch of electrical service, the trade is in a chaotic condition with regard to the design of the cookers, and each maker is working along independent lines, so that a great deal of work and

trouble is being needlessly incurred, and the same ground is being trodden many times. Scientific research would soon point out the direction along which the most rapid progress would be made. One manufacturer imitates the ordinary gas cooker as closely as he can; another abandons all idea of imitation, and adopts a totally different system—can both be right? It may be observed that the gas engineers have developed a design for their cookers which is practically standardised, the differences between the various patterns being found only in minor details; their design is not necessarily the most efficient, nor yet the cheapest possible. It is, we presume, the most effective—the type which has been found by experience to be the best adapted for the public use. We want to arrive at an equivalent result by the quickest method available, and we have no doubt that an exhaustive investigation by competent researchers, carried out, of course, in conjunction with practical trials in domestic use, would take us a long way on the road to that stage of development.

The process is akin to that pursued by breeders of animals, and by horticultural experts—they do not wait for natural evolution to bring about the results they wish for; they accelerate them by judicious selection and elimination, so that it is possible, in the course of a few trials, to intensify and develop any quality that may be desired. In the same way, the Sheffield steel experts, setting themselves the task of improving tool steel, quickly evolved a steel that would stand up to heavy cuts at a red heat—a steel that is the admiration of the world. Why should we be content to leave so important a problem as the development of the ideal types of heaters and cookers to chance?

Whatever the merits of the Edison storage cell in comparison with those of the lead accumulator, it cannot be denied that the former is an engineering product deserving of the highest commendation; as a mechanical device, it is a beautiful piece of work. It did not become so by haphazard trial and error, but by scientific investigation of the highest order. Examples might be multiplied, but we must stay our hand. The point is, that the work should be done in this way; funds are needed to carry it out, but the reward would be great. The subject is one of the greatest moment to the electrical industry, both to manufacturers and to supply authorities. It is one that the new Research Committee of the Institution of Electrical Engineers might take in hand, with the certainty of valuable results in the minimum time, and we earnestly commend it to the notice of that Committee, in the hope that something may be done.

Even when the design of the actual apparatus has been settled, there is more to be considered. The whole question of heating rooms, for instance, is at present in the crudest state imaginable. We use coal fires, and stoke up until the small proportion of the energy of the coal that gets into the room has raised its temperature to an unduly high degree; the fire dies down until we notice that the room is cold, and the process is repeated. Similarly we allow the room to cool at night, and warm it up again next morning. If electric or gas radiators are used, we still follow much the same routine—we heat up and cool down irregularly. How much better it would be if, as we have previously suggested, the room were kept always at the same temperature—that which was found the most comfortable and conducive to the prosecution of our respective occupations! There is no system of heating that lends itself so admirably to the attainment of this end as the electrical system; automatic devices to regulate the consumption of power in accordance with the actual requirements are, in fact, already on the market. Where such a system is in use the supply authority has a steady load with a low maximum demand, and can afford to give the supply at the lowest possible price, while the user is relieved of all concern about the heating of his house. It would be worth while to ascertain with certainty whether electrical heating carried out in this ideal way was able to bear comparison in point of cost—including all items of expense incurred, directly and indirectly—with the cruder methods of its competitors, which, it will be noted, usually involve the provision of chimneys at considerable cost to the builder.

**British Trade In Argentina.**

In a recent report on the trade of Argentina, the British Consul reports that the advantageous position of British trade in

Argentina is founded on the widely different economic conditions of the two countries which places each in a position to supply what the other requires. British capital and brains have found full and profitable scope for the development of railways in Argentina; the building of ports, the organisation of tramway services, providing machinery for economising and accelerating the preparation, storage and transport of grain, developing the cold storage and packing industries, advancing irrigation, water power, and land reclamation schemes, &c.; while the British flag now covers no less than 61 per cent. of the River Plate shipping—a circumstance that should in itself substantially reflect the upward tendency of our trade with Argentina. But the magnitude of British trading interests in Argentina may, perhaps, be more fully gleaned from the fact that no less than £500,000,000 of British capital is reported to have found its way into the country. The Republic, on the other hand, has attained the position of a great exporter of agricultural produce and meat, of which the United Kingdom is the largest consumer offering a growing and profitable market.

Although a study of trade conditions happily reveals British supremacy in the more important enterprises in the country, it would be unwise to ignore the progress that is being made by other nations who are gradually introducing elements of complexity into the economic conditions of the country. An effort is being made to secure a larger share of Argentine trade by the United States, and according to the figures of the Washington Department of Commerce for the year 1911-12, the imports into Argentina from the United States were £10,631,600 and exports to the United States £5,919,400, showing an increase on the general turnover of 22 per cent. as compared with the previous year. An increasing volume of business is likewise passing into the hands of our German competitors whose activity has been marked in the sugar industry, the electrical plant business, and harbour works. The following table shows the imports from leading countries in 1909, 1910 and 1911:—

	1909.	1910.	1911.
From United Kingdom....	£19,839,700	£21,875,500	£21,727,560
„ Germany ... ..	8,911,200	12,225,800	13,172,400
„ United States ... ..	8,613,800	9,683,800	10,470,700
„ France ... ..	6,160,200	6,730,100	7,605,300
„ Italy ... ..	5,373,600	6,355,200	5,879,200
„ Other countries ... ..	11,652,700	13,483,700	14,507,100
Total ... ..	£60,551,200	£70,354,100	£73,362,200

It will then be seen that although our trade with Argentina is still larger than that of any other competing country, our percentage of the total decreased from 32·8 per cent. in 1909 to 31·1 per cent. in 1910 and 29·6 per cent. in 1911. On the other hand, the German share increased from 14·7 per cent. in 1909 to 17·4 per cent. in 1910 and 18 per cent. in 1911; the United States' share remained much the same. Although it is only to be expected that as years go on the shares of the leading countries should show a narrower margin, there can be no doubt that part of the increased percentage of German trade in particular is due to the greater keenness shown by German capitalists and manufacturers during recent years. In view of the heavy harvests which have just been reaped, Argentina may be regarded as a profitable market at the moment, and we should lose no time in endeavouring to take advantage of the prosperous conditions. The following figures will be of interest to readers of the ELECTRICAL REVIEW, as showing the extent of the market for their goods:

Imports of	1909.	1910.	1911.
Iron and steel, and manufactures of ... ..	£7,315,000	£8,624,000	£8,617,000
Transport carriages, wagons, &c. ... ..	6,342,257	7,019,036	7,373,075
Building materials ... ..	5,673,178	5,847,467	6,757,888
Manufactures of metals other than iron and steel ... ..	2,042,164	2,574,091	3,095,937
Electrical apparatus ... ..	843,382	1,148,306	1,336,734

## A FRENCH INQUIRY INTO ELECTRICAL ACCIDENTS, AND SUGGESTIONS FOR PREVENTING THEM.

By W. STEUART, M.R.C.S., M.I.E.E., &c.

As the result of the very large number of electrical accidents that had occurred during the previous years, the French Minister of Public Works, at the end of 1909, appointed a Commission to make such inquiries and experiments as it thought advisable, and to draw up rules and regulations accordingly, with a view to reducing such accidents to a minimum.

The inquiry extended over a period of more than two years, and the results have recently been published by Dr. Weiss, one of the members of the Commission. The publication takes the form of a paper-covered book, entitled "Sur les effets Physiologiques des Courants Electriques," published by Gauthier Villars, Paris. The members of the Commission first directed their efforts to obtaining information regarding the causation of death by electricity, these observations being limited to the following groups of cases:—

1. Death from lightning.
2. Accidental shocks from industrial electrical apparatus.
3. Electrocutions in America.
4. Laboratory experiments on various animals.

As regards group 1 this was soon put on one side, as it was recognised, in the first place, that the conditions were completely different to those ruling in connection with industrial electricity, and further, through lack of competent observation, the data obtained were practically useless.

The same difficulty regarding competent observation again militated against reliable data being forthcoming in the second group, and the apparent idiosyncrasies of the current were extremely disconcerting.

Two cases were mentioned as instances in point:—In one the man received a fatal shock; the body showed no signs externally whatever, and the most careful post-mortem examination failed to disclose any cause of death.

In the other, the victim had been horribly burned, the forearms and legs being actually amputated, and yet the patient remained alive and the general health was not affected.

The electrocutions in America, although carried out by skilled observers, did not afford much help to the Commission. The object in these cases was to kill instantaneously, so that it was impossible to judge what organ gave way first, and in what manner. Apparently the only valuable result accruing from this source was to impress the Commission with the lack of success of this form of capital punishment.

The fourth group of cases, being the experiments on animals, permitted of a complete and methodical study of the effects of the electrical current. It had one objection, viz., that it was questionable whether the results obtained from animals, such as dogs, could be applied to man.

Inasmuch as some of the experiments on the dogs were similar in degree to accidents that had happened to human beings, it may be fairly deduced that the influence of the electrical current on animals should be an approximate guide to the effect produced on men.

In all, some 44 dogs were experimented on. In each case instruments were attached to the animal to register the blood pressure, the pulse, and the respirations. The varying values were recorded on paper driven by revolving drums, the length of paper used giving an accurate measure of the time of the operation.

The pressure was registered by a voltmeter connected across the electrodes applied to the animal.

The experiments were varied by changing the pressure, current, points of applications of the electrodes, and time of application. The tests were carried out with both alternating and continuous currents, and in the former case different frequencies were tried.

The results are carefully tabulated, and copies of all the curves are given at the end of the book. Specific details of the different experiments would render this article unduly long.

Briefly, it was found that with alternating currents the frequency (between industrial limits) had no apparent influence on the results.

If death is produced by an alternating current with a pressure of less than 120 volts, it is due to the arrest of the heart in fibrillary tremors. The failure of respiration follows as the result of the heart stopping.

If death occurs as the result of a current with a pressure of more than 1,200 volts, it is due to the inhibition of the nervous centres and consequent respiratory failure.

Between 120 and 1,200 volts, both phenomena occur simultaneously.

Within certain limits death occurs with a constant number of joules, *i.e.*, the danger increases with the intensity of the current, and with the length of time the current is passing.

An alternating current is approximately four times as deadly as continuous current. Death was brought about by a minimum current of 80 milliamperes (.08 ampere) alternating and a minimum of 339 milliamperes continuous. Although alternating currents were found to be more dangerous as regards immediate effects, they have no delayed action, such as has been observed after the passage of continuous currents. There are several cases recorded in which men have been subjected to strong continuous currents, have recovered for a time, and have then become paralysed in the limbs through which the current had passed.

Currents that were selectively fatal to the action of the heart did not cause death if the heart were not included in the circuit; *e.g.*, with the electrodes placed below the jaw and on top of the head the current did not destroy the dog, but brought about death when they were applied to the forepaws.

After the heart had entered into fibrillary tremors, no known treatment was of avail in bringing about recovery, but, in certain cases, where respiratory failure took place the respiration gradually recovered after a lapse of some 90 seconds.

From a consideration of various fatal accidents, it is probable that the reaction of human beings to the current is quite comparable to the reaction of dogs.

After due consideration of the materials obtained, the committee decided to have three sets of placards prepared. The first embodied instructions to experts, and these are to be displayed in the interior of all electrical works, substations, &c. The second set was for the general public who might not be able to differentiate between dangerous apparatus and, for instance, offensive telegraphic material. The third set was of an educational nature, and meant for distribution in schools.

The first set of placards commences with some general information and recommendations to be observed in all cases. The important item of advice under this heading is:—Release the victim from the influence of the current at the earliest possible moment, remembering especially that dampness and moisture render rescue work extremely dangerous.

The procedure differs according to the pressure of the current. If less than 100 volts alternating, or 600 volts continuous, no danger to the rescuer is to be feared, and the victim may be secured and pulled away, care being taken not to touch any conductor.

From 150 to 6,000 volts, it is necessary for the rescuer first to insulate himself thoroughly from the earth. This may be done by means of dry, clean bottles placed under a board, or better by some spare insulators supporting a board. If two hands are used they should both be placed on the same part of the injured man.

For pressures over 6,000 volts, rescue under any circumstances is extremely dangerous. It is necessary for the rescuer to insulate himself from earth with the greatest care, and on no account to touch the victim except through insulating material also.

The bill ends with instructions regarding first aid, &c. The second set of placards is meant for distribution in districts supplied with electricity. The public are warned not to attempt rescue unless the accident occurs inside a house, where the pressure may be assumed to be comparatively low. Under these circumstances,

people are advised to use only one hand, to cover the hand with dry linen or dry paper, not to touch the conductors, and to stand on a chair, if possible, before attempting to pull the victim free.

Where, however, the accident occurs in connection with some form of distributing apparatus, nothing should be done beyond informing the authorities, with a view to cutting off the current and getting expert help.

It was suggested that an attempt might be made to short-circuit the victim, but it was decided that this procedure would be inadvisable; for although certain and practicable in the laboratory, the attempt would be fraught with great danger when rapidly improvised on the occasion of an accident.

In the general report the Commission lays stress on the necessity of educating the public, and especially all children at school, of the danger there is in touching electrical apparatus. It further advises that all future accidents, particularly those of a fatal nature, should be carefully studied by skilled observers, so that they may report on the conditions obtaining at the time.

One curious error has crept into the report which has escaped the notice of the electrical engineers of the Commission. Dr. Weiss deduces from an experiment that the intensity of the current is the important factor, and not the pressure. He shows that by keeping the current constant, adding external resistance, and increasing the pressure, the dog behaves in exactly the same way in each experiment, quite overlooking the fact that the potential difference across the dog remains the same.

This fallacy, however, does not affect the value of the experiments, as the intensity of the current through the body is directly proportional to the E.M.F. applied to it.

To combat the idea that an electrical shock can only take place when a person is in contact with two wires, M. Guery contributes a note showing the effects of capacity in this connection.

He first points out how on any circuit which may have developed an earth, shock is possible from a single contact, and then goes on to consider a single-phase alternating-current line with a high insulation, and shows that with a capacity of 5 microfarads the pressure to which a person touching one wire would be exposed would be  $E/2$ ,  $E$  being the transmission voltage. Similarly on a three-phase mesh system, with a pressure of  $E$  between wires, the shock pressure would be  $E/\sqrt{3}$ .

Another note included in the report deals with protective clothing invented by Mons. N. Artemieff, of Kief. A similar device, however, has been known in England for some time. Trials and experiments carried out by the inventor himself showed that the idea might be of great value in practice.

The clothing is composed of a very fine metallic tissue formed in a single piece, and enveloping the whole body, including the head, hands and feet. The metallic tissue is fixed to fine cloth, and the whole garment is arranged to put on over the ordinary clothes, and is so made that it can be put on and off without assistance. The necessary gaps do not affect its efficiency provided they are closed in the prescribed way.

The clothing does not impede the workman's movements in any way.

Its protective action is twofold:—

1. The body of the operator is short-circuited by a resistance of less than .01 ohm. The costume can take a current of 200 amperes indefinitely and 600 amperes for several seconds.

2. A man clothed with such a garment can touch any part of a high-pressure apparatus without danger, provided it is sufficiently well insulated.

Although the clothing protects against death, it cannot obviate the possibility of very serious injury.

In all probability the increased current would promptly blow the fuses or operate cut-outs, but should it not do so the operator would establish an arc on breaking the circuit, leading to the destruction of the metallic tissue and the production of very severe burns.

When testing the clothing, the inventor is said to have short-circuited a machine having an output of 200 amperes at 1,000 volts through his hands, and then to have quickly

broken the circuit. The tissue was burnt in several places by the resulting arc, but the hands were not hurt at all.

Another test was the short-circuiting of a 20-kw. transformer, wound to give a voltage of 150,000 volts, without causing damage to the clothing of the operator.

## NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

THE Hydro-Electric Power Commission of Ontario recently issued its third and fourth annual reports (for 1910 and 1911) under one cover.

The reports show what contracts were entered into for the supply of power to various municipalities, the growth of the load, the survey work carried out by the hydraulic department, and the work done by the municipal department in planning out distribution systems, advising and assisting local electrical superintendents in the execution of their duties, &c.

Some interesting particulars are given under the heading of "Operation of the Systems."

Before being put into operation the various items of equipment underwent severe tests, the high-tension windings of the 110,000-volt transformers and the transmission lines being subjected to a test pressure of 220,000 volts between each phase and earth.

The load factor of the system is said to be fairly high, and for 18 hours of the day the load is, roughly, 75 per cent. of the maximum.

At first, when the load was very light, the power factor at Niagara Falls was lower than 70 per cent. leading, but as the load increases it is expected that the power factor will in time be a lagging one. Some of the larger municipalities have provided synchronous motors to control the power factor of their loads.

The voltage regulation on the high-tension system is within 2 per cent.

In 1911 electrical storms were reported on 55 different days, 18 of them being severe. Six interruptions have been caused directly by lightning on the H.T. system, but contrasting it with other H.T. lines, either on the Canadian or the American side of the Niagara district, this is only about one quarter of the number of interruptions which occurred during the same season on these other lines.

An interesting fact is that out of the 120,000 high-voltage insulator sections on the line, not one has been broken due to electrical causes.

A good deal of trouble was experienced with the operation of the Commission's private telephone lines, but this has now been practically surmounted.

The foregoing particulars refer to no more recent date than the end of October, 1911; it is expected, however, that the report for 1912 will be published before long, thus bringing the information available down to a recent date.

The article headed "Electrical Apparatus and Standardisation," by Mr. W. A. Topjin, in the REVIEW of February 21st, leads one to suggest that a leaf might very well be taken out of the "National Electrical Code" of the "Board of Fire Underwriters," which has been to the fore lately in these columns.

It is well that certain things should be standardised, more particularly those articles which, owing to breakage or other cause, are in constant demand by the ordinary consumer. It should be as easy for anyone to buy a new fuse, for instance, as to go out and purchase a box of tacks. Fuses over here are standardised, but they have one great objection: all fuses for from 1 to 30 amperes are of one size and interchangeable: the step should be a much smaller one, say, 1 to 5 amperes, 5 to 10 and so on.

In this connection the German system, employing the Edison plug type of fuse, is well worth consideration,

as all the threads for a considerable range of size, are identical, and differentiation is obtained in a very simple manner by making the connection at the bottom of the socket thicker or thinner for the various sizes; thus, a 10-ampere plug will not be long enough to reach the contact at the bottom of a 5-ampere socket, and, therefore, is useless. Of course it is quite impossible to arrange any fusing device so that a person cannot *deliberately* make use of it for a greater current than is intended; the best that can be done is to make it difficult or inconvenient to do so, and to make it impossible for any to do it accidentally.

Mr. Toppin refers to the need for a means of identifying "Association" and "non-Association" cable; over here every cable maker is required by the Underwriters' Laboratories to put certain coloured threads into the insulating covering whereby each firm's cable may be known. A similar system could, no doubt, be utilised to advantage with regard to the two classes of British cable, provided that necessary safeguards were devised to prevent unscrupulous makers from putting "Association" threads into "non-Association" cables.

These notes have before this contained references to the rapid growth of some of the towns here, especially in the West.

Calgary, Alberta, started its municipal tramway system in 1909 with two cars: last year there were 48. The track mileage was 3, but this year it will be 71. The population has in this time grown from 35,000 to 75,000.

According to a recent Government report giving telegraph statistics, there were, in 1912, 168,000 wire miles of line in Canada and nearly 42,000-pole miles. Over 9½ million land messages and more than ¾ million cablegrams were sent during the year ending June 30th, 1912.

The Grand Trunk Railway Co. is evidently satisfied with the use of the telephone for the work of train dispatching, as it is steadily extending the system, and the operation of a good many miles of track is now taken care of by this means.

### LIFE TARGETS.

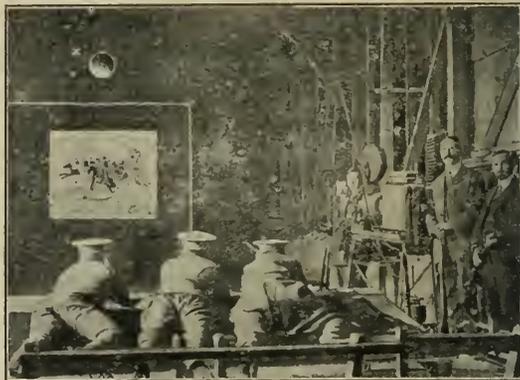
THE improvement of targets for rifle practice has received a powerful stimulus from the development of the "miniature," or, more correctly, "low-power" rifle clubs' movement during the past 10 years, and some very ingenious devices have been introduced with the object of lending realism to the pursuit of rifle practice and facilitating the recording of the shots; but nothing that we have hitherto met with can be compared in point of novelty and interest with the remarkable system which has been evolved by "Life Targets," of 12, Bow Street, E.C. We recently visited one of their rifle ranges where the working of the system is demonstrated, and can vouch for the excellence of the device as a means of enabling riflemen to practise under the most realistic conditions. To put the matter briefly, the marksman shoots at the images of moving objects—birds, animals, whatever one pleases—thrown on a screen by a bioscope; the report of the rifle instantaneously stops the mechanism, so that the picture remains stationary for a few seconds, while the bullet-hole, illuminated from behind, is seen as a bright spot of light on the screen, thus enabling the accuracy of the aim to be observed.

The motion of the picture is then resumed, and further practice can take place, the bullet hole disappearing from view. The means adopted to attain this end are most ingenious. The essence of the system is the use of the "KK" detector, which was described in our issue of October 11th, 1912, and was originally invented by Mr. von Kramer and Prof. Kapp for the purpose of the Rallophone, described in our issue of July 5th, 1912.

The detector as used in connection with the Rallophone is actuated by resonance when an alternating current of given frequency is induced in a coil carried on a railway vehicle, by a corresponding current sent through a wire laid alongside of the track. As employed in the target apparatus, however, the detector may be said to be actuated by resonance. A microphone is fixed in the roof of the rifle range, with a trumpet directed towards the firing point, and

is connected with a battery in series with the primary of a small induction coil, the secondary of which is connected to the KK detector. Ordinarily, therefore, the latter is inert; but on the occurrence of a loud noise such as the report of a rifle, the current in the microphone circuit is disturbed, and the KK detector is actuated, closing the circuit of a relay. Obviously, this having been accomplished, with the aid of electromagnetic devices and a local battery, the rest is easy; the motor driving the bioscope is stopped and a magnetic brake applied to the mechanism, instantly arresting the progress of the film; and a time-limit device is set in operation, which, after the lapse of any desired interval (3 seconds is sufficient), restores the circuits to the running condition. As the exposure of a stationary celluloid film to the rays of the projection arc lamp would cause its immediate ignition, a current of air is automatically directed upon it to keep it cool—without this or an equivalent device the system could not be operated. The air supply is derived from an electrically driven blower.

We have mentioned that the bullet holes in the screen disappear when the picture is set in motion again. The method by which this is accomplished is extremely clever. The picture screen consists of a wide sheet of stout paper wound on a roller below the target; the band of paper passes upwards, over a roller, and downwards to a third roller alongside of



x Indicates the position of the microphone.  
TERRITORIAL N.C.O.'S FIRING AT THE LIFE TARGET.

the first. Thus every bullet perforates the sheet twice. A white surface behind the target, brilliantly illuminated with flame arc lamps, forms the source of the light that shines through the bullet hole. The roller last mentioned is provided with a ratchet wheel, with which engages a pawl, actuated by a solenoid at the moment when the motion of the picture is resumed; by this means, the paper is wound up ½ in., and as the bullet hole is ¼ in. in diameter, the relative motion of the front and back portions of the band of paper puts the two holes out of line, thus causing the disappearance of the spot of light. This occurs at each shot, or, rather, at each resumption of motion of the picture target, as several shots may be fired simultaneously. As a large roll of paper is employed, it is, of course, desirable that it should be used over again many times; but if the paper were merely wound back and forth, the holes already made would evidently reappear. To prevent this, a second band of paper is passed once horizontally between the folds of the first band from one vertical roller to another. This sheet is perforated with the other; but by moving it occasionally the holes in the middle sheet are moved sideways out of line with those in the other sheets, and thus it is rendered so improbable that holes in the three sheets will accidentally register accurately that the contingency may be dismissed as too remote to be worth consideration. Moreover, the appearance of such a hole would necessarily coincide with the resumption of motion of the picture target and the movement of the screen, before any one could have fired, and therefore it could not lead to any mistake. By this clever device it is made possible to use the same paper over and over again, until, in fact, it is riddled with bullet holes.

It will be seen that the whole system depends absolutely

upon the aid of electricity, and the mechanism, which, we understand, is the work of several inventors and the subject of a number of patents, is exceedingly ingenious. We must express our admiration especially for the stroke of genius which utilised the K K detector to enable a sound to give rise to the motion of a relay. The effect could certainly be produced by other means, but nothing more beautiful could well have been devised than the device adopted.

The intense interest evoked in the breasts of riflemen by the "life target" is better experienced than described; rifle practice becomes a fascinating occupation when performed under such realistic conditions, and we cannot doubt that there is a wide scope for the new target, even when viewed only from the sporting aspect. But it has its serious side also, and as a means of training riflemen for military purposes it would be difficult to conceive of a more admirable scheme. The system has, in fact, been demonstrated before the military authorities, who have expressed the warmest approval of it, and there is every probability that it will be adopted by the War Office.

## THE FIXATION OF ATMOSPHERIC NITROGEN.

By P. H. S. KEMPTON, A.R.C.S., B.Sc.

THE increasing use of chemical or artificial manures in agriculture, especially for corn-culture in the United States, has rendered the manufacture of nitrogen compounds suitable for soil enrichment a matter of considerable economic importance.

The chief natural source of nitrates is the celebrated Chile petre beds, and some idea of the vast increase in the demands made on these beds can be gained from the following figures:—Output in 1896, 1,060,000 tons; output in 1905, 1,567,000 tons; output in 1910, 2,700,000 tons, of which 600,000 tons were supplied to the U.S.A. for corn culture. Assuming a steady increase in the demand, M. Vergara calculates that the Chile beds will be exhausted in 1923. With these facts in mind, many experimenters have turned their attention to the fixation of atmospheric nitrogen, and processes on a commercial scale are now in successful operation at Notodden in Sweden, Odda in Norway, Vevey in Switzerland, Patch, near Innsbruck, and at Niagara and other places in America, water power being invariably used to drive the electrical machinery.

The choice of a substance with which to combine the atmospheric nitrogen, and thus "fix" it, is subject to three important considerations:—

1. The cheapness of the combining substance.
2. The cost of the energy used in effecting the combination.
3. The availability of the nitrogen in the resulting product, and its consequent suitability for the purpose of soil enrichment.

Obviously the cheapest and most natural substance for combination is the atmospheric oxygen, and to the production of oxides and nitric acid most attention has been directed. Next to oxygen, hydrogen has been most in favour, and many experimenters have devoted their energies to perfecting methods for producing ammonia by acting electrically upon various mixtures of atmospheric nitrogen and producer gas, Dowson gas, &c. The combination with carbon to form cyanides, and with metals to form easily decomposable nitrides, has been referred to; while the most recent, and perhaps the most promising, direction of research is in the production of cyanamides.

*Fixation with Oxygen.*—As early as 1785, Cavendish combined nitrogen with oxygen by means of the spark discharge. In 1863 Meissner experimented on similar lines, and found that combination was effected more easily when the gases were moist. In 1892, Sir William Crookes suggested the use of the arc, and the same idea was also used by Rayleigh in 1897. In 1900, MacDougall and Howles, using a

high-tension alternating arc, concluded that the degree of fixation of the nitrogen was a function of the temperature. At about the same time Bradley and Lovejoy set up a plant at Niagara, in which 10,000-volt d.c. arcs were maintained between platinum electrodes. This undertaking ran for 15 months, and then failed, owing to technical difficulties arising with the apparatus and the smallness of the yield of saltpetre (430 kilos. per kilowatt-year). Soon afterwards, however, Birkeland and Eyde, at Notodden, perfected a process which is the basis of most modern methods of fixation. The essential difference between their method and the methods previously adopted is the drawing out of the arc into a disk by means of an electromagnet.

The arc is run at 5,000 volts a.c., and an electromagnet, placed equatorially, draws the arc out until it breaks; it then forms again, is again drawn out and breaks. This process, repeated very rapidly, provides what is, practically speaking, a "disk arc," and by suitably arranging the arc and providing a sufficiently powerful magnet (between 4,000 and 5,000 lines per sq. cm.), a disk as large as 3 ft. in radius can be maintained, and a field temperature of 3,000 C. reached. Hollow U-shaped copper electrodes are used, 2.5 cm. in diameter, which are water-cooled. The air is passed through this arc at a gentle pressure, 25,000 litres per minute being the normal rate of flow, producing 2 per cent. of nitric oxide. This nitric oxide is cooled, oxidised to the peroxide and passed into towers, where it is first converted into nitric acid and, finally, into calcium nitrate, by passing into milk of lime.

In 1910 the plant at Notodden consisted of furnaces consuming 1,500 kw., and capable of "fixing" 150 kgm. of nitrogen per kw.-year. This has recently been augmented by furnaces using 800 kw. each, and whereas the production in 1910 was 20,000 tons of calcium nitrate, the new plant is now supplying nearly 40,000 tons per annum. Larger furnaces are now being tested, one of 3,000 kw. being in regular use. Results seem to point to increase of yield, with increase in furnace power. The product which is put on the market is 75 per cent. calcium nitrate (equivalent to 13 per cent. nitrogen), and the estimated cost of production is £4 per ton. Birkeland calculates that it can be sold at a profit at £8 a ton, thus competing with the natural fertilising products, which sell at from £6-£10 per ton.

At Vevey, Moscicki and Kowalski have an arrangement in which the arc is maintained between two concentric copper poles and kept revolving by means of an electromagnet. In this way the arc is drawn out into an effective "ring arc," and the air passing through the annular space is "fixed," and the oxides produced are treated much as in the method described above. The arc is of exceedingly high frequency and voltage.

In the Badische Anilin und Soda Fabrik the arc through which the air is drawn is maintained in a tube 30-50 ft. in length, the upper end of which is water-cooled.

The arrangement of the furnace is such that the incoming air is heated to a temperature of about 500° C. by the outgoing gases.

The experimental furnaces working on this principle (the Schönherr arc) in Christiansand, work at 4,200 volts, and consume about 450 kw. In a new plant in course of erection, the arcs will be about 20 ft. long, the power consumed will be 600 kw., and the furnaces will require about 40,000 cb. ft. of air per hour.

It is claimed for this process that a 30 per cent. nitric acid is produced, and extensive experiments are being carried out at Notodden to determine the relative merits of the Birkeland and Schönherr systems with a view to installing the most successful method in the new works at Rjukan.

The furnaces used by the Salpetersäure Industrie Gesellschaft Gelsenkirchen, at Patsch, in the Tyrol, are of the Pauling type. The arc (of high frequency a.c.) is maintained between diverging electrodes and tends to spread to the widest space between them. The arc is also broadened by the stream of hot air passing over it.

The present plant consists of 24 furnaces taking 400 kw., each at 4,000 volts, and using 600 cubic metres of air per hour, but larger furnaces on this system are being installed in new works at Legnano, near Milan.

Haber and Koenig give the following comparison of the efficiencies of the flames:—

Paulig ...	60	grammes	HNO <sub>3</sub>	per	kilowatt-hour.
Birkeland ...	70	"	"	"	"
Schönherr ...	75	"	"	"	"

**Fixation with Hydrogen.**—In 1900, Hemptinne, experimented on mixtures of nitrogen and hydrogen with spark and silent discharges. He found that the best conditions for combination are low pressures and temperatures and narrow spark-gap. Three years later, Schlutins, experimenting with Dowson's gas, discovered that combination with atmospheric nitrogen proceeds fairly rapidly at temperatures below 80° C. in the presence of platinum under the influence of the silent discharge. The possibility of substituting Dowson's gas for purer forms of hydrogen has rendered the manufacture of ammonia by this method a commercial possibility, but as the supplies of gas-liquor ammonia are considerable, it is unlikely that this synthetic ammonia will enter into active competition with the nitrates which are produced more cheaply by the electrical methods previously described.

Other methods involving the use of catalytic agents other than platinum (*e.g.*, uranium) have been suggested, but have not achieved any commercial success.

**Fixation with Carbon.**—More recently attention has been turned to the possibilities of combining atmospheric nitrogen with another cheap material, namely, carbon. This has been accomplished indirectly by the following means: Calcium carbide or a mixture of carbide and chloride is heated in a specially constructed form of electrical furnace in the presence of nitrogen. The carbide takes up nitrogen, liberating carbon and forming calcium cyanamide (NCN<sub>2</sub>Ca), known commercially as kalkstickstoff. The nitrogen was originally obtained from the atmosphere by passing air over red-hot copper and then reducing the copper oxide by a stream of hydrogen or producer gas in order to recover the copper, but this method has now been superseded by the fractionation of liquid air to obtain the necessary nitrogen. Attempts have also been made to combine the production of the carbide and the cyanamide in one operation, but these have now been abandoned.

Theoretically, 1 kw. should suffice to "fix" 100 kg. of nitrogen per annum. In practice little over 40 kg. are obtained. The product—kalkstickstoff—contains 20 per cent. of nitrogen, and on treatment with water yields ammonia, and thus acts as an active fertiliser. Cyanamide factories are now in existence in Italy, the United States, Norway, Germany, Switzerland and France. The largest of these works is that at Odda, in Norway, which was originally built by the North-Western Cyanamide Co. to produce calcium carbide. The present output of cyanamide from this factory is 20,000 tons annually, the plant consisting of 196 furnaces, using a total of 20,000 H.P. derived from the River Tysse, four miles distant.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Business in Spain.

Your recent article on the backward state of British trade in electrical material in Spain is interesting, and may spur some manufacturers who do not already know the market to make efforts and spend money to obtain the trade which undoubtedly exists.

As a British manufacturer, with a good many years' experience of Continental trade, I might mention the following:—

For the last 11 years I have regularly worked Spain with travellers, from the rank of a director downwards, including some of my most competent engineers, of course speaking the language, but they have never yet secured sufficient business to pay more than their travelling expenses.

Thinking this system might be wrong, I appointed local agents, and endeavoured by moderate stocks to obtain the trade. This method also failed.

Then I tried employing a Spanish commercial traveller,

an engineer (certainly not a specialist in electrics), with a good working knowledge of Spanish requirements. The experiment was even worse than the others, and consequently I now feel the Spanish market is really no good to me. The trade is there, but the grade of material, whether accessories, fittings, motors or fans, is so low, that I find they will not even take the trouble to look at corresponding British articles, which as a rule are at least 25 per cent. more in first cost, and generally cost more to land through Customs duties, owing to their extra weight.

Further, the supply houses and jobbers of the principal cities are almost all tied houses, allied to the wealthy German, and occasionally French, manufacturers. These carry enormous stocks, and are willing to sell them at figures far below my works cost. Price, and price alone, seems the secret of the trade, and I think my experience will be found to be that of other manufacturers.

The only explanation I can offer is that so long as the German manufacturers are able to sell their machines at high prices at home (as I know from personal experience they do), they can continue with advantage to sell at dumped figures abroad. There may be some advantage to Spain as an importing country, but it effectually prevents her attempting the manufacture of this material, and as my experience shows, precludes any hope of success from England.

I should be interested to hear what other manufacturers' experience has been.

Manufacturer.

London, March 20th, 1913.

### Failure to Excite.

I should be pleased if any of the readers of the REVIEW could explain a curious difficulty which occurred to me the other day.

I wound a small shunt dynamo to generate 60 volts D.C. at 4,000 revolutions, to act as a speedometer for a variable-speed alternator, driven from the pulley of the same, and to record on a 0-60 voltmeter to be calibrated in "cycles per second" direct.

It ran at about 3,800 revolutions as a shunt motor on 60 volts, but when driven as a dynamo it refused to excite. Separately excited on 60 volts, however, we obtained about 55 volts from the armature, but even when we helped the excitation with a few turns carrying a heavy external current, when the shunt fields were connected across the two brushes, we only obtained 18 volts on the voltmeter, which slowly fell back to zero when this helping exciting current from the external source was switched off. The machine was a two-pole machine, the armature core and field stampings being of Sankey's "Lohys" iron (it being a core as usually used for small fan motors A.C. and D.C.); the field turns 1,500 per pole, carrying about 0.15 amp., and the armature resistance, brush to brush, being about 8".

Speedometer.

### Prospects in Electrical Engineering.

One of the most interesting sections in the ELECTRICAL REVIEW is the "Situations Vacant" columns, which I think are perused regularly by a large number of the profession, from chief engineers down to those young gentlemen who have studied Ohm's law for a few weeks and wish to become electrical engineers. These columns of your issue of March 28th are particularly interesting, and give one much food for thought. Take the case of a switchboard attendant wanted for an electricity works in Lancashire with three separate supplies—high tension, three-wire D.C. and traction—"should have technical school training," for the magnificent salary of 5s. per week of 56 hours (presumably seven shifts per week), which works out at 1d. per hour, with an odd 4d., with which the successful applicant can purchase the ELECTRICAL REVIEW to look for another job. This advertisement must be bad reading for some of the technical institutions.

Then, again, we notice that a chief electrical engineer is required at £500 per year clear of all expenses, and be it noted he must not exceed 40 years of age.

Now probably a young gentleman finishing a course at a

technical school notices these two advertisements, and immediately comes to the conclusion that he starts at the bottom at 5s. a week and rises to £500 a year before he is 40. Perhaps!!! He very likely consults the professor in charge of the institution at which he studies, and hears the old, old tale about starting at the bottom of the ladder, and goes straightway and takes the 5s. job, and in imagination we can hear the grunt of satisfaction of the electrical Mephistopheles, "Another one!"

The point I wish to impress is that the technical institutions do little or nothing to advise these young men. They are allowed to go to their dream without any warning, and they have not the least idea of the harm they do to the profession generally by accepting such low salaries for responsible positions.

I would suggest that the heads of all technical teaching institutions in the country should devote, say, one hour per session to a lecture on future prospects, with special reference to the danger of accepting small salaries for positions of responsibility, and perhaps reprints of articles on the subject from the technical Press could be distributed to all men finishing their course of study. Articles such as the one entitled "The Ends of the Rainbow," in the ELECTRICAL REVIEW of March 7th, 1913, would no doubt do much good. In this article is pointed out the folly of the rush to "the initial stages of a new branch of industry, or to the opposite pole when the industry becomes stereotyped." I had hoped to see some correspondence on the subject of this article, but electrical engineers seem at the present day very apathetic with regard to any subject which touches their status.

This brings me to another point—the apathy of a large number of electrical engineers with regard to the future prospects of the profession; this applies particularly to Birmingham and the Midlands.

When some members of the A.E.S.E. were visiting a number of electrical stations in the above districts, they found that a good number of the men engaged in them did not read the technical Press, and consequently knew nothing of what was going forward, other than in their own little sphere. A few back numbers of the ELECTRICAL REVIEW were distributed among them, and it is hoped that this will rouse these men to take more interest in their profession in the future. The majority are in receipt of very low salaries. Some have even dared to marry and have families. Perhaps they have heard tell of the reply which was given by a chief electrical engineer of a London supply authority when it was pointed out to him that he was paying his labourers as much as, and even more than, his engineers. He said the reason why the labourers were what he called "well paid," was because a labourer generally had a wife and about 10 children, giving the impression that if his engineers obtained a wife and a family each he would pay them a larger salary.

I must point out that any improvement must be initiated by the men themselves, in combination with their colleagues all over the country, and earnestly appeal to all electrical engineers who read this letter to come forward and help in the work that is going on to raise the status of the profession by means of the A.E.S.E.

W. J. Ebben,

Hon. Sec. Association of Electrical  
Station Engineers.

London, E., March 31st, 1913.

## WIRELESS TELEPHONY IN MINES.

THE system of wireless telephony described in the following paragraphs has been in regular successful operation in the Carolinenglück mine for some time past, and provides efficient communication between the pit head and stations within a radius of more than one mile from the shaft bottom. We are indebted for the particulars and illustrations to *La Technique Moderne*.

The equipment required is very simple, and the necessary primary currents can be obtained from small batteries, so that the capital outlay and working expenses are low. High-pressure high-frequency secondary currents are supplied to ropes, pipes and rails in appropriate positions in the mine, and the electromagnetic radiations from these conductors are received in suitable local circuits.

Referring to fig. 1, wireless telephonic communication can be established between the engine house and the shaft cages by (1) connecting a loop conductor  $a$  in the shaft lining to batteries and a microphone  $t$  in the machine house; (2) connecting a telephone  $t$  and battery  $b$  between the extremities of the over and under-winding ropes at each cage. These ropes and the winding pulleys form a closed circuit in which the current can be varied (by speaking into the cage transmitters), and thus corresponding variations can be electromagnetically induced in the engine-house receiving circuit.

The various strata of the soil play an important part in wireless telephony in mines. Electrically, the surface of the soil acts as a vast condenser, capable of absorbing any quantity of electricity. The lower strata act as an insulator with regard to static charges. The rails and pipes form a conducting system, sufficiently insulated by the surrounding layers of soil to be used as such—even for weak static charges.

Referring to fig. 2, a 12-volt battery in the surface sending station passes about 0.5 ampere through a microphone and the primary of an induction coil, which raises the pressure of the

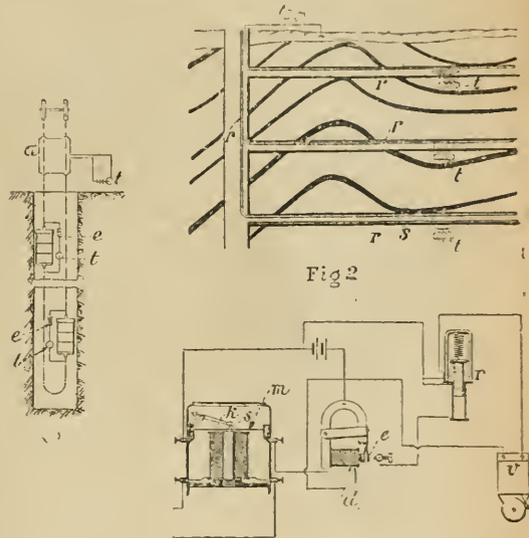


FIG. 1.

FIG. 3.

speech currents to several thousand volts. The secondary of the transmitting transformer is connected between earth and a pipe line  $r$ , traversing the mine shaft and galleries. The feeble high-pressure speech-currents flowing through the pipe line, or other conductors in the mine, emit electromagnetic waves, and the linear conductor may be interrupted at various points without disturbing the propagation of the waves. To collect some of these radiations and translate them into sound, one of three different arrangements may be employed. The simplest receiving circuit—see lowest gallery, fig. 2—comprises a high-pressure winding connected between  $r$  and the rails  $s$ , and a secondary low-pressure circuit containing a battery and telephone receiver  $t$ . In the middle gallery, the high-pressure winding of the receiving transformer is simply bridged across from 15 to 25 ft. of the pipe  $r$ , according to the distance from the sending station. A third arrangement—shown in the top gallery—requires no direct connection between the pipe line and the receiving circuit; the high pressure winding of the receiving transformer is connected to a loop of wire mounted parallel to the pipe line and constituting a receiving "antenna."

The chief difficulty encountered in perfecting wireless communication along these lines was to design a simple and reliable call device. After conducting a number of experiments, M. Reinecke has secured satisfactory results with the apparatus shown in fig. 3. A note of definite pitch is emitted by an "electrical trumpet" in the sending station, and the electromagnetic waves radiated from the pipe system in the mine impinge on a receiving antenna connected to an electromagnet mounted beneath a membrane  $m$  in the receiving station. This membrane is set in vibration by stimulating oscillations of predetermined frequency, and then makes and

**An Electric Cloth-Cutting Machine.**—An ingenious electrically-operated machine for cutting super-imposed layers of cloth has lately been brought out by Messrs. G. Stibbe & Co., of Leicester. The machine, which is known as the "Ballard," is a compact and fairly light piece of mechanism, capable of being operated from an ordinary electric lampholder, and consuming, it is claimed, no more current than that required for a 32-c.p. lamp. Two types of the apparatus are being made, one with a vertically-moving knife, the other with a rotary disk cutter. In use the machine is held and guided by a small handle, the switch being so located on the machine that the latter can be stopped and started by a movement of the operator's thumb. The cutting blades are guarded to prevent accident or injury, and each machine is provided with a lamp for throwing a strong light on the cutting line. As the electric wire connections may be conveniently arranged for moving the machines through a considerable distance, great lengths of cloth may be operated upon. The cutters are built in three sizes, for cutting cloth layers up to 4, 5, or 6 in. in thickness.

breaks the contact between itself and the style  $s$  on the balanced arm  $k$ , the adjustment of which is independent of temperature. In the first form of the call device the current normally flowing *via*  $k, s, m$  energised a solenoid  $d$ , and thus held open the spring hammer contact  $r$ . Directly the contact  $s$  was opened by the vibration of  $m$ , the contact  $r$  in a local call-bell circuit was closed. It was found, however, that purely mechanical vibrations in the neighbourhood of the calling relay might set  $m$  in motion, and thus give a false alarm, to avoid which a time relay  $t$  was included in the bell circuit, so that the latter might not be closed unless  $m$  was in continued vibration induced by true call-waves. As thus perfected, the call device only operates when that button is pressed in the pit-head station, which controls the "electric trumpet" tuned to the natural frequency of  $m$ . By tuning the membranes  $m$  at various stations to different frequencies, and by providing a number of electric trumpets emitting corresponding notes at the pit-head station, it is possible to call selectively the stations in the mine.

In order to simplify the equipment, the primary transformer coil at the pit-head station may be used to actuate the electric trumpet, the secondary winding being automatically placed out of circuit by the action of pressing the call button. Sparking at the trumpet contacts is avoided by the use of a shunt condenser in the ordinary manner.

The weight of the complete equipment at each station, comprising a battery of cells, an induction coil, microphone and call apparatus (the whole enclosed in a suitable case), is about 24 lb. The British rights on the invention are secured by Patent 15,256, 1912, and for a more detailed description of the system and apparatus, readers should refer to *Glückauf*, October, 1912.

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### ELECTRICAL TRADES BENEVOLENT INSTITUTION.

MR. E. GARCKE presided at the Institution of Electrical Engineers on Monday at the annual meeting of this Institution. Before moving the adoption of the report he mentioned that Mr. Justus Eck was not able to be present owing to his absence in Australia travelling. Mr. Garcke then proceeded to briefly summarise the financial position to which we referred in a leaderette in our last issue. The net surplus of the year, to carry to the accumulated funds, was £682. He said that the position as shown by the balance-sheet might lead to obvious comments to the effect that the grants and benefits bestowed were few in relation to the large number of men employed in the industry; that the expenses bore too large a proportion to the receipts; and that the subscriptions collected were small in the aggregate in relation to the size of the industry. Grants could only justifiably be made out of interest on capital; the latter was at present £4,000, yielding last year about £100, so that their benefits could not be conferred upon a large scale. But the benefits conferred were not expressed merely in figures; the money was given in such a form that the gift might lead to more permanent benefit, and the objective of the Committee always was to so assist those in need that they might be able to obtain new appointments, or more permanent relief in other ways. The item of expenses (£200) might be taken as a minimum, and it would not necessarily follow that if the income were doubled the expenses would increase materially, so that the proportion might look better than now. Attention must be given to the best ways of increasing income, rather than to cavilling at expenses. By incurring greater expense they could show better results in regard to subscriptions and donations, but they must have regard to the proportion which the expenses bore to the collection, and it was not practicable for the Committee to do very much more in the way of making efforts to increase income without increasing expense. They only hoped that by constantly calling attention to the Institution and its beneficent work the various companies and firms successfully engaged in the industry might take note of the desire of the Committee to be put into a stronger position, by increase of its capital, to do the work for which the Institution was formed. The industry was capable of doing very much more in benevolence than it was at present doing. There were something like 6,000 companies and firms engaged in the electrical industry in this country, and the capital invested exceeded 500 millions sterling, and he was not expressing an unduly optimistic hope when he said that if attention was called to the needs of this Institution those engaged in the industry would respond liberally. If only a small proportion of the 6,000 firms would subscribe even the moderate amount of five guineas per annum the Institution would be placed in an exceedingly strong position. The work of the electrical industry was not very highly profitable, though exceedingly interesting, yet on that huge capital even a moderate return yielded something like 20 millions sterling per annum; therefore, it was not much to ask that a very small percentage—an infinitesimal proportion—of those profits should be put aside annually for the purposes of benefiting those who had struggled and failed. There were 450,000 people engaged in the industry, and out of that total a certain number must occasionally fail and be in need of assistance: and it was the duty of all those who made profits to put aside some of those profits for such men. There were also 150,000 investors in the electrical industry who were deriving moderate profit out of that industry, and they were dependent upon the strenuous efforts of those who were engaged from day to day in the industry. It would not be all impertinent to ask shareholders to contribute to the Institution if only

1 per cent. of those 600,000 could be induced to become members, and pay a minimum subscription of 10s. per annum, there would be a handsome and increasing capital on which the Institution would be enabled to operate. Mr. Garcke then went on to refer to the question of legacies. It was only necessary to bring to the notice of gentlemen who were able to and did make wills that it was a very desirable form in which they could help this Institution. It would lessen the expense of collection and would not involve any immediate sacrifice on the part of those who so helped. The difficulty was to bring it to the notice of those in a position to make legacies of the kind. Most people were very busy, and it was only occasionally that they gave thought to the subject, and then, when they made their wills, the existence of the E.T.B.I. was not always in their minds. The Committee were strenuously considering the best means to adopt to constantly keep the matter before the minds of such people.

Mr. Bevis, in seconding the adoption of the report, mentioned that since making up the accounts, the Committee had invested another £300 in New Zealand stock, making a total of over £4,000 in investments.

The following members of the committee of management were re-elected: Messrs. Justus Eck, T. J. Grainger, E. F. Johnson, L. A. Lundberg, E. H. Nalder, H. Oppenheimer, W. R. Rawlings, L. G. Tate.

The names of Lord Vaux of Harrowden, director of an electrical manufacturing and other companies, Sir Ernest Spencer, a director of the Metropolitan Electric Tramways and other electrical companies, also Mr. Ernest Nash, of Faraday House, were added to the committee. Messrs. Price Waterhouse & Co. were re-appointed auditors, Mr. Garcke was thanked for presiding, and Mr. Wallis Jones suggested that legacy slips should be sent out annually.

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### THE FIRST INTERNATIONAL CINEMATOGRAPH EXHIBITION.

DESPITE the inconvenience of its date (from the exhibitors' standpoint), and despite the serious trade opposition encountered during the early stages of its organisation, the First International Cinematograph Exhibition—held at Olympia from March 22nd to March 29th inclusive—proved an unqualified success. Some 20,000 visitors were admitted on Easter Monday, and an average of 10,000 was reached on the other days. We know of no other trade exhibition which has realised such instantaneous success. The effect desired and secured was to raise the cinematograph industry to that independent status which it justly merits. In the words of one of the exhibitors—"The cinema industry has hitherto been a sort of parasite to the stage, but now that is altered." No small share of the elevating effect of the Exhibition has been due to the excellent series of Conferences arranged, and to the Industrial Welfare Section of the Exhibition which demonstrated the value of the cinematograph in social and educational work.

Probably for the first time on record, no fewer than 15 distinct theatres holding separate licences and using, roughly, 250,000 ft. of film per diem, operated under one roof. Every theatre was required to comply completely with the L.C.C. Cinematograph Regulations (as regards wiring, fire prevention and building construction, &c.), and the manner in which their erection was carried out (under the control of Mr. J. W. Barber, consulting engineer to the Exhibition) was remarkable for speed and efficiency. Only those who have had close experience of exhibition work can realise the chaos which reigns on the eve of opening, when jobs which properly follow each other in ordered sequence have to be performed piecemeal and practically simultaneously. In the present case, the holiday season increased the difficulties to be overcome, and the arrangement, construction and proved efficiency and reliability of the miniature theatres formed by no means the least attractive and instructive feature of the Exhibition.

In every case the auditorium of the theatre measured 40 ft. x 20 ft., and the usual size of screen picture was 12 ft. x 9 ft. 6 in. Whatever the feature specially demonstrated—whether projector, film or screen—excellent results were secured, despite the fact that the special gangway regulations enforced involved serious ingress of daylight during the daytime.

The general arrangements made for electricity supply in Olympia, from the Hammersmith mains, have already been described in these columns. From the permanent 220-volt converter sets were supplied motor-generators or auto-converters forming part of the individual theatre equipments. These machines, which were normally required to supply from 30 to 35 amperes at 65 volts to each projector, were of various types, each of which had its own special advantages, and no one of which showed any serious defect. There were in use three Siemens, three Grevenor and two G.E.C. motor-generators, in addition to a C.M.B. and two Pathé auto-converters and one Cooper-Hewitt rectifier: three theatres took current direct from the Exhibition supply mains.

There is prevalent a decided opinion that it is a mistake to run cinematograph arcs with too little ballast resistance, and we learn from a representative of Messrs. Pathé Frères that this firm prefers to use 100-volt supply in the projector circuit. The ballast loss is, of course, increased as compared with circuits supplied at, say, 65 volts, but the arcs run much more steadily, fluctuations in resistance now exercising little effect on the total resistance of the projector circuit. It is false economy to sacrifice excellence of projection, in however small a degree, to reduced energy consumption. Whether

rectifiers, motor generators, or "constant-current" auto-converters are used, a considerably higher ballast loss than is at present generally allowed in such cases should be tolerated.

The Exhibition has proved remunerative to its organisers and to exhibitors, and has proved a great public attraction. It has given the cinematograph industry a distinct status, and has demonstrated its remarkable technical development, and wide technical and social scope. The next exhibition will probably be held about September, 1911 (this being the first vacant date at Olympia), and will last a fortnight. At this and subsequent exhibitions the great difficulty is likely to be the accommodation of exhibitors. The success of the present show has already led to the projection of similar exhibitions in America (for July next), and in Paris (for next autumn).

In the succeeding paragraphs attention is chiefly confined to electrical features, but passing reference may be made to the interesting historical exhibits showing the early development of the zoetrope and cinematograph, and to the innumerable pieces of modern apparatus, including film perforators, cinema cameras for standard or special work, printers, developing appliances, projectors, and the accessories of each.

**Petrol-Electric Sets.**—Where electrical energy is not available, or only at prohibitive rates, from public supply mains, petrol-electric generating sets are coming into extensive use. Indeed, so reliable and so economical in fuel consumption have these equipments proved in service that they are now used in many districts where public supply is available at from 1 to 2d. per unit. The generating costs claimed for petrol or paraffin driven sets, now on the market, vary from 1'0 to 1'5d. per unit and the capital, attendance and maintenance costs are extremely low. Cinema halls of such size and in such numbers are now in operation in every town of any importance, that their energy demand is well worth securing and retaining by central stations. Supply from the public mains relieves the cinema proprietor of the cost and responsibility of installing a private generating plant and, to a great extent, of the risk of failure of supply. Taking these facts into consideration, there should be no difficulty in arranging, in large and medium-sized supply undertakings, a tariff which will secure cinema loads to the central station. In smaller undertakings, however, the cinema load and the time of its demand are often unfavourable, so that either a comparatively high charge has to be made for current or the supply has to be taken through an auto-converter or motor-generator from the power mains or from across the outers of a three-wire lighting network. In either of these cases, the cinema proprietor will probably prefer to install his own generating plant.

Among the excellent generating sets exhibited at Olympia mention may first be made of the "Pelapone" sets shown by the E.E.E. Co. The engine used in these sets develops from three to 12 H.P. at 800 R.P.M., according as from one to four cylinders are used, and is certainly one of the most silent and smooth-running internal-combustion engines it has been our pleasure to inspect. The quantity and quality of the fuel mixture are regulated by a shaft governor, and forced lubrication is provided to every working part. The oil consumption is  $\frac{1}{2}$  pint or less per B.H.P.-hour.

Messrs. Pathé Frères exhibited several Pathé-Astor sets suitable for stationary or portable use, and providing electrical energy at 1'25d. or less per kw.-hour. Owing to the small ballast resistance required where these sets are employed, it is estimated that their use is economical wherever public supply costs more than 0'75d. per unit. The "Ballot" petrol-electric set, which we understand is largely used in Pathé halls, is a particularly compact equipment providing 12 amperes at 75 volts, and weighing, complete with all tanking and piping, &c., 2 cwt.

Messrs. Fyfe, Wilson & Co. were exhibiting their well-known "Kelvin" sets, comprising a one, two or four-cylinder petrol or paraffin engine direct coupled to a compound generator, with or without interpoles. Standard sizes of this equipment provide 50, 70, 100, 135 or 270 amperes at 60 volts, and are sold complete with all tanks, piping and electrical control gear, either for stationary or portable use. Valuable features of the "Kelvin" engine are the partial intake of air from the enclosed crank case (thus preventing the accumulation of explosive vapour therein), and a quick starting device. The latter consists in the provision of about 18° play in the sprocket driving the L.T. ignition magneto. When starting up, the engine is brought into its firing position and a plunger is released which holds the magneto sprocket still, while the fly-wheel is rotated, till the limit of play of the former is reached. The spring plunger is then thrust upwards and the sprocket flies forward (under the action of two powerful springs), and thus provides a strong spark at the moment of firing, although the fly-wheel may have been moved quite slowly by the starting handle.

(To be continued.)

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### G.E.C. Combined Switch Fuse and Plug.

THE GENERAL ELECTRIC CO., LTD., are making a new combined switch fuse with a plug attachment, fig. 1 for use in docks, non-flery mines and other work where a flexible connection to a motor is employed.

The switch cover cannot be opened, nor the plug withdrawn nor inserted, with the switch closed. The cover is interlocked in the orthodox fashion, and the switch spindle carries a cam, which, when the switch is closed, presses down the upper end of a hinged steel bar. The lower end of the bar is turned at right angles and forked. In addition to its two current-carrying pins, the plug is equipped with a long steel pin, which passes through a hole in the case into the interior of the switch-box, and is so notched that it can be gripped and held firmly by the fork on the hinged bar, so that when the plug is in position and the switch closed, the fork

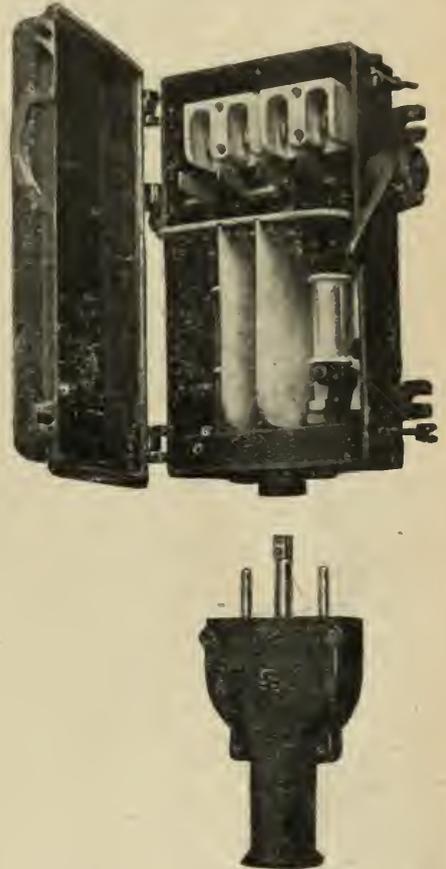


FIG. 1.—G.E.C. COMBINED SWITCH FUSE AND PLUG.

engages with the steel pin and absolutely vetoes all attempts to withdraw the plug. Moreover, if one tries to insert the plug while the switch is closed, the end of the steel bar effectually blocks up the aperture through which the steel pin has to pass, so that access is completely denied, and the operator is compelled to switch off before he can insert the plug.

The earthing conductor from the motor terminates at a contact in the plug, and the first step in the process of inserting the plug is to complete this earth connection. Then, and not before, the brass pins enter their sockets. On withdrawing the plug the earth connection is the last to be broken. A device is included for preventing the insertion of the plug in the reverse way.

### New Type of Rheostat.

The accompanying illustrations from *L'Industrie Electrique* show a new type of automatic rheostat, which appears to offer some advantages in connection with motor starting. The principle of the apparatus is that of the hour-glass, supposed to have been rendered obsolete for chronometrical purposes in this country by Alfred the Great's calibrated candles, but still used in miniature as an accessory in the delicate operation of egg boiling.

The tube A, fig. 2, is divided into two roughly equal parts by throttle plates B, and one half is filled with sifted and dried finely pulverised carbon. The flow of the carbon particles is regulated by the cone valve C, attached to the rod D; C serves the further

**Kent (Fortress) Royal Engineers.**—To-morrow the Gravesend Company of this branch of the Territorial Force will hold its annual dinner, and the prizes won during the year will be distributed by Colonel Seely. The Gravesend Company is one of the two Kent "Electric Light" Companies, and has a strength of 90 N.C.O.'s and men; it consists of three sections—engine drivers, electricians, and telephonists—and is well supported by the local employers, including Henley's, which contributes 21 men to the roll. Recently the Company, although it has not been two years in existence, won a valuable cup presented by Sir David Salomons, Hon. Colonel of the five Companies forming the Corps. The officer commanding the Company is Captain C. B. Grace, and the present headquarters is at the New Tavern Fort, Gravesend. A Cadet Company has also been formed in connection with the Company.

purpose of distributing the carbon more or less evenly in the lower half of A. The electrodes of the rheostat are the tube A and the rod E, which is insulated from direct metallic contact with A. As carbon particles collect round E, the circuit F G is closed through a resistance which decreases (according to an exponential law) as the

the lower part of the case, and the oil tank can be lowered away from it without moving the compensator as a whole. The no-voltage release coil is protected with a cast-iron cover. The largest

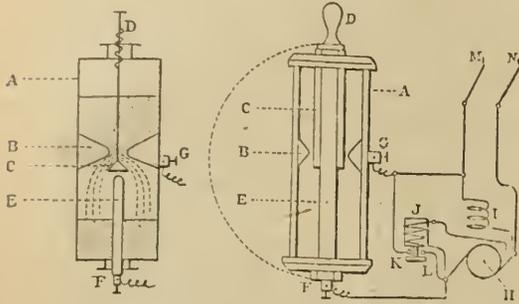


FIG. 2. FIG. 3. HOUR-GLASS RHEOSTAT.

depth of granules in the lower chamber increases. The tube being closed, the carbon cannot burn, even when worked at high temperature; as in enclosed arc lamps, an atmosphere of carbon-monoxide and dioxide forms within the tube A. The apparatus is claimed to be equivalent to a liquid starter, while possessing none of the disadvantages of the latter.

Fig. 3 shows the rheostat applied to starting a shunt motor H. An automatic contactor J, actuated by a pressure solenoid, short circuits the terminals F G when starting is completed.

**B.T.H. Starting Compensators.**

THE BRITISH THOMSON-HOUSTON CO., LTD., Rngby, have recently introduced a line of hand-operated starting compensators for two and three-phase squirrel-cage induction motors, on the auto-transformer principle, enabling these motors to be started without



FIG. 6.

FIG. 4.—B.T.H. STARTING COMPENSATOR.

drawing an excessive current from the line. In fig. 4 we illustrate the NR floor type compensator, which is one of a series suitable for starting motors up to 750 H.P., on voltages from 100 to 3,300 volts. The compensator consists of a strong iron box containing the transformer and an oil-immersed switch, the operating handle of which is on the right-hand side of the case; a no-voltage release is provided on the left-hand side, and overload relays can be fixed, as shown, above the case. The switch handle has three positions—off, starting and running—and is fitted with an automatic latch which prevents its being thrown from the off to the running position, while a strong spring prevents its being left in the starting position; the handle can only be thrown by a quick movement from the starting to the running position. When the no-voltage release operates, the handle automatically returns to the off position. The overload relays also actuate the no-voltage release coil with the same result. Fig. 5 shows the mechanism of the operating switch of one of the larger sizes of compensator, with the oil tank removed. In the case of the floor-type, illustrated in fig. 4, the switch is in the upper part of the case, and can be withdrawn together with the oil tank; the compensators are also made suitable for fixing to the wall, in which case the switch is in

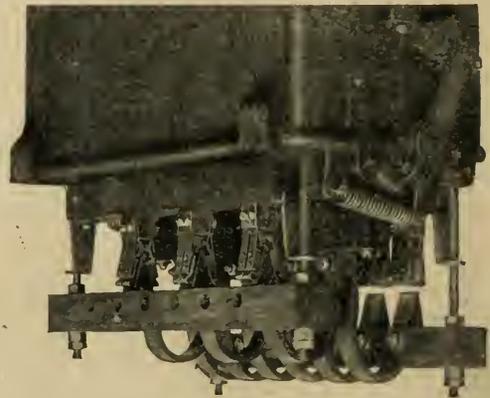


FIG. 5.—SWITCH OF COMPENSATOR, WITHOUT THE OIL TANK.

compensators are not provided with self-contained switches, but are operated from a separate panel fitted with the necessary switchgear.

**Electrical Shunt Calculator.**

In our issue of January 24th, 1913, we described a device for calculating the combined resistance of two or more circuits in parallel, invented by Mr. H. W. BROWN, of 169, Cathall Road, Leytonstone, N.E. This device has been greatly improved by the inventor, and now consists of three scales (fig. 7), so set out and numbered that a straight line drawn from any one number on A

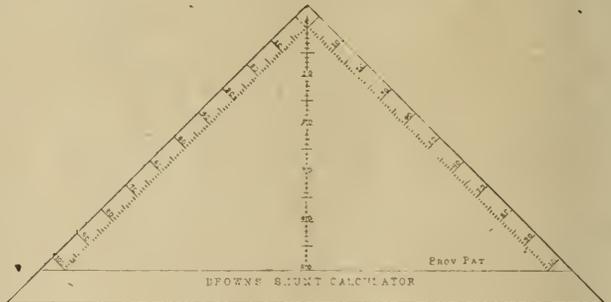


FIG. 7.—SHUNT CALCULATOR.

scale to any other number on B scale will cross C scale at a point which will indicate the value of the reciprocal of the sum of the reciprocals of the numbers to and from which the straight line is drawn. Of course, there is no need to draw a line at all; the edge of a ruler will answer the purpose. It will be obvious that by means of this calculator the joint resistance of two or more resistances in parallel can easily be determined.

The mathematical explanation of it is as follows:—

Referring to fig. 6, by similar triangles,

$$\frac{r_1}{r_2} = \frac{x}{r_2 - x}$$

Cross multiplying we get—

$$r_1(r_2 - x) = r_2 x$$

Therefore

$$x = \frac{r_1 r_2}{r_1 + r_2} \tag{1}$$

But

$$2x^2 = l^2$$

Therefore

$$x = l/\sqrt{2} \tag{2}$$

Hence, substituting the value of x given in equation (1), in equation (2) we get—

$$\left( \frac{r_1 r_2}{r_1 + r_2} \right) = \frac{l}{\sqrt{2}}$$

Hence if the diagonal scale is expanded to  $\sqrt{2}$  times the two scales at right angles to one another, the intersection point will give the value of the two resistances  $r_1$  and  $r_2$  connected in parallel. Similarly, the joint resistance of any number of resistances in parallel can be quickly determined, taking any two to begin with, and afterwards taking the result obtained in conjunction with another until all have been taken into account.

## BUSINESS NOTES.

**The "Mumps" Lampholder.**—Mr. G. St. John Day, of Mumps Electrical Works, Oldham, sends us a letter respecting the qualities of the Mumps lampholder adapters, and asks us to state that particulars will be forwarded to anyone interested therein.

**A Mazda House at Dublin.**—THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby and London, have recently opened offices and stores at Mazda House, 25, Suffolk Street, Dublin. The building is in a central position, about 50 yds. from Grafton Street. At the front is a display window, lighted by Mazda and Tungstolier fittings, equipped with Veluria reflectors and Mazda lamps. In the bottom of the window are arranged a number of samples of small wiring supplies, and in the centre is a pyramid of Mazda-lamp



VIEW OF SALES COUNTERS AND STORES.

cartons. On entering, the offices are on the right, and on the left are glass cases filled with examples of B.T.H. heating and cooking apparatus. At the back of the offices are the sales counters, which are sectionalised for different classes of material. The counter is 40 ft. long, and is lighted by a glass roof. Behind the counter are bins and racks containing varied stocks of lamps, reflectors and fittings. The whole of the wall on the other side of the room is occupied by show-cases. The premises are 120 ft. from back to front, and although narrow in front, they widen out considerably at the rear. The square space at the farther end of the sales counter is utilised as a fittings showroom, and a number of ready-wired fittings are hanging from the ceiling. These include samples of Eye-rest fittings, Mazdaliers and Tungstoliers, equipped with Holophane and Veluria reflectors, and semi-indirect fittings with Holophane and Alba bowls. There is an office railed off from the



FITTINGS STORES AND DEMONSTRATION ROOM.

showroom, where the clerical work of the stores is performed. On the right of the passage, coming in from the street, is the main office, which is tastefully decorated in green and white enamel. The whole of the basement is used as a stores, and it is thoroughly ventilated by a B.T.H. porthole fan. A portion of the stores is partitioned off to form a packing department, and this department opens directly into a yard leading into Wicklow Street. Large stores of electric lamps (Mazda, Gem, and B.T.H.-Edison), Veluria,

Holophane, Alba and Mazdalux reflectors, Eye-rest indirect lighting fittings, semi-indirect lighting fittings, Mazdalier and Tungstolier fittings, and wiring supplies of all kinds, are carried at the new stores.

**Electric Turret Clocks.**—MESSRS. GENT & CO., LTD., of Leicester, inform us that they have in hand at the moment the following large turret clocks all to work on their patented Waiting Train principle:

Holy Trinity Church, Rothport, with four 3 ft. 6 in. dials and striking the hours on a 2-ton bell, and taking current from the Corporation mains.

Public clock at (Inval, Penzance, with four 5 ft. 6 in. dials and striking hours and half hours on a 12-cwt. bell, with current from Léclanche cells.

Public clock for Petone, New Zealand, with four 6 ft. dials with Westminster chimes, and driven by Léclanche cells.

Three public clocks for St. Johns, New Brunswick, each with four dials, the largest being 5 ft. in diameter.

Faire Bros. & Co.'s new works, Leicester, 5 ft. dials and striking the hours on 4-cwt. bell.

United Free Church, Newton Street, Glasgow, with three 4 ft. dials.

Torquay Town Hall, with four 5 ft. 6 in. dials.

Also a special observatory transmitter, for the Glasgow Observatory.

**Liquidations.**—FOSTER ENGINEERING CO., LTD.—On March 14th, a petition was presented by A. F. Burman, manufacturer, a creditor, for the winding up of this company, and it is to be heard on April 8th.

CANADIAN POWER TRAMWAYS CONSTRUCTION SYNDICATE, LTD.—This company is winding up voluntarily, with Mr. H. G. Clarke, 3, Princes Street, E.C., as liquidator. A meeting of creditors is to be held on April 11th.

**Patent Applications.**—Application for restoration of Patent No. 8,207 of 1908, for "Improvements in or relating to the sinking and lining of shafts or wells," has been made by JOSEF VINCENT BRECHA.

MR. CHARLES RUDOLPH has offered to surrender Patent No. 9,145 of 1911, for "Improvements in unions or couplings with bayonet joints for pipes and tubes."

**Trade Announcements.**—THE WALSALL ELECTRICAL CO., LTD., of 57, Bridge Street, Walsall, are now carrying out further extensions to their works owing to greatly increased business. It is only about 15 months since we mentioned their last extension. We understand that the firm have close on twenty times as many workmen as they had three years ago. As works alterations naturally interfere with deliveries to some extent, they ask indulgence from their clients in that respect. Within the last few weeks they have put down a large number of new tools, which will enable a resumption of prompt deliveries to be given shortly.

MR. G. T. BELLAMY, electrical engineer, of Croydon, has removed to more commodious premises at 33, Cherry Orchard Road.

MESSRS. HASELTINE, LAKE & CO. patent agents, have removed to 28, Southampton Buildings, Chancery Lane, W.C. Telephone No., "5,611 Holborn."

**For Sale.**—The Glasgow Corporation electricity department has for disposal a quantity of steam-driven generating plant. The Nuneaton Corporation has for sale a main switchboard. See our advertisement pages in this issue.

**Bankruptcy Proceedings.**—ANDREW GEORGE ADAMSON, electrical engineer, of Acton, lately in business at 22, Christopher Street, Finsbury Square, E.C.—April 12th is the last day for receipt of proofs for dividend by Mr. C. Mercer, the trustee, 14, Bedford Row, London, E.C.

JOHN MITCHELL and FREDERICK MITCHELL (trading as Fred. Mitchell & Co.), electrical engineers, 97, Stockport Road, Ardwick, Manchester, and 58, Ashton Old Road, Openshaw, Manchester.—The first meeting of creditors herein was fixed to be held last week at the Official Receiver's offices, Byron Street, Manchester, but there was not a quorum of creditors present, and no business was therefore done.

SAMUEL SMITH (trading as Smith & Sons), 22A, 24 and 26, Victoria Square, Widnes, Lancaster, electrical engineer, &c.—The first meeting of creditors herein was fixed to be held last week at the offices of the Official Receiver, 11, Dale Street, Liverpool. The Official Receiver stated that no statement of affairs had yet been lodged by the debtor, and only one proof of debt had been received. Matters were complicated by the fact that the debtor last August executed a deed of assignment for the benefit of his creditors to the trustee, who took over the assets and liabilities. Since then the business had been carried on by the debtor under the supervision of the trustee, and he incurred fresh liabilities which were now scheduled against the estate. In order to raise the money to file his petition the debtor had sold certain stock. There was not a quorum of creditors present, and no resolutions were therefore passed, the matter being left in the hands of the Official Receiver.

At the last sitting of the Bradford Bankruptcy Court, an electrical engineer's clerk, named Jonathan Edward Mitchell, of Bradford, appeared to undergo his public examination. He stated, in reply to questions addressed to him by the Official Receiver, that his deficiency was £98 14s. 6d., and his difficulties had arisen through personal extravagances and exorbitant interest charged by moneylenders in connection with loans which he had obtained. Between March 4th and November 28th, 1912, he had obtained seven loans amounting to £130, in connection with which he had to repay £192 10s., but had only repaid £87 8s. It was suggested by the Official Receiver that a portion of these loans had been obtained on the debtor's statement that he was entering for an examination of the Institution of Electrical Engineers, and that if he passed he had been promised a good position, and would get the whole of his fees back, and if he failed he would get half fees returned, but the debtor denied these statements. He said that he

had told the gentleman from whom he had borrowed the money, that he would require £30 for the examination, and £5 a week for expenses, though he denied stating that this sum was returnable if he passed, and he would hand it over immediately he obtained it. After asking some further questions, the Official Receiver informed the debtor that he had written to the secretary of the Institution of Electrical Engineers in regard to the examinations which the debtor suggested he had entered for, and had received a reply stating that such examinations had never been held. The debtor replied that there were tests of qualification for the degree of M.I.E.E. but the Official Receiver suggested that the statements which the debtor had made, that he required money for fees for the examinations, were fables and fictions of the imagination, and were fraudulently made in order to obtain money for his own personal extravagance. The debtor acknowledged that he had not paid the fees for the examination, but said that the statements which he had made as the reasons for wanting the money were not false, though later when the Official Receiver suggested that the statements that the debtor was expecting to receive a portion of his examination fees back were lies, he acknowledged that they appeared to be falsehoods. In closing the examination the Registrar (Mr. Registrar Lee) said he thought when the examination opened that the debtor, being a young man, might have been led into extravagances, but he did not think so after he had heard the replies of the debtor, because the statements that he had made were altogether disgraceful and incredible. He could not, unless he heard it from the debtor's own lips, believe that a young man, who might have been comfortably placed, could have been guilty of such recklessness and extravagant folly.

**Book Notices.**—The *British and Colonial Printer* for March 29th is a special export number (6d.), containing a great deal of additional editorial and advertising matter of particular interest to Colonial readers.

"Elements of Electrical Engineering." By J. L. La Cour and C. S. Bragstad. 1913. London: Longmans, Green & Co. Price 16s. net.

"Prospectus of the Working Men's College, 1913. Melbourne: The College.

"Transactions of the University of Toronto Engineering Society." Vol. VII, No. 4. February, 1913. Toronto: The University.

"Journal of the South African Institution of Engineers." Vol. XI, No. 8. March, 1913. Johannesburg: The Institution. Price 2s.

"Journal of the Franklin Institute." Vol. CLXXV, No. 3. March, 1913. Philadelphia, Pa.: The Institute. Price 50 cents.

"The Physical Review." Vol. 1, No. 3. March, 1913. Lancaster, Pa.: The American Physical Society.

"The School of Mines Quarterly." Vol. XXXIV, No. 2. January, 1913. New York: Columbia University. Price 50 cents.

"Annales des Postes, Télégraphes et Téléphones," with Supplement, "La Dynamique de l'Électron." By Henri Poincaré. March, 1913. Price 6 fr. Paris: A. Dumas.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 5. March 15th, 1913. Milan: Stucchi, Ceretti & C. Price L1'50.

"Boletín de la Sociedad de Fomento Fabril." Vol. XXX, No. 2. February 1st, 1913. Santiago, Chile: The Society.

"La Télégraphie et la Téléphonie Simultanées et la Téléphonie Multiple." By K. Berger and P. le Normand. 1913. Paris: Gauthier-Villars. Price 4 fr. 50.

"Transactions of the Illuminating Engineering Society." Vol. XIII, No. 1. January, 1913. New York: The Society. Price 75 cents.

**The Trade Paper.**—"The efficient trade journal proves its worth by enjoying the confidence and respect of the majority of its readers to a greater degree than any other non-human element with which these individuals come in contact. The information and knowledge which trade papers impart could not be supplied as effectively, as regularly, or as economically, to the reader by any other known method, and were these publications suddenly to disappear, great trades and industries would be left without their most effective and efficient method of intercommunication. The position of the advertiser in the efficient trade journal may be described thus:—Given a merchantable product, these journals can so efficiently place this product before the manufacturer, who is, in many cases, the consumer or converter of the product, or before the dealer, who sells, that no other method of advertising publicity can compare favourably in measured, definite value per dollar of expenditure."—C. G. Phillips in the *American Printer*.

**Catalogues and Lists.**—MESSRS. SIEMENS BROTHERS AND CO. LTD., Woolwich.—Supplement 2 to Catalogue 517, illustrating and describing the "Rawiplog" patent plugs for use in plaster, stone, &c. The plug consists of a tube of stiffened fibres, which expand when a screw is driven home, and grip the sides of the hole, as illustrated in our last issue. One of these plugs, for which Messrs. Siemens Brothers are the wholesale agents, will stand a direct pull of 670 lb. in slate, or 140 lb. in hard plaster, with a screw  $\frac{1}{2}$  in. long.

THE ELECTRICAL CO. LTD., Charing Cross Road, London, W.C.—Illustrated and priced leaflet briefly describing their electric number indicator for theatres, music halls, cinemas, &c. A simple switch operates a lever which changes the numbers, automatically locking at each point. The indicator consists of one or two 20-in. zinc figure fields, into which 2-c.p. metal-filament lamps are fitted. The connections between indicator and switch are made by means of 25-strand cables.

MESSRS. A. REYROLLE & CO., LTD., Hebburn-on-Tyne.—Pamphlet No. 20, illustrating and giving prices of the latest designs of their dust-proof and watertight cast-iron distribution boxes, fitted with their patent self-aligning fuse handles. A separate price list illustrates and prices these low-tension self-aligning fuses.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Two 8-page publications in their standard style, No. 4401 containing an illustrated description and list of prices of overload relays for A.C. and C.C. circuits, No. 7,100 showing and particularly a number of types of B.T.H. fan motors and exhaust fans.

ARMORDUCT MANUFACTURING CO., LTD., Farringdon Avenue, London, E.C.—Publicity folder announcing that one of the largest English railway companies has placed a further order with them for about 100 miles of Armorduct 5,000-megohm grade vulcanised rubber cable.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Pamphlet No. 16B (24 pages), containing very full descriptive information, with illustrations and a great deal of tabulated data as to dimensions, speeds, H.P., efficiencies, power factor, and so on, concerning the Peebles self-contained polyphase induction motors. Eight different types of standard machine covering all ordinary requirements, are dealt with. There is a very full specification of the motors, with illustrations of various parts, also outline illustrations and full lists of approximate weights and dimensions of every size manufactured by the firm, while full lists of technical data for 50 and 25-cycle motors are also given, machines being dealt with for three separate ranges of voltage from 110 up to 3,500 volts, at speeds of from 1,500 down to 150 R.P.M.

THE POWER PLANT CO., LTD., West Drayton.—Small folder, giving a specification of their self-contained mill gears.

THE CLEVELAND ELECTRIC STORAGE BATTERY CO., St. Louis.—Illustrated leaflets respecting their lamps, &c., for motor-car lighting, ignition batteries, &c.

MR. GEORGE ELLISON, Victoria Works, Warstone Lane, Birmingham.—Two illustrated leaflets have been issued. No. 50/1 gives particulars of the firm's patent adjustable time-lag device for overload circuit-breakers; No. 450/1 describes and gives dimensions of brake solenoids for C.C. up to 600 volts.

THE GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, London, E.C.—A number of illustrated and priced trade leaflets have been issued: No. E1,664, describing cylindrical dust bellows; No. 1,671, describing sliding resistances for fine regulation; No. C1,668, detailing the "Armearth" system of cable protection (a new leaflet cancelling a previous one); and card C1,672, describing "Geekoduct" conduit-system porcelain block connectors and griptight continuity fittings.

MESSRS. VERITIS, LTD., 31, King Street, Covent Garden, W.C.—Illustrated and priced publication, No. 722, dealing with "Aston" indirect lighting fixtures fitted with metal reflector bowls, and semi-indirect fixtures with Holophane or alabaster bowls.

THE UNITED ELECTRICAL MANUFACTURERS CO., 89 and 90, Milton Street, London, E.C.—Advance illustrated price list of the 1912-13 season, of electric flashlights, batteries and measuring instruments.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., 38 and 39, Upper Thames Street, London, E.C.—Leaflet respecting their new "type 462" S.P. ironclad service fusebox, also pamphlets dealing fully with house service safety fuses and "Melda" house water pumps.

MR. H. C. SLINGSBY, Old Street, London, E.C.—List No. 50 giving illustrations and prices of all-steel tubular wheel-barrows.

THE UNIVERSAL ELECTRICAL MANUFACTURING CO., 14, Station Parade, Peckham, S.E.—April folder, with calendar for three months, concerning their combined ironclad switches and fuses.

MESSRS. SCHOLEY & CO., LTD., 151, Queen Victoria Street, London, E.C.—Fourteen-page catalogue with information relating to "Indestructible" cable of various grades for outdoor and indoor service. Outdoor cables are protected against atmospheric and chemical effects by the use of a jute braiding, which is impregnated on a special system. For both high insulation (suitable for 2,000 volts) and atmospheric protection, the firm supplies a grade in which the conductor is insulated with a double layer of impregnated paper, a spiral layer of cotton, and the special braiding mentioned. A third grade is suitable for up to 10,000 volts. A braided and impregnated rubber cable is supplied for indoor service, carried on insulators, and is used by the G.P.O., railway companies, mines, &c., for lighting and power; after 10 years' service the insulation results are most satisfactory. The pamphlet gives tabulated sizes, weights, code-words, prices, &c.

**A Model Gas Engine.**—To explain the working of the "Duplex" valveless gas engine, which was fully described in our issue of October 11th, 1912, MESSRS. MATHER & PLATT, LTD., have issued a working model showing the action of the mechanism in the form of a book. One view shows the engine cylinders in plan; on lifting the cover plate, the cylinders, which in this engine are single-walled castings, are seen fixed in a tank which contains the cooling water. The other view is a side elevation; the raising of one flap removes the side of the cylinder tank, showing the cylinders and the method of supporting them. Removing a second flap, the interior of the cylinders and pumps is exposed, showing the pistons, and by turning a disk at the foot of the model, the several pistons are set in motion in correct relation with one another; the pistons and ports are lettered to correspond with a brief explanatory description facing the model. By this means the cycle of operations of this interesting engine is made perfectly clear and easy to follow. The air and gas pumps are provided with a sleeve valve, which also is set in motion in the model, showing that the scavenging air is blown through the cylinders before any gas is admitted, and that after the gas charge is delivered to

the cylinders a following charge of air drives any of the mixture that remains in the ports into the cylinders. The pistons receive an impulse at every stroke, like a double-acting steam engine. The sleeve valve is not exposed to hot gases, but only to the charge of air and gas; and there is no other valve, the admission and exhaust ports being uncooled and covered by the working pistons themselves. The model is certainly very novel and ingenious, and admirably illustrates the unique cycle of operations followed in this remarkable gas engine. The mechanism of the model is operated by means of fibre gear wheels, with links to drive the pistons, &c.

**Aluminium for Power Transmission.**—While the conditions governing the erection of overhead transmission lines in this country are by no means as favourable to aluminium as those under which long-distance power transmission schemes are installed in countries where water powers abound, if a comparison be made, it will be found that the cost of construction is well in favour of aluminium as compared with copper. As considerable doubt has been expressed upon this point, the BRITISH ALUMINIUM CO., LTD., have plotted a series of curves showing the relative permissible sags of copper and aluminium overhead conductors of varying span, cross-section, temperature and wind pressure, in accordance with the Board of Trade Regulations. These data are embodied in a neat little book, containing "in a nutshell" the information necessary to make a comparison between copper and aluminium, and demonstrating the truth of the foregoing statement.

## LIGHTING and POWER NOTES.

**Aldershot.**—The Gas, Water and District Lighting Co. has applied to the B. of T. for consent to construct a generating station at the gas works in Ash Road, in order to enable the company to supply electricity within the parishes of Ash, Normandy and Seale.

**Argentina.**—The lighting of Buenos Ayres is undergoing a steady transformation, and the kerosene lighting in the outlying districts is being replaced by gas and the electric light. At the present time public electric lighting consists of 2,531 arc lamps, with an equivalent of 3,531,000 C.P. In accordance with the recent arrangement between the municipality and the *Compania Alemana de Electricidad*, the company has agreed to install, at its cost, 4,000 arc lamps at the rate of 1,333 per year, so that in 1915 the city will have 6,500 arc lamps in service with an equivalent of 6,500,000 C.P. The gas lighting of the city is in the hands of the *Primitiva Gas Co.*, which has actually in service 18,037 lamps, and in four years' time this number will be increased to 20,000, as the company has made a contract with the authorities similar to that of the *Compania Alemana* for a period of 15 years. There are also 2,181 alcohol lamps and 3,650 kerosene lamps.—*Review of the River Plate.*

**Bedford.**—A L.G.B. inquiry was opened on March 26th into the application of the T.C. for a loan of £11,590 for electricity purposes. Mr. R. W. L. Phillips, electrical engineer, stated that it was proposed to install a Diesel oil engine coupled direct to a 400-kw. Siemens alternator, and the tender of Messrs. W. H. Allen, Sons & Co. had been provisionally accepted. Questioned by the inspector, Mr. Phillips gave the list of tenders received, viz., Allen & Sons, £8,980; with own generator, £9,790; Hick Diesel Co., £7,160; with own generator, £9,335; Willans & Robinson, £9,429; with additions, £11,369. He added that the tenders of the Hick Diesel Co. and Willans & Robinson were not in accordance with specifications, as there was not sufficient protection of the working parts. The inquiry was, in the end, adjourned for inquiries to be made respecting statements made by the London manager of the Hick Diesel Oil Engine Co. respecting their tender.

**Blackpool.**—It has been decided to officially inaugurate the new plant at the electricity works on April 23rd, when members of the Council will be invited. The two new turbo-generators will be ready for starting, and in addition an installation for electrical cooking will be on view, and by way of refreshments members will be asked to test samples from the electrical stoves.

**Brighouse.**—A scheme is being put forward by the Corporation for electrically driving the machinery and plant at the sewage outfall works, and for this purpose a sum of £250 will be included in the estimate.

**Burnley.**—The increased demand for electricity for lighting, power, and traction, has led the Electricity Committee to take into serious consideration an extension of plant and service mains. The General Purposes Committee last week adopted a report suggesting the following:—(a) The installation of a 2,000-kw. turbo-alternator, with two 500-kw. rotary converters and transformers at the electricity station; and (b) the erection of a sub-station near the tramway depot in Colne Road, containing two 300-kw. rotary converters, one for lighting and one for traction, to supply certain districts. The proposed extensions will necessitate extensive alterations to the traction switchboard, and the Committee recommends that the traction and H.T. boards be mounted on a gallery, and that the cellular pattern of switchboard be dispensed with and replaced by a type similar to that supplied for the last turbine

installation. The cost of switchboard alterations will be heavy, but the Committee is advised that they should be carried out. Three small boilers in use since the commencement of the undertaking had been sold, and the Committee proposes to install two large boilers to replace them. It is also proposed to raise the pressure of three existing boilers from 130 to 160 lb. per sq. in., necessitating a new set of economisers; and to install a cooling tower with a capacity of 180,000 gallons per hour, or rather more than is required for a 2,000-kw. plant. The electrical engineer estimates the cost of the new works at £28,171, including one 2,000-kw. turbo-alternator, with condensing plant, £7,960; two 5,000 kw. rotary converters and transformers, £2,500; new switchgear and alternators, £2,200; cable and connections, £150; two boilers and mountings, £1,300; superheater, £250; economisers, £700; stokers, £110; boiler pump, £180; water softener and piping, £500; cooling tower and piping, £800; engine room crane, £600; a total of £17,660. The sub-station estimates are:—Buildings, &c., £1,300; rotaries and transformers, £2,000; switchgear, £800; sub-station cables and connections, £150; a total of £1,250. Two miles of '05 three-core cable in duplicate, £3,700. Allowing for contingencies, the grand total is £28,171.

The 1910 loan of £5,000 for mains and services will be exhausted during the summer, and the Committee recommend that the L.G.B. be asked to sanction a loan of £7,000.

The T.C. is now to be asked to authorise application to the L.G.B. for sanction to borrow £28,171 for additions &c., to the electricity undertaking, and £7,000 for electrical mains and services.

**Canada.**—The Windsor, Ont., municipality is to take 2,500 h.p. of hydro-electric power from the Commission, which will extend its 110,000-volt transmission from St. Thomas to Windsor 110 miles—for the purpose. The existing transmission from Niagara to St. Thomas is 135 miles long, so that the Niagara-Windsor transmission will cover 245 miles and be one of the longest in the world.

**Chester.**—At the meeting of the T.C. held on March 26th, it was agreed by 29 votes to 2:—(a) That the extension of the electricity works as suggested by the electrical engineer in his report dated March 7th be carried out at a cost of £11,550; (b) that application be made to the L.G.B. for sanction to borrow £7,550 in amounts to be repaid within the following periods:—£1,700 for buildings, 30 years' period; and £5,850 for battery, booster, switchgear, instruments and connections, seven years; (c) that the remaining £4,000 required be paid out of the reserve fund. It was also agreed that £500 of the net surplus revenue of the electricity undertaking for the current year be at the option of the Finance Committee, either carried to the credit of the local rate or applied to the improvement of the district under the provisions of the Chester Electric Lighting Order, 1890.

Mr. Britton's report, on which the Committee's recommendation to the Council was based, drew attention to the inadequacy of the plant last winter, when the maximum demand on the works reached 1,595 kw., being in excess of the normal capacity of the undertaking; he pointed out that this and the new consumers which will be added before next winter will appropriate the capacity of the hydro-electric extension for maximum load purposes. After considering the alternatives of steam and oil generating plant and storage batteries, he concluded that the most economical arrangement was to fully employ the hydro-electric plant by installing a storage battery at the New Crane Street works, to accommodate the electrical energy in excess of the demand during the night for use on the peak load of the following day; this surplus energy obtainable from the water-power plant at no additional cost will replace energy generated at the most costly period of the day. The battery recommended will have a net capacity of 550 kw. for three hours. Although the loan period for the battery is seven years, as compared with 15 years for generating plant, Mr. Britton estimated that the total annual expenditure would be from £620 to £1,530 per annum lower than if the latter plant were adopted. He further added that had steam plant been installed instead of the water-power plant, an extension either of generating or battery plant would now be required, and battery charging from steam plant would have been more costly than the proposed arrangement.

**Clacton-on-Sea.**—A L.G.B. inquiry has been held into the application of the U.D.C. for a loan of £6,000 for additional plant at the electricity works, viz., a Diesel generating set. There was no opposition.

**Continental Notes.**—BELGIUM.—An electrically-operated winding plant is to be installed at the Malassie pit of the *Société des Charbonnages des Kessales*, at Jemeppe-sur-Meuse.

A new generating station of a capacity of 4,000 kw. is approaching completion at Langerbrugge, near Ghent. It has been established by the *Compagnie des Centrales Electriques des Flandres*, and will supply current for lighting and power purposes to an area having a population of about 75,000.

The municipal authorities of Lierre recently invited tenders for the concession for the establishment and working of a central electric lighting station in the town. Apparently the conditions were too onerous a nature, as not a single offer was received.

FRANCE.—A new company has just been formed in Paris (41, Rue de Provence) with a capital of £80,000 and the title of *La Société de Distribution de l'Electricité de l'Ouest*.

The *Société Hydro-electrique des Basses Pyrénées*, whose several networks have hitherto been fed from the generating station at the Val Carlos fall, on the Spanish frontier, are now about to construct a second station on the Nive at Banca, where a fall equal to 4,500 h.p. is available. This station will be joined by two 30,000-volt lines to the steam generating station at Pont-de-Mongerre near

Bayonne owned by this society. The distribution systems which supply Bayonne, Boucau, Osnes and Cambo are also to be considerably enlarged. The programme in course of execution comprises for the 30,000-volt network, besides the two lines previously mentioned, a line serving the important industrial region of Boucau and a line to supply the Bayonne-Lycée-Biarritz tramway, hitherto worked by steam, the conversion of which is expected to be completed by September next. Further, a 5,000-volt network will supply, on one hand, the Basque coast as far as St. Jean de Luz and Aseain, and, on the other, the communes in the Landea region.—*La Lumière Electrique*.

GERMANY.—The Ruhrthalperrenverein, of Essen, which is installing a large plant to utilise certain available water-power in the Ruhr valley has placed a contract with Messrs. Bregleh, Hansen and Co., of Gotha, for the supply of four Francis double spiral turbines, each of 2,000 H.P., and four single spiral turbines, each of 1,000 H.P.

The Bavarian Minister of the Interior has addressed to local authorities the following official instruction with regard to the provision of electricity in this kingdom:—That (1) the supply of electricity is only possible by means of great bulk supply stations, serving large areas and pledged for long periods. (2) That the erection of such stations in each district must be relegated to separate companies, communal or other, or to large electric supply companies working in conjunction with banks. (3) That power must be generated to the utmost from the State-owned water resources. (4) That the bulk supply stations must be bound to serve every locality within their area at a unit price. (5) That the larger, and especially the municipal stations, must construct their own networks, taking energy from the bulk suppliers. (6) That rural authorities must leave the distribution of electricity to the bulk supply concerns, retaining merely the power of repurchase at some specified date. (7) That in areas where the supply will involve loss to the suppliers, special terms may be made, subject, however, to the State's approval. (8) That the price of current must be approved by the State and revised at stated periods. (9) That pre-emptive rights over the bulk supply stations must be retained by the State. (10) That bulk supply stations are to be built according to such plans, and in such sequences and at such periods as fixed by the State. (11) That the bulk supply concerns are to refrain from restricting free competition in such portions of installations not carried out at their own cost, especially in internal fittings; and, lastly, that the State will retain sensible touch with all the bulk supply stations with a view to conserving the interests of the general public. These conclusions are said to be the outcome of exhaustive investigations into local electrical circumstances, and of an inspection of the arrangements come to in other countries.—*Elektro, Nachrichten*.

The Rheinisch Westfälischen Electricitätswerke intends to construct a large new power station on the left bank of the Rhine near Zeche. The first equipment will include two 25,000-H.P. steam turbines.—*Zeit. f. d. g. Turbinenwesen*.

Negotiations are proceeding between the Rheinisch-Westfälischen Electricitätswerke and the five populous industrial Kreise of the Lower Rhine with respect to the completion of the distribution network and the construction of a special generating station. The five Kreise are prepared to place a loan of £525,000 at the disposal of the company, but the latter requires a larger advance (£750,000) in view of the fact that widely scattered and relatively unremunerative agricultural districts will have to be included in the completed network. A special opinion is to be taken on the merits of the divergent contentions, but it is considered in competent quarters that the company's standpoint will be eventually adopted.—*Elektro, Nachrichten*.

The Government of the Grand Duchy of Mecklenburg has just published its plans for providing electricity to the whole of the Grand Dukedom. It is intended to erect a large power station in Schwerin, at a cost of £100,000 for the supply of current to the whole of the south-western portion of the Grand Duchy. The remainder of the province will be served by another station; but, alternatively, a large transformer station may be substituted, in which event the current will be furnished by the Schwerin station. These plans obviate the resort to the private bulk supply station at Lübeck, in the neighbouring principality.—*Zeitschrift für Elektrotechnik und Maschinenbau*.

NORWAY.—According to official statistics, the number of electrical installations existing in Norway on July 1st last was 1,250, an increase for the 12 months of 100; the total generator capacity was 417,607 kW., an increase of 155,512; the number of accumulators in use remained at the same figure, 9,136; the utilised power for lighting in kilowatts is not on record, but in the foregoing period was 38,129; for motors it was 126,568, an augmentation of 28,856; the power used in the electrochemical industry totalled 211,131 kW., an increase of 114,345, and for other purposes 11,947, showing, however, a shrinkage of 4,418; the number of glow lamps in use was 980,317, representing an increment of 176,382, while arc lamps figured at 5,515, no record being made in the previous year. The number of motors in use was 12,825, an advance of 2,599. The Rjukan station, to serve the saltpetre industry, was opened during the official year.—*Elek. Zeitschrift*.

RUSSIA.—At the commencement of the present month the Société d'Electricité d'Odessa was supplying current to 3,588 consumers, with a total of 129,000 lamps and 116 electric motors, equal to a consumption of 4,510 kW.

Considerable additions are to be made this year to the iron works and collieries of the Union Minière et Metallurgique en Russie, the new plant including an electric power station comprising three gas engines and dynamos, each of 2,000 H.P.

A new company is being formed in Moscow with a capital of 6 million roubles, and the title La Société de Transmission Electrique.

SPAIN.—The special commission for the reform of the public lighting of Madrid has advised the municipality to declare the competition for the public lighting concession abandoned, and instead to raise a loan with the assistance of the Government, with a view to the establishment of a municipal installation, procuring current from the State-owned generating station on the Isabel II Canal.—*Electron*.

The municipal authorities of San Juan de Palamos (province of Gerona) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

SWITZERLAND.—A water-power plant is being installed at Martigny, utilising a head of 5,400 ft., through 3 miles of steel pipe. This will be the highest head of water so utilised in the world, the water pressure at the turbine being about 2,500 lb. per sq. in. Pelton wheels, with a total rating of 15,000 H.P., will be installed, and the *Electrical World* points out that only about 30 cu. ft. of water per sec. will be necessary to develop the full 15,000 H.P. output.

Darwen.—There is a movement on foot to extend the electrical undertaking to the village of Hoddleden. Messrs. Carus's new mill, and Messrs. Place's works, are already driven by electricity, and it is now proposed to ask for current for lighting purposes. Large firms and chief residents are willing to adopt electric lighting if the Corporation can see its way to supply it.

Doncaster.—Sitting in committee, the T.C. has decided to apply for sanction to borrow £12,500 for the extension of the plant, and also for structural alteration at the Corporation electricity works. It is proposed to put in a 1,000-kw. turbine set, bringing the total plant capacity up to 2,800 kW., and to adopt H.T. three-phase supply in order to reach the outside districts which are so rapidly developing owing to colliery enterprise. Alterations will be made at the electricity station, so that as the additions to the plant take place it will not be necessary to build a new station, the present one being sufficiently large for many years to come.

Dunfermline.—In view of impending developments in the district, the Fire Electric Power Co. has in contemplation a large extension at its works at Townhill. It is proposed to install a horizontal turbine set of 5,000 H.P., capable of developing 3,000 kW. With the necessary boiler power, the company will be able to supply double its present load.

Halifax.—The Electricity Committee has recommended that application be made to the L.G.B. for sanction to borrow £4,380 for the supply and fixing of two water-tube boilers and superheaters required at the electricity works.

Haslingden.—At a meeting of the T.C., held on Wednesday, last week, a letter was read from the L.G.B., sanctioning the borrowing of £3,750 and £1,500 for the electricity undertaking purposes.

Heston-Isleworth.—The Electricity Committee of the U.D.C. has decided to charge 4d. per unit for current supplied to the refuse destructor works for lighting purposes, and 1½d. per unit for power, instead of a uniform rate of 2d.

The seal of the Council has been affixed to an agreement with the Isleworth Brewery Co. for supplying its premises with current, and for laying down the necessary cables.

Leeds.—The Corporation Tramways and Electricity Committee has asked the Finance Committee to apply for borrowing powers to the extent of £168,500, which it is intended to apportion as to £38,500 for additions to the generating station, £100,000 for mains, and £30,000 for building sub-stations. The Committee also proposes to borrow £28,000 for building and equipment of a new depot in Sovereign Street.

The Corporation has a proposal in hand to reduce the price of energy for power purposes, and an additional discount is suggested for large consumers who take H.T. supplies and thus save the cost of transforming to low pressure.

Leyton.—Application is to be made to the L.G.B. for sanction to borrow £1,000 for services, and £5,370 for mains. An additional feeder is to be laid in Hainault Road at an estimated cost of £2,370. The estimated surplus on the working of the undertaking during the year ended March 31st is put at £951, of which £500 is to be set aside as a provision for the purchase of stores rechargeable to capital account as and when expended, and half of the balance, £225, is to be carried to reserve, while the remainder will be transferred to the credit of the district rate.

London.—LEWISHAM.—The B. of G. on Monday considered the question of installing the electric light at the infirmary and workhouse. A letter was read from the South Metropolitan Gas Co., stating that it would have been necessary for it to enlist the co-operation of a third party to undertake the responsibility of providing electrical plant and accessories, as distinct from gas engines, but the Guardians insisted that the installation should be the property of the gas company. The company had no doubt whatever as to its ability to generate electricity in the institutions with a gas-driven plant, and show a reasonable profit on the transaction. The Guardians decided to acknowledge the letter with thanks. A letter was also read from the South Metropolitan Electric Light and Power Co., offering to supply electricity for lighting at 2d. per B. of T. unit, and at 1½d. for heating, driving of electrical motors and ventilating, for 21 years, determinable at the end of the first 7 or 14 years by the Guardians only by giving 12 months' previous notice. The Board decided to accept these terms. The tenders received for the electric wiring of the two institutions are stated in our "Contracts Closed."

**Londonderry.**—The electrical engineer has submitted a report on probable cable extensions required during the next five years, and the E.L. Committee has approved it. The estimated cost of the extensions is £13,000.

**Manchester.**—The Electricity Committee proposes to apply for powers to borrow £75,000 for mains and services, and plant at consumers' sub-stations. The estimated increased revenue per annum is £12,000, against which working expenses, interest and sinking fund, amounting to £9,913, are to be set, leaving an annual surplus of £2,087, which represents a return of 2.78 per cent. upon the capital outlay involved. The Finance Committee raised no objection to the proposed application.

**Oulton Broad.**—The Board of Trade has revoked the 1908 Electric Light Order.

**Portishead.**—The Clevedon, Portishead and District Electric Supply Co. has applied to the B. of T. for permission to use overhead lines for the transmission of energy at a pressure of 100 volts for the purposes of supply under the order.

**Redditch.**—The U.D.C. has received a report from a special sub-committee on the working of the electricity undertaking. The undertaking has never been financially successful, due, it is said, to the installation of unsuitable plant, followed later by the introduction of metal lamps and recently by the numerous strikes. The capital cost of useless plant is stated to be £10,000 out of a total of £46,000. It is proposed to pay the works manager, Mr. Ferguson, £150 in respect of his special services as consulting engineer, and in order to give the committee freedom to make any necessary charges, he has decided to terminate his engagement as works manager. The sub-committee has made 22 recommendations to the Council, including one that a works manager be appointed at £250 per annum.

**Richmond.**—The Richmond (Surrey) Electric Light and Power Co., Ltd. is applying for further powers, including power to take a supply in bulk from the Metropolitan District Railway Co. the London Electric Railway Co., the County of London Electric Supply Co., Ltd., and any local authority, &c.

**Romford.**—The U.D.C. has provisionally agreed with the County of London Electric Supply Co.'s scheme for electric supply for the district, but the sealing of the agreement has been deferred until certain clauses are definitely decided upon.

**Siam.**—According to the *Indian Textile Journal*, La Compagnie Mutuelle de Tramways, of Brussels, is negotiating the formation of a large new company to undertake the establishment of an electricity station in Bangkok for the supply of current for lighting and power purposes, and for tramway operations in the Siamese capital.

**Stalybridge.**—The Joint Tramway and Electricity Board has approved a recommendation of the Generating Station Committee to amend an application to the L.G.B. for further borrowing powers from £20,000 to £22,551.

**Stoke-on-Trent.**—The B.C. has applied to the L.G.B. for a loan of £3,000 for extensions of the electric light mains to Fenton.

**Truro.**—The T.C. has received an intimation that the B. of T. proposes to grant the application of the Corporation for a prov. order for electric lighting.

**Walthamstow.**—Subject to the sanction of the B. of T. the Council has decided to undertake to supply Woodford with electricity in detail. When application is made for a prov. order, the Board is to be asked to provide in such order that the repayment of capital be deferred for a period of three years from date of borrowing, interest only being paid during such period.

**West Bromwich.**—The L.G.B. has sanctioned the borrowing of £6,500 for extensions of electric mains, repayment being spread over 20 years.

**Yarmouth.**—The electrical engineer is to make an experiment on certain tramway centre poles with 200-c.p. incandescent lamps placed at each end of the bracket arm, with the view of improving the lighting of the Marine Parade.

## TRAMWAY and RAILWAY NOTES.

**Argentina.**—Messrs. Otto Franke & Co., concessionaires for an electric railway between La Plata and the Federal capital advised the Department of Engineers of the Province of Buenos Ayres that they had commenced work, and, at the same time, they protested against that Department for the difficulties placed in their way. An investigation was ordered, and it is stated that the protest was only a pretext on the part of the concessionaires to endeavour to delay the concession being declared lapsed.—*Review of the River Plate.*

**Blackpool.**—The receipts from the Corporation tramways for the year which ended on Monday were £9,200 in advance of the previous year, and the statement made to this effect by Alderman Brodie at the meeting of the T.C. on Tuesday, was received with much satisfaction.

**Chile.**—Negotiations are being entered into to enable the Government to purchase the land on either side of the Rio Laja so as to make use of the water for a hydro-electric station to supply current for the third and fourth sections of the railway which are to be electrified, and also to supply electric light to several cities.—*Review of the River Plate.*

**Continental Notes.**—**BELGIUM.**—La Société des Tramways Liegeois has secured a concession for extensions of its electric tramway system, which will give connections between the southern portion of Liège and Chenée and Vaux-sous-Chevremont.

**GERMANY.**—The Local Government Board of Hirschberg has accorded permission for the construction of a new mountain railway in the Riesengebirge. The railway will be about 17 miles in length, and will run from Schmiedeberg through Steinsieffen Krummhübel, with a branch from there to Bruckenberg-Arnsdorf, Seidorf, Giersdorf, and Hermsdorf, so that a direct connection will be established between the eastern and western end of the mountains. The contract for the line has been secured by the Allgemeine Electricitäts Gesellschaft, of Berlin.

The system of working with single-phase current at 15,000 volts and 16½ cycles on the Dessau-Bitterfeld line is now adopted for the Magdeburg, Leipzig and Halle section. Three sub-stations are erected at Wahren, Marke and Gommern respectively each equipped with four 1,500-kw. transformers. The chief station at Muldenstein contains 16 boilers, and four 3,300-kw. turbo-dynamos. Four boilers, a turbo-dynamo, transformers, and switchboard form a complete power unit. The switchboard building is separate from the engine-room. For the working of the Prussian State railways, there have been ordered 72 new locomotives.—*Der Elektrische Techniker.*

**ITALY.**—In consequence of the results obtained from the installation of electric traction on the old Giovi line, the Ministry of Public Works has proposed to the State Railways Administration the conversion of the branch lines from Giovi to Sampierdarena and Ronco. The plans have already been settled, and the cost is estimated at about £210,000. The current for working, unlike that for the old line, will be supplied by a private company, and a contract to this end has, in fact, been signed with the Società Forze Idrauliche della Maira. Construction and equipment will be carried out under the direct supervision of the Railway Department and the line is expected to be completed by March, 1914.—*Giornale dei Lavori Pubblici.*

A 60-years' concession for the construction and working of an electric tramway between Naples and Acerra, a distance of 8½ miles, has lately been granted.

**RUSSIA.**—The Ministerial Commission for the Study of New Railways is about to examine two schemes for electric lines starting from St. Petersburg. One scheme, the author of which is Mr. C. Hedding, proposes to construct a double-track normal-gauge electric railway as far as the Finnish frontier; it will have a 10-minute service, is for passengers and goods (principally wood), and will derive its energy from a fall on the River Vouksa. Its cost is estimated at 2,969,000 roubles, and an 80-year concession is asked for. The second scheme, put forward by Messrs. Lipsky & Bielloff, proposes to construct a double-track normal-gauge railway, 17 km. long, as far as Ionkki, and a second line, 19 km., from Vosnessensky to St. Petersburg. The cost of the first line is estimated at 1,928,000 roubles and of the second at 2,007,000 roubles.—*La Lumière Electrique.*

**Dundee.**—The Tramways Committee of the T.C. has unanimously agreed to fix the ½d. stages on the Corporation's tramway system at a uniform length of 950 yards. A small Committee has been formed to decide upon the stages.

**East London Railway.**—On this line, now electrically worked, the electrical train service was started on Monday last. The service is maintained by Metropolitan trains, while the District Railway supplies the power required through its Whitechapel sub-station and a new sub-station at Surrey Docks, the latter equipped with three 300-kw. Westinghouse rotaries and transforming plant. The steam pumping stations at Rotherhithe and Surrey Docks have been converted for electrical pumping, and a special system of automatic signalling has been installed by the McKenzie, Holland, and Westinghouse Co., which utilises alternating-current track circuits. In the tunnel signals the red and green lamps are lighted by 5 and 50-volt lamps respectively, thus safeguarding the possibility of a "clear" signal being given in place of the "danger" signal.

**Halifax.**—A recommendation has been made that the Mount Tabor motor-bus service be extended to Wainstalls.

A request having been made that the tramway be extended from the terminus at Skircoat Green along the new road to Dudmell Lane, the Committee has passed a resolution regretting its inability to accede to the request, as it has no power to carry out the suggested extension.

**Liverpool.**—The report of the Corporation tramways for the year ended December, 1912, which has just been issued, shows that the total revenue for the year was £668,220. After apportioning the gross profit, the amount of net profit for the year is £133,857, an increase of £19,125 over 1911. The contribution in relief of the rates is £28,681 in excess of the amount handed over in 1911. There was an increase in the traffic receipts of £29,901. The City Council will consider a notice of motion, in the name of Councillor Holt, which reads:—"That it be an instruction to the Tramways and Electric Power and Lighting Committee to consider the practicability of utilising the tramway systems for the conveyance of goods to neighbouring towns."

At a meeting, which the public were invited to attend, held in the Picton Hall, Liverpool, last Friday evening, to protest against what was described as "a tramcar scandal," a resolution was

carried emphatically protesting against the prevention of a free discussion in the City Council, and calling for the publication of the reports of the tramways manager and the engineering experts on the condition of the cars. One speaker observed that Liverpool was one of the worst managed towns in the whole of Great Britain, and the majority of the members bolstered up their own interests and those of private enterprises to the detriment of the public interest. Another speaker declared that there was in the City Council a conspiracy of silence to prevent the public from knowing the condition of the cars.

**Middlesex C.C. and Its Passengers.**—The County Council has agreed, provided certain necessary approvals are obtained, that "while no dogs or other animal" shall be allowed inside a car, they can, at the conductor's discretion, travel on top, "but must be carried up the stairs." We quote the *Times*, which concludes its paragraph with the statement: "Dogs or other animals must be accompanied by a passenger." We trust that our canine and other friends will take note, and that the ladies will not claim a monopoly of the inside accommodation.

**Oldham.**—The past year has been a record one for receipts, number of passengers carried, and the diminution of working expenses, according to a statement made by Mr. Isherwood (chairman of the Oldham Tramways Committee) last week. The total receipts for the year ended March 24th were £107,083, as compared with £100,364 for the previous year, an increase of £6,719. The profit on the year's working was £4,500, and considering that the wages increase during the year added £1,400 to that item, the result, in Mr. Isherwood's view, was very good. The Committee would be able to wipe out the previous year's loss of £2,413, and have a balance of £2,087. He suggested that the balance should be placed to a reserve renewal account, and mentioned that during the next few years the track would require a good deal of repairing and renewal. During the year, 104,603 more miles had been ran than in the preceding year, but they had used 106,153 fewer units, and the resultant saving was £668. The saving was accounted for by the overhauling of cars and equipment.

**Plymouth.**—Up to March 15th the total income from the tramways for the current financial year amounted to £38,223, and the expenditure to £35,662, compared with £37,651 and £35,139 respectively.

**Stalybridge.**—The Joint Tramway and Electricity Board has decided that 14 additional cars be fitted with the Spencer mechanical slipper brake.

**U.S.A.**—According to the *Electrical World*, the electrified zone of the New York, New Haven and Hartford Railroad is expected to be in operation to New Haven some time in May. This will more than double the railroad's present electrified trackage, which extends from New York City to Stamford. The New Haven will then have about 35 miles under electrical operation, including, besides the single phase equipment, 12 miles of third-rail terminal tracks entering the Park Avenue tunnel and Grand Central Station. Several miles of overhead construction yet remain to be completed on the new Stamford-New Haven extension.

A run of 310 miles was made last month by a new Edison-Beach battery car, from New York to Boston. The car was 50 ft. long, and weighed 34½ tons; its equipment included four 20-H.P. 220-volt motors, and two batteries each of 230 cells. The car ran the first 114 miles (level) at an average speed of 35 miles an hour, and on an energy consumption of 37½ watt-hours per ton-mile. Subsequently a hilly route was followed; the batteries were recharged once, and subsequently received a short boost.

wished to deal solely with the rumour that he and other Ministers had made large profits out of the rise in Marconi shares before March, 1912, when the contract was accepted. He had informed the Prime Minister in August of his purchase. He would not agree that his sale of 8,000 shares could possibly have been the origin of the rumours which had been published.

The examination of Sir Rufus Isaacs was concluded on Friday. The Committee resolved not to permit him to answer the question whether he had made any communication to any member of the Committee of the fact that he had purchased shares in the American Marconi Co. He stated that in addition to the shares which Mr. Lloyd George obtained from him, part of which he had sold, Mr. George had bought on May 22nd a further batch of 3,000 American shares on his own account, and that of the Master of Elibank.

Mr. Lloyd George afterwards gave evidence. He said he took little part in the negotiations for the contract, having his hands full in other ways, but was prepared to defend the contract, for which he took full responsibility. He was on terms of intimate friendship with the Attorney-General and the Master of Elibank, and it was for that reason that he took part in the purchase of American Marconi shares, on the assurance of Sir Rufus Isaacs that the American company had no interest in any contracts between the British company and the British Government. He then confirmed the statements of the Attorney-General regarding the purchase of shares, and said that the net result was that he still held 1,643 shares, and had lost at present prices about £500. It was not true that he had made large sums by speculation. He purchased the Marconi shares on April 17th because he thought they were a good investment. On April 20th he sold 1,000 shares (for himself and the Master of Elibank). The shares were resold before they were delivered.

On Monday the examination of Mr. Lloyd George was concluded, dealing mainly with points of minute detail. He said that apart from the transactions described, he had had no dealings in Marconi shares. The Postmaster-General afterwards made a statement confirming his evidence in the case against *Le Matin*. The Committee sat again on Wednesday.

In the course of his statement on the Naval Estimates last week, Mr. Winston Churchill said that the development of wireless telegraphy in seagoing ships and in the shore stations of the Admiralty had during the year been very satisfactory. Good progress had been made, and the immense utility of wireless fully justified the considerable sum spent last year and the still more considerable sum included in the Estimates for this year. In one respect, however, Admiralty interests had suffered a grave and, to some extent, irreparable loss. The delay in ratifying the Marconi agreement, and the consequent prevention of all progress in the Imperial chain of wireless stations, had deprived us of the advantages in regard to wave length and priority which we had hoped to gain through being first in the field, and now that the company had refused to carry out the contract, and since it was manifestly impossible to compel them to do so, new arrangements of a different character would have to be devised, and it was possible that additional charges would be incurred by the public. No step, however, which would now be taken could put us back into the position which had been lost.

**Rural Telephones.**—In answer to a question, Captain Norton stated in the House of Commons that about 900 agreements for rural party lines had been accepted, and by the end of February about 450 subscribers were using the service. Proposals under consideration would provide for approximately 500 more subscribers. Some delay had arisen recently in dealing with applications for such lines owing to the necessity for applying to the Treasury for authority to exceed the experimental grant of £10,000.

**The Telephone Transfer.**—Replying to a question, the Postmaster-General stated that about 80 members of the electrical staff transferred from the National Telephone Co., out of a total of over 1,300, had resigned from the service since the transfer.

**Thefts from Call-Boxes.**—In consequence of thefts from cash boxes in public telephone call offices in Birmingham, the authorities invented an apparatus which caused a bell to ring when the lid of the cash box was opened. By this means a man named Charles Pollett was captured last week, and he was committed for trial.

**United States.**—The report of the New York Telephone Co., for the year 1912, on the combined operating results of the company and its associated companies, shows total telephone earnings \$65,632,688, telephone expenses \$18,461,690.75, net telephone earnings \$17,170,999.77; add other income \$1,510,072.57, making total net earnings \$18,681,072.34. After deducting interest charges and dividends declared a balance of \$5,492,161.77 is carried as surplus and reserves. Including the associated connecting companies, there were in service in the whole system at the end of the year 1,756,343 stations, an increase of 232,319 stations.

Arrangements are being made between the American and Russian Governments for the establishment of a regular wireless service across Behring Sea, which will ensure telegraphic communication between America and Asia at all times, even in the event of interruption of the cable service. The project, it is said, taken in connection with the existing trans-Atlantic radio service, completes the circuit of the globe by this means of communication.—*Journal of Electricity, Power and Gas.*

## TELEGRAPH and TELEPHONE NOTES.

**British Wireless Stations.**—It has been decided to construct small-power stations at Barbados, Mombasa, Penang, Singapore and Hong-Kong. It is understood that, subject to the necessary guarantees, the work will be given to the Anglo-French Wireless Co., the English branch of the Goldschmidt Co.

**France.**—For the first time wireless communication was established on March 28th between the Eiffel Tower and the station at Arlington, near Washington, U.S.A. The power of the Eiffel Tower station is to be increased from 35 to 140 kW.

**Imperial Wireless System.**—On Thursday last week the Select Committee of the House of Commons on the Marconi contract resumed the examination of the Attorney-General, who gave further evidence with regard to his purchase of shares in the American Marconi Co. He stated that his brother Harry convinced him that the shares were likely to prove a good investment, and said that he considered the American company's prospects to be unaffected by anything that might happen to the English company. He did not refer to his dealings in American shares in his statement to the House of Commons on October 11th, 1912, because he

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" to-day.

**VICTORIA.**—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

April 16th.—1,020,000 arc lamp carbons, 26,900 carbon-filament incandescent lamps, and bare hard-drawn copper cables, for the Melbourne City Council. See "Official Notices" March 28th.

**SYDNEY.**—May 12th. Fibre conduit for the City Council. May 26th.—Meters and glazed stoneware bridges. July 7th.—Arc lamp carbons. Specifications 10s. 6d. for each section, from City Electrical Engineer's Department.—*Australian Mining Standard.*

**TASMANIA.**—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

**QUEENSLAND.**—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" to-day.

**Ayr.**—Corporation tramways. Tenders for work in connection with Hawk Hill extension—permanent way construction, road widening, &c. Mr. J. Young, engineer, Town Buildings, Ayr.

**Blackpool.**—High and low-tension cables and transformer switch pillars. See "Official Notices" March 14th.

**Bradford.**—April 17th. Three-phase and continuous current switchgear for two sub-stations, for the Corporation. See "Official Notices" to-day.

**Buenos Ayres.**—April 15th. Supply of motors, cables, dynamos and other accessories for motive power. Oficina de la Direccion General de Minas, Geologia e Hidrologia, Buenos Ayres.

**Chorley.**—Board of Guardians. Tenders for a complete telephone installation for the workhouse.

**Dundee.**—The Corporation electricity department invites tenders for the supply of steel sashes and frames, and for the supply and erection of opening casements, for extensions at Carolina Port generating station. Mr. H. Richardson, general manager and engineer.

**Edinburgh.**—Electric lighting for the new Veterinary College buildings at Summerhall. Mr. D. McArthy, architect, 25, Frederick Street, Edinburgh. Deposit two guineas, returnable.

**France.**—PARIS.—The Administration des Chemins de Fer de l'Etat invites tenders for the supply of three electrical traversers. Particulars, 43, Rue de Rome, Paris.

**Germany.**—HANOVER.—April 15th. Tenders are invited for the supply of the plant in eight lots for the hydroelectric station in the Eder Valley, comprising two 3,000-H.P. double-spiral Francis turbines and one 1,550-H.P. ditto, with governors, &c., turbine piping, four 6,000-volt three-phase generators, two rotary converters and a storage battery, three 6,000-KW. oil transformers for 6,000/55,000 volts, transmission lines, two 25-ton hand cranes of 25 metres radius, and a completely fitted switchboard. Particulars and drawings of all the items save the switchboard may be obtained on application enclosing 15 marks (for the switchboard 20 marks) to the Königlichen Maschinenbau Amt, Hannover, Brandstrasse, 1.

**Glamorgan.**—April 10th. Electric plant, wiring, &c., for the Training College now erecting at Barry for the Glamorgan County Council. Plans, &c., to be seen at office of the Clerk to the Council, at the Glamorgan County Hall, Cardiff.

**Glasgow.**—The Tramways Sub-Committee on Works and Stores of the T.C. is inviting offers required under the annual contracts. Mr. James Dalrymple, general manager, Headquarters, Bath Street.

**Keighley.**—(a) Foundation work for a 2,000-kw. turbo-alternator and condensing plant at the electricity works; (b) rolled steel joists in connection with the above. Drawings and specifications obtainable from Mr. H. Webber, Borough Electrical Engineer, Coney Lane, Keighley.

**Leyton.**—Tenders are to be invited for meters, and for one mile of 2 and ½ mile each of '025 and '025 cable, for the Council.

The Education Committee invites tenders for wiring the Church Road school extension.

**Limerick.**—April 10th. Stores and materials for a year, for the Borough electricity department. See "Official Notices" March 28th.

**Lisnaskea (Co. Fermanagh).**—April 14th. Gas engine and suction gas plant, dynamo and booster, battery, wood poles, overhead mains, &c., and switchboard, for the Lisnaskea Electric Light Co., Ltd. See "Official Notices" March 28th.

**London.**—L.C.C.—April 15th. Electrical installation at Jeffrey's Almshouses, Shoreditch. See "Official Notices" to-day.

April 23rd.—Electrical installation at Shadwell High Street Special School. See "Official Notices" to-day.

**FULHAM.**—April 23rd. 6,000 tons of nutty slack coal, for the B.C. Electricity Works. See "Official Notices" to-day.

**Manchester.**—April 15th. Tramways Committee. Tenders for roofing over of avenues at the Hyde Road car works, Manchester. Mr. J. M. McElroy, General Manager.

April 15th.—(a) Tramway rail bonds; (b) Hard-drawn copper trolley wire; (c) Steel tramway poles; (d) Span drive brackets for tramway poles; (e) Granite setts. Mr. J. M. McElroy, General Manager. For (c) and (d) a deposit of £1 is required.

**Norway.**—The Norwegian Telegraph authorities in Christiania have just invited tenders for the supply of 105 tons of iron wire and 57 kilometres of steel wire and lead-covered cables for the telegraph service.

April 11th.—76,300 kg. galvanised iron wire; 18,000 insulators and 7,000 metres of rubber-insulated copper wire, for Norwegian State Railways. Apply Telegrafinspektorens kontor, Stenersgaten, 8-IV, Christiania; also Board of Trade Com. Intel. Dept., London.

**Maryborough.**—April 9th. 1,120-amp.-hour accumulator, for the District Asylum. See "Official Notices" March 28th.

**Salford.**—April 10th. Extra-high-tension switchgear, for the Corporation. See "Official Notices" March 28th.

**Stalybridge.**—4,500 yards E.M.T. three-core lead-covered cable. See "Official Notices" March 14th.

**Stockton-on-Tees.**—April 10th. One 200-kw. rotary converter, transformer and starting apparatus, for the Corporation. See "Official Notices" to-day.

**York.**—April 5th. The Board of Guardians is prepared to receive tenders for (1) a dug well round an existing bore hole, an additional cast-iron liner down the bore hole, a deep-well pump for 5,000 gallons per hour, and two small centrifugal pumps and electric motors; and (2) water-softening plant (without heat) dealing with 5,000 gallons per hour. Tenders to the Clerk (Mr. George Sykes), Union Offices, Museum Street, York.

### CLOSED.

**Belgium.**—Five German and three Belgian concerns submitted tenders last week to the Belgian Post and Telegraph authorities in Brussels for the supply of a large quantity of telegraph cables. For one lot the lowest tender was that of the Société A.E.G. Union Electricque, and for the second lot the Siemens and Halske Co. quoted the lowest price.

**Bexhill-on-Sea.**—The T.C. has renewed for a period of ten years the agreement with Tudor Accumulator Co., Ltd., for the maintenance of batteries, at £70 a year.

**Bushey.**—The U.D.C. has accepted the tender of Messrs. Stuart & Moore, of Ealing, W., for the installation of electric fire alarms, at £63 10s. per annum, for seven years.

**France.**—The French State Railway authorities in Paris have just placed a contract with La Société Alsacienne de Constructions Mecaniques de Belfort, for the supply of 1,350 metres of electric cables.

**Gloucester.**—The T.C. has accepted the tender of Messrs. Ruscoe, of Hyde, for mechanical stokers at the electricity works, at £195.

**Haslingden.**—The T.C., on March 27th, approved of the following tenders for the erection of machinery, &c., at the sub-station:—

British Thomson-Houston Co., Ltd.—Rotary converter.  
Ferranti, Ltd.—Switchboard panel, recording voltmeter and charts.  
Chloride Electrical Co.—Extension of tramway switchboard.  
Siemens Bros.—Additional feeder cable.

**Heston and Isleworth, and Belfast.**—Messrs. Chamberlain & Hookham have received contracts for meters from the Councils of Heston and Isleworth and Belfast.

**Hornsey.**—The D.C. has decided to place a contract with Messrs. Isaris, Ltd., for electricity meters.

**Hilford.**—The U.D.C. has accepted the following tenders:—

Electromotors, Ltd.—Middle-wire reversible booster, £51.  
Wardle Engineering Co., Ltd.—Electric light fittings for centrally lighting High Road.

The following tenders have been accepted for annual supplies:—

Main cables.—Unicn Cable Co.  
Arc lamp carbons.—J. & H. Grevenor, and Sloan Electrical Co., Ltd. ("Couraity" make).  
Incandescent lamps.—Siemens Bros. Dynamo Works, Ltd., and Cryselco, Ltd.  
Meters.—Ferranti, Ltd.; British Thomson-Houston Co., Ltd.; and Siemens Bros. Dynamo Works, Ltd.; Isaris, Ltd.  
House service fuse boxes.—W. Lucy & Co., Ltd., and W. T. Henley's Telegraph Works Co., Ltd.  
Joint boxes.—W. Lucy & Co., Ltd.

The following tenders have been accepted for tramway supplies:—

General Electric Co., Ltd.—Lampholders, tatten holders and tapes.  
R. W. Blackwell & Co.—P. and B. tapes.  
La Carbone.—Carbon brushes.  
British Westinghouse Co.—Armature coils.

**Kendal.**—The Westmorland County Council has accepted the tender of Messrs. R. Hadwin & Son, of Kendal, for the electrical installation at the Allen Technojn Institute at Kendal.

**Leyton.**—The U.D.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for Shipley fine slack coal for the electricity works, at 13s. 10d. per ton, for a year.

**Liverpool.**—The tender of the Compania Fabril de Carbons Electros, per Mr. C. W. Webster, Bradford, has been accepted by the T.C. for an annual supply of flame arc lamp carbons.

**London.**—LEWISHAM.—The following tenders were before the Guardians at their meeting on Monday for electrical installation work at the Infirmary and the Workhouse:—

	Infirmary.	Workhouse.
Smeeton & Page .. .. .	£1,192	£1,003
Chapman & Co. .. .. .	1,300	1,300
Haycraft & Sons .. .. .	875	759
Ellis & Ward, Ltd. .. .. .	1,380	1,095
Alliance Electric Store, Ltd. .. .. .	998	970
V. G. Middleton .. .. .	1,050	1,200
A. J. Ewens .. .. .	749	875
Weston & Sons .. .. .	909	640
Tredegar & Co. .. .. .	866	668
Watson & Co. .. .. .	1,247	1,135
W. R. Reynolds, Ltd. .. .. . (accepted)	479	449
A. K. Klamet .. .. .	925	1,039
Stegmann & Co. .. .. .	1,127	837
Coxens, Ltd. .. .. .	1,249	1,010
Malcolm & Allan, Ltd. .. .. .	1,505	1,304
Saville & Walton .. .. .	940	797
L. Sunderland Co. .. .. .	1,400	1,050

The tender of Messrs. W. R. Reynolds, of East Ham, was accepted. In the event of the firm not agreeing to carry out the contract, the Board decided that the wiring of the Infirmary should be done by Mr. A. J. Ewens, and the Workhouse by Messrs. Weston & Sons.

**FULHAM.**—The Fulham Board of Guardians has accepted the tender of the Hart Accumulator Co., Ltd., for the supply of a storage battery of 102 cells required for the Fulham Workhouse.

**Luton.**—For Council. Brush Electrical Engineering Co., Ltd., two 1,000-KW. turbo-alternators and condensers, £9,200.

**Maidenhead.**—The T.C. has accepted the tender of the Crynant Colliery Co. for 1,000 tons of coal for the electricity works, at £1 1s. 10d. per ton.

**Plymouth.**—The Borough Surveyor reported to the Tramways Committee that he had communicated with four firms for the purpose of obtaining quotations for the supply of 100 tons of tramway rails. Two of the firms had declined to submit a price, being too busy, and the other two had submitted prices which were subject to acceptance within seven days. After communicating with the Chairman, and with his authority, he had accepted the tender of Messrs. Walter Scott, Ltd., at £8 10s. per ton. The surveyor's action was confirmed.

**Salford.**—The following tenders have been accepted by the T.C.:

General Electric Co., Ltd.—Three rotary converters and static transformers, £6,200.  
Bertram Thomas.—Extension of lighting and power switchboard at electricity station, £438; supply of extra feeder panels, if required, £54 each.

**Southend-on-Sea.**—The contract for poles, brackets, &c., mentioned last week, was placed with Messrs. Watlington & Co. not Worthington & Co. as stated in our last issue.

**Stalybridge.**—The Joint Tramway and Electricity Board has accepted the tender of Messrs. Wm. Storrs, Sons & Co., Ltd., for the erection of a chimney at the generating station.

**Traction Lamps.**—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract from Messrs. Balfour, Beatty & Co. for the supply of traction lamps (tantalum and Wotan) for the following tramways for 12 months:—Luton, Llanelly, Dartford, Carlisle, Leamington and Warwick, Notts and Derby.

**Walthamstow.**—The U.D.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., at £3,478, for the supply of four additional tramcars, and the tenders of Messrs. Chamberlain & Hookham and Messrs. Ferranti for meters for the ensuing year.

**Warrington.**—The British Westinghouse Co., Ltd., has received an order from the T.C., for a 25-H.P. motor.

The following tenders have been accepted by the T.C.:

Brush Electrical Engineering Co., Ltd.—Transformers.  
General Electric Co., Ltd.—Direct-current motors.  
British Thomson-Houston Co., Ltd.—Alternating-current motors.

**Worcester.**—The City Council has placed a contract with B.I. and Helsby Cables, Ltd., for cables for three years.

**Wrexham.**—The following tenders for the supply of materials to the electricity works have been accepted:—

Reason Manufacturing Co.—Miniature electrolytic meters.  
Edison & Swan United Electric Light Co.—Carbon-filament lamps.  
Jas. Light & Son, Ltd.—Crank chamber oil.  
Henry Wells Oil Co.—Cylinder oil.  
Wm. Hughes.—Boiler solution.  
Barton & Co.—Slack.

The Committee has also accepted the following tenders:—

British Westinghouses Co.—Condenser, £150.  
H. Davies.—Erection of sluice gates, £75.

**Yarmouth.**—The tender of Messrs. Walter Scott & Co., Ltd., has been accepted by the T.C. for 180 tons of steel tramway rails, at £8 2s. 6d., as has also the tender of Messrs. John Baker and Co. (Rotherham), Ltd., for 60 steel tires, at 3s. 6d. each.

## FORTHCOMING EVENTS.

**Electro-Harmonic Society.**—To-night. At 8 p.m. King's Hall, Holborn Restaurant. Last Smoker of the season.

**Salford Technical and Engineering Society.**—Saturday, April 6th. At 7 p.m. At the Royal Technical Institute, Salford. Paper on "Modern Gas Engines," by Mr. K. Cox.

**Association of Engineers-in-Charge.**—Saturday, April 6th. At 8 p.m. Visit to the works of the Westminster Electric Supply Corporation, Horsley Road.

Wednesday, April 9th.—At 8 p.m. At St. Bride's Institute, E.C. Paper on "Notes on the Design and Economy of Diesel Oil Engines," by Capt. H. Riall Sankey.

Saturday, April 12th.—Annual Dinner.

**Institution of Electrical Engineers (Scottish Section).**—The annual general meeting is postponed from April 8th to April 15th.

(Newcastle Students' Section).—Monday, April 7th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Notes on the Operation of Three-Phase Transformers," by Mr. R. C. Phillip.

(Manchester Section).—Tuesday, April 8th. At 7.30 p.m. At the University, Manchester. Annual general meeting and lecture by Prof. E. Rutherford.

(Birmingham Section).—Wednesday, April 9th. Meeting at the University, Birmingham.

(Newcastle Section).—Wednesday, April 9th. At 7 p.m. At the Lit. and Phil., Middlesbrough. Paper on "Power Supply on the Rand," by Mr. A. E. Hadley. Afternoon visit to the works of the Skinningrove Iron Co.

(London).—Thursday, April 10th. At 8 p.m. "Self-Synchronising Machines," by Dr. E. Rosenberg.

(Dublin Section).—Thursday, April 10th. Meeting at 8 p.m. At the Royal College of Science, Dublin.

**Society of Engineers.**—Monday, April 7th. At 7.30 p.m. At the I.E.E. Paper on "The Status of Engineers and Engineering, with Special Reference to Consulting Engineers," by Mr. W. Ransom.

**Royal Society of Arts.**—Wednesday, April 9th. At 8 p.m. Paper on "Electricity Supply in London," by Mr. F. Bailey.

**Junior Institution of Engineers.**—Friday, April 11th. At 89, Victoria Street, S.W. Paper on "Methods of Regulating and controlling Working of Electric Accumulators," by Mr. G. C. Allingham.

**Physical Society.**—Friday, April 11th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "Some Errors in Magnetic Testing due to Elastic Strain," by Messrs. A. Campbell and H. C. Booth, and "Note on Cathodic Sputtering," by Dr. G. W. C. Kaye.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Monday, April 7th.—"A" Company. Recruit training, 7 to 10 p.m. company training, 7 to 10 p.m.

Tuesday, April 8th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, April 10th.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Friday, April 11th.—"D" Company. Company training, 7 to 10 p.m.

Saturday, April 12th.—Headquarters will be opened for regimental business from 10 a.m. till noon.

(Signed) J. H. S. PHILLIPS, Major.

For Officer commanding L.E.E.

## NOTES.

**The Electro-Harmonic Society.**—To-night the last Smoking Concert of the season will be held at the Holborn Restaurant (King's Hall), commencing at 8 o'clock. The artists are as follow: Vocalists—Mr. Henry Turpin (tenor). Mr. Peter Dawson (baritone); Humorists—Mr. Dutch Daly, Mr. Ben Osborne; Original Character Sketches—Mr. Stacy Ammonier; Entertainer at the Piano—Mr. Harrison Hill; Humorous Recitations—Mr. Walter Churcher; Banjo Solo—Mr. Olly Oakley; Entertainer—Mr. Hewson Brown; Piano Solo and Accompanist—Mr. Bernard Flanders, A.R.A.M.

**Copper.**—In the course of his speech on the difficulties of the year 1912, the chairman of the United Alkali Co., Ltd., mentioned that they had to pay about £70,000 more for coal and other articles than in the previous year, and prices had been permanently increased. The average price of copper, he said, had been about £18 per ton higher. The position for 1913 was difficult for the company as they could not raise their selling prices.

**Faraday House Old Students' Association.**—The Annual Dinner of this Association will be held at the Hotel Cecil (Victoria Hall), on Friday, April 11th, at 7 (for 7.30 p.m.), with the president, Mr. Haydn T. Harrison, M.I.E.E., in the chair. Any Faradians desirous of attending, who have not received a notice, are requested to communicate with the hon. secretary, F.H.O.S.A., Faraday House, Southampton Row, London, W.C.

**Will.**—According to the *Times*, the late Sir William H. White left estate of the gross value of £38,377, of which the net personalty has been sworn at £34,599.

**I.M.E.A. Preliminary Programme.**—The eighteenth annual Convention of the Incorporated Municipal Electrical Association will be held in London in June, and the following programme has been arranged tentatively:—

*Tuesday, June 17th.*

10.0 a.m.—Opening of the Convention at the Institution of Electrical Engineers. (1) Address by Mr. C. E. C. Shawfield, ex-President, late chief electrical engineer, Wolverhampton; (2) Paper on "Prime Movers," by Dr. S. Z. de Ferranti, Past President I.E.E., to be followed by a discussion.

1.0 p.m.—Luncheon interval.

2.30 p.m.—Visits to the West Ham Electricity Works and works of the London Electric Supply Co., Ltd., at Deptford.

*Wednesday, June 18th.*

10.0 a.m.—Meeting at the Institution of Electrical Engineers. Discussion (members and delegates only). Subject to be announced.

1.0 p.m.—Luncheon interval.

2.30 p.m.—Visit to London Electric Railway Power Station, Lot's Road, Chelsea.

7.0 p.m.—Annual dinner, Hotel Cecil. Members, delegates, visitors and ladies.

*Thursday, June 19th.*

10.0 a.m.—Special train from Waterloo.

11.0 a.m.—Meeting at the Empire Theatre, Kingston-upon-Thames. (1) Paper on "Electric Vehicles," by Mr. A. H. Seabrook, member of Council, and Messrs. W. Watson, and R. J. Mitchell. (2) Paper on "Air Filtration," by Mr. J. Christie, Past President, chief electrical engineer, Brighton.

1.30 p.m.—Luncheon interval.

3.0 p.m.—River trip to Walton and Hampton Court, &c.

*Friday, June 20th.*

10.0 a.m.—Meeting at the Institution of Electrical Engineers.

(1) Annual general meeting to receive the Council's annual report and the auditor's report and balance-sheet, elect the officers and Council, and transact other business. (2) Special general meeting to revise the articles of association.

*Saturday, June 21st.*

10.0 a.m.—It is hoped that it may be possible to arrange for a visit to the Metropolitan Water Board's new pumping plant at Chingford.

The headquarters of the Association will be the Hotel Cecil, and members are advised to book their rooms there or elsewhere at once, as it will be difficult to obtain accommodation later. The attendance of ladies accompanying members and delegates will be welcomed at the annual dinner and the visit to Kingston. An official programme will be issued in due course, and in the meantime all communications should be addressed to Mr. C. McArthur Butler, 28, Bedford Square, London, W.C.

**Manchester Electro-Harmonic Society.**—The closing concert of the first season of this Society was held last Friday evening. There was an attendance of something like 120, and the meeting was under the chairmanship of Mr. Sells. We hear that the musical items were exceptionally well received, notably the singing of "The Erl King," by Mr. Bridge Peters. Mr. F. S. Sells, in the course of a vote of thanks to the President, Mr. Pearce, remarked that the Society was exceptionally fortunate in having a gentleman of Mr. Pearce's standing as its president, who, notwithstanding that he was an exceptionally busy man, had taken great interest in the Society. Another notable point was that the Society, which only started in October last with a membership of 70, had now increased that membership to 170. Mr. Sells made an earnest appeal to each of the members to endeavour to get at least two new members, and it is hoped that the Society will commence next season with at least 300 members. A vote of thanks was proposed by Alderman Walker (vice-chairman of the Electricity Committee) and seconded by Mr. William Cramp, to the musical director, Mr. W. J. Smith, the secretary, and the treasurer. Each of these gentlemen responded, and a successful season was brought to a close with "Auld Lang Syne."

**Parliamentary.**—**SAFETY LAMPS.**—Sir Fred. Cawley asked the Home Secretary whether he had done anything to meet the complaints of safety-lamp manufacturers that they were charged a high fee for having lamps tested, whilst for testing lamps in Germany, France and Austria there was no charge, and that the testing station was not accessible and caused inconvenience; and whether he would say under what statute the Government had power to levy fees for testing safety lamps. Mr. McKenna said it had been found possible, in view of the large number of lamps which the makers proposed to submit, to make substantial reductions in the fees as originally fixed. The fees were so fixed as merely to cover the expenditure actually incurred in connection with the testing of a lamp, and no statutory authority was required for charging the fees. The testing station was established at Eskmeals because the Home Office already had an experimental station there, and the work could be carried out more economically for the makers as well as more conveniently for the Department than if the Home Office had had to acquire a special site and appoint a special staff. It might be possible later on to make arrangements for its transfer to a more central spot.

**Tramway Accident Claim.**—A settlement has been effected in the Court of Session action by a Renfrew teacher against the Paisley District Tramway Co., for £500 damages. Pursuer alleged that a tree which interfered with defenders' overhead wires was being cut down, and that she was struck on the head by a falling branch. Defenders denied fault. They made a payment of £50 and expenses, and the action has now been taken out of Court.

**Annual Dinners and Socials.**—**LONDON.**—One of those fixtures which we have always the greatest pleasure in attending is the annual staff dinner of the Gram and Robertson Lamp Works, which was again held in the Corporation Hall, Clarendon Restaurant, Hammer-smith, on Friday March 26th. In the unfortunate absence, through illness of Mr. Hirst, the chair was genially filled by Mr. C. Wilson, ably supported by Messrs. Sheppard and Driver, while Mr. Gosling looked after the general welfare of the visitors, among whom we noticed Mr. Jack Fletcher, manager of the lamp sales department of the G.E.C., Mr. Scolding, of Messrs. W. Cory & Sons; Councillor Johnson of the Hammer-smith Electric Light Committee; Councillor Cook, and other well-known local gentlemen, the company mustering about 90 in all. After the usual royal toasts given by the chairman, Mr. P. P. Driver proposed "The Allied Firms," to which Mr. Wilson responded, expressing his regret at the absence of Mr. Hirst, and referring to the steady progress of the firms, whose personnel had increased from a total of 90 to a present total of 1,700, which, when the extensions now in progress were completed would shortly be increased to 2,000. He was delighted to say that, throughout the works, there was a complete absence of friction and in every department a loyal striving for success. He also made the announcement that the directors had provided the necessary funds for the establishment of a club house, and he hoped, on the next occasion, to welcome their guests in their own house. The company then settled themselves to enjoy an excellent programme, provided, with one exception, by the members of the staff. Liszt's Rhapsodic Hongroise No. 2 was excellently played by Mr. E. C. Hosier, while Miss Dallender sang delightfully to her own accompaniment, besides taking part with Mr. J. Minson in a short farce. Mr. E. G. Sheppard proposed the health of "The Visitors and the Press," coupling it with the names of Mr. Scolding, Mr. Jack Fletcher and Mr. Sydney Rentell, who suitably responded. Mr. Fletcher, who was, according to Mr. Sheppard, suffering from "Osmramitis" (a strange disease whose symptoms are more noticeable among competitors than with the actual sufferer) pointed out that the year's sales had far exceeded any previous year, and that it was a subject of congratulation that this increase was not due to one or two exceptionally large contracts, but to a general expansion of the field of operations. The toast of "The Chairman," proposed by Mr. P. Pring, was received most heartily, and Mr. Wilson responded, calling the attention of those present to memories of the growth of the concern.

**BARNESLEY.**—The staff of the Corporation Electricity Works held their first annual dance in the Arcadian Restaurant, Barnsley, on Thursday evening last week, when nearly 200 people were present.

**Electricity Supply Rifle League.**—A representative match was shot on Saturday last between a team chosen from the above League and the London and South-Western Railway Rifle Club, on the latter's range at Clapham Junction. The scores were as follows:—

L.S.W.R.—H. Baker, 97; F. J. C. Mercer, 97; G. E. Barnes, 95; G. Coffin, 95; J. Cole, 95; W. Colley, 95; R. A. Hazeldine, 95; F. R. Wilson, 93; total, 762; E. Gray, 91; C. I. Barnes, 89.

E.S.R.L.—H. Muggford, 97; E. Neville, 97; J. K. Wells, 97; F. Winchcombe, 97; W. J. D. Partridge, 95; F. Barber, 93; A. W. Law, 93; E. G. Furneaux, 92; total, 761; H. P. Gaze, 91; H. A. Peerman, 91.

As the match was 10 to shoot and 8 to count, the result was a win for the railwaymen by the smallest possible margin, viz., one point, but on the total for all 10 men the electricians were one point to the good. After the match both teams were entertained to high tea by the general manager of the L.S.W.R. It is hoped to have a return match very soon.

**A Surveyor's "Loan."**—*Lloyd's Newspaper* reports a matter which was before the Sittingbourne County Court, on Saturday last, in which Mr. W. Richmond Warlow, surveyor to Milton Regis Urban Council, sued Mr. C. D. Richardson, an electrical engineer, and formerly member of the Whitstable Urban Council, for £20, money alleged to have been lent.

"In 1911 Mr. Warlow entered a competition for the best plan for sewage works at Whitstable. This scheme was accepted, and afterwards he became on friendly terms with Mr. Richardson. The latter, he said, asked him to lend him some money, and he sent Mr. Richardson two cheques for £10 each. Whitstable Council objected to the site of the proposed works, and ultimately Mr. Warlow's scheme was not taken up. When the plaintiff wrote for repayment of the loan defendant ignored his letters. Mr. Richardson said he did not ask for a loan. The money was a gift for services rendered in connection with the acceptance of the sewage scheme. Defendant's wife corroborated his account. Judge Shortt said he was convinced that the money was given by Mr. Warlow with the corrupt and illegal intention of influencing the conduct and vote of the defendant as a member of the Whitstable Urban Council in respect of Mr. Warlow's sewage scheme, and that it was accepted by Mr. Richardson with a knowledge of plaintiff's intention. The amount could not be recovered. Judgment was entered for the defendant."

**Imperial Services Exhibition.**—A preliminary prospectus has been issued regarding the above exhibition, which is to take place at Earl's Court from May onwards this year. The object of the Exhibition is to show the great advance that has taken place in late years in the scientific preparation for the defence of the Empire by land and by sea. The exhibits will include examples of transport, field cooking, signalling and wireless telegraph equipments. The Empress Hall will be converted into a lake, and electrically-driven models of Dreadnoughts, cruisers, and torpedo boats will manoeuvre thereon. Wireless telegraph and signal stations will be at work.

**Association of Electrical Station Engineers.**—A meeting was held at Birmingham, on Thursday last week, for the purpose of forming a branch of the A.E.S.E. for the Birmingham district. After some discussion, it was resolved not to appoint a Committee at that meeting, but that the secretary be asked to obtain by correspondence and reference to the register of the Association a representative Committee, and that another meeting be called to elect the Committee. All those present promised to make application for membership, and to endeavour to get others to make application. For the time being the affairs of the A.E.S.E. for Birmingham and district are in the charge of Mr. E. A. Gordon, 41, Spencer Avenue, Coventry.

A meeting was held at Grimsby on Friday last for the purpose of forming a branch of the Association. Fourteen gentlemen were present. The meeting was opened by the reading of a letter from the hon. secretary (Mr. Ebben), and, after the aims and objects of the A.E.S.E. had been freely discussed, it was unanimously resolved that a branch be formed for Grimsby and district. A Committee of six gentlemen was appointed, with Mr. W. M. Fowler as hon. secretary. It was decided to hold another general meeting to-day (Friday) to enable those who were on shift during the above meeting to attend.

**Accident.**—Mr. George Widdlake, chief electrical engineer at the Coxside works of Plymouth and Stonehouse Gas Co. met with a nasty accident on Saturday. He was engaged in cleaning a revolver at a bench in the works, when by some means the weapon was discharged and the bullet struck him, grazing a lower rib. He was removed to the South Devon and East Cornwall Hospital, where he is doing well.

**Inquiries.**—A correspondent asks if there is any system of wiring for private houses, which is the permanent property of the tenant and does not become landlord's fixtures. Another correspondent asks for names of makers of small portable power-driven air pumps, capable of producing a vacuum down to about .001 mm. The present makers of the "Niblett" solid accumulator are asked for.

**Appointments Vacant.**—Correspondence clerk, for the Swindon Corporation Electricity and Tramways Departments (£70); installation inspector and tester, for the Birkenhead Corporation Electricity Department (£104); mechanic, for the Science Departments of the University College of North Wales, Bangor (30s.); assistant engineer, for the Burgh Electricity Works, Hamilton (£125). See our advertisement pages in this issue.

**Institution and Lecture Notes.**—**INSTITUTION OF ELECTRICAL ENGINEERS.**—The following are the nominations for election to the Council for 1913-14:—

The names in italics are those of the persons nominated by the Council for the vacancies which will occur on September 30th, 1913. Others remain in office.

President.—*W. Duddell, F.R.S.*  
Vice-Presidents (two vacancies).—*Hon. Sir C. A. Parsons, K.C.B., F.R.S., J. F. C. Snell, W. Judd, C. H. Merz.*

Honorary Treasurer.—*R. Hammond.*  
Ordinary Members of Council.—Members (one vacancy).—*A. L. C. Foll and G. Scott Ram, F. Gill, J. S. Highfield, H. Hirst, B. M. Jenkin, J. E. Kingsbury, Dr. A. Russell, W. Rutherford, A. H. Seabrook, Roger T. Smith, C. P. Sparks, H. E. Wimperis.*

Associate Members (three vacancies).—*F. E. Berry, Captain E. O. Henriot, R. E. A. W. Martin, S. W. Melsom.*

Associates (two vacancies).—*E. Russell Clarke, Francis Ince, A. M. J. Ogilvie, C.B., A. B. Anderson.*

(MANCHESTER SECTION).—A meeting of the Section was held on the 1st inst., when a paper was read by Dr. E. Rosenberg on "Self-Synchronising Machines." An interesting discussion followed, to which the author replied. The annual meeting of the Section will be held next Tuesday, when a lecture will be given by Dr. E. Rutherford on "The Electrical State of the Atmosphere."

**PHYSICAL SOCIETY.**—At the meeting held on March 14th, 1913, a paper on "Some Oscillograms of Condenser Discharges and a Simple Theory of Coupled Circuits," was read by Dr. J. A. Fleming, F.R.S. The author gave a very short method, involving only the simplest algebra for arriving at a formula for the time of free electrical oscillation of a leaky condenser in series with an inductive resistance, the oscillations being damped. Oscillograms taken at low frequency with a Duddell oscillograph were shown, demonstrating the accordance of fact with deductions from the formula. In the same manner the case of coupled circuits was considered, and Dr. Fleming deduced an equation, which showed that there were, in general, oscillations of three frequencies in the circuits. This was confirmed by photographs of oscillograms and diagrams of resonance curves.

A second paper by Dr. Fleming described some Braun cathode ray tubes used as high-frequency oscillographs, and an electrostatic influence machine giving a steady current of 300 to 350 microamperes for working them.

**Prize Competition for a Miner's Electric Safety Lamp.**—The Verein für die bergbaulichen Interessen im Oberbergamtsbezirk Dortmund are offering an award of £1,250 for a miner's electric safety lamp possessing the following advantages:—Unprovocative of explosions, even after having received a blow or damage; useable for 12 hours uninterruptedly; easy to carry, not cumbersome, strong, simple to control, economical; furnished with a gas indicator, like the ordinary oil or benzine lamp; and of a lighting power of 1 hefner after 12 hours' burning. Lamps must be sent in, with explanations in German and drawings, before October 1st, 1913.

**Electricity Works in the Argentine Republic.**—In a leaderette in this issue we refer to the rapid development in Argentina. The following list of cities and towns in which electric light stations exist or for which concessions have been obtained or contracts are pending, has been compiled by the *Review of the River Plate*, and is of some interest in connection with the above:—La Plata, C. de Patagones, Chivilcoy, Dolores, Pergamino, Necochea, Carmen de Areco, Luján, Bahía Blanca, Punta Alta, San Fernando, General Alvear, Coronel Vidal, Campana, Navarro, 24 de Mayo, Saladillo, Chascomis, General Belgrano, Las Flores, Dolores, Azul, Olavarría, La Madrid, Coronel Suarez, Pigué, Concordia, Florencio Varela, Mercedes, Dorrego, Tres Arroyos, Mar del Plata, Balcarce, San Martín, Tandil, Ayacucho, Maipú, Pringles, Suipacha, Bragado, Avellaneda, Lomas, Trenque Lauquen, City of Buenos Ayres, Corrientes, Goya, Monte Caseros, Curuzú, Cuatiá, Posadas, Paraná, Victoria, Concepcion, Gualeguay, Gualeguaychú, Catamarca, Rioja, San Juan, San Luis, Villa Mercedes, Mendoza, Salta, Santiago del Estero, La Banda, Jujuy, Tucuman, Córdoba, Villa María, San Francisco, Bell Ville, Suñio, Santa Fe, Rosario, Coronda, Galvez, Rafaela, Esperanza, Reconquista, San Carlos Centro, Caseros (Buenos Ayres), San Rafael, Pelotas, Colon, General Paz, Capilla del Monte, San Antonio Oeste, San Andres de Giles, 9 de Julio, Trelew (Chubut), Laboulaye (Córdoba), Nogoya, San Justo, Venado Tuerto, Vera (Santa Fe), San Lorenzo, General Villegas, Villa Nueva, San Cristobal, Junin, Merlo, Carcaraña (Santa Fe), General Pico, General Sarmiento, San Martín de los Andes, Alberdi, Cruz (Córdoba), Ramos Mejía, Villa Ballester.

**India.**—A demonstration of certain sources of weakness said to be common to nearly all forms of block instruments at present in use on Indian railways was recently given, at Delhi, by Mr. McCloskey, assistant electrical engineer, B., B. and C.I.R., before a Committee of senior Government Inspectors, representing the Railway Board. Experiments were shown illustrating irregularities in block working by which the Ghaziabad disaster, and many subsequent collisions and potential collisions, may have been caused. Arrangements have been made to give an extensive practical trial to the safeguards suggested.—*Indian Engineering.*

**First Aid in Case of Electrical Burns.**—A commission, representing the American Medical Association, the National Electric Light Association and the American Institute of Electrical Engineers, suggests the following rules as embodying the approved methods for first care of electrical burns:—

"A raw or blistered surface should be protected from the air. If clothing sticks, do not peel it off; cut around it. The adherent cloth, or a dressing of cotton or other soft material applied to the burned surface, should be saturated with picric acid (0.5 per cent.). If this is not at hand, use a solution of baking soda (one teaspoonful to a pint of water), or the wound may be coated with a paste of flour and water. Or it may be protected with a heavy oil such as machine oil, transformer oil, vaseline, linseed, carron or olive oil. Cover the dressing with cotton, gauze, lint, clean waste, clean handkerchiefs or other soft cloth, held lightly in place by a bandage.

"The same coverings should be lightly bandaged over a dry, charred burn, but without wetting the burned region or applying oil to it.

"Do not open blisters."—*Electrical World.*

**Electric Cooking: Australian Development.**—We have at the authority of the *Australian Mining Standard* that remarkable demonstrations have lately taken place in Melbourne of a new system of electric heating and cooking which "allows such economy in current consumption and gives such rapid heating effects that the stove suitable for the average householder, fitted with the new unit heated to 600° within 7½ minutes, turned out a batch of perfectly cooked scones within 17½ minutes of the current being applied." Our contemporary mentions the great simplicity of its construction, and says that "the cheapness of manufacture of the elements will enable the owners of the patents to manufacture at such low costs that a full-sized electrical stove can be sold to the householder at a price approximately that of the ordinary gas stove, and full electrical appliances at similarly low figures. The cost of cooking will be reduced by between 50 and 75 per cent. below any other apparatus at present on the market." We shall await fuller particulars with no little interest.

**Fatalities.**—Alex. Faulds, a Vale of Leven man, in the employment of the Dominion Power Transmission Co., Hamilton, Ontario, was recently killed instantly by receiving a 4,000-volt shock while working on a transformer.

A correspondent says that a young man named Herbert Allen, aged 19, an electrical fitter of Nottingham, was killed at the transforming station at Ushaw Moor Colliery, Durham, on Monday.

**Correction.**—On page 552, in the last paragraph of the article on the "Fixation of Atmospheric Nitrogen," it is stated that 1 kw. should suffice to "fix" 100 kg. of nitrogen per annum, but that in practice little over 400 kg. are obtained; these figures should be 1,000 and 4,000 respectively.

**Killed by Lightning.**—At an inquest held at Keigate on Mrs. Charlotte Oxley, according to a son's evidence, the deceased was preparing for church when there was a flash of lightning; witness heard a fall, and found his mother on the floor. Dr. Watson said there were no external marks, but an examination revealed several bruises on the skull bone, small hemorrhages on the surface of the brain, and a larger one at the base. The lightning must have caused death, the current passing through deceased without injuring the skin. A verdict in accordance with the medical testimony was returned.

**The Aberdeen Slander Action.**—A correspondent says that it is understood that the action raised by Mr. James Alexander Bell, electrical engineer of the City of Aberdeen, against Mr. Alfred Edward Milne, solicitor, Aberdeen, hon. secretary of the Aberdeen branch of the Electrical Contractors' Association of Scotland, for £1,000 damages for alleged slander, will come up for proof in the Court of Session on June 21th. Lord Hunter recently adjusted the issues for trial by jury.

**Alleged Fraud.**—The charge against H. G. Mönige, an electrical engineer, reported in our last issue, was before the Marlborough Street Police Court again the other day, when, according to the *Morning Advertiser*, it was urged by counsel in defence that there was no case against his client, as by the terms of the agreement the defendant was a partner in the firm. He contended it was not a *bona fide* prosecution. Mr. Denman thought it was a case for a jury to decide. He would express no opinion on its merits. Mr. Lewis said the defendant bore an irreproachable character, and he submitted that no jury would convict. Mr. Denman committed the prisoner for trial, allowing bail in the sum of £30.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—On Sunday, March 30th, the staff of the Wolverhampton Corporation electricity department met at the Commercial Road Works to wish farewell to the retiring chief, MR. C. E. C. SHAWFIELD. After being photographed, the party moved to one of the offices, where Mr. Shawfield was presented with a solid silver salver, suitably inscribed, which had been bought by subscriptions from the whole of the staff. Speeches were made by several members of the staff, who wished Mr. Shawfield every success in his new undertaking, and expressed their great regret at losing him. More than one speaker said that the only fault he had to find with Mr. Shawfield as chief, was that he had been unable to use the profits of the undertaking to bring salaries and wages up to a reasonable level, rather than to hand them over for the relief of rates. In reply, Mr. Shawfield thanked those present for their kind appreciation, and said that he and Mrs. Shawfield, who had always taken the keenest interest in the work of the department and in the staff, would consider the salver one of their most treasured possessions, not only for its intrinsic value, but chiefly for the good feeling which prompted the gift. He referred to the development of the department since its commencement, and gave accounts of amusing incidents which occurred in its early days. He expressed the opinion that it was to be regretted that any money had been paid over to the relief of the rates, as he thought it was not in the best interests of the department; or the town as a whole, that the profits of a trading undertaking should be used for this purpose. He thought that the first call on the profits of the undertaking should be to improve the status of employment, as the success or otherwise of the department depended, to a very large extent, on the efforts of those employed therein; any surplus beyond this should go to reducing the price of current to the consumers. However, Mr. Shawfield said that the chief of a department had not a free hand in the matter of salaries and wages, but that he, in turn, had to carry out the instructions of his employers—the municipality. He also imparted the information that he would not be leaving the town—at any rate, for a few years—and thus hoped still to keep in touch with those with whom he had been associated for so long a period.

Out of 134 applicants, MR. R. B. LEACH, electrical engineer to the Turton District Council, has been appointed electrical engineer and tramways manager to the Heywood Corporation, at £200 per annum.

We regret to learn that MR. A. A. DAY, borough electrical engineer, Bolton, who has been staying at the Cleveley's Hydro, Blackpool, had another seizure last week end. His medical adviser was summoned, and Mr. Day's condition caused considerable anxiety. Mr. Day was seized with sudden illness whilst on the train at the beginning of last September, when he was commencing his holidays, and he has not been himself since.

MR. J. E. STARKIE, Burnley's electrical engineer, is suffering from a nervous breakdown, and has been advised to spend some time at St. Anne's.

Through a mishap at the Accrington generating station on March 27th, MR. ERNEST HALL, charge engineer, sustained serious injuries. The cause of the accident is not known, but Mr. Hall was found in a sluice in connection with the gas generating plant. He was taken to hospital, where it was discovered that he had badly injured his head and fractured an arm.

MR. W. G. COATH, who has been on the staff of the Newton Abbot Electricity Works for the past 33 years, was on Friday last presented with a handsome case of instruments by members of the staff, on the occasion of his departure to Swindon. The presentation was made by the resident engineer, Mr. G. E. Smith.

MR. THOMAS D'ARCY NASSAU, who is at present resident engineer to the Honiton and District Electric Supply Co., Ltd., has been appointed resident engineer and manager to the County of Dorset Electric Supply Co., Ltd.

At a special meeting of the Lowestoft Town Council on Tuesday, MR. W. H. MAY, who has been assistant engineer at the Corporation Electricity Works for 10 years, was appointed borough electrical engineer (in the place of Mr. G. A. Bruce resigned) at a salary of £250 a year, rising to £280 by annual increments of £10. MR. H. H. SAUNDERS, chief accountant in the Borough Tramways Department, was appointed general manager of the electric light and tramways undertakings, at a salary of £250 a year, increasing to £250 by increments of £10 per annum.

MR. R. H. LEE has resigned his position of junior engineer at the Fulham Electricity Works, in order to take up the post of junior shift engineer at the Borough of Islington Electricity Works.

**General.**—MR. E. P. BENNETT has been transferred from the sales department of the London office of Simplex Conduits, Ltd., to take up the position of manager at their Liverpool branch.

MR. EDWARD ALFRED GIMMINGHAM, M. LEE and MR. CHARLES ERNEST HONTER, the works managers of the lamp and engineering departments respectively of the Edison & Swan United Electric Light Co., Ltd., have been elected to seats on the board of the company.

MR. J. P. MURKLEJOHN, who has been works manager with Messrs. Grindlay, Ross & Co., of Glasgow, has been appointed chief assistant engineer to the Penarth Electric Lighting Co., Ltd.

The marriage took place last week at Bargoed of MR. T. S. THOMAS, electrical engineer, of Ystradgynlais, and Miss Mabel Clement, daughter of Mr. H. Clement, of Bargoed.

MR. G. GILKES, of Messrs. G. Gilkes & Son, turbine makers, of Kendal, has been re-elected an alderman of Westmorland County Council.

The marriage took place on March 27th at Wellingborough of MR. THOMAS JAMES LARGE, electrical engineer, of the staff of Messrs. Belliss & Moreom, of Birmingham, and Miss Jessie Gadsby, youngest daughter of Mr. W. K. Gadsby, of Brigstock.

MR. WATSON, of Messrs. W. G. Watson & Co., Ltd., Sydney, will be in England, Europe, and the United States, toward the middle of the year in connection with the opening up of a London office of the company.

MR. A. B. SCORER has joined the board of Messrs. Meldrums, Ltd., who have moved their London office to 92, Grosvenor Road, Westminster, S.W.

MR. HERBERT LAWS WEBB has removed from 35, Old Queen Street, S.W., to 104, Victoria Street, Westminster, S.W.

Congratulations and good wishes to MR. and MRS. LEONARD G. TATE. The marriage of the secretary of the Electrical Contractors Association was to take place at Richmond Parish Church yesterday. We regret having to mingle our congratulations with condolences, for we read in the *Electrical Contractor* that Mr. Tate's mother passed away a few days ago.

**Obituary.**—MR. J. PARKER.—The death occurred suddenly, at Blackpool, on Saturday, of Mr. John Parker, who had a long connection with the firm of E. Green & Co., Ltd., engineers, of Manchester and Wakefield. He was in his 76th year.

MR. G. HUMPHREY.—The death is announced, at the age of 65 years, of Mr. Geo. Humphrey, head of the firm of Geo. Humphrey and Co., electrical and general engineers, of High Street, Sevenoaks.

## NEW COMPANIES REGISTERED.

**Rio Grandeuse Light and Power Syndicate, Ltd. (127,761).**—Registered March 14th, by S. Morse, 1, Kingsway, W.C. Capital, £100,000 in £1 shares. Object: To carry on the business of suppliers of electric gas for lighting, heating, motive or other power, etc., in Brazil and elsewhere, to adopt agreements (1) with Emilie Gullayn giving an option of purchase of the electric light undertaking in the town of Baga, State of Rio Grande de Sul, Brazil; (2) an agreement with Buxton, Cassini & Co. for sale and purchase of a concession for the exploitation of electric tramways, power and light service in the City of Pelotas, in the said State; (3) an agreement with the British Electric Traction Co., Ltd., appointing them the company's London agents; and (4) with Buxton, Cassini & Co., appointing them the company's local agents in Pelotas. The signatories (with one share each) are:—Emilie Gullayn, Salisbury House, E.C., banker; T. Bower, Electrical Federation Offices, 1, Kingsway W.C., secretary. Private company. The directors are to number not less than three or more than five. The Articles of Association specify that the first directors shall be Senor Emilie Gullayn and one to be nominated by the British Electric Traction Co., Ltd. A copy of register of directors filed at same time names Senor Gullayn and Charles H. Dade (of 1, Kingsway W.C.) as the directors. Registered office, Electrical Federation Offices, 1, Kingsway, W.C.

**Barton-on-Humber Electric Supply Co., Ltd. (127,760).**—This company was registered on March 14th, with a capital of £20,000, in £1 shares, to carry on the business indicated by the title, and to adopt an agreement with F. Hopper. The subscribers (with 100 shares each) are:—F. Hopper, Elm Tree House, Barton-on-Humber, cycle manufacturer; J. B. Tomblson, Westfield, Barton-on-Humber, brick and tile manufacturer; H. Wilson, The Hall, Barton-on-Humber, solicitor; H. Pigott, Eagle House, Barton-on-Humber, managing director; J. Barraclough, Westfield Road, Barton-on-Humber, shipowner; W. H. Blyth, Highfield, Barton-on-Humber, brick and tile manufacturer; J. C. Lee, George Street, Barton-on-Humber, pharmacist. Minimum cash subscription, £3,000; the number of directors is not to be less than three or more than seven; the first are F. Hopper, J. B. Tomblson, H. Wilson, H. Pigott, J. Barraclough and W. H. Blyth; qualification, £100; remuneration as fixed by the company. Solicitors, Nowell & Son, Barton-on-Humber. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**Reform Lighting Co., Ltd. (127,911).**—This company was registered on March 20th, with a capital of £3,000 in £1 shares, to take over the business of electric lamp manufacturers carried on as the "Reform Lighting Co." The subscribers (with one share each) are:—G. W. Lomas, 26, Moore Street, W., clerk; T. Rowson, 14, Harcourt Street, Marylebone, W., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by Pakemah, Son & Read, 11, Ironmonger Lane, E.C.

**Frank Tomey & Co., Ltd.** (127,769).—This company was registered on March 14th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers and dealers in glass, electric lighting, electric lamps, Hötting ray and glass bulbs, &c., to acquire the business carried on by F. S. Tomey & J. Kent at the Borough Glass Works, Victoria Road, Aston, Birmingham, and at 66, Hatton Garden, E.C., as Frank Tomey & Co. The subscribers (with one share each) are:—F. S. Tomey, 140, Victoria Road, Aston, Birmingham, manufacturer; J. Kent, Kenmore, Green Lane, Palmer's Green, manufacturer. Private company. The number of directors not to be less than two or more than five; the first are F. S. Tomey (permanent managing director) and J. Kent; remuneration, £14 each per month. Solicitors, Botteley & Sharp, 104, Colmore Row, Birmingham. Registered by Jordan & Sons, Ltd., 116 117, Chancery Lane, W.C.

**Southern Brazil Electric Co., Ltd.** (187,856).—Registered March 14th, by Linklater & Co., 8, Bond Court, Walbrook, E.C. Capital £1,000,000 in £1 shares. Objects: To acquire shares, debentures, and other securities of any interests or participations in any companies, corporations, or firms carrying on tramway, light and power, waterworks, sewage and drainage construction business, or the business of carrying out local improvements or any of such businesses, or similar thereto, in Brazil or elsewhere, to carry on business as electrical and hydraulic engineers, &c., and to adopt agreements (1) with A. J. Byington and (2) with the Parana Power Syndicate, Ltd. (vendors) for the acquisition of shares, properties, businesses and rights referred to therein. The signatories (with one share each) are: E. A. Fellows, 1, Cornhill, E.C., stockbroker; F. E. O. Toombs, 1, Cornhill, E.C., stockbroker; H. Phillips, 1, Cornhill, E.C., clerk; D. J. Piria, 1, Cornhill, E.C., clerk; E. Fisk, Lotherfield, Tadworth, Surrey, clerk; G. Barnard, 48, Carrington Road, Golder's Green, N.W., clerk; T. F. Lyon, 21, Rumney Road, Brixton, clerk. Minimum cash subscription seven shares. The directors are 11 in number, not less than two or more than ten. A letter addressed to the Registrar says "that no directors have yet been appointed nor have any persons yet consented to act," but the articles of association state that the first directors of the company are all nominees of the vendor syndicate or directors or shareholders thereof or otherwise interested therein. The directors are authorised to pay to the said A. J. Byington the cash purchase price payable to him on the terms of the agreement with him and to allot to him or his nominees the 600,000 fully paid shares of £1 each, which are to be allotted under the terms thereof, and to pay to the vendor syndicate the cash purchase price payable to them under the terms of the agreement with their syndicate, and in addition to allot to the syndicate, or its nominees, the 399,999 fully paid shares of £1 each, which are to be allotted pursuant to the terms of the said agreement. Remuneration as fixed by the company.

**Electric Zinc Co., Ltd.** (127,838).—Registered March 14th, by Burchells, 5, The Sanctuary, Westminster. Capital £3,000,000 in £1 shares (400,000 preferred). Objects: To acquire, work, and exercise patents, inventions, and secret processes for the production of zinc and other metals from their ores, slimes, or other compounds by the application of electricity or otherwise, to grant licences in respect thereof; to carry on the business of electricians, electrical and mechanical engineers, and contractors, suppliers of electricity, contractors of and dealers in all kinds of apparatus and things required for or capable of being used in connection with the generation, distribution, supply, accumulation, and employment of electricity, winners and workers of electrical, miners, smelters, mining chemists, dealers in minerals, plant, and machinery, &c. The signatories (with one share each) are:—J. A. Braik, 20, Cambridge Road, Wimbledon, accountant; W. A. French, 171, Carlingford Road, Tottenham, N., cashier; A. B. Lambert, 32, Bleinheim Gardens, Walsington, solicitor; C. Vince, Croxford, Elm Park Gardens, Barnes, E.W., clerk; C. Hendy, 5, Marylebone Road, W., solicitor; W. W. Barnes, E.W., clerk; E. G. Robinson, 18, Thornhill Square, Bartsbury, N., clerk; D. A. Dennis, 8, Lucerne Road, Thornton Heath, clerk. Minimum cash subscription, seven shares. The first directors (to number not less than two or more than 10) are to be appointed by the signatories, and shall be entitled to remain in office until the close of the ordinary general meeting for the year 1915; qualification (except first directors, who require none), £250; remuneration (except managing directors) not less than £30 each per annum (chairman £200 extra). The preference shares shall confer the right to a fixed cumulative preferential dividend at the rate of 7 per cent. per annum on the capital paid thereon, subject to the rights of the said preference shares to such dividend. The ordinary shares shall be entitled to be paid out of the surplus profits of each year available for dividend, divided at the rate of 7 per cent. per annum for that year on the amount credited as paid up on the ordinary shares held by them respectively. The residue of the surplus profits of each year available for dividend, shall belong to and be divided among the holders of the preference and ordinary shares proportionately. Registered office, 5, The Sanctuary, Westminster.

**Eastern Electric Co., Ltd.** (127,767).—This company was registered on March 14th, with a capital of £2,000 in £1 shares, to take over the business of electrical dealers and manufacturers, carried on as the Eastern Electric Co., and to adopt an agreement with C. E. H. Walter and C. Midworth. The subscribers (with one share each) are:—C. E. H. Walter, 11, Queen Victoria Street, E.C., civil engineer; C. Midworth, 11, Queen Victoria Street, E.C., electrical engineer. Private company. The first directors are C. E. H. Walter and C. Midworth (both permanent). Registered office, 11, Queen Victoria Street, E.C.

**"Der" Trading Syndicate, Ltd.** (127,871).—This company was registered on March 14th, with a capital of £1,000 in £1 shares, to deal in electric light and other lamps and globes, wires and other accessories and fittings; to manufacture electric and other clocks, accumulators, &c., and to adopt an agreement with R. B. Gault, 23, Young Street, Kensington. The subscribers (with one share each) are:—A. E. Derry, 217, King's Road, Chelsea, S.W., gentleman; J. R. Gault, 148, Fellows Road, Hampstead, N.W., gentleman; Dr. S. G. Rumschisky, 117, Clifton Hill, N.W., private company. The number of directors is not to be less than two or more than five; the first are A. E. Derry, J. R. Gault, and Dr. S. G. Rumschisky. Registered by Shephards & Walters, 23, Young Street, Kensington, W.

**Shipton Electrical Co., Ltd.** (128,010).—This company was registered on March 28th, with a capital of £3,500 in £1 shares (1,000 preference) to take over the business of an electricity supply works carried on at Camden Road, near the Bull's Head, Worcester. The subscribers (with 10 shares each) are:—F. E. Brown, 63, Parade, Leamington Spa, electrical engineer; J. M. Herman, 10, Rosefield Street, Leamington Spa, engineer. Private company. The first directors are F. E. Brown (permanent) and F. Jones, with power to appoint one other before the general meeting in 1911; qualification, £150. Registered by Alfred H. Atkins, Ltd., 27-8, Fetter Lane, E.C.

**Chalmers, Ltd.** (N. 590).—This company was registered in Edinburgh on March 26th, with a capital of £2,000 in £1 shares, to carry on the business of electrical engineers and manufacturers. The subscribers (with the share each) are:—E. L. A. Bostock, 6, Borehead Terrace, Glasgow, electrical manager; A. Campbell, Kilmory, Kilmacoll, solicitor. Private company. The number of directors is not to be less than two or more than five; the first are E. L. A. Bostock and A. Campbell; qualification, £1. Registered office, 118, West Regent Street, Glasgow.

**Headcorn and Maidstone Light Railway Co., Ltd.** (128,000).—This company was registered on March 26th, with a capital of £10,000 in £1 shares, to construct, work and maintain a railway, light railway, tramway, tramroad or other permanent or semi-permanent way from Headcorn to Maidstone, Kent. The subscribers are:—F. G. Lamborn, 44, Regent Street, Hastings, Hastings, solicitor, 1 share; W. G. Scott, Sandrook, Athelstan Road, Hastings, 1 share; E. H. Langham, 41, Robertson Street, Hastings, solicitor, 1 share; H. F. Stephens, Balford Terrace, Tonbridge, civil engineer, 100 shares; W. A. Wardle, 6, Pump Court, Temple, E.C., barrister, 100 shares; A. E. Strick, 172, Athelstan Road, Hastings, clerk, 1 share; A. E. Wilkes, 2, Lorne Villas, Harold Road, Hastings, clerk, 1 share; J. H. M. Birtles, 4, Birmingham Terrace, Hastings, clerk, 1 share. The number of directors is not to be less than three or more than five, are F. G. Langham, H. F. Stephens and W. A. Wardle; remuneration, £10 each per annum. Registered office, Balford Terrace, Tonbridge.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**London and Suburban Traction Co., Ltd.**—Trust deed, dated February 25th, 1913, to secure £550,000 4½ per cent. first mortgage debenture stock, charged on £61,781 fully paid £1 6 per cent. cumulative preference and 492,627 fully paid £1 ordinary shares in Metropolitan Electric Tramways, Ltd.; 72,684 fully paid £10 5 per cent. cumulative preference and 96,534 fully paid £10 ordinary shares in London United Tramways, Ltd.; 200,000 £1 shares (1s. 6d. per share) in the Tramway (M.E.T.) Omnibus Co., Ltd., and all further shares (if any) of any class in such companies acquired within three months. Trustees: Parr's Bank, Ltd., 4, Bartholomew Lane, E.C.

**Electric Ozone Syndicate, Ltd.**—Capital, £12,000 in £10 shares; return dated November 19th, 1912 (filed January 8th, 1913); all shares taken up; £11,930 paid, leaving £70 in arrears. Mortgages and charges: £9,572 16s. 5d.

**Central Electric Supply Co., Ltd.**—Capital, £100,000 in £5 shares; return dated February 18th, 1913 (filed February 25th); all shares taken up; £104,000 paid. Mortgages and charges: £450,000 4 per cent. guaranteed debenture stock.

**Lamp Manufacturing Co., Ltd.**—Capital, £10,000 in £1 shares; return dated February 16th, 1913 (filed February 21st); 5,400 shares taken up; £5,400 paid. Mortgages and charges: £2,500 debentures.

**Melbourne Electric Supply Co., Ltd.**—Trust deed, dated March 7th, 1913, to secure 5 per cent. debenture stock for an amount not exceeding £500,000 or the amount of the issued share capital for the time being, whichever is greater, charged on company's undertaking, and assets, present and future, subject to first mortgage debenture stock, except uncalled or unissued capital and sums placed to dividend equalisation account. Trustees, Electric and General Investment Co., Ltd., 1 and 2, Great Winchester Street, E.C.

**Adelaide Development Co., Ltd.** (64,393).—Capital, £42,500 in £10 shares. Return dated December 31st, 1912. All shares taken up. £10 per share called up on 3,700 and £3 on 220 shares. £37,750 paid. £9,000 considered as paid on 300 shares. Mortgages and charges: Nil.

**Rangoon Electric Tramway and Supply Co., Ltd.**—A memorandum of satisfaction, the extent of £5,466 on March 14th, 1913, of debenture stock dated February 1st, 1906, and December 22nd, 1908, securing £250,000, has been filed.

**South London Electric Supply Corporation, Ltd.**—Issue on March 4th, of £300 debentures, and on March 18th, 1913, of £600 debentures, parts of a series of which particulars have already been filed.

**Fraser & Chalmers, Ltd.**—A memorandum of satisfaction on various dates from March 21st, 1912, to February 20th, 1913, of debentures for £22,100, in respect of which a statement under Sec. 12 of the Companies Act, 1907, was filed on October 8th, 1908, part of a series of £350,000 6 per cent. debentures, secured by a mortgage dated June 30th, 1898, has been filed.

**S. Burnett & Co., Ltd.** (89,565).—Capital, £2,000 in £1 shares (1,000 pref.). Return dated March 10th, 1913. 950 ord. and 757 pref. shares taken up. £1 per share called up on 757 pref. and £1 5s. on 200 ord. £1,007 paid. £750 considered as paid on 750 ord. shares. Mortgages and charges: Nil.

**St. James' and Pall Mall Electric Light Co., Ltd.** (26,015).—Capital, £300,000 in £5 shares (20,000 pref.). Return dated March 4th, 1913. All shares taken up. £5 per share called up on \$9,650 ord. and 23,000 pref. £298,250 paid. £1,750 considered as paid on 350 ord. Mortgages and charges: £150,000 3½ per cent. deb. stock. £125,000 4 per cent. guaranteed deb. stock of the Central Electric Supply Co., Ltd., being half the total loan capital.

**National Electric Engineering Co., Ltd.** (62,605).—Capital, £5,000 in £1 shares. Return dated December 31st, 1912. 2,659 shares taken up; £651 paid; £2,005 considered as paid. Mortgages and charges: Nil.

**Walsall Electrical Co., Ltd.**—Mortgage on freshhold property, Nos. 57, 63, Bridge Street, Walsall, &c., dated March 7th, 1913, to secure all moneys due or to become due from the company to London City and Midland Bank, Ltd.

## CITY NOTES.

### Rhondda Tramways Co., Ltd.

The annual meeting of this company was held at the offices, 3, Laurence Pountney Hill, E.C., on March 13th, Mr. L. B. Schlesinger presiding. Our reporter was informed that the meeting was private, but he was subsequently granted permission to see the chairman's speech. This showed that after providing for interest on debentures and loan, redemption of debentures, rent of the Rhondda U.D.C., and depreciation, there was a balance of £2,778 on the year's working, plus £1,198 brought forward. Out of this, £2,000 had been added to the reserve and renewals account, bringing it up to £10,000, and leaving £1,976 to be carried forward. During the coal strike their receipts dropped from between £400 and £1,000 per week to as low as £594, and the weekly receipts following the termination of the strike were £736, £832, £971, £947 and £1,064, but, unfortunately, just before Whitsuntide their own employés were smitten with the strike fever, and put forward extraordinary demands in the form of an ultimatum, which demands, however, after careful consideration by the directors, it was decided could not, in the interests of the shareholders and the future welfare of the company, be entertained. The undertaking was closed down for about a month, but no damage was done to the company's property, and as events turned out, the directors' action was fully justified. At the request of the chairman of the Rural Council, who had been approached by the men, Mr. Cowrie was asked to meet the men's committee at Perth, and this he did, with the result that on the following day the strike was at an end, the men returning to work on the old terms. As 25 new hands had in the meantime been taken on, 25 of the old hands had to stand down

although within a short time the manager was able to offer them employment. Unfortunately, however, as the strike occurred just before Whitsuntide, one of their biggest weeks, the company was hit pretty heavily; for instance, during Whitsuntide week they certainly looked to take receipts up to about £2,000, but they only got one day, and their receipts were £108. Although the undertaking was closed down, a considerable portion of their expenditure still ran on, and he thought the directors were on the safe side in stating in the report that the profits suffered to the extent of £5,500 owing to the coal strike and the strike of their employees. It was mentioned in the report that the receipts for the six months to December 31st last amounted to £30,000, as compared with £19,700 for the previous six months. The extensions which were opened helped the receipts, and judging from the results already obtained, the original traffic estimates from the extensions would be thoroughly justified, and he would not be surprised if this year their traffic revenue exceeded £60,000, provided no further labour troubles were experienced. He thought, however, that both masters and men had had enough of these disputes, and that every effort would be made to keep the peace. The directors, however, did not represent philanthropists, but investors, who naturally looked for a fair return upon their capital. Although further debentures to the amount of £10,000 were only issued in November, 1912, and interest on them paid from that date, he could point out that until then they financed the construction of the extensions by loan from the bank, on which interest had to be paid. The report referred to a Bill which was being promoted to construct a railless traction system to serve a very important colliery district within a few miles of their terminus at Williamstown. There were some 16 pits being sunk, and it was estimated that within the course of a few years the population to be served would have increased from approximately 14,000 to over 50,000. They were asked by the manager of the collieries in question to provide travelling facilities for the miners, and, after studying the scheme, they came to the conclusion that if powers could be obtained on reasonable terms, the scheme would be a profitable one for the company, and would bring considerable extra traffic over the tramways. The capital account now stood at £364,200, an increase of £35,581. The discount on debentures issued to cover the cost of the extensions had been added to the account, and after deducting the debentures redeemed, the amount was £21,400, compared with £19,800 for last year. To-day they had at the bank and on loan £15,000, so that as regarded finance the company was in a strong position. Turning to the revenue account proper, comparison with the revenue account for 1911 was impossible, having regard to the troubles already referred to. The speaker referred to a number of items. Traffic expenses amounted to £9,953, as compared with £10,315, the decrease being due to the strike. General expenses amounted to £7,336, compared with £6,786, a small increase. Repairs and maintenance amounted to £4,859, as compared with £4,226, the increase being largely due to repairs on cars, which were overhauled and repainted. Traffic revenue was £49,778, an increase of £1,561, which was very gratifying under the circumstances. While the results must be unsatisfactory to the shareholders, they were satisfactory to the directors, considering the troublesome experiences of the year, which no foresight on their part, or on the part of the management, could have prevented. A word of praise was due to the manager, Mr. Nesbitt, for the manner in which he had handled the business throughout the year, and particularly during the strike. The thanks of the shareholders were due to Mr. Barnett for his numerous visits to Rhondda on behalf of the board. It was, of course, a great regret to the directors that they were unable to recommend a dividend, but a careful study of the results, together with the opinions that he had been able to give them, would only lead to one conclusion, viz., that they had in the Rhondda Tramways a valuable undertaking with great potentialities, and all that was wanted to obtain a satisfactory return upon their capital, was peace in the labour world. Their traffic receipts from January 1st to March 12th were £11,004, as compared with £9,163, or an increase of £1,841.

Mr. J. T. JERVIS seconded the motion, which was adopted.

**Browett, Lindley & Co., Ltd.**—According to the *Financial News*, the gross profit for 1912 was £5,253. After deducting £2,191 for bank and debenture interest, and £5,019 for depreciation, there remains a loss on the year's working of £1,965, making, with the former adverse balance, a present debit to profit of £17,562. The adverse trading is attributed to low prices for contracts, the continuous rise in the cost of materials, increased wages, and the coal strike. The directors state that the orders now on the books are at better prices. The preference dividend remains paid since December, 1901.

**Oriental Telephone and Electric Co., Ltd.**—At the annual meeting on 30th inst. (subject to final audit) the directors will recommend the following dividends:—At the rate of 6 per cent. per annum on the preference shares for the half year ended December, less income-tax; a final dividend of 7 per cent. on the ordinary shares issued, free of income-tax, making a total of 10 per cent. for the year. The share transfer books will be closed from April 17th to 30th, inclusive.

**Continental Note.**—SWITZERLAND. — La Société d'Electricité d'Altoth, of Basle, which has a working arrangement with Messrs. Brown, Boveri & Co., of Baden, is declaring a dividend of 4½ per cent. for the last financial year, the same as for the preceding 12 months.

### Arbroath Electric Light and Power Co., Ltd.

At the fifth annual meeting, held on Friday, Mr. George Balfour presided. The report showed that the profit for the year amounted to £1,440, plus £856 brought forward while £170 had to be deducted for interest leaving a balance of £2,126. The directors proposed to apply to reserve and renewal funds £500, for dividend at 3 per cent. on preference shares, £180 in payment of dividend at 3 per cent. on ordinary shares, £684 and to carry forward £922 subject to deduction of directors' and auditors' fees. The general business of the company was steadily extending and there had lately been a large and increasing demand for power. In view of this, the directors had resolved to enlarge the plant at the electric station and the additions would be carried out during the course of the present year.

Mr. BALFOUR referred to the increase in capital from £20,000 to £10,000, which had been divided into 1,000 preference shares and 25,000 ordinary shares. He pointed out that with the issue of preference shares there was no likelihood of it ever being necessary to issue debentures, as the preference shares would provide approximately the amount required for repaying existing loans and providing for increasing the plant capacity at the power station by approximately 130 per cent. of the existing plant. The directors had resolved during the coming summer to install additional generating plant. Power-users in this country had only recently wakened up to the great advantage of electricity for power purposes, and this was particularly noticeable in Arbroath, as the company had secured the leading engineering and manufacturing firms as consumers for driving the whole of their works. The prospects of the company were exceedingly bright, and but for the increased price of coal, which materially affected costs during 1912, the results shown, excellent as they were, would have been still better.

The motion adopting the report and accounts, and declaring a dividend of 3 per cent. on the ordinary shares was unanimously carried.

### Provincial Cinematograph Theatres, Ltd.

—This company held its annual meeting on Tuesday at the Holborn Restaurant. The report showed receipts from theatres for the year amounting to £198,702, and the trading profit £80,355, an increase of £32,250 over 1911. After providing for debenture interest and redemption, preferred dividend, depreciation, writing off preliminary expenses, and issue of preference shares, and carrying £5,000 to reserve, the ordinary dividend is 20 per cent., and there is a bonus of 4 per cent. upon debentures. The company is going to issue 200,000 7½ per cent. cumulative "B" preference shares of £1 each for redeeming the debentures and extending the business, including the erection of new theatres in Edinburgh, Portsmouth, Newcastle and elsewhere, and the enlargement of existing ones.

### Braunton Electric Light and Power Co., Ltd.

—The first annual report of the directors congratulated the shareholders upon the success attained. The net revenue account showed a profit of £81, and the directors recommended payment of a dividend of 5 per cent. (less income-tax) on the cumulative preference shares from October 1st, 1911, which would amount to £29, writing £30 off the formation expenses, and carrying forward £21. Mr. T. Yeo, C.C. (chairman of directors), who presided, said the capital authorised to be raised was 5,000 £1 shares, divided into 1,000 5 per cent. cumulative preference shares, and 4,000 ordinary shares, each of £1, and the amount of capital issued totalled £3,250 of fully paid shares. That, he said, was found not quite sufficient for the whole matter, but the directors did not feel there was any necessity for the calling up of extra capital, thinking it better to raise a certain amount out of revenue account. So far as they could see, their present machinery, equipment and capital in hand, would be sufficient. He moved the adoption of the accounts, and observed they had good reason to be gratified at the first year's results. The report was adopted.

### Wemyss and District Tramways Co.—Mr. Geo.

Balfour, of Balfour, Beattie & Co., moved the adoption of the report at the annual general meeting on Saturday. He intimated that it was the intention of the directors to double the line by degrees until the whole service was lined up. Councillor Barrow, Leven, who seconded, drew attention to the congestion which existed in the service, and also asked when the electric cable would be laid through Leven. Mr. Balfour said he was afraid they could do nothing with the congestion until the whole line was doubled and double-decked cars were run. The report was adopted.

### Newmarket Electric Light Co., Ltd.—Mr. F. E.

Gripper presided at the annual meeting of this company, and said that the revenue had increased during the year by £300, and the expenses by £158. The coal bill had advanced by £95. The report was adopted.

### Kalgoorlie Electric Power and Lighting Corporation,

Ltd.—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the six months ending March 31st, 1913, payable April 28th.

### Lancashire Dynamo and Motor Co., Ltd.—The

*Financier* states that the directors have declared a dividend at the rate of 10 per cent. on the ordinary shares, making 7½ per cent. for the year, placing £6,000 to reserve fund, and carrying forward £1,634.

### Folkestone Electricity Supply Co., Ltd.

THE annual meeting was held on Thursday last week. ALDERMAN SPURLEN, J.P., who presided, in moving the adoption of the report, said they had had a very fair year's work. There had been an increase in the receipts of £1,417, and if that had stood alone they would have had a good year. It was, however, neutralised by the fact of the increased cost of £1,873, which put them £456 on the debit side. The increased cost of coal owing to the strike had been £1,128. As he told them last year, the mine-owners, owing to the unrest of the miners, were cautious about entering into contracts, and, unfortunately, they were caught just at a bad time, and their coal worked out at 3s. 4d. per ton more than in the previous year; but they had made a saving in the amount of coal per unit. They were looking forward to the time when the Kent coalfields were developed and when they would be able to get a supply in their own neighbourhood. Personally, he was very hopeful that, in another 18 months, they would get their supply from the Kent coalfields. Rates and taxes had also increased considerably, and the national taxes, with the National Insurance Act, represented an increase of £216. They had, however, written off £6,073 on depreciation account, and that fund now stood at £28,573, and in addition to that they had carried £4,100 to reserve fund. Shareholders might say that £2,000 depreciation fund was very large. All their plant in active use was in excellent order, but new machinery was constantly being brought out, and they might find it imperative some day to get rid of some of the present machines and introduce others of a newer type. They had had a good year so far as new lamps were concerned. They had put in 7,104, as against 6,100 last year, and they had 189 more consumers. There were no bank charges, as they had a deposit of over £10,000, and altogether things looked very hopeful. He moved the adoption of the report and that a dividend of 6 per cent. be paid for the half-year, making 6 per cent. for the whole year, less income-tax.

ALDERMAN PENFOLD seconded, and it was carried.

### Tynemouth and District Electric Traction Co., Ltd.

MR. H. S. DAY presided on 26th ult. at the Electrical Federation Offices, Kingsway, W.C., over the annual meeting of this company.

The CHAIRMAN, in moving the adoption of the report, said that the total revenue for the year amounted to £13,661, a decrease of £508 compared with 1911, and after deducting all expenses chargeable to revenue, including £1,000 for renewals, and writing off a loss of £278 on the sale of consols, there remained a surplus on the year's working of £4,377, which, with £551 brought forward from last account, made an available balance of £4,929. The directors had placed £1,250 to reserve, and recommended a dividend of 5 per cent. on the cumulative preference shares and 4 per cent. on the ordinary shares, and that £297 be carried forward. With the sum recommended this year the renewals and reserve funds of the company would amount to £19,502. Trade during the year at Tynemouth was very unsettled, owing to the coal strike in the first portion of the period, and the strike of railway men on the North-Eastern Railway later, but a better condition of affairs now existed, and he thought the present year would show an expansion of the improvement. He was pleased to say that so far their net position this year compared most favourably with the same period of 1912. They had carried 1,992,000 passengers during the year, as compared with 2,093,000 in 1911, a decrease of 101,000. This decrease was entirely due to the bad weather experienced during the summer. The average traffic receipts per passenger, 1'3d., remained the same, chiefly due to the increased fares put in force during the year, whilst the average expenditure per passenger, 8'7d., also remained the same. The proportion of expenses to receipts, 56 per cent., remained the same, whilst the number of car-miles run had decreased by 3,379. The negotiations with the Tyneside Corporation for an extension of the line to Preston Village was still proceeding, and it was hoped that satisfactory terms would be arranged for carrying out the work of construction. The junction formed with the Tyneside Tramways and Tramroads Co. with the tramways of the Tynemouth Co. in North Shields for the purpose of improving the interchange of traffic between the two companies had proved satisfactory.

MR. S. J. SOMERVILLE seconded the motion, and the report was adopted without discussion.

**American Telephone and Telegraph Co.**—The directors' report for 1912, which has appeared in the financial papers in abstract during the past week, shows that the net earnings were \$37,907,644 an increase of \$4,606,398 over 1911. The interest charges were \$5,844,099, and the dividends, at the regular rate of 8 per cent. per annum, were \$26,015,588. Of the balance, \$6,047,357, there was carried to reserve \$2,800,000, and to surplus \$3,247,357. During the year \$13,652,000 of new stock was issued under the offer of June 20th, 1911. In addition, \$2,726,200 of stock was issued upon conversion of bonds, making the total increase of capital stock during 1912 \$16,378,200. At the close of business December 31st, 1912, \$132,908,000 of the \$150,000,000 of convertible bonds of 1906 had been handed in for conversion, leaving outstanding at the end of the year \$17,002,000, a reduction in 1912 of \$3,457,000. The number of shareholders, 50,297, on December 31st, 1912, shows an increase of 2,956 during the year. As to the future of the company, the board state it was never brighter.

### Berlin Elevated and Underground Railway.

THE report of the Gesellschaft für Elektrische Hoch und Untergrundbahnen, of Berlin, for 1912, states that the extensions in progress, according to the programme, were so far advanced in the year that the prospective opening to traffic of the northern section from the Spittelmarkt, *via* the Alexander Platz to the Schönhauser Allee, will take place in May, and the south-western sections from Wittenberg Platz to the Nurnberger Platz, and to the Kuffürstendamm, in September of the present year. By means of these prolongations the length of the railway will be increased from 11 miles to 15.8 miles, and that of all the lines operated by the company from 12.7 miles to 22 miles, including the level railway and the communal lines to be connected with the Nurnberger Platz station. The complementary line from the "triangle" station to the Wittenberg Platz will re-establish direct connection between the Eastern line and the West, and the triangle station will then become a junction for two large through lines, sanction having already been given to the section between the triangle and the Potsdamer Strasse. The accounts show the following results for the two years:—

	1912.	1911.
Share capital .. .. .	£2,500,000	£2,500,000
Working receipts .. .. .	415,000	414,000
Working expenses .. .. .	206,000	199,000
Working surplus .. .. .	209,000	215,000
Various receipts .. .. .	79,000	60,000
Brought forward .. .. .	31,000	21,000
Gross profits .. .. .	319,000	303,000
Interest on loans .. .. .	81,000	80,000
Renewal fund .. .. .	36,000	36,000
Local taxes .. .. .	8,900	9,000
Depreciation .. .. .	3,600	3,600
Net profits and balance forward ..	176,000	193,000
Dividend .. .. .	127,000	122,000
Dividend, per cent. .. .. .	6	5½

The dividend is on paid-up capital of £2,125,000, and the interest is on loans totalling £3,492,500. During the year the number of passengers carried was 62,731,827, as compared with 62,585,512 in the preceding year, and the average receipts per passenger were 1'52d., or a fraction less than in 1911. The train-miles run amounted to 2,347,275, the trains being composed of from two to four coaches, and the rolling stock at the end of 1912 comprised 143 motor coaches and 116 traliers. It is now proposed to increase the share capital by £500,000, and the loan capital also by £500,000, in order to provide for the extensions in progress or in contemplation.

**Prospectus.**—*Minas Geraes Electric Light and Tramways Co.*—The list was to close on Wednesday in an offer of £120,000 5 per cent. first mortgage bonds at 90½ per cent., the principal and interest being unconditionally guaranteed by the Government of the State of Minas Geraes, Brazil. A letter from the chairman of the company issued with the prospectus states as follows:—"The properties comprised in the lease include four electric generating plants, of which three are water-powers and one is steam. The first hydro-electric plant, situated on the River das Pedras, about 25 miles from the City of Bello Horizonte, has a capacity of about 1,600 H.P., and is now being equipped with a new unit of about 800 H.P. The company is now building a new transmission line with 300 steel towers. The second hydro-electric plant, situated on the River Santa Barbara, about 45 miles from the city, has a capacity of about 665 H.P., and is now ready for the installation of a new water turbine of about 330 H.P. A further 10,000 H.P. can be developed at this point when required. The third hydro-electric plant, situated on the River Arrudas, about three miles from the city, has a capacity of about 330 H.P., and is already fully equipped for the generation of electric power. The fourth is a steam plant, situated near the distributing station in the city, and is used as an auxiliary plant, its capacity being about 1,400 H.P. The company has the exclusive right, subject to the terms of the lease, for the period mentioned, to supply electric light and power and to operate the tramways and telephone system of the City of Bello Horizonte. The total length of the tramway system is 19 miles. The municipality has entered into a contract with the company for the public lighting of the city until 1965. In respect of the period from April 1st 1912, to January 31st 1913, the net earnings of the company, after allowing for the rental to be paid to the State, amounted to £12,327, being at the rate of £14.784 per annum, or sufficient to pay the interest and sinking fund of those bonds more than twice over. The company is paying dividends on its share capital at the rate of 7 per cent. per annum."

*African Mica Mines, Ltd.*—A prospectus is in circulation offering an issue of 60,000 shares of 5s. each in this company, which has been formed to acquire mining rights and work mica deposit in Transvaal Colony. Estimates given in the prospectus show on a sale of 50 tons of trimmed electrical mica, realising £500 per ton, a profit on the first year's working of £20,500. The nominal capital is £40,000 in 5s. shares.

**South Metropolitan Electric Light and Power Co., Ltd.**—The warrants for interest on the 4½ per cent. first mortgage debenture stock, payable on the 1st inst., for the six months ended that date, have been posted.

**Rees Roturbo Manufacturing Co., Ltd.**—According to a financial daily, after providing for administration expenses and interest on loans, the accounts for 1912 show a net profit of £2,031, thus converting the debit balance of £1,544 brought forward into a credit of £487, which the directors propose to carry forward.

**British Aluminium Co., Ltd.**

MR. A. W. TAIT (chairman) presided on Friday at Winchester House, E.C., over the meeting of this company.

The CHAIRMAN, in moving the adopting of the report (see ELECTRICAL REVIEW, p. 533), said that the trading profit for the year, together with interest and dividend on investments and the revenue derived from the Kinlochleven and Foyers Estates and transfer fees, was £191,824, as compared with £152,902 for the previous year, or an increase of £38,922. The results for the year were satisfactory considering the prices which had ruled during the period, which were exceptionally low owing to the keen competition of foreign producers. The average price obtained for the metal was even lower than during the previous year, when prices were also at an unsatisfactory level. These results had only been achieved by a substantial increase in output and some decrease in cost of production. The increase in profits was almost entirely accounted for by the increase in the trading profit, which had risen from £140,378 in 1911, to £181,529 for the year 1912. There were slight variations in the amount of dividends on investments and interest on deposits, but the increase in the former was almost negated by the decrease in the latter. There was also a slight decrease in the revenue from the Kinlochleven and Foyers Estates, and a small increase in the amount of transfer fees. The output and sales for the year were greater than in any previous year since the company's business was founded. The continued expansion in the demand for metal was an encouraging feature of the business, and if this continued the surplus of the productive capacity of all existing works over the world's consumption would be rapidly taken up. The contracts which had so far been made for delivery over the current year were satisfactory, and the prices, of course, showed a material improvement over those of last year, so that there was every reason to believe that when they came to present accounts to the shareholders next year, the position should show some further material improvement. The company had purchased the reduction and carbon works at Vigelands, near Christiansand Norway, which were controlled by the Anglo-Norwegian Aluminium Co. This purchase was concluded by the board after the works had been visited by their experts, and their reports duly considered, and in the opinion of the board, it was an advantageous purchase for the company. These works were well and substantially built, and were able to give a considerable production of aluminium all the year round. They were also capable of important development without very large capital expenditure. Part of the purchase price had been paid, and the balance of the purchase price would be paid within the next few months, and as this was being done entirely out of the internal resources of the company without the necessity of raising any additional capital, the shareholders would appreciate the considerable improvement in their position, owing to the fact that the company now controlled a substantially larger output than previously. These works were in full operation, and the company would obtain the benefit of it in the current year's accounts. The increase in the production of aluminium necessitated the increase in the company's capacity of production of alumina. In order to supplement the supply of the works at Larne, which were sufficient for the requirements of the three works at Kinlochleven, Foyers, and Stangford, the purchase had been made of one-half interest in the works of the Bauxite Refining Co., at Hebburn-on-Tyne, which gave the company the right to one-half the output of these works. Certain additions were at present being made to increase the capacity of these works, and it was expected that these extensions would be completed in the course of the next three months. At the last two meetings he had mentioned that extension had been carried out at the rolling mills at Milton, Staffordshire, which had now been brought up to their full capacity under existing conditions. In order to cope with the increased demand for the company's manufactures, arrangements had been completed for the acquisition of land and buildings at Warrington, Lancashire, and the site provided for considerable future expansion if necessary. These had been obtained on favourable terms, and contracts had been made for the supply of rolling plant, and it was expected that these works would be in operation at the end of this year, or the beginning of next. As the demand increased, further plant would be put in, so that the shareholders would observe that this was a growing and important part of the company's business. The directors were of opinion that it was a wise policy to extend this part of the business, because it enabled the company to be more independent of fluctuations which might take place in the demand for ingot metal, while the business was in itself a profitable one, which contributed a substantial amount to the general trading profits of the company. The demand for sheets and circles, tubes, and other forms, continued to grow in a satisfactory manner, and the increase in the demand from the electrical industry for the use of the metal in transmission lines, insulated cables, and switchboard work, showed encouraging expansion. All the works of the company had been operated satisfactorily during the year, and the whole of the plants had been maintained in a thoroughly efficient manner out of revenue. The plant installations referred to in the last report had all been completed, and were working satisfactorily. The reduction works at Kinlochleven, Foyers and Stangford, had been practically fully employed, and he was pleased to say that the reservoir capacity at Kinlochleven had been sufficient for all their requirements during the year, and at the end of the year the reservoir was overflowing. Trade in general for the year 1912 was considerably interrupted, and the company's business in particular was directly affected by the coal and dock strikes. The shareholders were probably aware that they were very large consumers of coal at their Alumina Works and at their rolling mills, but they were able, by making proper provision beforehand, to keep these works in full operation during the whole period of the coal

strike. This, however, was only done at considerable cost, owing to the increased price of coal, and he was afraid that, as the result of that strike, coal prices were likely to be on a higher level for some time to come. There had also been a considerable rise in freight rates during the year, due to general commercial activity. They were, however, always endeavouring to improve their methods of production, and economies were being made from time to time, all of which had a cumulative and growing effect, and although last year suffered because of these abnormal expenses, he did not think that their costs of production should show any increase in the near future. In order to improve the labour conditions at Kinlochleven, some further expenditure had been incurred during the year, and the board had authorised the erection of further workmen's cottages for the accommodation of their workmen and their families. This expenditure was having a good effect in the gradual improvement in the standard of labour. In last year's report it was mentioned that the company had authorised its subsidiary company, the Union des Bauxites, to complete the purchase of certain bauxite mines. This was done, and in order to ensure a large reserve supply, a considerable tonnage had been purchased by this company from the Union des Bauxites, which would be at seale for future requirements. This purchase would also enable the Union des Bauxites to increase considerably the development of its mines, so that a further large stock of the raw material might be built up. It was absolutely essential for this company that the reserves of raw material should be in hand for a long time ahead, and the arrangements which had now been made would ensure this. With regard to the Orskere power scheme, there was nothing new to report. The necessary development work mentioned at the meeting last year had now been carried out, so that the works could be maintained at the minimum cost. The company's rights were being properly protected, but it was not intended meantime to proceed further with the development of the scheme. The railway was being operated and maintained in an efficient manner, and the gross earnings were more than sufficient to meet the operating expenses. The chairman proceeded to deal with the salient features in the accounts and pointed out that the investments had increased from £571,255 to £749,217, due to the purchase of the Vigelands works and the interest in the Bauxite Refining Co. With regard to the liabilities, from now onwards the prior lien debentures would be gradually reduced by the application of the cumulative sinking fund of 1 per cent. per annum, whilst already £28,685 of debenture stock had been redeemed. After providing £17,420 for legal expenses, depreciation, &c., and proportion of profits payable to directors; £40,000 for prior lien debenture interest; £43,223 for debenture stock service fund; £40,000 for depreciation; and £30,000 to reserve account, the board recommended the payment of the 6 per cent. preference dividend, which left £10,206 to be carried forward. In conclusion, he congratulated the shareholders on the successful manner in which the company was emerging from its difficulties.

MR. S. H. POLLEN seconded the motion.

MR. KENNEDY asked what remuneration the directors received, and

The CHAIRMAN said they were entitled, under the articles of association, to 5 per cent. of the profits after payment of the prior lien interest of £40,000.

MR. KENNEDY: How much is that?

The CHAIRMAN: That is a matter of calculation; I am sure you can do it for yourself.

The motion was then carried.

**Bromley (Kent) Electric Light and Power Co., Ltd.**—The directors report that during 1912 the lamp connections increased from 101,276 to 107,649. The sale of current increased from £16,418 to £16,651. The works have been maintained in good order and repair. The result of the year's trading, including £703 brought forward from last year, shows a profit of £13,262, and after payment of debenture interest and trustees' fees, &c., amounting to £3,059, and writing off the balance of the cost of motor-car, and the cost of fitting up a new showroom, there is a balance of £10,044. An interim dividend at the rate of 4 per cent. per annum was paid for the half-year in October, and the directors recommend the payment of a further dividend for the second half-year at the rate of 8 per cent. per annum, making a total dividend of 6 per cent. for the year, and that £1,000 be placed to general reserve account, leaving £1,544 to be carried forward. To fill the vacancy caused by the death of Mr. R. Taylor, the directors propose the election of Mr. E. G. Peill, of Bromley. The meeting is to be held at Bromley on April 7th.

**Vickers, Ltd.**—Mr. Albert Vickers presided, on March 28th, at the annual meeting, and said that there was no reason to think that 1913 would be less favourable than 1912. Their subsidiary companies had brought much profitable business, especially foreign business. The report was adopted, and a dividend of 10 per cent. on the ordinary shares was approved. A resolution was passed to issue 740,000 new ordinary shares of £1 each at 30s, one new share to be allotted to holders for every five now held.

**Dublin and Lucan Electric Railway Co.**—Mr. J. W. Hill presided at the half-yearly meeting on March 28th, and moved the adoption of the report, which showed gross receipts £93 less than in the corresponding half of last year. The expenditure increased by £178. After paying 5 per cent. preference dividend, £378 is carried forward. The mechanical stokers had enabled them to save on the coal bill, notwithstanding the higher price. The report was adopted.

**Automatic Telephone Manufacturing Co., Ltd.**

THE directors' report for 1912 states that the profit for the year amounts to £13,499. After payment of dividend on 6 per cent. preference shares to December 31st, 1912, £11,816, and deducting amount written off preliminary expenses, &c., £1,313, there remains a balance of £370 to be carried forward. The directors report that the transfer of the Liverpool works and business of British Insulated and Helsby Cables, Ltd., and the assignment of the patents of the Automatic Electric Co. were satisfactorily carried through, and the company commenced business on January 1st, 1912. In the early part of the year two automatic exchanges, each of about 500 lines, were completed for the British Post Office, and these exchanges have worked remarkably well throughout and continue to give good and efficient service. Other automatic equipment orders to the extent of about 8,000 lines have since been received, and the company is at present negotiating and tendering for a number of other automatic exchanges in this country and abroad. The works of the company at Liverpool have been considerably extended during the year, and good progress has been made in the manufacture of automatic equipment there. The manufacturing business taken over from British Insulated and Helsby Cables, Ltd., shows a satisfactory increase. During the year several manual exchange equipments were supplied or completed, and orders for manual exchanges to the extent of about 12,000 lines are now in hand. The telegraph business of the company also shows a material increase. This being the first year of the company's trading, nothing has been written off for depreciation.

The annual meeting will be held at Liverpool on April 7th.

**STOCKS AND SHARES.**

Tuesday Evening.

THE greatest apologist for Stock Exchange markets must be fain to admit that the position of affairs generally speaking—politically, domestically and financially—is not all that it might be, and that the shyness which business shows in coming forward has, at all events, a good deal to excuse it. War news from day to day swings see-saw fashion, and although by the end of this week the termination of the struggle may be within actual sight, in these earlier days there is obviously plenty to do before peace can be confidently counted upon. With peace will, or should, come cheaper money, and it is to this last that the Stock Exchange is looking for relaxation of tension and anxiety.

The Home Railway market has had a bout of strength. Speculation ran strongly upon some of the lower-priced stocks, and Metropolitan Consolidated formed a conspicuous feature. The price was run up to 54, reverting later to 53½, at which a rise of 2½ is left on the week. Districts rose 1½, and the Underground Electric group improved at the same time. The rise in "Mets." was accompanied by a general tip to buy the stock; and since it is one of those which moves quickest in the Home Railway market, some of the bullish operators were content to take a hand. Talk has it that the price is to be put still higher, but it is not an investment for the nervous individual.

Another strong feature this week was London and South-Western Railway Deferred stock, where the price shot up suddenly, and this had the indirect effect of dragging down London United Tramways 4 per cent. Debenture stock, causing it to lose four points. It is argued that if the South-Western Railway is at last going to wake up and galvanise its suburban traffic on electric lines under the energetic new management, this may be had for the London United Tramways Company. The East London electrification was started in working order on Monday last, and the price of the Ordinary stock hardened to 10½, to revert later to 10½. Central London Ordinary rose 1, in connection with the jump in South-Westerns.

British Electric Traction issues are still somewhat dull, the 7 per cent. Preferred stock being ½ lower. City and South London 4 per cent. Debenture at 96 shed a point; and, considering the nature of the security, the yield of £4 2s. 6d., which this stock now affords, must be regarded as good.

The market for English Electricity Supply shares remains well-nigh comatose. County of London Ordinary shares went back to 11, but most of the other alterations are caused by the ex-dividend markings of last Friday. Brompton Ordinary recovered its dividend deduction, and Westminsters gained ½; otherwise the net movements are almost nil. Business, what there is of it, comes in fitful fickers. Even in City of London Ordinary there is hardly anything doing.

At the end of last week started a boomlet in most of the Mexican issues, prices of the railway and utility companies being run up substantially. A good part of the improvement is retained. Mexican Light and Power Common is up 3, and the Preferred 2½. Mexico Trams show a gain of 3½, while the Company's bonds of both classes are materially higher. Monterey Fives are a point to the good, and similar improvements were secured by other stocks in this group. At the same time, most of the Latin Canadians assumed better complexion. Brazil Tractions spurted ½, to the accompaniment of vague rumours about a further and a larger rise yet to come. Montreals are 3 up, Shawinigans gained 7 and improvements were secured by Alabamas, Georgias, Columbia Electric, and similar shares. Mississippi rallied on

the understanding that the disastrous floods have come nowhere near the company's area. Columbia Gas and Electric shares dropped to 12½ when it was announced that the town of Dayton was in the middle of the afflicted country, but this, it seems, is not the Dayton which is served by the Columbia Gas and Electric undertaking, the shares in which promptly rallied to 15½. Canadian General Electrics partially recovered the deducted dividends, and Rio Tramway bonds have hardened.

In connection with the Latin-Canadian group, mention must be made of a most serviceable volume which has just been published for its third year, dealing with the utility concerns of the Americas. The book, "Atkin's Manual," contains illuminating details of all the principal concerns, but what renders it of particular value is the fact that in many cases maps are provided by which the scope of the undertakings can be grasped with a readiness that would be impossible without this aid. The book is prepared by a firm in the Stock Exchange; and while one hesitates to use so hackneyed a word, the term "indispensable" is in this case no exaggerated compliment to pay it.

In the Telegraph market, Anglo-American Telegraphs are better. Eastern Ordinary is ½ up, Great Northern's have advanced, while West India and Panama, after showing the big jump of 6s. 3d. per share, lost part of the rise. The latter are being bought again by the same speculative division which on previous occasions has taken the market in hand, and the price is largely at the mercy of extrinsic considerations—such as political news, and so on. Telegraphs are not by any means active, but the tone of the market is good, and dealers declare that there is not much stock about. An increase of 4s. in the dividend on the Great Northern's caused the price to rise 50s. to 32½.

New York Telephone Bonds continue to creep up, being now quoted at 99½. National Telephone Deferred is neglected, but keeps about 20½. Marconi rose to 4½, from which they have reacted a little; but the Preference at 3½ have recovered their loss of last week. The Automatic Telephone Company, the British Insulated "baby," announces a net profit for its first year's working of £13,500; and while no dividend is to be paid on the ordinary shares for the period, the future prospect is distinctly satisfactory.

There is little of interest to record in connection with the Manufacturing market. A recovery of 2 points, after its drop of 5 points, has resulted in Brush Second Debenture being raised to 27. Dick, Kerr's are quoted at 10s. middle, showing a loss of 2s. 6d. British Aluminiums retain their rise, and the 5 per cent. Prior Lien is up a point, in consequence, of course, of the excellent report, to which attention was drawn here. British Westinghouse 6 per cent. prior lien is better. Castner-Kellners at 3½ have rallied, and in the armament market Armstrongs are the principal feature of strength, with a big rise on the proposal of the board to distribute as a bonus one new share for every four old now held. The rubber share market has been acutely weak, for which the incessant sagging of the price of the raw material is responsible. If the American buyers of the product do not come forward as they are expected to do, it seems likely enough that the price of rubber will go still lower, in which case, of course, it is only to be supposed that quotations for the shares will follow suit.

**ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.**

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of wks.	Total to date.		Route miles open.
		£	£*		£	£*	
Bath	Mar. 26	3,160	+ 575	13	9,400	+ 606	..
Blackpool-Fleetwood	" 29	2,115	+ 121	12	4,417	+ 917	8
Bristol	" 28	29,727	+ 5,552	13	86,481	+10,076	80.5
Brit. Elec. Trac. Co.	" 21	11,071	+4,839	12	56,245	+16,387	..
Chatham and Dist.	" 27	3,416	+ 313	12	10,168	+ 567	14.9c
Cork	" 27	1,844	+ 34	12	5,402	- 17	9.8c
Dublin	" 28	22,034	+ 267	13	67,771	+ 1,130	54.2c
Hastings	" 27	3,649	+ 760	..	..	+ 858	19.3c
Lancashire United	" 26	5,976	+1,446	12	16,761	+ 2,032	39
Llandudno-Col. Bay	" 28	966	+ 371	17	5,680	+ 809	6.5c
London United	" 29	13,477	+1,003	13	71,219	+ 831	..
Tyneside	" 26	2,386	+ 536	13	5,912	+ 653	11
Anglo-Argentine	" 25	255,420	+11,310	12	668,155	+46,720	..
Ankleland	" 14	19,516	+2,103	8½	179,095	+24,528	24.1
Bombay (B.E.T.)	Feb. 27	12,567	+ 437	9	26,511	+ 623	..
Brisbane	" 26	22,860	+16,166	8	47,670	+23,496	..
Brit. Columbia Rly.	Mar. 29	17,687	+1,044	..	..	+ 1,493	..
Calcutta	" 28	2,645	..	..	..	..	..
Cape Electric T. Ltd.	Feb. 28	3,854	..	8½	10,760	+ 924	14.7
Raigoorlie, W.A.	" 28	2,645	..	..	..	..	20.5
Lisbon	Mar. 31	8,645	+ 872	29	50,500	+ 924	14.7
Madras	" 31	39,140	+1,616	21	169,676	+12,347	..
Montevideo	Mar. 29	19,783	+ 962	19	63,348	+ 4,612	6.78
Cen. London Rly.	" 29	11,956	+1,103	13	39,219	+ 4,166	7.26
City & S. Lon. Rly.	" 28	551	+ 65	18	1,491	+ 60	7
Dublin-Lucan Rly.	" 29	5,657	+1,274	13	15,620	+ 2,926	8.5
G.N. and City Rly.	" 31	6,175	+ 355	18	24,486	+ 1,856	6.6
L'pool Overhead Rly.	" 29	56,325	+1,920	14	189,425	+ 1,840	21.2c
London Elec. Ry. Co.	" 26	8,450	+ 648	13	29,289	+ 1,734	4.5
Mersey Railway	" 30	69,147	+ 9,413	18	217,114	+ 4,468	26.75
Metropolitan Rly.	" 29	52,121	+1,929	19	171,333	+ 6,422	25

\* Compared with the corresponding period of 1912.  
 † Includes horse, steam and other receipts.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations April 1st.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations April 1st.	Rise or Fall	Present Yield p.c.
Boornemooth & Poole, Ord.	10	1911. 6	1 1/4 - 1 1/4 x d	..	6 18 5	Kennington & Knightsbridge, Ord	5	1911. 81	7 1/2 - 8	..	5 12 6
Do. 4 1/2 % Pref.	10	4 1/2	1 1/4 - 1 1/4	..	4 14 9	Do. 4 % Deb.	Stock	4 1/2	90 - 93	..	4 6 0
Do. Second 8 % Pref.	10	8	1 1/4 - 1 1/4	+ 1/4	5 15 8	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 4	76 - 80	..	5 12 6
Do. 4 1/2 % Deb. Stock	Stock	4 1/2	96 - 98	..	4 11 10	London Electric, Ord.	8	2 1/2	1 1/2 - 1 1/4	..	4 0 0
Brompton & Kennington, Ord.	5	10 10	8 1/2 - 8 1/2 x d	+ 1/2	6 6 8	Do. 5 % Pref.	5	6	4 1/2 - 5 1/4	..	5 14 8
Do. 7 % Cum. Pref.	5	7 7	8 1/2 - 8 1/2 x d	..	8 13 10	Do. 4 1/2 % First Mort. Deb.	Stock	4 4	91 - 94	+ 1	4 5 1
Central Electric Supply, 4 % Guar. Deb.	100	4 4	95 - 98	..	4 1 8	Metropolitan	5	4 4	8 1/2 - 8 1/2 x d	..	5 8 3
Charing Cross, West End & City	5	5 5 1/2	4 1/2 - 4 1/2	..	5 2 7	Do. 4 1/2 % Cum. Pref.	5	4 4	4 1/2 - 4 1/2	..	4 17 4
Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2 - 4 1/2	..	4 11 9	Do. 4 1/2 % First Mort. Deb.	Stock	4 4	57 - 100	..	4 10 0
Do. "City Undertaking" 4 1/2 % Cum. Pref.	5	4 1/2	3 1/2 - 4 1/2	..	6 2 10	Do. 8 1/2 % Mora. Deb.	Stock	8 1/2	84 - 86	..	4 1 5
Do. Do. 4 % Deb.	100	4 4	91 1/2 - 93 1/2	..	4 5 7	Midland Electric Corporation	100	4 1/2	98 - 101	..	4 9 1
Chelsea, Ord.	5	5 4 1/2	4 1/2 - 5	..	5 0 0	Do. 4 1/2 % First Mort. Deb.	5	5 5	4 1/2 - 4 1/2 x d	..	6 5 3
Do. 4 1/2 % Deb.	Stock	4 1/2	96 - 99	..	4 10 11	Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5 5	4 1/2 - 4 1/2	..	6 5 3
City of London, Ord.	10	8 9	116 - 117 1/2	..	5 6 8	North Metropolitan Power Supply, 5 % Mortgage (Red.)	100	5 5	99 1/2 - 103 1/2	..	4 17 7
Do. 6 % Cum. Pref.	10	8 6	12 - 13	..	4 10 7	Notting Hill, 6 % Non-Cum. Pref.	10	6 6	92 1/2 - 102 1/2	..	6 11 7
Do. 5 % Deb.	Stock	6 6	116 - 120	..	4 3 4	Oxford	5	7 1/2	6 1/2 - 6 1/2	..	5 13 9
Do. 4 1/2 % Second Deb.	100	4 1/2	100 - 102	..	4 8 3	St. James' and Pall Mall, Ord.	5	10 10 1/2	6 1/2 - 9	..	5 11 1
County of London, Ord.	10	6 6	102 - 11 1/2	- 1/2	5 6 8	Do. 7 % Pref.	5	7 7	6 1/2 - 7 1/2	..	4 16 7
Do. 6 % Pref.	10	6 6	11 1/2 - 12	..	5 0 0	Do. 8 1/2 % Deb.	100	8 1/2	84 - 87	..	4 0 6
Do. 4 1/2 % Deb.	Stock	4 1/2	104 - 106	..	4 4 11	Smithfield Markets, Ord.	5	2 2	2 1/2 - 3 1/4	..	7 7 8
Do. 6 % Second Deb.	Stock	4 1/2	93 - 102	..	5 0 0	South London, Ord.	5	6 6	84 - 85 1/2 x d	..	5 0 0
Edmundson's, Ord.	£3	Nil	4 1/2 - 4 1/2	..	Nil	Do. 5 % First Mort. Deb.	100	5 5	97 - 100	..	5 0 0
Do. 6 % Cum. Pref.	5	Nil	4 1/2 - 4 1/2	..	..	South Metropolitan, 7 % Pref.	1	7 7	1 1/2 - 1 1/2	..	5 17 11
Do. 6 % Non-Cum. Pref.	5	..	13 - 12	..	..	Do. 4 1/2 % First Deb. Stock	100	4 1/2	94 - 97 x d	..	4 11 3
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	81 - 84	..	6 7 2	Urban, Ord.	£3	Nil	..	..	..
Falkenstein, Pref.	5	5 5 1/2	4 1/2 - 5 x d	..	6 0 0	Do. 5 % Cum. Pref.	5	2 1/2	2 1/2 - 2 1/2	..	..
Do. 6 % Pref.	5	5 5	4 1/2 - 5 x d	..	4 17 10	Do. 4 1/2 % First Mort. Deb.	100	4 1/2	83 - 85 x d	..	5 2 3
Do. 4 1/2 % First Deb.	100	4 1/2	90 - 92	..	6 12 6	Westminster, Ord.	5	10 10	8 1/2 - 9	+ 1/4	6 11 1
Have ..	5	9 8 1/2	7 1/2 - 8	..	..	Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2 - 5 1/2	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	8 8	5 - 5 1/2	..	5 14 8	Monterey Riv. Light & Power, 5 % 1st Mort. Deb.	100	5 5	83 - 86	+ 1	5 16 8
Dalton, Ord.	5	5 1/2	6 1/2 - 7 1/2	+ 1/4	5 19 4	Montreal, Lt., H. and Power	\$100	8 9 1/2	225 - 130	+ 3	3 13 3
Do. 6 % Pref.	5	5 5	4 1/2 - 5 1/2	..	4 17 7	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$500	5 6 1/2	10 - 20	..	..
Calgary Power, 1st Mort. Bds.	100	5 5	93 - 95	+ 1	5 5 8	River Plate, Ord.	10	..	217 - 227	..	4 8 0
Canadian Gen. El. Com.	\$100	7 7	113 - 117 x d	..	5 19 8	Do. 5 % Non-Cum. Pref.	Do.	6 6	105 - 110	..	5 9 1
Do. 7 % Pref.	\$100	7 7	119 - 123 x d	..	5 13 10	Do. 5 % Deb. Stock	Do.	6 6	100 - 102	..	4 18 0
Dordoba Lt., Power and T., Ord.	1	8 8	4 1/2 - 4 1/2	..	5 14 3	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	4 1/2	100 - 102	..	4 8 3
Do. 5 % Deb.	100	5 5	8 1/2 - 8 1/2 x d	..	5 3 8	Shawinigan Water, Capital	\$100	5 5	140 - 145	+ 7	3 9 0
Elec. Lt. and P. of Cebu-Samba, 5 % Bonds	100	6 6	93 - 95	..	8 6 4	Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	107 - 109	..	4 11 9
Elec. Supply Victoria, 6 % 1st Mort. Deb.	100	6 6	90 - 93	..	5 7 6	Do. 4 1/2 % Per. Deb.	Stock	4 1/2	101 - 103	..	4 7 5
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5 5	93 - 95	..	5 5 3	Toronto Power, 4 1/2 % Deb.	Do.	4 1/2	97 1/2 - 99 1/2	..	4 13 6
Esigeille Elec. P. and L., Ord.	10 1/2	Nil	..	..	Nil	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5 5	91 - 94	..	5 6 5
Do. 6 % Pref.	1	6 6	..	..	9 15 2	Victoria Falls Power, Pref.	1	11 1/2	17 1/2 - 17 1/2	..	..
Kamistiquia Power, 6 % G. B. Bonds	\$500	6 6	101 1/2 - 103 1/2	..	4 16 7	West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6 6	106 - 108	..	5 11 1
Kadras, Ord.	5	Nil	13 - 14	..	..						
Melbourne, 6 % 1st Mort. Deb.	100	6 6	101 - 104	..	4 16 2						
Mexican El. Lt., 5 % 1st Mort. Bds.	5	5 5	81 - 84	..	5 19 0						
Mexican Lt. & Power, Common	\$100	4 4 1/2	73 - 82	..	5 17 7						
Do. 7 % Cum. Pref.	\$100	7 7	108 - 116	+ 2 1/2	6 12 1						
Do. 6 % 1st Mort. Gold Bds.	5	6 6	92 - 94	+ 1	5 6 5						

TELEGRAPH AND TELEPHONE COMPANIES.

American Telegraph	10	4 4 1/2	7 - 7 1/2	..	6 0 0	Monte Video Telephone, Ord.	1	5 5	4 1/2 - 1 1/2	..	5 13 0
Do. 5 % Deb. Red.	Stock	5 5	97 - 99	..	5 1 0	Do. 5 % Pref.	1	5 5	..	..	5 14 8
American Telegraph & Teleg., Cap.	\$100	8 8 1/2	133 - 135 x d	..	5 16 10	New York Teleg., 4 1/2 % Gen. Bnds.	100	4 1/2	98 1/2 - 99 1/2	+ 1/2	4 10 3
Do. Collat. Trust	\$1000	4 4	90 - 92	..	4 7 0	Ontario Teleg. and Elec.	1	8 8 1/2	1 1/2 - 1 1/2	..	4 7 0
Anglo-American Telegraph	Stock	8 8	6 1/2 - 6 1/2	+ 1/2	4 8 3	Do. 6 % Cum. Pref.	1	8 8	1 1/2 - 1 1/2	..	4 18 6
Do. 6 % Pref.	Do.	8 8	11 1/2 - 11 1/2	+ 1/2	5 3 8	Do. 4 % Red. Deb.	Stock	4 4	88 - 90	..	4 8 11
Do. Def.	Do.	80 -	9 1/2 - 9 1/2	..	6 1 10	Pacific and European Tel., 4 % Guar. Deb.	Do.	4 4	97 1/2 - 99 1/2	..	4 0 5
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	6 6	99 1/2 - 101 1/2	..	4 18 6	Renter's ..	10	10 10 1/2	11 1/2 - 11 1/2	..	8 10 2
Bhili Telephone	5	7 7 8	7 1/2 - 7 1/2	..	5 1 1	Do. New Shares	10	..	107 1/2 - 11 1/2	..	..
Commercial Cable, Stig., 4 % Deb.	Stock	4 4	80 1/2 - 82 1/2 x d	+ 2	4 17 7	Submarine Cables Trust	Cert.	6 6	127 - 180	..	4 12 4
India Telegraph	10	6 6 1/2	8 - 9	..	6 9 0	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	Stock	4 1/2	96 - 98	..	4 11 17
Do. 10 % Pref.	10	10 10	16 - 17	..	5 17 8	United River Plate Telephone	6	8	7 1/2 - 7 1/2	..	5 4 11
Direct Spanish Telegraph, Ord.	5	4 4 1/2	8 1/2 - 8 1/2 x d	..	6 8 8	Do. 5 % Cum. Pref.	5	5 5	6 1/2 - 6 1/2	..	4 9 0
Do. 10 % Cum. Pref.	5	10 10	6 1/2 - 7 x d	+ 1/2	7 2 10	West Coast of America	2 1/2	2 1/2	1 1/2 - 1 1/2	..	4 8 4
Direct United States Cable	10	6 6	6 1/2 - 7 1/2	..	5 10 4	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 4	95 - 98	..	4 1 8
Direct W. India Cable, 4 1/2 % Reg. Deb.	100	4 1/2	99 - 101	..	4 9 0	West India and Panama Teleg.	10	2 1/2	3 1/2 - 3 1/2	+ 1/2	5 14 3
Eastern Telegraph, Ord. Stock	Stock	7 7 1/2	13 1/2 - 13 1/2	+ 1/2	5 1 8	Do. 6 % Cum. 1st Pref.	10	6 6	10 - 10 1/2	..	5 14 3
Do. 8 1/2 % Pref. Stock	Do.	8 1/2	78 1/2 - 80 1/2	..	4 6 11	Do. 6 % Cum. 2nd Pref.	10	6 6	9 - 10	..	6 0 0
Do. 4 % Mort. Deb.	Do.	4 4	9 - 9 1/2	..	4 2 6	Do. 5 % Debs.	10	6 6	101 - 103	..	4 17 1
Eastern Extension	10	7 7 1/2	12 1/2 - 12 1/2	..	5 4 8	Western Telegraph, Ltd.	100	7 7 1/2	13 - 13	..	6 3 8
Do. 4 % Deb.	Stock	4 4	95 - 97	..	4 2 6	Do. 4 % Deb.	Stock	4 4	95 - 97	..	4 2 6
East and S. Africa Tel., 4 % Mt. Dh. Mauritius Sub.	25	4 4	98 - 101	..	3 19 8	Western Union 4 1/2 % Pdg. Bonds	\$1000	4 1/2	97 1/2 - 100 1/2	..	4 10 0
Globe Telegraph and Trust	10	8 8 1/2	11 1/2 - 1 1/2	..	5 7 10						
Do. 5 % Pref.	10	8 8	12 1/2 - 13	+ 2 1/2	4 12 4						
Great Northern Telegraph	10	18 20	8 1/2 - 8 1/2	..	5 19 5						
Indo-European Telegraph	25	13 13 1/2	68 - 60	..	6 3 4						
Italcable Companies Common	100	5 5	8 1/2 - 8 1/2	..	6 2 2						
Do. 4 % Cum. Pref.	\$100	4 4	67 - 69	..	5 16 0						
Marconi's Wireless Telegraph	1	20	4 1/2 - 4 1/2	+ 1/2	4 10 1						
Do. 7 % Cum. Partio. Pref.	1	17	..	+ 1/2	4 7 10						

\* Unless otherwise stated, all shares are fully paid.

† Paid in deferred interest warrants.

‡ Interim Dividend.

§ In. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations April 1st, Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations April 1st, Rise or Fall, Present Yield p.c.

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations April 1st, Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations April 1st, Rise or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations April 1st, Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations April 1st, Rise or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

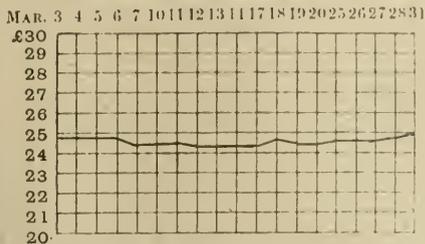
METAL MARKET.

ELECTRIC COOKING APPARATUS.

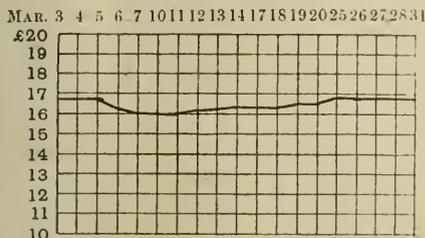
Fluctuations in March.

By "ELEMENT."

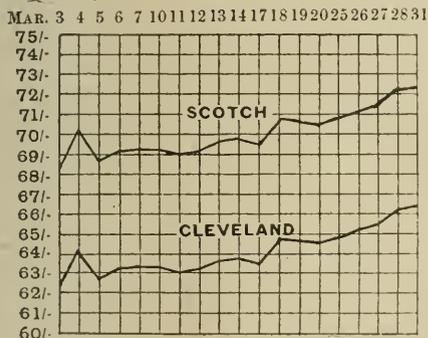
SPELTER (G.O.B's.).



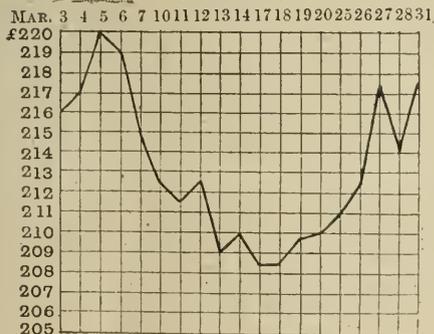
LEAD (ENGLISH).



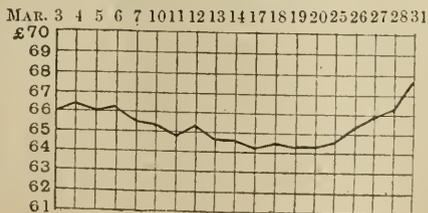
IRON.



TIN.



COPPER (G.M.B's.).



ELECTRIC cooking may now be considered as well beyond the early experimental stage, but its development and general adoption must, of necessity, be extremely gradual, even after the ideal apparatus has been put on the market. It is not intended, in this paper, to dwell on the many advantages of this system of cooking, but rather to plunge at once into the matter of the construction and working of the apparatus. It is sufficient to state that the merits of the system are so great that the few shortcomings, which at present tend to hinder its general use, are almost negligible when compared with the many disadvantages of other methods of cooking. Granted that we have reasonable prices for energy, and that the more costly apparatus may be obtained on hire from the local supply authority at a nominal rental, then it may safely be said that the most convenient and economical method of cooking is within the reach of anyone who has the electric supply cables laid into his or her house. With electricity, there are no noxious fumes to cause a smell in the kitchen; no dust or dirt is caused by the use of electricity; and an improvement in the appearance of the food will be noted by those who generally have their food cooked by coal or gas. The shrinkage in the food cooked in an electric oven is found to approximate one-tenth, as compared with one-fourth when the article has been cooked in a gas oven.

These considerations are weighty in themselves, but they are not sufficient to warrant the householder in discarding, say, a gas cooker. They must be backed up by strong and reliable apparatus, or electric cooking will undoubtedly fall into disfavour. It must be remembered that the appliances will be in the hands of the good lady of the house, or the domestic servant, whose business is to cook, and not to look after complicated electrical machinery. The appliances must, therefore, be "fool-proof," so that mistakes will not have very dangerous consequences. Most of the serious defects in the early cooking outfits have now been remedied, and the only stumbling block to makers of this class of goods seems to be the manufacture of a heating element which will give a high efficiency with *absolute reliability*. Some of us are familiar with the cry: "The electric apparatus has broken down." A trivial oversight has resulted in a stoppage of the electricity flowing through a heating element, or a drop of water has, perhaps, been spilled on a portion of an exposed wire. But the breakdown is enough to make a topic of conversation for a few hours afterwards, and the result is a set-back in the development of electricity for domestic purposes. The same outcry might also be brought about by an appliance with defective insulation. Someone receives a slight electric shock from the surface of a kettle, and the electric method is thereupon condemned as "highly dangerous."

The apparatus, then, must also be electrically perfect, in having reliable heating elements, well insulated from the other parts, and in having all exposed metal efficiently connected to earth. Makers are now turning out cookers with a guarantee against breakdown within five years, and it would seem that we have now almost reached the stage when little trouble should be experienced under this head. It would be impossible, within a short article, to detail all the different types of electric cookers, but a brief description will be given of a few which have come under the notice of the writer. We are all familiar with electric kettles, electric stewpans and frypans, milk boilers, &c., with their self-contained elements. The latest forms of these are most efficient utensils, some of them attaining an efficiency of over 90 per cent. For fast cooking by electricity, they are, without doubt, the proper appliances. It is possible, by the use of an electric kettle, to boil 1 pint of water in less than four minutes, which is quick enough to satisfy the most impatient housewife, and this is obtained with an expense of  $\frac{1}{15}$ th of a unit, which, at  $\frac{3}{4}$ d. per unit, works out at  $\frac{1}{10}$ th of a penny, so that with this utensil the operation of boiling one pint of water 20 times entails a cost of only 1d., where energy is sold at  $\frac{3}{4}$ d. per unit for heating purposes.

The great drawback to the use of self-contained appliances,

however, is, of course, the confusion of flexible leads, where many cooking operations are in progress at one time, and this has led some makers to confine most of their experiments to the design of separate heating appliances on which ordinary utensils may be used. And in this pursuit, the principal difficulty has been to design an element which will immediately impart its heat to the vessel placed over it, without great loss of heat in the material supporting the element. This necessary loss of heat must appreciably lower the efficiency of the method. With the use of hot-plates the efficiency is between 60 and 70 per cent., showing that the best arrangement of apparatus, taking account of the before-mentioned objection to self-contained appliances, will be that in which roasting, grilling, frying, &c., are carried out on the separate heater system, and a self-contained, heavily-loaded kettle or urn is provided for the quick boiling of water. The utility and economy of a combination such as this would, it is believed, outweigh its possible disadvantages in one or two isolated cases.

In considering the many types of heating units, let us refresh our memory regarding the elementary principles underlying the transmission of heat from one body to another. As is well known, heat is transferred by radiation, convection, and conduction, and it will be seen that all three modes of transference have been tried by electrical manufacturers in their endeavours to further the cooking business. The sun's heat is radiated to the earth during the day; heat currents are conveyed through liquids and gases without luminosity; and conduction takes place when substances at different temperatures are in actual contact with one another. Let us see in what manner these fundamental principles have been applied in the various types of cookers to be considered.

The element in one firm's goods consists of lamp-heaters fixed in a cast-iron case forming an oven, grill and hot-plate. The heat is radiated from the lamps to the food or the vessel containing the food. This form of cooker never was successful, as the lamps were too easily destroyed by drops of water or grease breaking the glass bulbs. Another maker uses spiral resistance wires placed in a quartz tube. The objection to the lamp heater applies to the quartz system also, although the cost of renewal of the quartz tubes is not so great as that of the replacement of an entire lamp in the first-mentioned type. The purpose of the quartz tube is to increase the incandescence of the element so that more radiated heat is emitted, but it also serves to hinder the process of oxidation of the wire when at a red heat. Notwithstanding this precaution the quartz type of element "burns out" very readily, and on this account no great reliance can be placed on it. A small hot-plate with a quartz element has lately been put on sale, consuming about 200-300 watts, but it cannot do the electric cooking business much good, as its construction and wattage only render it of value where the maintenance, and not the raising, of temperature is required. Instructions issued by the manufacturers of this small article contain a list of its accomplishments, which include "the heating of dinner plates, the maintenance of boiling temperature in a kettle, the roasting of chestnuts, and the boiling of an egg," but a footnote carefully informs the reader that one must first of all procure the hot water in which the egg is to be boiled. This hot-plate, no doubt, fulfils the purpose for which it is intended, but it seems that to expend energy at the rate of 300 watts "to roast chestnuts" is a wicked waste of electrical energy, and an uninitiated person might be pardoned for thinking from the appearance of the hot-plate that it should do the ordinary work of a gas-ring.

Several manufacturers have convectors, &c., made up with elements of metal deposited on mica sheets, and these have also been fitted to ovens, grills and kettles. The heater usually consists of a deposit laid between two short strips of mica in such a way that air is prevented from reaching the metal; consequently little oxidation takes place at high temperatures. The elements are placed in parallel, so that should one burn out the others will not be affected. Another advantage is that, as there is not much material surrounding the element, the heat passes off as soon as it is generated. It is evident, too, that with an oven having heaters of this type renewals can be fitted expeditiously.

Then we have the composition known as "silundum," which may be heated to a very high temperature—about

3,000° F.—without oxidising. This material has been used in the construction of electrical cookers, and the results have been fairly satisfactory, but the efficiency does not seem to be very remarkable.

A few years ago electric ovens having cartridge elements were turned out by a well-known electrical firm. Each cartridge was formed of a spiral of resistance wire, wound on an asbestos cylinder, and inserted and sealed in a metal tube. Three elements were placed in the oven—two in the bottom and one at the top. Owing to the large amount of material forming the element, the efficiency was not good, and, therefore, little has been done in the improvement of the cartridge heater. Other forms have spiral wires, in some cases supported on, and in others embedded in, enamel or porcelain, and this brings us to the question whether the heating wires should be exposed to the atmosphere, or enclosed in mica or other insulating material, unaffected by reasonable temperatures. Exposing the element to the oxygen of the air limits the temperature to which the wire may be raised, while deterioration of mica occurs in the enclosed element when subjected to the higher temperatures; so that at the present time, elements must be designed which have a large dissipating surface per unit of power consumed, otherwise the apparatus will be liable to breakdown through overheating. In the cast-iron hotplate, lately brought out, one might suppose we had the ideal electric cooker, and it certainly is an improvement on former attempts, but considerable energy has to be expended in heating the cast-iron slowly, to prevent the deterioration already alluded to. If a substitute for mica were discovered which did not perish with great heat, cookers could be designed with a high initial wattage, giving a quick rise of temperature on the element, after which the power could be automatically reduced to a value sufficient to maintain the high temperature. This would, it is believed, be the cooker *par excellence* if the elements were constructed in a solid and reliable manner. Putting aside the objection of the slow initial rise of temperature in the existing hotplate system, the arrangement has much to be commended. The heating resistance is a flat spiral strip laid between two sheets of mica, which are inserted in an imperishable cast-iron disk. Expansion and contraction of the iron are allowed for, and the whole is fixed on the top of an iron support with the disk projecting above the level of the supporting frame. Ordinary utensils may be heated on the disk, but greater efficiency is, of course, obtained by the use of special vessels having flat ground bottoms to ensure good conduction between the disk and the utensil, and having bright, polished surfaces to prevent the escape, by radiation, of the heat. It is well known that a black surface will radiate heat quicker than a brightly polished surface, so that, to obtain the best results, it is necessary to have the sides of the utensils polished, while the surface of the hot-plate and the bottom of the vessel should be a dull black. It must be remembered, however, that the contact areas should be quite clean and free from soot and other non-conducting material. The hot-plate should also be fixed to its support in such a way as to prevent, as far as possible, the transmission of heat to the other metal parts of the cooker. This will ensure that almost all the heat generated is brought to the exact position where it is required for cooking purposes. The tinware vessels, supplied by the makers of the cooker, have special flat and very thin copper bottoms, which not only fit well on the top of the plate, but also overhang round the edge of the plate. It has been found in practice that the overhung rim of the utensil becomes too hot on account of the heat transmitted to this portion not passing off quickly, and thus the rims of utensils very soon get burned and cause leakages from the vessels. The best utensils are, therefore, those of cast metal having a dull bottom and highly polished on their other surfaces. An oven is provided to fit over the hot plate, and, to give additional heat, a second hot plate is inverted and placed in an opening in the top of the oven. The oven, as in the case of the other utensils, has polished surfaces, and a further precaution against loss of heat is given by the provision of an air space between the outer and inner walls of the oven. The whole apparatus can be used in a great variety of ways, and advantage may be taken of all the heat generated in the plates. A complete set consists of a

public cooker, having two hot-plates on one frame, an extension plate for the top of the oven, and an assortment of utensils for use with the apparatus. To the back of the frame is connected a flexible armoured cable which carries the current required for the three hot-plates.

A Scotch firm of manufacturers has recently put forward an electric cooker, which, with the possibility of improvement, bids fair to become the ideal cooker we have looked for. The makers have copied, to a certain extent, the design of a gas cooker, in having a cast-iron oven for roasting and baking, two hot-plates on top for boiling, stewing, &c., a double grill and toaster, and a hot cupboard for keeping food warm, warming plates, or for slow cooking. The oven is lined with white porcelain enamelled steel sheets, and fitted with an inner glass door, so that food can be examined while cooking without loss of heat. It also has a thermometer added to show temperature of oven is required for the various cooking operations. The grill is fitted with white enamelled sides and back, and both oven and grill are thoroughly lagged with asbestos. The elements are of thick high-resistance spirals mounted on fire-brick, and so arranged in sections that it is a matter of minutes to replace a section should it burn out. It will be interesting to see how the claims for reliability of the new cooker are borne out in practice. From its similarity to the gas cooker at least has the advantage that no special instructions in its use need be given to anyone familiar with the working of a gas cooker.

The control of electric cookers has always been a difficult problem for manufacturers. Good appliances have been completely spoiled for lack of perfect switching arrangements. In the case of the disk stoves, two switches are provided—one to give full heat and the other to give about one-third of full heat. To obtain even distribution over the plate at both degrees of heat, the element must be divided into two parts, and the switches arranged so that on top of the two portions are in parallel, while on "low" the current passes through them in series. To allow of this, one maker has double-pole tumbler switches, which have been designed with no great heed to proper insulation between plates, and practice has shown that, after being in use for some time, the insulation breaks down, and arcing across the full pressure takes place on switching off. In another type, three two-way switches have had to be linked together to give the desired change from series to parallel in the two parts of the element. A firm of accessory manufacturers has, however, come forward with special, well-designed switches of ample capacity, and having the necessary insulation resistance, and little trouble should be experienced from this source in future where the new pattern of switch is adopted.

It is desirable to fix the control switches on a separate board close to the cooker, unless a position on the cooker can be selected where they will not be damaged by water or steam. Connecting wires should, however, be as short as possible, as a great many breakdowns to ovens and hot-plates occur in the leading-in wires. They should also be of such heavier wire than the heating element. One switch only, having several positions, should be fixed to control each complete heating element, and as the top heat is always required in commencing operations, the positions should be arranged so that the handle of the switch can be moved directly from "off" position to the point connecting with full heat, and from "full" to the lower values before switching off. This arrangement, it will be observed, also tends to minimise the arcing at the switch contacts on inductive circuits. A single-pole enclosed clip fuse (a "Zed" type is almost ideal) should be inserted in the circuit with each element.

It is of great importance that the cook should know, not only that the switch is "on," but also that current is actually flowing through the element, and where the latter is not exposed to view, some method must be devised to show that current is passing.

A small pilot lamp at a convenient point has been tried, and in some instances, switches have been used which are provided with small glow lamps behind the index, which indicate not only that current is flowing, but also the relative strength of the current. These special devices naturally increase the cost of an electric cooker to a figure

which may seem ridiculous when compared with the cost of a gas cooker, but it is quite decided that apparatus for use with electricity must necessarily be very much more expensive than gas appliances, and it will be a great mistake if the development of electricity for cooking is hampered by leaving out devices which tend to greater reliability. Certainly the public will require to be educated in the new way of cooking, no matter how simple the apparatus may be, just as it had to be familiarised with gas cookers when these first came into vogue. With handy controlling gear on an electric cooker it will be evident that once a cooking operation has been carried out satisfactorily, the same satisfaction should be obtained again for the same operation, with the switches arranged and time allowed, as in the first case.

Cheap sets of breakfast outfits are to be had, consisting of a hot-plate, frypan, stewpan, and an electric kettle, and the results attained with these compare very well with those of the ordinary gas-ring, if we neglect the delay occasioned through the initial raising of the temperature of the hot-plate. It is easily possible to cook a breakfast by electricity for three persons within half an hour with an expenditure of less than half a unit, taking full advantage of the heat stored in the hot-plate after the current is switched "off." When account is taken of the enormous waste in the ordinary kitchen fire—about 90 per cent.—and the losses which occur with a gas-ring through radiation of heat from dirty utensils, and on account of soot on the bottom of kettles, &c., it will be seen that the electrical method is, after all, a very efficient system.

The loading of the elements of cookers has already been briefly referred to. The wattage for hot-plates should not exceed 23 watts per sq. in. of boiling-plate surface where mica enters into the construction, and should not be less than 20 watts per sq. in. A higher loading than 25 watts per sq. in. will disintegrate the mica and destroy its insulating properties.

In the foregoing notes an endeavour has been made to emphasise the fact that to popularise electric cooking, the apparatus must be *absolutely reliable* on all occasions. Elements will, naturally, burn out through time, but they must be so constructed that only that portion which gives way will be affected, and a complete stoppage of the cooking made an impossibility. The heaters must be cheap, and so simple that any housewife may be able to replace them in a few minutes. So far as present knowledge goes, we have not quite got the ideal apparatus, and it is to be earnestly hoped that, as the price per unit is still further reduced by supply authorities, manufacturers will on their part leave nothing undone in their attempts towards the perfecting of their electric cooking apparatus.

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## DUMPING: A NOTE ON A PARTICULAR CASE OF DISCRIMINATIVE CHARGES.

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By JOSEPH GOODMAN, A.M.I.Mech.E., A.M.I.E.E.

IN the following note it is not intended to treat the above question fully or in any way dogmatically, but it is written with the hope that any person who will bear with the arguments to the end, will be sufficiently interested to think for himself on the matter, and not content himself with the popular view, which usually only leads to a deeper misconception of the principles involved.

When considering the question of dumping, it is well to define at the outset the particular meaning attached to the word in the particular instance under notice, or, in other words, to distinguish between the various kinds of dumping.

The dumping of surpluses may first be considered. The manufacturer of a certain article can seldom, if ever, predict the exact demand that there will be in any certain period of time for that article, but he will, at any rate, see that he is not short of the amount that will bring him a maximum of profit: hence it frequently occurs that his supply is excessive, and a surplus arises.

Now, as a matter of business, the manufacturer will

probably prefer to keep a fairly high price level in his home market; this means that he will restrict his supply to the home market, and will dispose of the surplus, which consequently arises, in the foreign market.

This surplus will, as a matter of fact, sell at the price which then obtains in the foreign market for that particular article, which price, however, may actually be lower than the figure which would leave any profit for the manufacturer, were his whole output to be sold at that particular price.

It is at once seen from the above that in this case a surplus may be considered as a quantity of output which would not have been manufactured if the price for which it was to be sold had been foreseen.

A second kind of dumping is that which consists in deliberately manufacturing an excess so that increased quantities of the manufacture can be sold abroad (at a loss) in order to advertise the goods or to drive competitors from the market. It is, however, very doubtful if any manufacturer would adopt this plan in view of the excessive cost (except possibly in the case of some unique article, where it might be done to create a market, the price being afterwards raised when the public taste had been whetted).

With regard to competitors the above course would be feasible if actually the competitors could be driven from the field with small chance of recovery within a reasonable time. It will be seen that this should not be the case in ordinary commercial life.

Take the case of the old-established industries: these would work and sell for many years below their full cost of production (*i.e.*, including standing charges) rather than shut down, since shutting down would mean the destruction of their plant. They would manufacture so long as the selling price was well above the works cost of production, *i.e.*, exclusive of standing charges, which would not be saved by a shut down.

Again, taking the case of other industries so controlled that, directly prices become in the least unremunerative, their output immediately contracts; it is equally fair to assume that immediately upon a recovery in price, which would again render manufacture profitable, the output can be as easily increased.

Briefly, it seems probable that competitors who are easily driven from the market when prices are unfavourable, are easily rallied on an improvement in the market; whilst those competitors who are not easily routed, can only be finally driven out of the market after a long and expensive campaign. Also in either case an eventual rise in price occurs which involves the danger of losing the custom which was obtained at the lower price; in short, the commodity must be somewhat unique or indispensable for such a course to be taken.

Finally, one may consider dumping in which there is to be no ultimate raising in price, *i.e.*, the commodity is sold at first, and for all time (in the foreign market), at a price which is below the cost of production. This is a very different case, and is a much more feasible and business-like proceeding. Such a supply has to be manufactured that after the home demand has been satisfied at a high or moderately high price, a quantity is still left which has to be sold in outside markets at a price below the cost of production.

An ordinary method of argument, attempting to show that the policy pays, is to say that the manufacturer can afford to sell at a loss in the foreign market, because he obtains more than a normal profit from his home sales. This necessitates explaining why, when he is making easy money at home, the manufacturer deliberately determines to carry on a losing trade with foreign customers.

It can, however, be shown that under favourable conditions, it is possible for a manufacturer to sell continuously abroad at a price below the cost of production, cost of production being understood to mean the average cost (cost per unit) over the whole of the output manufactured. Then sales in a foreign market at a price beneath the cost of production will be profitable, provided that the foreign price is greater than the additional cost made to the total costs of the industry by the production of the additional exported quantity of output, when this additional

cost is estimated per unit of the exported output. Hence we see that the industry must be subject to increasing returns.

The fact that the foreign market (*i.e.*, increased output) is deliberately catered for in manufacturing, involves the expansion of the industry, and the enlarged industry properly organised means a lower cost of production per unit of the article or commodity manufactured. In addition to this must be reckoned the reduction in the cost of articles still sold on favourable terms in the home market.

N.B.—When the expansion of a business is accompanied by a fall in the marginal cost, it is usual to say that the business is subject to increasing returns; if the expansion is accompanied by a rise in the marginal cost, it is usual to say that the business is subject to decreasing returns.

The above involves the term "marginal cost":—Suppose a firm manufacture in any period one thousand boots, then the additional cost of production incurred by manufacturing the last boot over and above the previous nine hundred and ninety-nine boots may be taken as giving the "marginal cost"—a crude explanation of an important term, but sufficient for the present purpose.

## PROCEEDINGS OF INSTITUTIONS.

### Electric Heating and Cooking.

THE YORKSHIRE LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS discussed this subject on March 12th, 1913. In opening the discussion, MR. THOMAS ROLDS said the subject was one which, in his opinion, was of the greatest moment to the electrical industry. As far as he had been able to ascertain, the United Kingdom was well ahead of all other countries as regards both the manufacture and use of electric heating and cooking apparatus. This progress has been principally due to three causes, *viz.*:—(1) The reductions which had been made in the prices at which the apparatus was sold; (2) The reduction in the prices charged for electricity used for such purposes; and (3) The more active steps which had been taken to make public the advantages of the use of electricity and to push its sale.

The remarkable developments in the application of electricity for power purposes had overshadowed to a large extent the question of the use of electricity for heating and cooking purposes, as supply engineers and contractors had had their hands full in dealing with work in connection with power supply.

In areas where few manufacturing industries were in existence, the local electrical engineers had had to turn to business and domestic premises as the only outlets for increased output, and in a number of instances the heating and cooking problem had received the special attention at their hands which, in most manufacturing centres, had been given to the question of power supply. In one of these areas—*viz.*, the Metropolitan Borough of St. Marylebone—an average of over 150 kw. of electric heating and cooking apparatus was being installed per month, and nearly 200 complete electric cooking outfits were on hire by consumers from the supply undertaking. This had been accomplished in the face of very keen competition on the part of the large company supplying gas in the borough. He could unhesitatingly state, from actual experience, that there was a demand for electric heating and cooking in manufacturing districts, and it was his belief that this demand would grow rapidly, with the result that in a few years' time electric heating and cooking would to a greater or lesser extent become an everyday practice in the majority of houses having electric lighting installations, and that eventually electricity would be far more popular than gas for these purposes.

The invariable experience of those engineers who had energetically tackled the heating and cooking problem was that they had not been troubled by excessive peak loads, but had benefited by a general increase in output and load factor.

Up to December 31st last, the total capacity of the heating and cooking apparatus which was known to have been connected to the Bradford Corporation mains, exceeded 1,000 kw. Included in this figure were the following appliances which had been connected by consumers who had adopted the special domestic rate:—251 radiators, 138 irons, 27 kettles, 25 cooking ovens, 12 hot plates, and other small utensils, such as shaving-pots, milk and egg-boilers, toasters, &c. A very considerable number of the connections, however, were only represented in the department's books as plugs, and when apparatus was purchased for attachment to these, in the majority of cases no formal notification was made. There were undoubtedly very considerable numbers of radiators, irons, &c., connected to the Bradford mains which were not included in the above figures.

The number of cooking outfits connected might have been very considerably increased had the electricity department instituted a scheme for hiring out such apparatus at reasonable rates. The design of cookers of several makes had, however, now become so far standardised that in all probability a hiring scheme would soon be inaugurated, and a considerable number of consumers had expressed

a desire to give electric cooking a trial immediately such a scheme was put into operation.

The increase in the heating and cooking output had been almost solely the result of the special charge of 15 per cent. per annum on the net rateable value of the premises, plus  $\frac{1}{2}$ d. per unit for all current consumed, as registered by meter (which was provided free of rental charge), and of recommendations made by consumers to their friends after personal experience of the use of electric heating and cooking apparatus.

In his opinion no great headway would be made by any supply undertaking working in an area where gas was supplied at 3s. per thousand cubic feet or under, unless electrical energy for such purposes was supplied at a price not exceeding  $\frac{1}{2}$ d. per unit. The author was of opinion that such a tariff was remunerative, provided that a reasonable fixed charge was also made.

The lower the price charged for current the higher will be the load-factor of the supply. This had been proved to be the case in connection with lighting and power supplies. The question of load-factor was not of such great importance when dealing with cooking loads as when applied to heating loads. Leaving out exceptional cases, cooking loads must be intermittent, and a low tariff could only be justified by reason of their great diversity factor. Radiators and convectors would only be used for occasional purposes where a high tariff was imposed, but with the reduction of the tariff they would become more and more popular for all-day heating. (See table.)

*Statement showing Total Number of Units Sold to Consumers who have adopted the Special Domestic Rate each year since its institution.*

Year ended.	Units.
December 31st, 1910 (six months only) ...	53,733
December 31st, 1911 ... ..	263,618
December 31st, 1912 ... ..	435,765

When considering the best method of applying electricity for heating purposes, the actual requirements of the case should be taken carefully into consideration. Should the heater only be required for intermittent use, or to provide warmth immediately, a radiator should be installed. If, however, it was desired to warm the whole of an apartment in the shortest possible time, and to maintain the warmth afterwards, a convector would be found most suitable.

It has been found by the author that to obtain satisfactory heating the consumption of the heater should not be less than 1 watt per cb. ft. of the apartment to be heated. In apartments where there are a number of doors or windows, or the door is being continually left open, the consumption should be greater. Now that current is obtainable at  $\frac{1}{2}$ d. per unit, and cheaper designs of radiators and convectors have been evolved, it is quite common for two and three-unit heaters to be installed, with the result that satisfactory heating effects are obtained.

The luminous radiator of Mr. H. J. Dowsing is as efficient as any on the market, and it is advisable that this form or some modification thereof should always be used when luminous radiators are adopted.

In some designs of lamp radiators which have come under the author's notice, the lamps are more or less hidden at the top, bottom, or sides of the radiator by some portion of the body. This tends to cause overheating of the lamps, and to shorten their life. Overheating of the lamp holders also results, with consequent trouble with their contacts, and further reduction in the efficiency of the heater as a whole. Designers of radiators should always bear in mind that the object for which a heater is required is to give off as much heat as possible, and not to retain the heat in its body. This object can only be achieved by allowing the air to have as free access as possible to the heater, in order to reduce the temperature of its parts, and, in the case of radiators, to design the body so that there is as little obstruction as possible to the rays of heat given out by the elements. There are many luminous radiators on the market which do not comply with the above conditions.

Bastian and other types of open glowers should be guarded to prevent fire occurring through inflammable materials touching the elements, and should not be mounted too close to the floor unless the latter is well heat insulated, as it is found that these types of heaters throw a considerable amount of heat downwards. The connections to the heating elements should be of good mechanical construction, simple clips, such as are often used, being a source of great trouble, especially if the glowers are of high capacity, as in course of time, through the continual expansion and contraction which takes place, the clip becomes loose.

The type of radiator known as the Ferranti fire is very efficient. The usual form in which this is made is that of a metal bowl some 18 in. in diameter, in the centre of which is fitted a hot plate covered with a quartz disk. After current has been switched on for some little time both the face of the hot plate and the disk become red hot, giving the heater a cheerful appearance, and the formation of the metal bowl causes the radiant heat to be well thrown out into the room. In using this type of heater, care must be taken to prevent inflammable materials from touching the quartz disk.

Many convectors are made with insufficient air inlets, and the outlets are often considerably baffled. This causes over-heating of the elements and contacts, and tends to reduce the efficiency of the heater. In a recent case which came under the author's notice, a convector was returned by a consumer on the ground that the heat given off was insufficient, and with the request that additional heating elements should be inserted. The capacity of the convector was increased by adding further elements, which were of

wire wound on mica strips, the air openings in the lower part of the body were increased by 100 per cent, and the baffle plate, which had been fixed above the original elements, was removed. On the heater being returned to the consumer it gave every satisfaction, so much so that the additional heating units were not required, the temperature of the room being maintained with less consumption than was the case when the convector was used in its original condition.

A simple and effective form of convector is that known as the G.E.C. tube heater, in which radiator lamps are fitted inside metal tubes of about twice the lamp's diameter. In this case the radiant heat of the lamps is not utilised directly for warming the room, but to heat up the enclosing metal tubes, which in turn heat the air which passes rapidly through them.

Radio-convectors have during the past few years become very popular. These usually consist of a four-light luminous radiator at the back of which are arranged a number of coils forming a convector. By combining the two forms of heaters a very satisfactory result is obtained.

Generally speaking the electric heater can only compete with other forms of heaters by reason of its adaptability, and the fact that the whole of the heat units given off by it can be efficiently utilised. In preparing schemes for electric heating, therefore, it is most desirable that the whole of the conditions should be thoroughly studied and the heat applied in the most suitable manner and positions.

One of the first firms to make a serious attempt to put a practical cooking outfit on the market at a reasonable price was the Berry Construction Co., Ltd., whose "Tricity" cooker has had a very considerable sale, and is well known throughout the country. Very satisfactory results have been obtained from the use of this outfit, but it has been found by experience to have a number of disadvantages. Amongst these may be mentioned the following:—

The flexible connections to the hot-plate on the top of the oven and the extension cooker are often found to be in the way, and, as is the case with all flexibles, faults develop where the wire is attached to the plug or to the plate. The plugs also after a time make bad contact owing to the pins losing their spring through constant use. When this happens, either the plug heats up the fuses, or, as had been the case on a number of occasions, the contact is so bad as to prevent current passing to the hot-plate, with consequent loss of heat in the oven and spoiling of the food being cooked. Another great disadvantage which is found in connection with this outfit is its novelty of construction, which causes it to fail to appeal to the average cook, who is usually of a conservative disposition. Having been used to coal fires and gas ranges, the cook naturally prefers that an electric cooker should be constructed somewhat on the same lines, and for this reason electric ovens designed on somewhat similar lines to gas stoves are now becoming the standard article provided for electric cooking purposes.

The majority of manufacturers, however, cannot be said to have yet settled down to what may be regarded as standard lines, as they do not seem to have sufficiently studied the requirements of the various classes of people for which they have to cater.

The varying requirements of different parts of the country have also not been realised. Most electric stoves appear to have been designed to suit London conditions, and the ovens made sufficiently large to cook a small joint and pastry. On introducing these ovens in Bradford, it was soon ascertained that they would not meet the local conditions, as one of the first requirements for an oven in the West Riding seems to be that it should be capable of baking bread, whereas in London and in most towns in the south it is unusual for bread baking to be carried out at home. The internal dimensions of the cookers originally supplied were too small to accommodate the usual baking of half a stone of bread. In addition to this, the elements in some types of ovens were arranged round the sides, and, as, in connection with the baking of bread, it is generally conceded that a bottom heat gives the best results, and as the majority of coal ovens in Bradford are so arranged that the most intense heat is at the bottom, the consumers who tried the electric ovens could not obtain satisfactory results from them. In London and the south, cooks have become quite used to side heat by reason of the general use of gas stoves; and in the case of coal-fired ovens for domestic use, the most intense heat is applied at their tops.

The ovens should be provided with at least three separate sets of heating elements, so controlled that not less than three regulations are provided. It is advisable that the capacity of the heating elements should be such that two sets are capable of maintaining sufficient heat for all ordinary baking operations. The advantage of this arrangement is that the oven can be quickly brought up to full heat by the use of all three elements, and that in the event of the failure of one of them, the remaining two would provide sufficient heat to complete the operations in hand without spoiling the food.

It would appear an advantage if ovens were constructed so that a glowing type of unit could be used for the cooking of meat, and controlled by a series-parallel arrangement, so that the heat in each individual element could be reduced when bread or pastry was being baked.

A thermometer of the mercurial type, protected from injury, should be provided on the door or other convenient portion of the oven, and a table of temperatures and instructions as to the heats required for the cooking of various dishes should be sent out with each cooker.

Glass panels are provided by some makers in the door of the oven, and these are of unquestionable use if the heating elements used glow sufficiently to provide enough light to enable one to see the food being cooked.

It is generally found that two hot plates and one grill mounted above the oven are sufficient for all ordinary purposes. The hot plates should be so arranged that either the plate as a whole, or the heating element, can be easily removed for the purpose of repair, otherwise repairs prove costly and of great inconvenience to the persons in whose houses the cookers are installed.

A flat plate of not smaller dimensions than 36 in. x 18 in. should be fitted at the top of the oven, level with the base of the hot plates, so that cooking utensils, dishes, plates, &c., may be stood thereon. This plate should be left bright and kept clean.

The space between the underside of the hot plate and the oven should be utilised partly as a hot cupboard for warming dishes, plates, &c., and partly as a grill, the grill elements being fixed to the underside of the plate. The grill should be of not less dimensions than 12 in. x 8 in., and should be arranged with two heats, so that one half of the heating elements can be used if found desirable. Arrangements should be made so that the grid on which the article to be grilled is placed can be supported at varying distances from the elements.

The whole of the heating units should be separately switched and fused. Each hot plate should be provided with at least two, and preferably three, regulations of heat in the proportions of quarter, half and full, the regulation being provided by a Diamond "H" switch having one "off" and three "on" contacts. The switches and fuses should preferably be mounted on a board. On the same board should be mounted a main double-pole switch, so connected that it can be used to cut off entirely the supply of the cooker, sub-switches and fuses. A pilot lamp should also be mounted on this board, unless one is fitted on the stove itself. The pilot lamp should be separately fused.

The wires between the cooker and the switchboard should be enclosed in flexible metallic tubing, and the whole of the metal portion of the apparatus, apart from the electrical circuits, efficiently earthed.

Where a cooker is supplied from a circuit of which one pole is maintained at earth potential, if plug connections are used for all or any of the various circuits, the pins of the plugs should be of different diameters or some other device used to prevent change of polarity, otherwise single-pole sub-fuses will afford no protection.

With a hot plate the heat is transmitted to the containing vessel entirely by reason of the conductivity of the materials employed. Unless, therefore, the bottom of the utensil bears evenly throughout the whole of its area on the surface of the hot plate, points of excessive local heating occur at the places where the vessel touches the plate. If water is being heated, a rapid convective action takes place at these points, and the heat units are thereby distributed throughout the whole of the liquid. In the case of milk, gravies and similar thick liquids, however, the convective action is so slow that the heat cannot be transmitted from the bottom of the vessel sufficiently rapidly to prevent an excessive rise in temperature, with the result that burning takes place. These facts should be borne in mind when choosing utensils for use on hot plates.

The best results are obtainable with stiffly constructed vessels, such as those made of cast-iron or castaluminium, having machine-ground or turned bottom surfaces of fair thickness. Excellent contact is made by such vessels with the turned surface of the hot-plate, which contact, owing to the vessels' rigid construction, is not broken by buckling. In addition to this, due to the thickness of the metal in the base of the utensil, the heat, even if absorbed unequally over its under-surface, is equalised by the rapid conduction which takes place in the metal itself before reaching the surface exposed to the liquid. Not only does the use of such utensils tend to prevent the burning of food, but the heating is more rapid, and, therefore, more efficient.

Enamelled iron utensils have been found very unsuitable for use with hot-plates.

MR. T. HARDING CHURTON said he thought that if Mr. Roles had been in America recently, he would have felt that the United Kingdom was a long way behind. As to the use of radiators at 1d. per unit, he had come to the conclusion that to heat a room of any considerable dimensions was rather an expensive matter. In small rooms, such as dressing rooms and the like, a radiator was very nice indeed. He found the cost of a coal fire was 4d. an hour, whilst that of the radiator was 1d. per hour, and the coal fire did very much better service. It would require half a dozen radiators to make much difference to the temperature of an ordinary living room. However, they were handy for supplying warmth to the individual, as they could be moved about the room for that purpose.

MR. W. B. WOODHOUSE said he thought the great advantage of electric cooking was the convenience of it. From Mr. Roles's paper he worked it out that to treat a house rated at £50 would involve a heating bill of something like £80. He considered that Mr. Roles made out a very strong case against the Marylebone or Telephone Tariff, because where there was a plug by which the customer could connect anything he liked, it would be extremely difficult to apply accurately such a tariff. He thought Mr. Roles was claiming too much in saying that he was supplying current for domestic cooking and heating at a 4d. per unit. There was the rateable value charge to take into account. Cooking would give them a Sunday load, and that might become a very important thing. He thought the tendency to copy the form of the gas stoves was wrong. Far better would it be for the makers to develop a stove which was absolutely right in type for electrical use, and then to persuade the public that, though different from the gas stove, it was better than it.

MR. A. B. MOUNTAIN said many years ago he persuaded the Huddersfield Corporation to spend a good many hundreds of pounds in establishing a showroom and buying fittings for hiring, and so far as cooking was concerned it was a great failure. The great

difficulty was the lady problem. The wealthy ladies left the matter to the servants; what he might call the economical genteel class could not afford the appliances, and the working class at once raised the question of how to boil water. His experience of radiators agreed with Mr. Churton's.

MR. H. VESGER said he did not think any reasonable man would suggest heating a house with radiators under present conditions of price of energy, though the radiators might be a most excellent thing for old people and babies going to bed and getting up in the morning. There was no comparison between heating an ordinary sized room with radiators and with anthracite coal. As to cooking, he thought there was distinctly a field for it. The enormous advantage of cleanliness was most obvious. A single unit "Tricity" cooker was most useful and economical for cooking odd things in case of sickness and so forth.

DR. R. POHL said he had seen German figures which led him to the conclusion that 4d. per unit for electric current and 2s. 5d. per 1,000 cb. ft. for gas amounted to exactly equal cost for cooking. These figures, however, related to individually heated vessels, and he believed that the efficiency of these was 80 or 90 per cent., whereas the efficiency of the stoves which were so largely used now would not be more than 60 per cent., and, therefore, would be about 40 per cent. more expensive in working than the individually heated vessels. In regard to the load factor point of view, he thought that Mr. Roles had rather under-estimated the importance of the fact that cooking went on in summer as well as winter, whereas heating was in winter only.

MR. W. LANG thought that Mr. Roles might well have dealt with the claims which were made as to the saving in weight of food by the electric cooking, and also the better flavour, the absence of loss of juices, and the increased pleasure of eating the food. A difficulty which operated against the manufacture of ovens was that the disks for heating the vessels had to be made of very light castings, and in use they were liable to buckle, and so the uniformity of surface for the vessels to rest upon was spoiled, and when the pots and pans were resting upon two or three points only, the advantage of the heat was largely lost. As to heating, he thought that by a very simple arrangement the fresh air admitted into a room by a wall ventilator could be heated by means of a small electric heater fitted into the wall.

MR. ALBERT INNES, speaking upon the subject from the contractor's point of view, referred particularly to difficulties in educating the customers. There was great difficulty in persuading ladies that convectors were better than radiators for heating rooms.

MR. E. C. WALLIS testified to the great usefulness of radiators in case of illness.

MR. HAME, of York, said he had been very gratified at the fewness of the cases in which electric cookers had been returned. He thought the public liked the cookers very much indeed, and at York the authorities were only waiting to see whether the popular favour was permanent before going into the provision of more cookers. There were difficulties sometimes—as, for instance, when, as he remembered in one case, cooking was attempted on a small "Tricity" cooker for a family of 12, who had hot lunch every day, and hot dinners most evenings—in hitting upon the right size and style of apparatus. Obviously the possibilities of electrical heating were limited, but he knew of a case in which a church at York was heated solely by electricity, and though it was a very old and damp church the results were satisfactory. It was done by double tiers of tubes about four inches in diameter, and six tubes high running right round the building. He believed the cost was about 6s. or 7s. per Sunday, and the people concerned seemed to think that it was worth the money. Though he had started with the greatest doubt about electric cooking, he now thought it had come to stay.

MR. CAMPION, of Dewsbury, said it was a very good thing that the makers were now prepared to enter into contracts for the maintenance of the elements of the ovens.

MR. ROLES, in his reply, said that, notwithstanding Mr. Churton's observations, all the information that he had been able to gather suggested that the Americans were not up to the standard of this country in regard to cooking and ovens. He had not advised anyone to attempt to heat a house all through by electricity. If people began to do that, he would have to start another work. One advantage of the electric cooker was that it was safer than the gas cookers, with which many accidents happened. In Bradford the people who were chiefly taking an interest in electric cooking, were people living in houses rated at from £20 to £35 a year, who had little domestic help and wanted apparatus that they could use with safety and cleanliness themselves, the lady doing the cooking whilst the one servant did the rougher work, and for these people the electric cooker was very much better than the gas stove. With regard to saving in weight of meat, results obtained by himself showed very material advantages in favour of electric cooking.

The subject was further discussed at Sheffield, on March 26th.

MR. KING said that he desired to consider the matter of electrical heating and cooking from the point of view of the man in residence, for with such an individual practically the only question was that of cost. For the purposes of comparison he took a nine-roomed house, containing an average family of five grown-up people in Sheffield. Such a family would spend about £13 per annum on electricity for lighting, gas for boiling water and cooking purposes at only 1s. 3d. per thousand, and £8 2s. for coal for heating for the year. In the case of greater use of electricity for a house and family of the same size, he estimated that for lighting, heating and cooking purposes they would require 5,271 units per annum in total, and, working this out on Mr. Roles's basis of 15 per cent. on the rateable value and 4d. per unit, the cost would come to £17 16s. 6d. There was thus a difference of between £4 and £5,

and in order to make it worth a person's while to go in for electric cooking and heating they would have to save the amount of the difference. Some saving would be made in dispensing with a certain amount of labour in house cleaning and so on. In regard to the matter of diversity factor they would all probably have noticed for themselves that persons went to work at different times in the morning, and therefore they also had their breakfasts at different hours. It was absolutely necessary to have red heat for grilling and to have black heat for baking.

MR. E. J. MARSH said that electrical cooking and heating offered a great field for electrical engineers. In the past the trouble had been that lightly built materials had been used, and the designs soon became obsolete.

THE CHAIRMAN (Mr. Wilson Hartnell) said that years ago he had made experiments with a gas oven in order to find how little gas was being used, but in actual use the consumption of gas was doubled and even trebled. The same thing applied to electric installations. In both cases it was due to carelessness in use.

MR. BURNAND said that it was pretty well recognised that they had to have a fixed charge and a charge according to the amount of current used, and the only point at which that system failed was when the diversity factor was altered. The ideal tariff was one where there was a fixed charge and a charge per unit at a low rate, and also an increased rate at a time of maximum load at the station, and it was possible with this system to make one charge for current for heating and lighting or anything else, and yet get a fair revenue.

MR. ROLES, in reply to the discussion, agreed with the estimates which had been made by Mr. King. He always found that, after persons had commenced using an electrical installation for heating and cooking, they continued with it, and in cases of illness in the house, the occupiers when they had once tried an electric radiator, would, under no consideration, use a gas stove and run the risk of leaving the gas turned on and getting asphyxiated. At the present time he thought the manufacturers were getting down to a standard type of oven, and this, together with the experience of users, showed that the new ovens would not become obsolete in the course of a year or two, as they had done previously. The prices for ovens were dropping, and a satisfactory one could now be obtained for £10 or £11; there did not seem to be any reason for doubting that the prices would drop still further. At the present time he was very anxious to get a two-rate system for shops and smaller consumers. He was not altogether satisfied with the rateable-value system for shops, and yet, at the same time, he could not at present find another system that would suit his purpose.

**Recent Developments in the Street Lighting of Manchester.**

By S. L. PEARCE, M.I.E.E., and H. A. RATCLIFF, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Manchester, February 25th, and London, Birmingham and Glasgow.)

(Continued from page 498.)

THE Portland Street light has a much warmer and more cheerful effect than the comparatively cold light in Princess Street.

The curves (figs. 4 and 5) show the horizontal and vertical components of the illumination on planes 3 ft. 3 in. above the ground, and on the ground level. Table III gives a summary of the actual results obtained. The figures in Table II were obtained with a luminometer, and clearly show that, as regards the intensity of the illumination at a considerable distance from the lamps, the flame arcs give better results than the gas lamps.

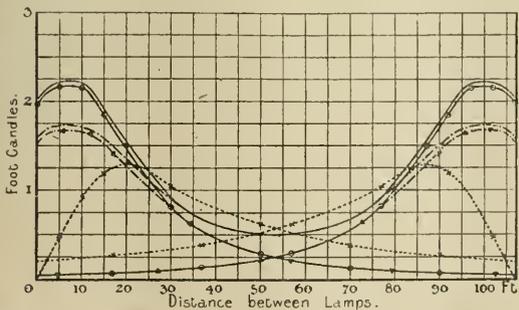


FIG. 4.—Curves showing the results of the photometric tests on the Princess Street three burner high-pressure gas lamps. Full-line curves represent illumination on a horizontal plane 3 ft. 3 in. above the ground level; dotted curves, the illumination on a vertical plane; chain curves, the illumination on the ground.

Purely from the point of view of illuminating effect, there is much to be said in favour of both systems; but the electric lighting system possesses all the practical advantages, a few of the more important of which are:—

- (a) Lower cost

- (b) Simplicity of switching operations, and possibility of dispensing with lamplighters.
- (c) Flexibility and ease of erection.
- (d) Lamps not affected by vibration when suspended from traction poles.
- (e) Possibility of reliable check on running costs (i.e., current consumption and carbons).
- (f) Negligible leakage.
- (g) Absence of globe breakages due to heating, &c.

All the above advantages are absent in the case of the high-pressure gas system, and in contrast may be mentioned the disadvantages incidental to its use:—

- (a) Extensive and highly dangerous leakage of high-pressure gas.
- (b) The detrimental effect of a foggy or heavily smoke-laden atmosphere on the mantles, resulting in a serious diminution of candle-power just at a time when it is most required.
- (c) Partial and occasionally complete failure in frosty weather.

Portland Street is a most unsatisfactory street to illuminate, owing to the nature of the buildings and the absence of any appreciable amount of reflection; nevertheless, the present lighting is

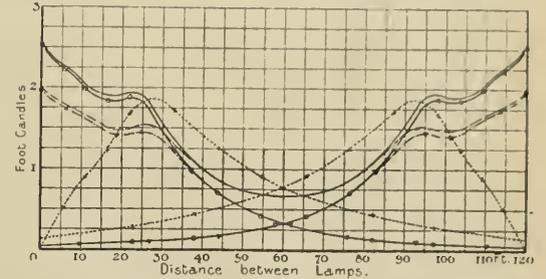


FIG. 5.—Curves showing the results of the photometric tests on the Portland Street 550-watt lamps, fitted with the latest type of outer globe having a graded frosting. Full-line curves represent illumination on a horizontal plane 3 ft. 3 in. above the ground level; dotted curves, the illumination on a vertical plane; chain curves, the illumination on the ground. The elimination of the shadows under the lamps should be noted.

probably as good an example as will be found elsewhere of uniform street lighting with a high average intensity of illumination on the horizontal plane, and a reasonable absence of glare.

The minimum intensity of the illumination on a horizontal plane 3 ft. 3 in. above the ground is, with unimportant exceptions, 0.5 ft.-candle, and the ratio of maximum to minimum illumination in the centre of the road is 3.75. The ratio of the maximum to the minimum illumination on the horizontal plane may conveniently be referred to as the "variation factor."

When carefully analysed it will be noticed that the experts' reports very closely confirm the values of candle-power and illumination claimed by the Corporation Electricity Department as a result of the tests made by their own staff.

Mr. Abady refers to the meaning of "illumination" and the difficulties incidental to its measurement. Throughout this paper, illumination has been regarded as the equivalent of impressed light flux density multiplied by the cosine of the angle of incidence.

Apart from actual values, the proportionality of Mr. Abady's figures for the illumination of Portland Street and Princess Street is in fairly complete agreement both with the electricity department's and Mr. Harrison's results; and his values for the candle-powers of the Princess Street lamps provide important confirmation not only of the electricity department's tests, but also of the fact that the lamps were not giving anything like the candle-power claimed by the manufacturers.

This result is both interesting and important, for it has always been the experience of the authors that gas lamps give substantially lower candle-powers than the values claimed by the manufacturers. This is evident from the figures given in Table I.

TABLE I.

Description of lamp.	Year of test.	Rated candle-power.	Actual maximum c.p. (Average results.)
Keith 3-burner high-pressure gas ... ..	1912	4,500	2,300
Keith 2-burner high-pressure gas ... ..	1912	3,000	1,630
Keith, single-burner high-pressure gas ... ..	1912	1,500	725
Welsbach-Kern, twin-burner	1907	1,200	655
Suggs "Belgravia" ... ..	1907	1,800	1,025
Lucas "Thermopile" ... ..	1907	1,250	765
Intensified gas, Sackville Street ... ..	1904	1,000	525

In Appendix A is set forth the method of arriving at the cost of the current under the conditions that obtain in Portland Street.

The totals for "fixed" and "running" costs respectively are arrived at in the manner shown.

The resultant figures are £6.133 per kilowatt of demand plus 0.293d. per unit metered. Applying these values as shown in Appendix B, the costs of the current for the 11 o'clock and for the all-night lamps respectively come to 0.97d. and 0.6d. per unit.

Appendix C contains a statement of all costs involved in lighting Portland Street.

Appendix D is a statement showing the cost per lamp per annum of lighting Princess Street, as given by Mr. Abady in his report.

The following particulars of the lighting in Princess Street and Portland Street are extracted from Mr. Hadyn Harrison's report. In order to make the figures strictly comparable, the Portland Street lamps are assumed to be all switched out at 11 p.m.

	Princess Street high-pressure gas.	Portland Street arcs.
Candle-power of lamps ... ..	1,750	2,970
Number of lamps to the mile ...	49.34	43.6
Running costs per lamp per hour ...	1.5d.	0.7d.
Capital cost per mile of street ...	£2,537	£1,569
Running cost per 1,000 C.P.-hours ...	0.857d.	0.236d.
Cost per annum per mile, equal illumination ... ..	£675	£254
Minimum illumination, basis of comparison	0.39 ft.-candle	0.5 ft.-candle
Cost per mile of street per annum (up to 11 o'clock) at above illumination ... ..	£617	£254

The high-pressure gas lighting in Mosley Street is a very poor display compared with the arc lighting. It is also a very poor display of high-pressure gas lighting. An illumination on the horizontal plane 5 ft. above the ground level equal to 0.5 ft.-candle is only obtained up to a distance of 22 ft. from the bases of the lamp-posts, and the minimum midway between the posts is only 0.07 ft.-candle, the "variation factor" being as high as 43.

St. Peter's Square is distinctly a better example of high-pressure gas lighting, and compares favourably with the flame arc lighting in Albert Square. The illumination on a horizontal plane 5 ft. above ground level is maintained at a sufficiently high value, and is equal to 0.5 ft.-candle in all parts where there is any great amount of traffic.

The 500-watt lamps in Albert Square are fitted with slightly opalescent globes, and are mounted on poles at a height of 22 ft. 8 in. above the ground. The illumination is fairly uniform.

The average horizontal illumination in Piccadilly is well over 1 ft.-candle, and in no part where there is any appreciable amount of traffic is it less than 0.5 ft.-candle. The roadway is lighted by means of 12 500 and four 550-watt lamps fitted with clear inner and outer globes, and fixed on the tramway standards at a height of about 27 ft. 6 in. above the ground. In addition, there are also 10 450-watt lamps on the esplanade. These lamps have opalescent bowl-shaped globes. They are suspended from swan-necked pole-brackets at a height of 18 ft. 6 in.

The reading tests and observations in Table II refer to clear weather; there is no question as to the superior penetrating power of the rays from the arc lamps in foggy weather.

TABLE II.

Sizes of type.	Maximum distance at which distinctly readable.	
	High-pressure gas.	Flame arcs.
Large (Pica Doric) ...	339.0 ft.	371.5 ft.
Medium (Small Pica) ...	265.0 ft.	313.0 ft.
Small (Brevier) ...	212.5 ft.	242.0 ft.

All figures are the average of not less than six sets of observations taken on different nights.

A very considerable amount of testing and experimental work has been undertaken in order to discover, if possible, the most satisfactory type of outer and inner globe for use under the conditions obtaining in Portland Street, and to comply with the following requirements:—

Reasonably uniform illumination; absence of glare; moderate cost of globes; light distribution not affected by slight alteration

in the position of the arc; maximum candle-power approximately between the 20° and 25° rays below the horizontal.

The light distribution with the original globes was anything but satisfactory, and the glare was very objectionable.

The first attempt to overcome these defects was by the use of opalescent outer globes of the same shape as the clear globes. The result was a distinct diminution of the shadows under the lamps, and the complete disappearance of the concentric rings; but unfortunately the light distribution was very considerably reduced, and the dark gaps midway between the lamps were very noticeable.

Various types of dioptric and inner diffusing globes were then tried, but without appreciable success. This lack of success was no doubt due in a great measure to the position of the arc and the shape of the original outer globes. It was not until the type of outer globe now in use had been adopted that any headway was made with the various attempts to improve the light distribution (see fig. 3).

Fig. 6 shows the polar curve for the 11-ampere lamp fitted with the clear inner and outer globes. This curve possesses many excellent features, but can be modified with considerable advantage. For street-lighting work, the upper portion of the curve between 15° and 25° from the horizontal is of most importance,

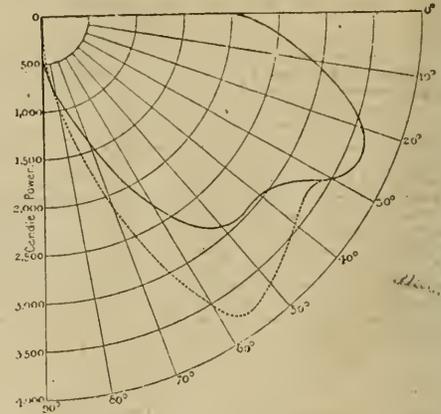


FIG. 6.—Polar curve for 550-watt flame arc lamp as used in Portland Street. The dotted portion shows the effect of the original experimental obscuration. Tested with "old type" carbons.

but the portion between the 40° and 65° rays could be reduced with advantage. The absence of appreciable candle-power between 80° and 90° is a result of the rather pronounced shadows cast by the ash-trays.

The first attempt to reduce the distribution of light between the 40° and 65° rays, and at the same time to improve the distribution in the neighbourhood of 20° below the horizontal, was by the use of dioptric globes. The results were not entirely successful.

These tests seem to demonstrate very clearly a rather objectionable feature of dioptric globes, namely, the strongly defined optical centre, in consequence of which the light distribution is very considerably distorted if there is any appreciable change in the arc position.

It is very probable that the open lower end of the dioptric globe is largely responsible for the very marked dip in the polar curve.

Attempts were made to modify the shape of the polar curve by suitable obscuration of the outer globes, and it was owing to the success of the early attempts that further investigations were conducted upon these lines. The necessary obscuration was

TABLE III.

Description of lamp.	Where situated.	Height above ground level.	Maximum candle-power. Average results.	Illuminations on horizontal plane in foot-candles			Variation factor.		
				Maximum at centre of road.	Minimum at		Height of measuring place.	Centre of road.	Maximum.
					Centre of road.	Building-line.			
550-watt flame arcs, original globes. Outer globe opalescent	Portland Street	27 ft. 6 in.	2,250	3.14	0.370	0.280	5 ft.	8.50	11.20
550-watt flame arcs. New type inner and outer globes. Final graded frosting				2.50	0.670	0.500	3 ft. 3 in.	3.75	5.00
	2.00	0.670	0.500				Grnd level	3.00	4.00
550-watt flame arcs. Clear inner and outer globes ... ..	Piccadilly	25 ft. 6 in.	3,580	5.95	0.760	0.500	5 ft.	7.85	11.90
Keith 3-burner high-pressure gas ... ..	Princess Street	26 ft. 6 in.	2,300	2.23	0.575	0.400	3 ft. 3 in.	3.88	5.58
Keith single-burner, high-pressure gas ... ..	St. Peter's Square	17 ft.	725	* 2.45	0.180	0.120	5 ft.	13.6	20.4

\* These values are the maxima obtained approximately 5 ft. from the posts and not at centre of road.

at first obtained by the application of whitening on the inside of the lower portion of the outer globe.

Globes obscured in this manner have actually been in use in Portland Street for over six months, and no doubt the slight difference between the test results obtained by the Corporation's own staff and the independent experts are traceable to the variable nature of this obscuration, and also to changes in the type of carbons used.

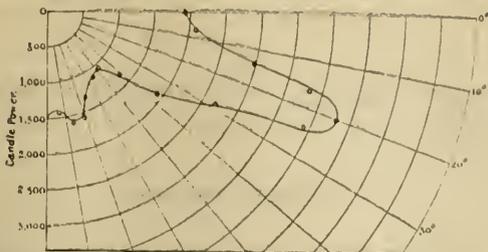


FIG. 7.—Polar curve for 550-watt lamp with dioptric inner globe and clear outer globe with dense frosting up to 48° above horizontal.

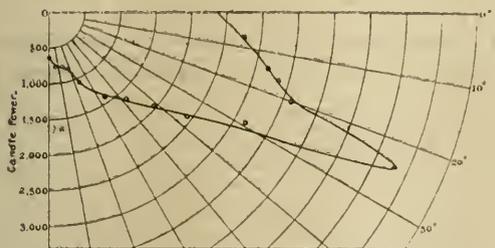


FIG. 8.—Polar curve for 550-watt lamp with dioptric inner globe and clear outer globe with graded frosting tapering off to 40° above horizontal.

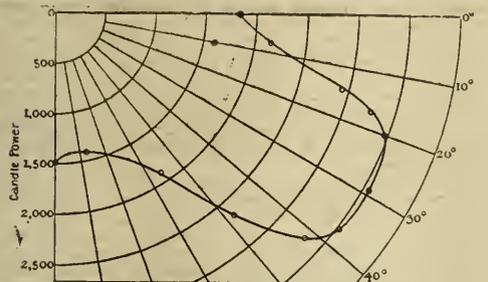


FIG. 9.—Polar curve for 550-watt lamp, fitted with clear inner and outer globes, as shown in fig. 3 (full lines), and having a graded frosting on the lower portion of the outer globe. The frosting is densest at the bottom of the globe, and disappears at an angle of about 40° below the horizontal.

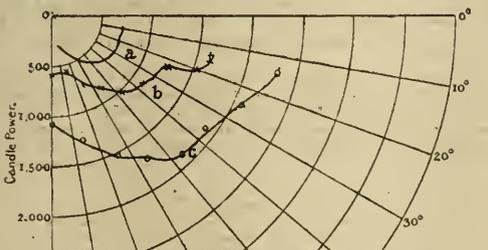


FIG. 10.—Polar curves for Keith high-pressure gas lamps. (a) Single-burner; (b) twin-burner; (c) three-burner.

Attempts were then made to obtain from the globe makers suitable obscured globes, but the greatest difficulty was experienced in obtaining exactly what was required. No manufacturer would undertake to give a graded effect, at any rate on a diffracting globe, although a flashed opalescent globe with a graded effect on the lower portion was eventually obtained.

The experimental etching of globes was therefore undertaken. The globes were clamped on to a special lead stand and filled to the desired height with the etching acid. The grading effect was then obtained by allowing the acid to run out of the globe through an adjustable orifice in the lead stand, and any desired degree of frosting could be obtained by regulating the rate of flow.

Figs. 7 and 8 show polar curves obtained with different combinations of globes, and it is obvious that they are very suitable for giving a fairly uniform illumination on a horizontal plane.

(To be concluded.)

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

AMENDMENTS.

**NORTHERN RHODESIA.**—The Board of Trade has issued a copy of a new Customs tariff of Northern Rhodesia. The new tariff divides the country into two zones: the Zambesi basin and the Congo basin, and deals with these zones separately. The "general" rates of duty in the Zambesi are practically identical with those in the South African Customs Union, but the preferential rates of duty leviable on British goods are in some cases lower. In the case of the Congo basin no provision is made for the preferential treatment of British goods. In any case electrical plant and machinery, and tramway material, are duty free.

The certificates of origin necessary in order to obtain entrance for British goods under the lower preferential rates are the same as those already in force for the South African Customs Union.

The new tariff has effect from February 1st last.

**SIAM.**—The Board of Trade Journal reports that the Director-General of Customs and Excise at Bangkok has issued a notice laying down regulations with regard to the entry of goods for importation and exportation; the regulations were to come into force on Tuesday last, and are as follows:—

1. The entries must be made in the form prescribed by the Department.

2. The goods must be denominated in strict accordance with the classification shown in the official Import and Export List.

3. Particulars of quantity and value must be furnished for each separate kind or class of goods, and quantities must be given in the terms of the Import and Export List.

4. The country from which the goods are consigned, in the case of imports, and the country to which they are consigned, in the case of exports, must be declared for each separate kind or class.

The Department, it is stated, will not accept entries which are not in accordance with these regulations, which have been framed with a view to providing more complete and accurate statistical information; and it is the intention of the Siamese Government to enforce them at all the ports of Siam.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 6,513. "Electrical device to enable several spindles to be driven synchronously as required in cinemas and gramophone shows, and in like cases." W. J. SWAIN. March 17th.
- 6,544. "Apparatus for regulating the ignition of internal-combustion engines." SIR A. W. RUYSSENAERS. (Convention date, March 18th, 1912, Germany.) March 17th. (Complete.)
- 6,551. "Sockets and terminals for electric leads." A. G. BLOXAM (firm of R. Bosch, Germany.) March 17th. (Complete.)
- 6,581. "Electric incandescent lampholders." S. W. MARTYN. March 17th.
- 6,602. "Electric lamps." W. E. BLADON. March 17th.
- 6,603. "Device for the improved stopping of pulley automatic electric lifts." J. W. SODDEN. March 17th.
- 6,647. "Manufacture of insulated windings or coils for electrical purposes." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H., Germany.) March 18th. (Complete.)
- 6,648. "Commutators for dynamo-electric machinery." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens Schuckertwerke G.m.b.H., Germany.) March 18th. (Complete.)
- 6,664. "Circuit arrangement for semi-automatic telephone systems." SIMONS & HALSEKE AKT.-GES. (Convention date, March 19th, 1912, Germany.) March 18th. (Complete.)
- 6,668. "Process and apparatus for the electrical treatment of cellulose and other substances of which it forms the essential part." A. L. C. NODON. (Convention date, March 26th, 1912, France.) March 18th. (Complete.)
- 6,673. "Portable electric battery lamps." A. MENZEL and B. POEDERS, trading as United Electrical Manufacturers Co. March 18th. (Complete.)
- 6,700. "Electric safety lamps." P. WOLF. March 18th. (Complete.)
- 6,730. "Switches and other electrical apparatus where circuit is made and broken." F. DURET. March 19th.
- 6,738. "Electric lamps." F. WESTWOOD. March 19th.
- 6,739. "Safety-wired conduit for electrical installation in mines and all electrical purposes." L. J. RODERICK. March 19th.
- 6,757. "Combined wall plugs and switches." B. P. K. WALSH. March 19th.
- 6,764. "Electric lamps." H. ROKJAER. March 19th.
- 6,767. "Transmitting apparatus for electric switches." WESTERN ELECTRIC CO. LTD. (Western Electric Co., United States.) (Divided application on 25,382 of 1912, November 5th, 1912.) March 19th. (Complete.)
- 6,768. "Paper-lift mechanism." WESTERN ELECTRIC CO. LTD. (Western Electric Co., United States.) (Divided application on 25,382 of 1912, November 5th, 1912.) March 19th. (Complete.)
- 6,772. "Distance-operated mechanisms and signals on electric supply systems." H. W. HANCOCK, A. H. DYKES and W. DUBBLE. (Addition to 6,716 of 1912.) March 19th. (Complete.)
- 6,775. "Electric incandescent lampholders." S. W. MARTYN. March 19th.
- 6,799. "Electric transformer arrangements." BRITISH ELECTRIC TRANSFORMERS CO., LTD., and R. CROSSIE-HULL. March 19th.
- 6,800. "Electric clocks." COVENTRY ELECTRIC CLOCK CO., LTD., and T. RYBTON. (Addition to 14,646 of 1911.) March 19th.
- 6,806. "Electrical regenerative motor control systems." CROFTON & Co., LTD., and H. BURK. March 19th. (Complete.)
- 6,807. "Electric distribution systems." BRITISH THOMSON-HOUSTON CO., LTD., and E. B. WEDMORE. (Divided application on 26,368, 11, July 22nd, 1912.) March 19th. (Complete.)
- 6,817. "Electric cables." A. T. MIRZA. March 19th.

- 6,834. "Reversible double electric fuse." W. PATTERSON. March 20th.
- 6,873. "Electrical switches." BRITISH L.M. ERICSSON MANUFACTURING CO., LTD., and A. G. ROGERS. March 30th. (Complete.)
- 6,875. "Incandescent electric lamps." G. E. GODIN and A. A. GODIN. March 20th.
- 6,880. "Fuses for electric circuits." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, March 21st, 1912, Germany.) March 20th. (Complete.)
- 6,891. "Synchronous dynamo-electric machines." E. ROSENBERG. March 20th.
- 6,897. "Process and apparatus for the production of copper by electrolysis." M. P. LLOYD. (Convention date, March 22nd, 1912, France.) March 20th. (Complete.)
- 6,900. "Means for protecting direct-current working electrical instruments from being operated by extraneous or unauthorised currents which may reach the line to the instruments by accident or design and a relay for the same and like purposes." R. DORNER. March 20th.
- 6,901. "Electric candle fittings." F. HODGSON. March 20th.
- 6,902. "Microphones especially applicable to wireless telephony." G. E. HEYL, E. SANDER-SHEPHERD and T. T. BAKER. March 20th.
- 6,911. "Process for manufacturing articles or objects of tungsten." C. VOIGTLANDER. (Convention date, March 23rd, 1912, Germany.) March 20th. (Complete.)
- 6,933. "Dynamo-electric machines." BRITISH THOMSON-HOUSTON CO., LTD., F. R. CLOVER and L. DUNNER. March 20th.
- 6,934. "Electric clock control." ALLGEMEINE-ELECTRICITÄTS-GES. (Convention date, March 22nd, 1912, Germany.) March 20th. (Complete.)
- 6,936. "Circuit arrangements for registering subscribers' calls in semi-automatic telephone installations." SIEMENS & HALSKE ART.-GES. (Convention date, March 21st, 1912, Germany.) March 20th. (Complete.)
- 6,950. "Electric dry batteries." B. STERN. (C. Hubert, United States.) March 20th.
- 6,952. "Electric furnaces for treating metallic filaments." G. LUDWIG and BRIMDOWN LAMP WORKS, LTD. March 20th. (Complete.)
- 6,964. "Electric arc lighting." S. L. FRANCE and A. WILKINSON. March 22nd.
- 6,965. "Arc lamp globes." S. L. FRANCE and A. WILKINSON. March 22nd.
- 6,982. "Sealing means for boxes containing electric point controllers, switches, and the like." S. T. QUILLMAN. March 22nd.
- ELECTRICAL INDICATOR OR ALARM APPARATUS. E. E. WEIKEL and D. WEIKEL. 21,983. September 26th.
- ELECTRIC COOKING APPARATUS. Downe and Brompton and Kensington Accessories Co. 25,185.
- SUPPORTS FOR METALLIC FILAMENTS OF ELECTRIC INCANDESCENT LAMPS. H. A. GILL. (Vollframlampen Akt.-Ges.) 25,249. November 15th.
- ELECTRICAL SWITCHES. A. WYNNE. 25,517. November 19th. (Divided application on No. 13,135 of 1912, June 5th.)
- TELEGRAPHERS' KEY CUSHION. H. A. KELTY. 27,079. November 26th.

1913.

TRIMMING INDICATOR FOR ARC LAMPS. Korting & Mathieson Akt.-Ges. 253. January 4th. (July 29th, 1912.)

RECEIVER FOR SUBMARINE SIGNALING. Signal Ges. 2,185. January 27th. (December 18th, 1912.)

**The Progress of the Allmänna Elektriska A.B., Sweden.**—The report of this company for 1912 contains, according to the *Affärsvärlden*, the following interesting statements about the larger orders which have been executed during the year. The sixth generator for the Trollhättan power station has been delivered, and Nos. 7 and 8 have been taken in hand. With the installation of these machines the first part of the scheme will be completed. For the Bullerforsen power station, three generators of 4,100 kW. each are under construction, and two of 2,600 kW. each for the Uddeholms power station. The company has also had large orders from abroad, and has now completed the construction of the Electrical Works of Copenhagen, for which have been further delivered three cascade transformers of 1,000 kW. each. For the transformer station of the Union Electrica Madrilenä, at Madrid, have been delivered generators with an aggregate capacity of 20,000 kW., and electrical plant to the power stations at Linares and La Cruz, in Spain, besides a generator of 4,000 kW. to Nokia, in Finland, while some larger installation orders have been executed in various places in Russia. From Norway the company has received several good orders, among which may be mentioned a generator of 20,000 kW., ordered by the Arendals Fosekompani, for their new electrical iron and steel works. Canada has also been a good customer of the company for larger machines, orders having been received for five electric motors of 2,000 H.P. each, from the Ontario Paper Co.; from Eddy & Co., for three generators of 3,750 kW. each; and from the Calgary Power Co., for two generators of 4,250 kW. each. The company has, during the year, completed the construction of the electrical plant at Ljungfors, consisting of an electrical power station and a smelting furnace transformer plant. These works have been done for the Stockholm Superphosphate Manufactory, and both plants have been designed for about 17,000 kW. each.

Another large order for transformers with a total capacity of 30,000 kW. has been placed by the Alby United Carbide Factories, at Odda, in Norway, and from Arendal the company has got an order for a smelting works plant of 3,000 kW. The company has previously delivered the electrical machinery for the nitrate manufactories at Svågfors, in Norway, and has in 1912 supplied generator No. 5 of 10,000 H.P. for their power station. The work in connection with the electrification of the railway from Kiruna, in the north of Sweden, to the Norwegian frontier, has made good progress, and the time for its completion is approaching. The same may be said about the electrification of the railway, Stockholm-Saltsjöbaden, which soon is going to be opened for general traffic. The company has during the year made experiments with Diesel-electric carriages, which have given very satisfactory results and are very promising for the future.

A number of 40 tramway carriages have been delivered to the towns of Helsingfors, in Finland, Viborg and Gothenburg. Fifteen electrical winches for the Diesel engine ship *Selandia*, which was built in the shipbuilding yard of Barmeister and Wain, of Copenhagen, were supplied by the Allmänna A.B. The results of the working of same during the first voyage of the ship, and afterwards, have been so satisfactory that the company has now received orders for nearly 100 winches more. Among other things delivered from the company's workshops may be mentioned a large number of hoisting apparatus, chiefly for Russia. The manufacture of electric heating apparatus has increased to such a degree that it has become necessary to establish a separate department for this class of goods.

**The Frankfort Dynamo Works.**—When the Frankfort Dynamo Works were acquired from the Lahmeyer Co. two years ago apprehensions were entertained by a portion of the staff that the A.E.G. would close the works and transfer manufacturing to Berlin. Although these fears proved to be unfounded a similar idea has now been revived at the works, where several thousands of workers are employed. The A.E.G., however, states that the intention to shut down the works does not exist, although a small portion of the business—the construction of large machines—is to be removed to Berlin. The building of large machines has only been continued at Frankfort until the extension of the Berlin machine works, commenced four years ago, was completed, which is now the case. For the rest all the other departments at Frankfort are being constantly extended, and the development would proceed more rapidly if a larger number of skilled workmen was locally available.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

STARTING AND SPEED CONTROL GEAR FOR USE WITH ELECTRIC MOTORS. G. W. MARCORD. 26,964. November 30th.

### 1912.

ELECTRICALLY-OPERATED TRIPHESES AND TRACKS THEREFOR. Strachan and Strachan & Henshaw, Ltd. 190. January 2nd. (Cognate application, No. 15,831 of 1912.)

AUTOMATIC AND SEMI-AUTOMATIC TELEPHONE CIRCUITS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 2,320. January 29th.

ELECTRICAL CONDENSERS. British Insulated and Helsby Cables, Ltd., and E. A. Bayles. 2,701. February 2nd.

PORTABLE ELECTRIC BATTERY LAMPS. H. F. JOEL. 5,170. March 1st.

THERMOSTATS. H. H. GRUNDY. 5,311. March 2nd.

METAL VAPOR ALTERNATING-CURRENT RECTIFIERS AND SIMILAR APPARATUS. HARTMANN & BRAUN Akt.-Ges. 5,845. March 2nd. (March 2nd, 1911.)

METAL VAPOR ALTERNATING-CURRENT RECTIFIERS AND SIMILAR APPARATUS. HARTMANN & BRAUN Akt.-Ges. 5,415. March 4th. (March 2nd, 1911.)

SUPPORTS FOR LAMPS. E. I. PARKES. 5,587. March 5th.

ELECTRICAL SIGNALLING APPARATUS. L. M. POTTS. 6,050. March 11th. (November 18th, 1911.)

HOLDERS FOR ELECTRIC LAMPS, ELECTRIC SWITCHES, CEILING ROSES, PLUGS and THE LIKE. A. R. MULLER. 6,395. March 14th.

ELECTROSTATIC SEPARATING DEVICES FOR SORTING HETEROGENEOUS MATERIALS, MORE ESPECIALLY MINERALS, METALLIC and OTHERS, SULPHUR, PHOSPHATES OF LIME and LIKE MATERIALS. A. M. F. BLANCHARD. 6,772. March 19th.

PROCESS FOR THE MANUFACTURE OF INCANDESCENT ELECTRIC LAMP FILAMENTS. R. JAHODA and Elektrische Glühlampen-Fabrik "Watt" Schaid Lotz and Latzko. 7,977. April 2nd. (September 30th, 1911.)

TELEPHONES. C. F. KILLAR and J. C. GROVE. 9,714. April 21th.

OSCILLATION-GAPS OR DISCHARGES FOR USE IN RADIO-TELEGRAPHY, RADIO-TELEPHONY and LIKE PROPOSES. W. TORIKATA, E. YOKOYAMA and M. KITAMURA. 10,823. May 7th.

TELEGRAPH SYSTEMS. E. POPE. 11,604. May 15th.

APPARATUS FOR THE ELECTROLYSIS OF ALKALI CHLORIDES. J. V. JOHNSON. (Badische Anilin und Soda Fabrik.) 16,773. July 18th.

INSTRUMENTS FOR MEASURING OR CONTROLLING THE FREQUENCY OR WAVE LENGTH OF ALTERNATING CURRENTS, OR FOR INDICATING SPEED. G. SEIDL. 16,874. July 19th.

ELECTRICAL GENERATING SET. J. A. REY. 19,025. August 3rd.

METAL VAPOR ALTERNATING-CURRENT RECTIFIERS AND SIMILAR APPARATUS. HARTMANN & BRAUN Akt.-Ges. 18,693. August 13th. (June 5th, 1911. Divided application on No. 5,414 of 1912, March 4th.)

TELEPHONE SYSTEM. J. BAUMANN. 18,677. August 14th. (August 14th, 1911.)

CHEMICAL GENERATORS OF ELECTRICITY. C. SOZZI. 20,101. September 3rd.

TELEPHONIC TRANSMITTING APPLIANCE. J. K. RHODES. 20,196. September 4th. (April 6th, 1912.)

BRUSH-HOLDERS FOR DYNAMO-ELECTRIC MACHINES. A. E. BERDON. 20,224. September 25th.

METHOD OF MANUFACTURING ELECTRIC INCANDESCENT LAMP FILAMENTS. E. M. BAILEY and H. F. McDOWELL. 20,521. September 10th.

MOVABLE SLEEVE DEVICES TO FACILITATE THE INSPECTION OF WIRES IN ELECTRIC CABLES. J. A. WILLIAMS. 21,215. (September 18th.)

# THE ELECTRICAL REVIEW.

Vol. LXXII.

APRIL 11, 1913.

No. 1,846.

## ELECTRICAL REVIEW.

## MUNICIPAL SALARIES.

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TRADE activity invariably brings in its train discontent in labour circles. No sooner does a manufacturing concern show a large credit balance than its employes are up in arms for better pecuniary recognition of their individual services. In illustration of this, take the recent strikes of coal miners, railwaymen, dockers, carters, restaurant waiters, and the less important strikes of electric wiremen in Bradford, Glasgow, &c. With the price of raw materials increased by 20 to 30 per cent., and manufacturers' costs proportionately augmented, freights have become high, giving a corresponding rise to the price of foodstuffs. Rents and taxes, also, have gone up considerably all over the country. It is, therefore, not surprising that skilled artisans, and, for that matter, foremen and superintendents, should expect their wages to be increased in such proportion as will allow them to live at least as comfortably as they have hitherto been able to do.

In another column of this issue we print an article dealing with the standard of salaries and wages paid to officials in municipal undertakings in this country, illustrated with curves indicating how their emoluments vary with the responsibilities appertaining to their positions. From a consideration of the data given in the article, it would appear that the average municipal electrical engineer's responsibilities are not adequately recognised. Too often is a cheese-paring policy adopted by Electricity Committees in fixing the salaries of the electrical staff, on the ground that they are thereby tending to reduce the assessments levied on the ratepayers of the Borough. In many municipalities, the Committee appoints an engineer to control the whole undertaking, with full powers to deal with all the members of the staff; in others, all the primary assistants hold their appointments directly from the Committee. With the former arrangement, each employe's hopes for future advancement in this world are centred in one individual—his chief. Under the latter arrangement a competent assistant, who has inadvertently given his chief cause for annoyance, may have some consolation in knowing that, although he must submit to the ruling of his chief in matters affecting his work, he is not entirely at the mercy of his superior in office. Much can be said for both methods of management.

The Stoke-on-Trent Council evidently holds the belief that it, as a body, is best able to decide what increase of wages, if any, should be granted the employes of its electrical undertaking. In the minutes of a Council meeting held on March 28th, when consideration was given to salaries and appointments in a number of the Council's departments, it is reported that "the new general policy of the Corporation is to arrange, or re-arrange, appointments and salaries within a fixed maximum, with a view to combined efficiency and economy."

## THE ELECTRICAL REVIEW.

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,**  
4, Ludgate Hill, London, E.C.

Reading further, we find that the Electricity Committee, in adopting the sub-Committee's recommendations with regard to applications for increase in wages, has perfunctorily shelved the question for another 12 months, in so far as it concerns resident engineers, charge engineers, and switchboard attendants. The inconsistency of this decision, having in view the general policy of the Corporation, certainly savours of economy, but as regards efficiency, we hold a different opinion. Greater consideration, however, has been meted out to the mains superintendents in the three districts under the Council's jurisdiction. The salaries of these gentlemen, which at present range from £130 to £145, have to be increased by £5 per annum in each case. Advances of 1s. to 2s. per week have also been granted to the three shift engineers in the Burslem works, thus raising, in that station, the average wage of this class of employe from 35s. to 36s. 6d. per week.

The case of Stoke-on-Trent is by no means an isolated one. As a matter of fact, the same conditions will be found to exist in almost every city and town in the kingdom, and it is no wonder that great numbers of our young electrical engineers, on the completion of their apprenticeship or pupilage, and after spending a year or two as shift engineers or attendants in a power station, accept minor but more lucrative situations abroad, and leave the power stations of the home country in the hands of juniors and marine engineers grown tired of sea-going. Many instances could be cited where the chief engineer has pleaded with his committee to raise the standard of wages in his department, but without success. On the other hand, we understand that there are municipal chiefs who not only make no attempt to raise the standing of their subordinates, but even frustrate any efforts put forward with this intention by the assistants.

The tabulation of central station costs has become quite a fine art with municipal engineers, some of whom would almost risk their professional reputation to reduce their working charges by one-tenth of a penny per unit sold. After much scrutiny of the manner of burning coal at the station, and the possibility of cutting down the coal bill, and an inquiry into the superintendent's methods of tackling repairs, the chief finally arrives at the conclusion that something will have to be lopped off the wages item. We have a case in mind where an engineer, on taking over the management of a municipal undertaking in the North, had the existing members of the staff replaced by others at approximately two-thirds the salaries previously in vogue in the town. His brother engineers waited with considerable interest for the result of his first year's working with the new staff, which showed that although the wages costs per unit had dropped by 30 per cent., the increased costs per unit on coal and repairs items caused the total working charges per unit to jump up to an alarming figure. The reason for this was undoubtedly bad staffing, as the prices of coal and metals had not altered to any appreciable extent during the two years when the comparison was made.

A chief's time is taken up principally with the commercial side of the undertaking, while he exercises supervision over his departmental superintendents. He is therefore in large measure dependent on the ability of his engineers for the smooth and economical running of the plant, and a discontented shift engineer or superintendent can be the cause of greater losses to the undertaking than one might at first sight imagine.

We are in perfect agreement with the statements made by Mr. C. E. C. Shawfield at the farewell meeting with his staff at Wolverhampton on the 30th ult. In reply to several remarks regarding the application of profits towards the improvement of salaries and wages, he said that it was to be regretted that any money had been paid over to the relief of

the rates, as he thought it was not in the best interest of department, or the town as a whole, that the profits of a trading undertaking should be used for this purpose. The first call on the profits should be to improve the status of employment, as the success or otherwise of the undertaking depended to a very large extent on the efforts of those employed therein. The chief, however—added Mr. Shawfield—had not a free hand in the matter of salaries and wages, but had to carry out the instructions of his employers—the municipality.

Fortunately the impropriety of robbing the electricity undertaking for the sake of relieving rates, upon which we have so often and so long insisted, is becoming more and more widely recognised, and amendment in this respect will, we hope, be accompanied by justice to the *personnel*.

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#### An Agreement between Electrical Undertakers.

We publish elsewhere in this issue a report of the case of the London Electric Supply Corporation *v.* Westminster Electric Supply Corporation, which was decided last week by the House of Lords. For the convenience of those who have not time or inclination to study the whole case, we propose to give a summary of the decision, which appears to establish a very important principle in relation to that particular kind of transaction. We trust that no apology is necessary for repeating in a shortened form that which has been enunciated at greater length in the stately language of the House of Lords. To extract the kernel from a legal nut is not always easy. An old lawyer once told us that even with his experience he never understood a case until he had read it through three times. Let the following be regarded as the product of a frequent perusal of this important decision: The London Electric Supply Corporation and the Westminster Electric Supply Corporation, Ltd., are each authorised to supply electricity in parts of the Borough of Westminster, the "London" supplying alternating, and the "Westminster" continuous current. The Westminster Borough Council is entitled at a certain time to exercise the right to purchase the undertakings of both companies—the right in regard to the London falling to be exercised in 1931. In 1910, the London transferred to the Westminster the right to exercise their powers subject to the annual payment of £22,000, and to the right of the London to retain the purchase money at the date of compulsory sale, the Westminster agreeing to make up that sum to £100,000, if less were awarded.

It will be seen that, having regard to this agreement, the continued supply of alternating current was of importance to the London Co. In these circumstances they found it necessary, in 1911, to seek an injunction to restrain the Westminster Co. from soliciting customers who took alternating current to take continuous current. They also sought a declaration that, having regard to the agreement, the defendant company were bound to supply alternating current to any person in Westminster who might apply to the plaintiff company for such a supply. To put the matter in a nutshell, it appears that the Westminster Co. claimed, in effect, the right to act as if they were purchasers of the London Co.'s undertaking. In other words, they claimed the right, if so minded, to supply continuous current to all consumers, and to do that which would ultimately have destroyed the goodwill of the London Co. in the area. The judge of first instance and the Court of Appeal both refused to grant an injunction or to make any declaration; but the House of Lords has reversed this decision. The Lord Chancellor, in giving judgment, pointed out that the sale of an electrical undertaking was prohibited; that he could not treat the agreement as an arrangement under which the respondents had purchased for fixed sums the appellants' undertaking in the area with freedom to do what they pleased with it. Finally, he declared that the Westminster Co. were bound, without prejudice to their right to carry on and develop their own undertaking in a fashion consistent

with their obligations under the agreement, to do nothing while the agreement lasted which would destroy the appellant's undertaking within the area. In the event, the House of Lords made a declaration to the above effect, holding that it was unnecessary to grant an injunction, as it was certain that the Westminster Co. would loyally act in accordance with the law as thus declared.

The principle to be drawn from the case may be thus briefly stated: Where undertakers, having power to supply electricity in a district, transfer their rights to rival undertakers supplying electricity, on the terms of a money payment, and on the terms that when compulsory purchase takes place, the purchase price shall be paid to the first company, the second company must not attempt to do anything which will destroy the goodwill of the first company.

We have been at pains to expound this decision as clearly as possible, inasmuch as the arrangement come to between these two companies is one which may at some future period be considered desirable in other districts.

Two important exhibitions are being organised for the autumn of 1913.

**Exhibitions at Glasgow and Sheffield.** One will be exclusively electrical—at Glasgow, and the other largely so—at Sheffield. They will run concurrently, though the former will open a day earlier than the latter, that is, on Thursday, October 23rd, and both will close after three weeks' duration, on Saturday, November 15th.

The literature that has just been officially issued regarding both undertakings suggests that they will be business-like displays calculated to popularise the lighting and industrial applications of electricity if appropriate action be taken.

Glasgow has already had a couple of Smoke Abatement Exhibitions, but these are admitted to have applied to only one or two sides of the electrical industry, and the Corporation now feels that the time is ripe for holding in the Zoo Buildings a purely electrical exhibition (incorporating engineering and machinery), at which it is intended to include examples of all branches of electrical engineering, making a show which will "be at once worthy of the Second City of the Empire and of one of the youngest and greatest industries." It will be under the auspices of the Lord Provost and the Electricity Committee, with Mr. W. W. Laekie, of course, as electrical engineer. A feature of convenience from an exhibitor's point of view is the decision to have stands of uniform design erected by the Corporation, the cost being included with the charge for floor space; current will be provided free. It is intended to take advantage of the educational value of the cinematograph by displaying films of the latest uses of electricity, which manufacturers are invited to provide, in a hall which will be specially built for the purpose. There will also be lectures as well as special daily demonstrations of electric cooking, baking, bread-making, sick-room cooking, fancy bread making, and sweet making. It is considered by the authorities that the time is opportune for making, before the people of Glasgow and district, a powerful demonstration of the progress that has been made in telephony, lighting, power, heating and cooking, and as we have always thoroughly believed in properly organised exhibitions as a means of stimulating electrical interest, and have urged electricity supply authorities to adopt up-to-date business-getting methods, we wish every success to the Glasgow Corporation venture, and refer our readers to Mr. J. M. Freer, of 38, Bath Street, Glasgow, who has been appointed general manager.

In regard to the Sheffield undertaking, this is a Fuel, Light and Power Exhibition, which will be held in the City Exhibition Hall, under the auspices of local Health and Smoke Abatement Societies, and with the patronage of the Lord Mayor, the Master Cutler, and the president of the Sheffield Chamber of Commerce. The Advisory Committee includes Mr. S. E. Fedden, the manager of the Corporation electricity department; Mr. T. Scott Anderson, and Prof. W. Ripper, of the University. From the electrical point of view, the event may not at first appear to be so important as the Glasgow display, and electrical ardour may be

damped somewhat by reading in the preliminary prospectus, that the Hall "is well lit with high-pressure gas," but while at Glasgow electricity will have no would-be rival in the Zoo buildings, at Sheffield it may be put upon its mettle. For instance, in the "Fuel" Section, "Electricity for Cooking" follows "Gas Stoves and Ranges for Cooking," and in the "Light" Section, "Electricity for Lighting and Heating" is sandwiched between certain gas and acetylene lines. By way of compensation, in the Power Section, electric motors and electric generating plants are allowed to lead, gas, oil and steam engines following. To some of our readers it may appear that this mixing up of different classes of lighting and power agents in one exhibition render it all the more important that electricity should make a strong showing.

Of course, the Sheffield management's idea is to lessen the smoke nuisance of that great industrial centre, and there is room for means many and varied, electrical and non-electrical, to obtain that very desirable result. No doubt the Sheffield Corporation Electricity Department will make an effective display of its own, and we trust that the exhibition will bring on many new consumers of all classes. Electrical firms who are interested should communicate with the hon. secretary, Mr. Wm. Bashford, at the Exhibition offices, 45, Bank Street, Sheffield.

**Electrical Benevolence.** WE make no apology for again reminding our readers that the annual Festival

Dinner of the Electrical Trades Benevolent Institution will be held on Wednesday next, and urging them to lose no time in conferring effective support upon a movement which, above all others, merits their approval. The spirit of co-operation is in the air; it makes its influence felt throughout the world, from the highest to the lowest. European Powers, Oversea Dominions, Cabinet Ministers, British manufacturers, suffragettes, central station assistants—all feel the need of combining for mutual assistance and support in furthering their various aims, and the electrical industries ought to regard it as a sacred duty to their weaker members to co-operate in making provision for the relief of their necessities. As Mr. Garcke pointed out last week, the industry is not doing anything like as much as it ought to do towards this end: whereas there is a capital of 500 millions sterling invested in electrical concerns, employing nearly half a million souls, there is no more than a beggarly £4,000 in the coffers of the Benevolent Institution, the interest on which is quite inadequate to cope even with emergency grants, let alone the granting of pensions. If only the 6,000 firms engaged in the business would contribute on the average the trifling sum of one guinea each per annum, the Benevolent Institution would at once be put into a position of prosperity: surely it is not much to ask?

We do not, and cannot, believe that the will is wanting; the fact is, we think, that the interest of the vast majority of these firms has never been effectively aroused, although every effort has been made by the organisers and the Press to direct their attention to the Institution and to the benefits which it desires to confer upon the victims of unforeseen calamity and misfortune—benefits which cannot be secured in any other way. If the employes themselves would contribute the sum of *one penny each per annum*, the Institution would double its present capital every two years. How insignificant a contribution—and yet what magnificent results it would ensure! If only one good voluntary organiser could be obtained in every important centre to arrange for the collection of this trifle, a new era would dawn for the Benevolent Institution.

But this by the way. The immediate question is—the dinner. The chairman, Mr. George Sutton, has done splendid work for the cause—let it not be said that he lacked the support of his friends, each and everyone of whom, whether he realises it or not, is saddled with a real and personal responsibility in this matter towards his less fortunate neighbour.

SALARIES IN MUNICIPAL UNDERTAKINGS.

[COMMUNICATED.]

In the ELECTRICAL REVIEW of February 28th, 1913, a comparison was given of the wages paid to shift engineers and switchboard attendants in numerous central stations throughout the country.

A study of the salaries paid to chief electrical engineers and their principal assistants, and the relationships which exist between their total emoluments and the capacity, output and value of the undertaking, will elicit many facts and figures of personal interest, not only to those who at

the application sometimes depends, in a greater or less degree, on the relationship, harmonious or discordant, which exists between the engineer and his committee or its chairman.

Many chiefs of departments are allowed to practise at private consulting work, while others are granted the privilege of engaging premium pupils and retaining the premiums for themselves. There are managers, too, who, even in the face of greatly increased responsibility through the growth in the size of the undertaking, steadily oppose, as unnecessary and superfluous, all suggestions of the appointment of a chief assistant, so that thereby their own positions may be strengthened. It should be recognised that where the capital value of an undertaking exceeds £100,000, an assistant manager and engineer should be appointed, to take entire charge and have absolute responsibility for the working of the plant in the absence of the chief.

With the object of tracing the connection between the capacity, &c., of a municipal station and the salaries paid to officials in charge, the accompanying information relating to 39 undertakings has been extracted from the latest returns in the ELECTRICAL REVIEW Tables, and the "Personal" and "Situations Vacant" columns of the same journal during the last few months.

Table I contains particulars regarding chief engineers' salaries in the 39 towns, expressed in pounds per annum for each 100-kw. capacity, mains connections and maximum demand respectively, and also per £1,000 of capital, £1,000 of revenue and 1,000 of population in the area of supply.

TABLE I.—SALARY OF CHIEF ENGINEER.

Municipal undertakings. Plant capacity. No.	Per 100 kw. of plant.	Per 100 kw. connected to mains.	Per 100 kw. of maximum load.	Per 100,000 units sold per annum.	Per £1,000 of capital.	Per £1,000 of revenue.	Per 1,000 of population.	
1,000—3,000 KW.	(1)	£20	£21	£57	£35	£5'0	£40	£6'6
	(2)	30	13	46	29	3'6	31	12'0
	(3)	31	21	56	58	3'3	30	9'1
	(4)	23	14	42	33	2'3	19	9'5
	(5)	29	15	44	32	3'4	29	8'0
	(6)	24	9	23	12	7'2	29	5'4
	(7)	21	9	43	33	2'5	20	8'5
	(8)	9	6	17	10	2'2	21	7'1
	(9)	21	12	33	16	3'6	21	5'0
3,000—5,000 KW.	(10)	16	10	31	19	3'0	19	3'9
	(11)	12	6	19	12	2'8	19	4'7
	(12)	17	9	23	12	2'1	16	3'6
	(13)	19	8	24	14	2'5	17	5'1
	(14)	18	9	26	22	3'2	21	11'9
	(15)	12	7	19	11	1'8	15	6'2
	(16)	9	5	11	7	1'3	9	2'8
	(17)	11	7	32	16	2'2	25	5'8
	(18)	12	9	25	15	1'7	17	3'0
5,000—10,000 KW.	(19)	11	7	18	15	1'5	11	2'1
	(20)	16	7	19	11	1'7	15	4'0
	(21)	14	5	14	6	2'0	12	3'7
	(22)	16	8	21	11	2'1	16	3'7
	(23)	12	5	20	9	2'3	15	6'1
	(24)	11	6	17	9	1'8	10	3'4
	(25)	10	7	20	10	1'8	16	4'8
	(26)	9	4'3	11	7	1'5	9	2'0
	(27)	9	4'0	13	7	2'0	12	3'5
10,000—40,000 KW.	(28)	7	4'1	11	5	2'3	11	7
	(29)	8	4'3	12	5	2'3	13	6
	(30)	8	7'1	17	8	3'1	17	5
	(31)	5	4'3	7	4'2	1'5	9	4'2
	(32)	10	7'0	18	8	2'2	17	6
	(33)	6	4'1	8	4'3	1'7	9	1'7
	(34)	7	2'9	9	6	1'0	10	1'8
	(35)	6	3'5	9	5	1'1	8	2'1
	(36)	5	2'6	7	5	0'8	7	2'5
40,000 KW.	(37)	6	2'0	6	3'1	0'7	5	2'2
	(38)	2'6	1'8	5	2'7	0'6	4	1'5
	(39)	2'5	1'6	4	2'3	0'4	3'7	1'2

TABLE II.—SALARIES OF ASSISTANTS.

Municipal undertakings. Plant capacity. No.	Chief assistant. Ratio to chief engineer's salary.	Mains engineer. Per 100 kw. connected.	Chief clerk. Per £1,000 of revenue.	Station engineer. Per 100 kw. of plant.	
1,000—3,000 KW.	(1)	50	£8'5	£10'6	£10'4
	(2)	39	—	9'2	—
	(3)	—	11'1	7'0	9'2
	(4)	—	6'4	10'2	11'1
	(5)	36	4'9	8'4	—
	(6)	—	2'2	5'4	6'0
	(7)	53	4'0	6'1	6'0
	(8)	—	2'5	6'7	4'3
	(9)	—	3'6	3'9	6'4
3,000—5,000 KW.	(10)	40	3'1	3'6	5'0
	(11)	50	2'2	7'1	4'1
	(12)	39	—	4'6	4'4
	(13)	50	—	5'1	6'9
	(14)	29	2'1	3'8	4'1
	(15)	60	—	7'2	3'8
	(16)	—	1'6	3'6	4'0
	(17)	44	2'1	6'6	3'7
	(18)	—	4'5	6'4	5'4
5,000—10,000 KW.	(19)	40	2'5	4'6	—
	(20)	32	2'2	4'3	5'0
	(21)	50	1'6	4'0	4'4
	(22)	43	—	3'9	4'2
	(23)	35	—	2'4	3'5
	(24)	50	2'3	3'9	4'2
	(25)	—	2'4	4'0	3'5
	(26)	50	1'5	2'8	3'1
	(27)	42	1'3	3'7	3'3
10,000—40,000 KW.	(28)	—	1'2	2'6	2'6
	(29)	26	0'8	3'8	2'2
	(30)	—	1'9	4'5	2'7
	(31)	44	—	3'8	2'4
	(32)	—	1'5	3'5	2'1
	(33)	52	1'4	2'6	1'9
	(34)	60	0'9	2'4	2'7
	(35)	—	1'0	2'6	—
	(36)	47	0'9	1'1	1'7
(37)	23	0'7	1'5	1'7	
(38)	—	—	—	—	
(39)	60	0'6	1'4	0'8	

present hold those appointments, but also to the charge engineers, switchboard attendants and other employes who hope to fill the higher positions on the staff in years to come.

On what bases are the salaries of chiefs and assistants fixed? Very often the settlement of the chief's salary is limited to a consideration of purely local conditions, and no external influence is allowed to enter the question. In many cases, however, when an increase of salary has been requested, the chief himself inaugurates a crusade for the purpose of ascertaining the salaries paid to his confreres in other towns of approximately similar size, or having an output comparable with that of the undertaking which he controls. Having obtained the desired particulars, he carefully weeds out information that should be withheld from his committee, and the remaining data are embodied in a report showing how small his salary looks in comparison with the salaries of chief engineers in other undertakings, and how important his department is when compared to the electrical departments in other towns with approximately the same population. The matter will then be decided by a committee of gentlemen who probably have no electrical knowledge, and who are not aware of the responsibilities which rest upon their electrical engineer. The ultimate fate of

As the plant capacity of a station usually represents the status of that station, the 39 undertakings have been arranged in the order of their generating powers, and the curves in figs. 1 and 2 have been included to indicate graphically the extent of the variation of the values in Table I from the smaller works, with 1,000 kw. of plant or thereabouts, to the 40,000-kw. stations. It will be noted that the fluctuations of all seven sets of values follow closely the line of the curve known to station engineers as the "Capital cost per kilowatt" curve.

The minimum, average and maximum values of the above figures are as follows:—

	Minimum.	Average.	Maximum.
Salary of chief engineer:—			
Per 100 kw. of plant ...	£2'5	£13'1	£31
Per 100 kw. of connections ...	1'6	7'2	21
Per 100 kw. of maximum load ...	4'0	21'5	57
Per 100,000 units sold ...	2'3	13'6	58
Per £1,000 of capital ...	0'4	2'2	7
Per £1,000 of revenue ...	3'7	16'1	40
Per 1,000 population ...	1'2	4'9	12

In figs. 3 and 4 the curves show the average total salaries of chief engineers in comparison with the power plant in the

tricity Committee, but the assistants have not the same opportunity of improving their positions on the staff as they would have if they were responsible to the Committee instead of to their chief.

It is quite common to hear of a chief engineer absolutely forbidding his assistants to engage in private consulting work in their leisure hours, while he himself openly accepts fees for specifications which may not improbably have been drawn up by one of his assistants.

As the chief assistant is of next importance to the chief, he should have a salary worthy of the responsibility he has accepted. In the third column of Table II the ratio of the chief assistant's to the chief's salary is given for as many of the 39 undertakings as have a chief assistant. A glance at the tabulated figures will show that out of the 39 stations, 13 have no assistant, while in six of them, the chief assistant also acts as mains engineer. In some of the columns blanks have been left where the information is not available. It will be observed that a common rule evidently adopted in fixing the assistant engineer's salary is to make it one-half of the chief's salary. Out of the chosen 39 towns, in as many as seven, the chief has a salary exactly double the amount of his under-study's.

The topmost curve in fig. 5 delineates the diversity of the ratios between the assistant's salaries and the chief's, while the other three lines represent the variations for the various undertakings of salary of mains engineer per 100 kw. of mains connections, salary of chief clerk per £1,000 of revenue, and salary of station superintendent per 100 kw. of plant installed.

The minimum, average and maximum values for these items are:—

	Minimum.	Average.	Maximum.
Ratio of chief assistant's to chief engineer's salary ...	26	44	60
Mains engineer's salary per 100 kw. connected ...	£0'6	£2'7	£11'1
Chief clerk's salary per £1,000 of revenue ...	£1'1	£4'7	£10'6
Station engineer's salary per 100 kw. of plant ...	£0'8	£4'3	£11'1

The chief clerk's sphere is the supervision, under the chief engineer, of all office work—such as the issuing of energy and other accounts, the checking of invoices for goods purchased, and the general book-keeping of the department. Correspondence on non-technical matters may also be included in his tasks, as well as the filing of all records relating to the undertaking. Generally he acts as secretary to the chief engineer, and, in certain instances, he is also the collector of all moneys due to the department. His salary will naturally be in proportion to the duties appertaining to his office. It is assumed in this comparison that he controls the cash transactions, being, of course, dependent in this connection only on the City or Borough Treasurer. Comparing his salary with the income from all sources, the fluctuations in pounds per £1,000 of revenue are clearly shown in the curve.

The most satisfactory basis on which to compare the salaries paid to station superintendents is the total generating capacity of the plant for which they are responsible. In some cases the superintendent has charge only of the running of the plant, the repairs being placed in the hands of an independent engineer. In other power stations dual responsibility exists for the running and maintenance, the dividing line being drawn

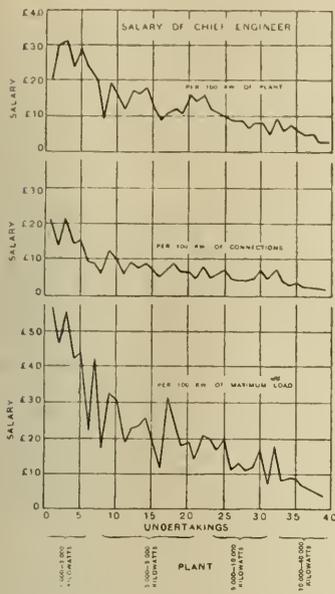


FIG. 1.

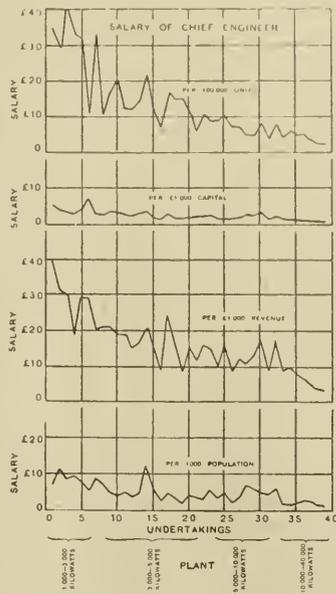


FIG. 2.

station, the capital cost of the undertaking, and the units sold per annum. A striking similarity will be seen to exist between the "plant" curve and the "units sold" curve, which would seem to show that the load factors of these stations do not vary to any great extent.

Assistants in electrical departments have, as a rule, many grievances, real and imaginary. These most often arise from discontent over the magnitude of their work, and the meagreness of their remuneration. As the undertaking expands in size and importance, and the chief's salary is augmented in like proportion, the assistants, who possibly do

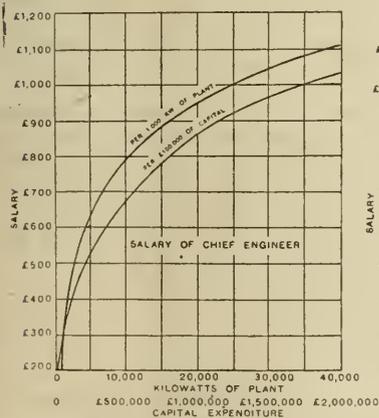


FIG. 3.

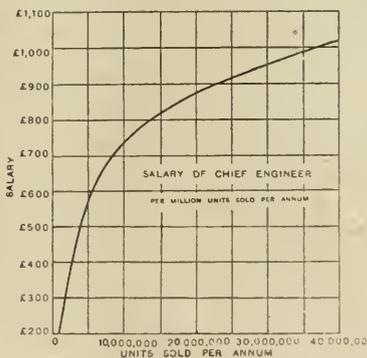


FIG. 4.

the bulk of even the administrative work of the department, may be entirely overlooked. Where the chief is the autocratic controller of the whole staff, including the chief assistant, the standard of discipline has certainly proved to be better than if several of the assistants are directly under the Elec-

between the electrical and the mechanical portions of the plant. The best results are obtained, however, where a good all-round mechanical and electrical engineer is

THE COST OF HOUSE SERVICES.

By "IMPROVER."

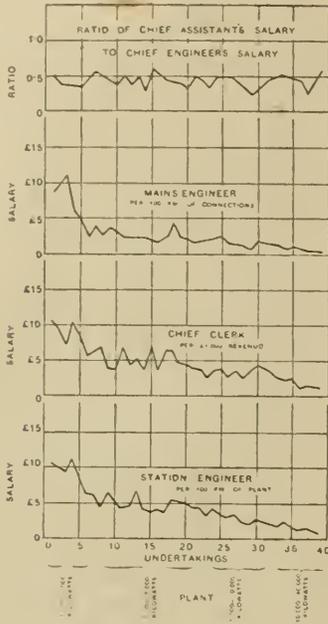


FIG. 5.

placed in absolute charge of the running of, and repairs to, all the appliances and machinery at the generating station.

As opportunity seldom arises for assistants in electricity undertakings to compare their wages with those of a number

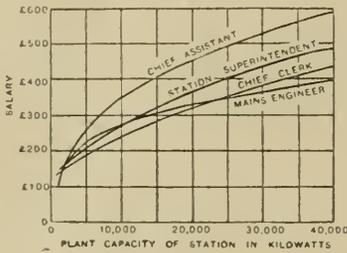


FIG. 6.

of other towns, in the same manner as chief engineers are privileged to do, the curves in fig. 5 may be of some interest to them. With a view to arriving at average values for different sizes of stations, the average results obtained from

Capacity in kw.	Chief engineer.	Chief assistant.	Mains engineer.	Chief clerk.	Station engineer.
1,500	£320	£150	£150	£150	£150
2,500	450	200	180	160	170
5,000	620	260	230	190	200
10,000	800	350	270	240	260
15,000	880	400	310	290	320
20,000	950	460	330	320	380
30,000	1,000	520	360	380	430
40,000	1,100	580	390	440	480

fig. 5 have been plotted in fig. 6. Reading from the latter curves, the accompanying table of average salaries for different sizes of stations has been compiled.

Very little has been written in connection with the all-important item of house connections and their cost. The amount of money spent annually on this class of work must have a considerable bearing on the efficient running of mains departments, whether company or Borough Council; and yet very little attention is paid to this important spending department.

As is usual with the ordinary operation of a service-laying gang, the foreman of the department pays a visit to the premises about to have a service laid on, and measures up the amount of cable required for the job, and the usual requisition goes into the stores. Care has to be exercised in choosing the run, and accurate measurements are necessary, as the writer has frequently seen cases where the amount of cable brought on the job has been considerably in excess of all ordinary requirements, and anything from two to three yards has been returned as scrap ends.

Twelve years ago, the whole of the service work of a certain undertaking was carried out by one of the cable companies, and, in spite of the special supervision which was supposed to exist, the cost of services was quite out of all proportion to the length of any particular service, some of the reasons being:—(1) The price charged for service boxes; (2) cut-outs; and (3) waste labour.

The service boxes were of a type that had fuses controlling the installation, and were fitted with glands for plumbing to the outer sheathing of the lead-covered cables. The boxes were supposed to be the best of their kind at the time, but they have since been proved to be a nuisance through the fuses giving trouble. Many cases occurred where the fuses were found to be eaten through, and thus, together with other complaints, caused them to be discarded. The cost of these boxes was £1 8s. each.

The use of such a box on a conduit system of distribution meant the building of a brick pit with a frame and cover for easy access, the cost being £1 9s. in each case.

The type of cut-out used, regardless of make, was a somewhat costly piece of apparatus, but in most cases the workmanship was good and the whole thing was reliable.

The labour was a very variable amount, and little judgment was exercised in setting out a day's work. In consequence there was a great deal of what the writer regards as waste labour, by which he does not necessarily mean loafing. This, together with hasty measurements of cable and consequent waste, completed what was a very costly job.

In more recent years the prices of joint boxes and cut-outs have decreased considerably, and at the present time a good joint box can be obtained at a few pence over 5s. Cut-outs, too, have decreased in price to the same low level, the workmanship being quite good and the cut-outs quite substantial in every way. The abolition of boxes that contained fuses having done away with the necessity of frames and covers, led to an improvement in cost of about £2 3s. per service.

In dealing with waste of time, the writer has in use a system of service connections which reduces this waste to a minimum, by the use of a cast lead shell for service boxes. At the same time use is made of all scrap lead stripped from the ends of cable returned to stores from the various works. This shell, in addition to providing the usual protection and receptacle for the compound, forms a continuous lead sheathing, and its value as such must be obvious to all.

It frequently happens that the service gang cannot begin operations until about 7 a.m. in the case of private houses, and, perhaps, 9 a.m. in the case of shops. The joiner and mate are, consequently, compelled to wait about until one end of the cable is fixed in the basement of the premises (unless some "hospital" job can be found for them). This gives a considerable amount of time that can be profitably utilised, and is so utilised where the system of casting lead carcasses is in vogue. The preparation of metal and moulds is quite a speedy process, and sufficient carcasses can be turned out during the waiting period of the ordinary joiner's day. After a careful study over several months, it appears that the cost of turning out these carcasses amounts to:—Labour, 9d. per set; lead (if at scrap value), 1s. 6d.

**Meter Approved.**—The Board of Trade has approved of the Chamberlain & Hookham polyphase watt-hour meter, type A.I.T., deposited by the makers in February, 1912.

per set, and if new lead 1s. 10d. per set, or not more than 2s. 7d. per set of two halves. Together with fitting, this completes a very cheap service box.

The cost of connecting or fixing is no more than that of the ordinary cast-iron shell, and a jointer and mate can, during the early morning, cast three sets of six halves and fix and complete three service boxes and cut-outs during one working day of 9½ hours where the mains are clear.

The only process is that of laying a strip of prepared tape along the joints of the two halves of the boxes and applying a powerful blow-lump for 15 minutes. This also serves the very useful purpose of warming up the joint-box and keeping the compound in a very fluid state for a considerable time, and allows any air to escape. The sealing and completing of the box is done by laying a small sheet of metal over the opening in the top half.

As a means of checking the scrap cable sent in, a book is kept in the stores, and the jointers' mates return daily all ends from the completed jobs, which materially assists the stores clerk in keeping an accurate record; this used to be a very troublesome task and meant much "cooking" of cable measurements.

Below is given a record of the cost of service laying complete with reinstating charges, at various periods from 1901 to the present year, the service laying being done by a contractor from 1900 to 1902, and by the Council's employes from 1903 to date. In the case of all services laid prior to 1907, both by the contractor and Corporation, wrought-iron pipes were used to draw the cable through from the Council's mains to the consumers' basements. From 1907, the cable used has been strip armoured, and here there is a slight saving of about 3d. per foot run. In the case of armoured cable services, the mains are laid at an increased depth to avoid damage to the mains by other mains layers, who are many and have not always the respect for electric cables that they might have.

In 1901 a service was laid by the contractor (and is representative of those of its class). The length of cable was 45 ft., and the cost was as under:—

45 ft. '05 L.T.C. and W.I. pipe ... ..	£3 10 0
Box and cut-out, stores, jointing, materials, &c.	3 3 0
Brick pit, frame and cover ... ..	1 9 0
Paving ... ..	1 0 0
<b>Total ... ..</b>	<b>£9 2 0</b>

In 1903 a service was laid by the Council's men, the joint box and cut-out being identical, and the method of laying the cable the same as in the previous case. The cost worked out as follows:—

45 ft. '05 cable in 1½ in. W.I. pipe ... ..	£3 8 4
Box and cut-out, stores, jointing, materials, &c.	2 12 4
Brick pit, frame and cover ... ..	1 6 0
Paving ... ..	0 19 6
Extra for meter-board fixed by Council ... ..	0 4 0
<b>Total ... ..</b>	<b>£8 10 2</b>

In 1907, using armoured cable, a non-fused type of joint box, and a much cheaper, though equally good cut-out, a service was laid costing:—

45 ft. '05 armoured cable ... ..	£2 17 0
Box and cut-out, jointing, materials, stores, and "blind" brick-box ... ..	2 0 0
Paving ... ..	0 19 9
<b>Total ... ..</b>	<b>5 16 9</b>

Here a brick pit was built, but a frame and cover were not needed. A slab of York stone was placed over the box just under the paving, and a mark peculiar to the department was cut into the wall of the premises to indicate the point of entry.

From this date the services cost less, mainly owing to the reduction in the price of service boxes and cut-outs, the cheapening of compound, the better manipulation of the various gangs, and the sandwiching-in of other useful work, until in 1909 we had services of 40-ft. run costing:—

40 ft. 7/18 cable ... ..	£1 1 3
Joint-box ... ..	0 4 9
Cut-outs... ..	0 4 9
Meter-board ... ..	0 1 8½
Stores, compound, &c ... ..	0 2 4½
Labour ... ..	1 7 6
Paving ... ..	0 12 8
<b>Total ... ..</b>	<b>£3 15 0</b>

A service laid the same year, but having a larger size cable, cost:—

45 ft. '05 cable... ..	£1 17 11
Joint-box ... ..	0 4 7
Cut-out ... ..	0 4 9
Meter board ... ..	0 1 9
Stores ... ..	0 2 6
Labour ... ..	1 3 7
Paving ... ..	0 19 7
<b>Total ... ..</b>	<b>£1 14 8</b>

Since 1911, the new method of joint boxes has been in vogue, and the cost of services has worked out at an average of:—

35 ft. 7/18 cable ... ..	£1 0 5
Box fitting ... ..	0 1 7
Box carcass ... ..	0 2 6
Cut-out and meter-board ... ..	0 6 2½
Labour ... ..	0 10 6
<b>Total ... ..</b>	<b>£2 1 8½</b>

Thus it will be seen that marked improvements have been made in cheapening the cost of services, this being primarily due to the better setting out of work and the consequent reduction in the cost of labour, and the cheapening of service boxes and cut-outs.

In the case of the first service mentioned we had a cost of £3 8s. 4d. for cable and laying, exclusive of paving, or 5s. 4d. per yard run. Of this amount, 3s. 7½d. per yard was for cable and wrought-iron pipe, laid and jointed. The balance of 1s. 8½d. per yard was for laying service line only. This should have shown a very fine return, as some hundreds of connections were made in the year, and the fact has also to be taken into consideration that only 24 ft. of ground had to be opened, the balance of cable being simply cleated to the wall of the consumer's basement. The cost of the service box and cut-out was £2 12s. 4d., including fixing. Of this sum, 10s. 8d. was for fixing only, leaving a figure quite in keeping with the charges for electrical apparatus in those days.

As a fair comparison, I place alongside the above a service laid by the Council's men in 1909, the size and length of the cable being the same, with the exception that armoured cable was used. The cost of this service was £1 17s. 11d., or 3s. 11d. per yard. Here the service box cost 9s. 4d., exclusive of fixing, which was an immense saving on the old charge, while the quality was good. Of the labour charge of £1 3s. 7d., the sum of 6s. 3d. was for the time of the jointer and mate fixing service box, meter board and cut-out. The balance of 17s. 4d. was for excavating, laying cable and building "blind box" (the system is a draw-in one). This represents an all-in price of 1s. 3½d. per yard, which must be regarded as a great improvement.

### CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

#### Maintenance of Tramway Rolling Stock.

Referring to the interesting article on "Some Difficulties with Tramcar Motors," in the issue of the ELECTRICAL REVIEW for the 28th ult., I beg to suggest that it contains some food for reflection for those tramway managers who are anxious to maintain reliability of service and efficient running of the rolling stock.

Undoubtedly the receipts per car-mile and the ratio of receipts to expenses, &c., are important items in tramway management; but it is to be feared that in some undertakings the commercial aspects overshadow, to a large extent, the technical or engineering considerations, with the unfortunate result that the rolling stock is apt to receive less skilled engineering supervision than is desirable to secure the most efficient results.

It is not uncommon either to find that the car-shed staff consists principally of "fitters" whose training and wages are inadequate for the work that generally devolves upon them, for it is often supposed that rolling stock repairs can

be efficiently carried out by skilled labourers or fitters, with little or no training in shop methods or the use of tools, &c.

Indeed, in more than one instance, the writer has known the depot staff to be under the control of men whose previous experience was acquired in a winding shop or in jointing on a lighting network: and although such men may eventually become efficient "fitters," it is more often than not at the expense of both the equipment and the time-keeping on service. It may be argued that "it would not pay to employ skilled fitters at, say, 8½d. per hour," but when one has had actual experience with "fitters" and fitters on rolling stock repairs, I venture to think that an analysis of the various items which compose the working expenditure will, in the majority of cases, amply prove that it pays to employ efficient men.

The best of traction equipments have a fairly low overall conversion efficiency under service conditions, and in these days of the extensive use of meters and methods of diagnosing inefficiencies, it is all the more surprising to find that in many cases so little interest is evinced in the condition of the mechanical details of the rolling stock from an engineering point of view.

L. Marshall Jockels.

York, April 5th, 1913.

#### Electric Laundry Irons.

I should be glad to hear, through your valued columns, from any of your readers who have discovered a practical electric iron for laundry or factory use. I have tried all the well-known makes, but cannot find one that will stand up without attention for more than three months. The chief difficulty is the disintegration of the copper of the flexible close to the connector terminals, due to the heat rising from the iron, which also destroys the rubber on the flexible, and causes short circuits.

Has anyone experimented in this connection with the brass flexible that was on the market some 10 years ago, and, if so, with what results?

Another fault with most irons is the way the connection is made between the heating element and the brass terminal pins. This is, as a rule, very crude, and has not the attention given to it which it deserves, the result being arcing, and eventually an open circuit.

These faults are, of course, not nearly so frequent in household electric irons, partly due to the lower temperatures at which they are run, and their intermittent use.

Ironical.

#### Electrical Shunt Calculator.

Referring to the description of an electrical shunt calculator on page 556 of your last issue, I would say that this is quite an old device for summing reciprocals. Its use for combining resistances was described some years ago in the American journal *Power*, and is also to be found in Peidie's "Construction of Graphical Charts." It is, of course, a particular example of the monographic diagram which M. Oeagne brought into prominence many years ago, and of which a large number has appeared in American journals from time to time.

It may be noted that the solution of this problem is quite readily effected by the slide rule, only one movement of the slide being necessary.

I trust this information may save Mr. Brown expending further time and trouble in this connection.

C. N. Pickworth.

Withington, Manchester, April 4th, 1913.

#### Prospects in Electrical Engineering.

I read with interest Mr. W. J. Ebben's letter in the current issue of your paper, and as a former teacher, with many years' experience, perhaps you will allow me to make a few remarks.

In London at present the "system" pursued by the London County Council in its numerous technical institutions is that associated with the name of Lancaster, and is

as follows:—Number of students  $\times$  hours = work done per annum. Anything tending to reduce this product is absolutely "taboo" at present. As for the merits of this system, they have already been dealt with, but it is extraordinary to find a system exploded many years ago still rampant in London.

Consequently the duty of the teacher is clearly to impress on all the students that the special system of teaching inaugurated by the L.C.C. is for the express purpose of increasing his "money-earning capacity"—a matter, no doubt, of great importance to people who know nothing of education.

W. H. F. Murdoch, B.Sc., M.I.E.E.

Millhill, Middlesex, April 5th, 1913.

#### Failure to Excite.

I should like to suggest, in reply to "Speedometer," whose letter appears in the "Correspondence" columns of your current issue, that the fact that his generator refuses to excite itself when run up to speed in the ordinary way may be due to the fact that one of the field connections is not making perfect contact, with the result that the initial low voltage induced by what is at first only remanent magnetism is not high enough to drive any more current through the shunt coils than is already passing, and that, therefore, the field cannot "build up."

This suggestion is supported by the fact that the machine runs O.K. as a motor.

I may say that I have had the same experience on more than one occasion, and, by tightening up the field connections after scraping them, have found the generator quickly build up its field.

When the machine was run as a generator with series turns on the fields, these were quite possibly opposing and overcoming the small effect of the shunt winding.

C. V. Peake.

Birmingham, April 7th, 1913.

#### Electric Heating and Cooking Apparatus.

The writer of the article under the above title in your current issue states that my "Pygmy" heater consumes about 200 to 300 watts, and I trust you will allow me to correct this statement, the actual consumption being from 125 to 140 watts.

Considerably over 10,000 of these little hot plates have now been sold, and whatever the technical man may think of them, it is an undoubted fact that they are well appreciated by the public. They serve as a useful object lesson in electric heating and cooking, and in exciting the interest of the public they may be looked upon as a very useful canvasser for business of a more ambitious nature.

The same writer states that the quartz type of element burns out very readily, and I think that his experience cannot have been obtained from apparatus made during the last two years. My quartz glowers do not burn out very readily unless they are greatly over-run, and the only trouble that has been experienced during the last two years has been with heaters used on alternating-current circuits, such trouble not being due to the burning out of the elements, but to failure at the terminals. This latter defect has now been entirely eliminated, and if the writer of the article will be so good as to test some of our recently-constructed apparatus, I am quite confident that he will be forced to adopt an entirely favourable view as to its reliability.

I have read with interest your editorial remarks on the subject of the electric heating of rooms, and it seems to me that the only golden rule that one can follow in connection with the design of apparatus for that purpose, is to imitate as nearly as possible the appearance and temperature of the glowing coal fire, the comfort of which, so far as physiological effect is concerned, is very generally admitted.

In the course of the recent discussion at the Yorkshire Local Section of the Institution of Electrical Engineers, on the subject of electric heating and cooking, Mr. H. Veeger said that he did not think any reasonable man would suggest

heating a house with radiators under present conditions of price of energy, but I am prepared to demonstrate to Mr. Vesger that heating by electricity at one penny per unit compares very favourably indeed with heating by gas at 3s. per 1,000 cu. ft. provided adequate ventilation is arranged in each case. The open coal fire is admittedly cheaper than electricity for heating continuously an ordinary living room, but it is absolutely useless for temporary heating, for which electricity can practically defy competition.

Surely the facts cannot be as Mr. Vesger would like us to believe! The tens of thousands of electric heaters that are sold every year are evidence that the public entertain a contrary opinion.

C. Orme Bastian.

London, E.C., April 7th, 1913.

#### Remote Control by Vibrations.

Among other interesting matter, your issue of April 11th contains descriptions of inventions relating to "Life Targets" and "Wireless Telephony in Mines," both of which include apparatus for governing a local circuit by means of vibrations, air being the medium in the first case, and ether in the second.

I had the pleasure in December, 1907, of showing you my method of effecting control of operations at a distance without solid connections, a sound being received on that occasion by a microphone transmitter in series with a battery and the primary of a small induction coil, the secondary of which was connected to the magnet illustrated on page 963 of the ELECTRICAL REVIEW of December 13th, 1907. A time relay was combined with a step-by-step motion by means of which a variety of actions were governed in a model torpedo. Without the time relay, the apparatus responds to sudden loud noises such as gunshots. The corresponding devices described in your last issue under the head of "Life Targets," bear some resemblance to those previously invented by me, as may be seen from a reference to your article of December, 1907, and to my Patent Specification No. 11,021 of 1906.

Your Mr. Gatehouse may recollect that a curious discovery was made at the time of his inspection of my instruments. A common deal box in which the microphone transmitter was enclosed, was found to have a pronounced natural period of its own—about 275 v./s. The instruments could sometimes be caused to respond to the pitch of the box when Mr. Gatehouse sang the appropriate note.

It soon became obvious to me that my membrane might be set in vibration by ether waves if its natural period were brought into correspondence with the train or group frequency of such waves. In this case the alternations passing through the magnet under the membrane were derived from a receiving aerial, instead of a microphone transmitter. The arrangement is the subject of my Patent 12,183 of 1906, and there appears to be little difference between it and the call device described in your last issue under the head of "Wireless Telephony in Mines."

J. Gardner.

Fleetwood, April 5th, 1913.

[In our article we pointed out that "the effect could certainly be produced by other means," having in mind such devices as those of Mr. Gardner's invention.—EDS. ELEC. REV.]

#### Replacement of Plant.

I should be glad to hear if any readers of the ELECTRICAL REVIEW have replaced old plant, the capital of which has not been fully paid off, out of their invested reserve fund, and if they have found any difficulties, legal or otherwise.

R. N. Torpy,

Borough Electrical Engineer.

Electricity Works,

Tunbridge Wells,

April 1st, 1913.

## PARLIAMENTARY.

### Coventry Corporation Bill.

A SELECT Committee of the House of Commons, presided over by Mr. H. LAW, considered this Bill on April 2nd and 3rd. The chief object sought by the Bill had relation to the water supply, but there were also clauses to empower the Corporation to run motor-buses, and to extend the area for the supply of electricity so as to include the parishes of Allesley, Binley, Coundon, Keresley, Stoneleigh, Walegrave, Willenhall and Wyken. The estimated expenditure on motor-buses was £11,200, and there was a further estimate of £3,900 for the erection of a garage. Mr. Hutchinson, K.C., and Mr. Jeeves appeared for the promoters, and Mr. Talbot, K.C., and Mr. Field for the Warwickshire County Council, and Mr. Maconachie for the Leicestershire and Warwickshire Electric Power Co.

The Warwickshire County Council opposed the running of motor-buses over the main county roads outside the city, and after a consultation it was decided to withdraw all such routes.

The County Council also opposed the extension of the area for the supply of electric light, on the ground that there was no real necessity for such extension, which, if granted, might ultimately be used as an argument for the extension of the city boundaries.

MR. HUTCHINSON announced that all the electricity extensions would be withdrawn, except in regard to a part of Stoneleigh parish lying contiguous to the existing municipal boundary.

MR. MACONACHIE opposed the extension of the electricity supply powers to Stoneleigh, and called

MR. GEO. BALFOUR, of Balfour, Beatty & Co., Ltd., who stated that the Leicestershire & Warwickshire Electric Power Co. had completed a trunk line, which was to go *riù* the outskirts of Coventry to Warwick; and he was also making a contract with the Leamington & Warwick Electric Co. to supply them with power from Hinckley. The company intended to apply for a provisional order for lighting, and would be prepared to supply Stoneleigh.

The Committee decided to allow the Corporation's proposal for extending their electric lighting area to the part of Stoneleigh parish defined.

On the consideration of the clauses, MR. MACONACHIE, on behalf of the Leicestershire and Warwickshire Electric Power Co., asked the Committee to insert a clause defining the position of the Corporation in regard to the supply of electricity in Stoneleigh. He pointed out that under the company's Act of 1902 the company was debarred from supplying electrical energy in the Coventry district without the consent in writing of the Coventry Corporation, and the object of the clause was to make it perfectly clear that the company would not need such consent when they exercised their powers to supply in the Stoneleigh district.

MR. FRITCHARD (Parliamentary agent for the Corporation) said no such protective clause was necessary, as the Bill took no power to extend the boundaries of the city.

The CHAIRMAN said the Committee would allow the clause of the company, although they thought it was somewhat superfluous. As some apprehension appeared to exist in the minds of the company, they would grant the clause, as it was not the intention of the Committee to place the company in any worse position with regard to the area in question.

The Bill was ordered to be reported for third reading.

**Dundee Corporation Bill.**—This Bill, which presumably has for its object the widening of streets, &c., came before the House of Commons Committee on Unopposed Bills on 4th inst., and was ordered to be reported for third reading. The Bill contains estimates for tramways to the amount of £13,000. To meet the wishes of the Scottish Office, the Corporation inserted a clause in the Bill providing that not more than £1,000 in any one year should be paid from the tramway receipts to the relief of rates.

## LEGAL.

BUCKLEY & BEACH v. NATIONAL ELECTRIC THEATRES, LTD.

IN the Court of Appeal on Wednesday, April 2nd, Lords Justices Vaughan Williams and Hamilton heard an interlocutory appeal in an action brought by plaintiffs, electrical engineers, against the defendants, to recover moneys alleged to be due in respect of work done and materials supplied at three electric theatres, namely, at York, Hull, and Chatham.

MR. TINDAL ATKINSON, for the plaintiffs, said that his clients appealed from an order of Mr. Justice Bucknill in chambers reversing an order of Master Bonner. In October, 1910, the plaintiff and the defendants entered into a contract under which the former were to install electric light in defendants' theatre at York, the contract price being between £400 and £500. The work was completed in July, 1911, but the architect's final certificate was not given, and payment was not made until October, 1911. Rather more than 12 months after completion of the work at York, defendants suggested that there were defects, and the dispute between the parties was whether the defects were due to the faulty work of the plaintiffs originally, or whether they were due, as the

plaintiffs alleged, to negligent treatment of the installation by the defendants' servants. Plaintiffs, in consequence of the complaint, did certain work at the York theatre. About the same time they also did some work at the defendants' theatres at Hull and Chatham. Plaintiffs instituted proceedings, claiming against the defendants £33 11s. 10d., as to which £18 3s. related to work at the York Theatre, and £15 8s. 10d. to work at the other two theatres. A letter was received from the defendants, complaining of the work at Hull, and saying that they would probably counterclaim in respect of it. Eventually two summonses came before Master Bonner, one by the plaintiffs asking for summary judgment under Order 11, and the other by the defendants asking that the proceedings should be stayed by reason of an arbitration clause in the York contract. The plaintiffs' contention was that the work having been completed under that contract the arbitration clause had ceased to be effective. In the circumstances, Master Bonner remitted the whole action to the West London County Court. That, said Counsel, worked no injustice upon the defendants, because they could counterclaim as well in the County Court as in the High Court. Twelve days afterwards, after the plaintiffs had entered the case for trial in the County Court, the defendants appealed to Mr. Justice Bucknill. The appeal was out of time, but the learned Judge extended the time for appealing and then dealt with the matter on its merits. In the result his Lordship reversed the Master's order, stayed the whole action and referred the dispute to arbitration. Counsel submitted that the judge was wrong in making such an order. In the first place, he contended that the arbitration clause had ceased to be effective, and that in any event it did not cover the claim for the work at Hull and Chatham, and in the second place, the case having been set down in the County Court the judge had no jurisdiction to hear the appeal at all.

MR. POLLOCK, K.C., who appeared with Mr. Newbolt for the respondents, supported the judge's order.

LORD JUSTICE VAUGHAN WILLIAMS giving judgment allowing the appeal, said that when Mr. Justice Bucknill made the order he had no jurisdiction because the cause of action had been lodged in the County Court before the defendants issued their summonses asking for an extension of time to appeal.

LORD JUSTICE HAMILTON concurred. He thought the appeal succeeded on both points.

The appeal was accordingly allowed with costs, and the order of the Master restored.

#### TRADE MARKS.

In the Chancery Division on Friday, April 4th, before Mr. Justice Swinfen Eady, Mr. Kerly said he had a motion on behalf of the Western Electric Co., Ltd., by way of an appeal from the decision of the Comptroller of Trade Marks. The parties, however, said counsel, had made arrangements of which the Comptroller approved, and he proposed in these special circumstances to withdraw his decision. That being so, he (counsel) asked to be allowed to withdraw his appeal.

His LORDSHIP granted the application.

#### ELECTRICITY SUPPLY IN WESTMINSTER.

In the House of Lords on Friday last, before the Lord Chancellor and Lords Atkinson, Shaw and Moulton, judgment was given in an appeal by the London Electric Supply Corporation, Ltd., to which the Westminster Electric Supply Corporation, Ltd., were respondents. The facts and arguments were fully reported in the ELECTRICAL REVIEW of March 7th, ante pp. 377-378.

Mr. Danckwerts, K.C., Mr. Buckmaster, K.C., and Mr. Austen Cartmell appeared in support of the appeal. Sir Robert Finlay, K.C., Mr. Younger, K.C., and Mr. W. S. Kennedy for the respondents.

The LORD CHANCELLOR, in the course of his judgment, said that the case appeared to him to be not unattended with difficulty, but he had come to the conclusion that the judgment appealed against could not stand. The question was whether the agreement of 1910 was, as held by the Courts below, one under which the respondents were at liberty to manage the undertaking of the appellants within the Westminster area with the same freedom as they could have done had they been out and out purchasers for their own benefit. Put less abstractly, were the respondents left free to reduce the working of that undertaking by soliciting persons, who were entitled to apply, and did apply, to the appellants to supply them with electricity, to take their supply from the respondents instead? Were they further at liberty as between themselves and the appellants, to say to those who, under the terms of the appellants' Provisional Order of 1889, were entitled to claim a supply from the appellants, and subsequently to the agreement did so claim, that they, the respondents, had acquired the right to manage the appellants' undertaking as well as their own, had an option to tell these persons which supply they should have? In order to understand the meaning of the agreement, it was necessary to remember the state of legislation affecting these companies when the agreement was made. Sec. 11 of the Electric Lighting Act, 1882, had prohibited such companies from divesting themselves of their legal powers and liabilities as imposed by that Act, without the consent of the Board of Trade. The object was to maintain competition and avoid monopoly. The provisional orders of the appellants and the respondents, which were made in 1889, and were confirmed by Parliament, accordingly prohibited them from purchasing or acquiring the undertakings of, or from associating themselves with, any other company or person supplying electricity under any

licence, provisional order, or special Act within London, unless authorised by Parliament. In 1908 by the London Electric Supply Act of that year they were authorised to enter into and carry into effect, with the approval of the Board of Trade, any agreement for mutual assistance or for association with each other in regard to, among other things, the giving and taking of a supply of electricity, and the distribution and supply of electricity so taken, and for the management and working of any part of their undertakings. It was to be observed that this permission did not in terms authorise purchase or transfer. Sec. 11 of the Act of 1882, and the orders of 1889, remained standing except so far as the words of the Act of 1908 relaxed their stringency. Sec. 11 was, indeed, afterwards repealed by Sec. 14 of the Electric Lighting Act, 1909, but its substance was re-enacted by the same section in rather more stringent terms. Under these circumstances, the two companies negotiated, and the Board of Trade approved, the agreement in question. It was dated May 4th, 1910, and consisted of 21 articles. His Lordship then referred to Article 2, which provided that the appellants were to place their undertaking in the hands of the respondents during the continuance of the agreement: to Articles 3 and 4 which referred to the upkeep of existing mains and the cost of extensions; to Article 9, reading of meters and collecting accounts, and Article 11, by which the respondents were, in a proper and efficient manner, to fulfil and comply with all the conditions and requirements in respect of supply to which the appellants were or might be subject within the area, and were to indemnify the appellants against claims for default of supply. Turning to Article 13, he said the appellants were to supply to the respondents such amount of alternating current as might be required for enabling the respondents to supply all the requirements of the appellants' consumers for alternating current within the area, and of all such other consumers within the area, as might be required for enabling the respondents to supply their own customers with current within the area. By Article 15, the respondents were to pay to the appellants in each year until 1931 the fixed annual sum therein mentioned, and, if the statutory purchasing authority did not purchase the undertaking in that year, a reduced annual payment thereafter until such purchase. By Article 16, the price to be paid to the appellants by the purchasing authority was to go exclusively to them and the respondents were to make up the amount payable for the portion of the undertaking within the area to £100,000 should it fall short of that sum. By Article 17, the respondents were, in addition to the annual payments already mentioned, to pay the appellants for electricity supplied under the agreement £2,000 a year to meet certain standing charges and 85d. for each Board of Trade unit of electricity supplied. He also read Articles 19 and 20. The Lord Chancellor, continuing, said he agreed that the agreement must be read as a whole and its real substance sought for. It seemed to him that the construction sought to be placed upon the powers conferred by the agreement upon the respondents could not be upheld. He did not, however, think it necessary to grant an injunction at present. It would be sufficient, looking to the circumstances, to give liberty to apply in the action if such an injunction or other relief should prove necessary. He had had the advantage of considering the declarations suggested in the judgment about to be delivered by Lord Moulton, and he thought that the wording he proposed, with the addition of liberty to apply, was the proper form for such declarations to take. Accordingly, he moved that the appeal should be allowed, and as the respondents had been substantially wrong, they must pay the costs there and below.

LORD ATKINSON concurred.

LORD SHAW read a judgment to the like effect.

LORD MOULTON then read an exhaustive judgment dealing with the course of legislation, the agreement, and the grounds for the conclusion at which he had arrived. He said that the appeal raised points of general importance, as well as issues affecting only the parties to the suit. For the sake of clearness, it would be well to deal with matters in chronological order. His Lordship referred to the Act of 1882, the Act which still formed the basis of the legislation applicable to the subject, and said that no practical action took place under that statute, because of the shortness of the term which Parliament then was willing to give undertakers of electric lighting enterprises. By the Act of 1888, things were made more favourable, and many applications for provisional orders covering various areas of London were made in 1889, and among them those of the plaintiffs and the defendants. The plaintiffs' area was a very large one, and extended on both sides of the Thames. It included the district of Westminster. The system of supply was an alternating current generated at a station outside the area, the energy being transmitted at very high pressure to the districts of supply, and there transformed down to a low pressure. In 1908 it was felt that difficulties of establishing generating stations in populous districts, and the advantages of producing on a large scale, and with large units of machinery, rendered it advisable to make some concessions in the provisions aimed against monopoly in the statute of 1882 and 1889, and accordingly the Act of 1908 was passed to allow authorised undertakers of electric lighting to enter into arrangements as to certain matters with other electric supply companies. It was under the powers of that Act that on May 4th, 1910, the parties to this suit entered into the agreement out of which this action arose. The differences relative to the meaning and effect of that agreement might be summed up in two plain issues. First, the Westminster Co. claimed the right to use all means in its power, whether in the form of persuasion or by the exercise of powers possessed by it under and by virtue of the agreement, or the statutes regulating the undertakings, to detach customers from the London Co. and transfer them to the Westminster Co.; and, secondly, the Westminster Co. claimed the right to refuse to give alternating current

from the London Co.'s mains to members of the public having a right to be supplied by that company, and to compel them to take the Westminster Co.'s continuous current if they wished to receive a supply of electric energy at all. The first question, therefore, was, What were the powers and duties of the Westminster Co. with regard to that part of the London Co.'s undertaking which was situated in the Westminster area? Those powers and duties could only have been acquired by the Westminster Co. in virtue of the existence of corresponding provisions in the agreement. Those provisions must be within the powers given in the London Electric Supply Act, 1908, for, apart from that Act, no such powers or duties could have been acquired by the one company with regard to the undertaking of the other, either by agreement or otherwise. His Lordship said that this was evident by the chain of statutory enactments, which he proceeded to consider at some length, beginning with Sec. 11 of the Act of 1882, and tracing the changes, as referred to by the Lord Chancellor, brought about by the subsequent statutes. He referred to Sec. 4 in each of the Provisional Orders under which the companies respectively worked their undertakings, which provided that "the undertakers shall not purchase or acquire the undertaking of, or associate themselves with, any other company or person supplying energy under any licence, provisional order, or special Act within the Administrative County of London, unless the undertakers are authorised by Parliament to do so." Before examining the agreement of May 4th, 1910, in detail, it was necessary to state shortly the position of the two companies with respect to the nature of the supply that they were respectively authorised and compelled to give to the public. The Westminster had from the first sought, and obtained, powers to supply to the public low-tension continuous current only. From the first the London had adopted the alternate current as its form of supply, and down to the year 1905 it was not authorised to give any other form. In June of that year it obtained powers for an additional system—namely, an extra-high-pressure alternating-current supply to motor-generators placed in substations erected above the ground, and from those motor-generators a continuous-current low-pressure supply to the public by means of conductors on the three-wire system. But although they had acquired such powers, they availed themselves of them only in districts south of the Thames. In Westminster, for instance, they neither installed the requisite motor-generators nor laid down any mains for such supply, which required separate mains of a different construction to the company's mains in that area. It followed, therefore, that in the Westminster area they remained as they had been from the commencement—a company supplying to the public alternating current only. His Lordship then referred to the recitals in the agreement, and said that the main provisions which dealt with the "giving and taking of currents" were to be found in Clauses 13 and 14. The monetary terms of the agreement were as follows:—The Westminster Co. was to take the whole of the customers' payments, *i.e.*, the entire revenue produced by the London Co. in the Westminster area. In return it made a fixed annual payment of an amount to be ascertained once for all in a manner specified in the agreement. It was argued by the parties that this had been done, and that the sum so ascertained amounted to £21,735 per annum. It also paid for all the alternating current supplied by the London Co. under the agreement at the rate of '85d. per unit. And, finally, it paid £2,000 to the London Co. to meet the standing charges of the London Co. for the maintenance, renewal and upkeep of the works handed over to the Westminster Co. under the agreement. It then came to be considered the bearing of the various recitals he had referred to on the points at issue between the parties. With reference to the first question—What was the effect of the Westminster Co. taking over the "management and working" of the London Co.'s undertaking in Westminster?—in his opinion, the words must be taken to mean just what they did in the Act of 1908, under which the agreement was made, and which it purported to put into practice. The company, like an individual, were bound to manage and work the business with reasonable care and skill and with an honest regard to the interest of the parties entrusting them with it. He had no doubt that it was in this sense that the words were used in the permissive section of the Act of 1908, and this must prevail in agreements made to carry into effect the powers so granted. The power to allow another company to manage and work an undertaking which was rendering services to the public did not mean that it might be put into hostile hands to be strangled. If, therefore, the language of other parts of the agreement were such as to compel their Lordships to give to these words the meaning contended for by the respondents, a serious question would arise as to whether the agreement was not self-contradictory or in the alternative was not *ultra vires*. But he could see nothing in the language of the agreement which gave rise to difficulties of that sort. His Lordship then examined the arguments of the defendants on this head. They claimed, *inter alia*, that the London Co. had no further interest in the undertaking—its sole asset was the annual payment of £21,735 and the guarantee as to the purchase price, and that, therefore, it was the intention of the parties that the defendants should do what they liked with the undertaking, avoiding, of course, violation of the statutes. But it could not be assumed that if fairly worked and managed by the defendants, the plaintiffs' undertaking might not fetch a higher sum than £100,000, and he did not think that the defendants' contention was sound, that the arrangement meant that, on their undertaking to pay £21,735 per annum and to guarantee a purchase price of £100,000, they obtained the privilege of getting rid of a competitor so far and so soon as they could do so without violating statutory obligations. That was not, in his opinion, a fair exercise of the permission to allow companies to associate or give mutual assistance

In the management and working of their undertakings, or a fair interpretation of the language of the agreement itself.

The second question was whether the Westminster Co., as managing and working the London Co.'s undertaking, was entitled to refuse to give a supply of alternating current to owners and occupiers applying to that company for it, and entitled to a supply of electric energy from that company. He thought the one simple and decisive answer to that question was this. The London Co. was bound to give to such owner or occupier a supply of alternating current, because it could give no other. It had never taken the necessary steps to qualify itself in the Westminster area for distributing continuous current, either by laying the requisite mains or erecting the stipulated generating, or, rather, transforming plant, *i.e.*, the motor-generators. It was abundantly clear that an electric lighting corporation could only give its statutory supply from its own mains. The order was full of provisions as to the responsibility of the company for the conditions of its mains, the preparation of maps of those mains, which were to be open to the public for inspection, and so forth. All these precautions were for the benefit of owners and occupiers who were entitled to a supply from the company. The whole of these provisions would be evaded if the company could refuse to connect a would-be consumer with its own mains and force him to take his supply from some other source. It followed, therefore, that the London Co. had no power to give a statutory supply of continuous current in the Westminster area, because it had laid no mains for the purpose, and, indeed, had done nothing to enable it to make use of the additional system of supply which it used in some parts of its area south of the Thames. His Lordship, having referred to what he characterised as the "curious process of reasoning" by which the defendants seemed to have arrived at the conclusion that the London Co. might distribute continuous current to the public in Westminster—namely, that, as managers of the London Co.'s undertaking, they were entitled, as against the public, to call the mains of the Westminster Co. London Co.'s mains, which he considered wholly unsupported by anything in the agreement, said:—

It follows, therefore, that in both of these, their main contentions, the Westminster Co. have been in the wrong. It remains to consider what should be the relief given by this House in the circumstances of this case. It is not necessary to grant any injunction, as there is no reason to think that the defendants will fail to act in accordance with their obligations when these have been duly declared. I should suggest the following declarations:—

1. That it may be declared that the defendants in managing and working the plaintiffs' undertaking in the Westminster area are bound to do the same with reasonable care and skill, and with due regard to the interests of the London Co. therein.

2. That it may be declared that according to the true construction of the said agreement of May 4th, 1910, the defendants are as between themselves and the plaintiffs bound, if required so to do by the plaintiffs, to supply electric energy by means of the plaintiffs' alternating current to any consumer, or proposing consumer, in the Westminster area who applies to the plaintiffs for a supply of electric energy, and is entitled to receive from them a supply of the same, and whose application is duly forwarded by the plaintiffs to the defendants for execution, and to do, and permit to be done, all acts and things necessary for furnishing such customer with the plaintiffs' alternating current.

The defendants should pay the costs of the actions and the appeals.

#### HARRIS v. HULTON

In the City of London Court, on Tuesday, before his Honour Judge Lumley Smith, K.C., a claim was made by Mr. Corbin Harris, the liquidator of the Oro Light and General Supply Co., Ltd., 36, Cock Lane, Snow Hill, E.C., to recover £2 17s. 4d. against Messrs. R. P. Hulton & Co., electrical engineers, 109, Great Eastern Street, E.C., for electric lamps supplied last year. The claim was admitted, but the defendants raised a set off for £3 18s. 6d., alleging that the lamps were useless.

Defendants' solicitor stated that the defendants required 72 105-volt electric lamps for use at the Picture Palace, Windsor. The defendants had to return them, because the caps were loose, and defendants had to get others at a cost of the sum now counter-claimed for.

Defendants' manager said the plaster that held the cap became loose, and they were useless.

MR. HARRIS, the plaintiff, said he was formerly the chairman of the Oro Light Co. He received the order in question. Every lamp was tested before it was sent out and found to be quite satisfactory. That was the only complaint which they had had. If the lamps were put in the damp, such as outside a picture palace, they would be injured, because the cap was fixed on with plaster of paris. If the lamps were to be put outside they ought to be put in a proper casing. That was usual; otherwise they had to be fixed on with gutta-percha. That was the only way of resisting the wet. The lamps in question went wrong because they were put outside the picture palace. They might have been spoiled by too strong a voltage being used.

JUDGE LUMLEY SMITH: My voltage is 200. I expect the lamps to stand that.

WITNESS: If you put a 150-volt lamp on to your 200 voltage it will soon smash the lamp.

JUDGE LUMLEY SMITH thought the plaintiffs' lamps ought to have lasted some time without going to pieces as they had done. Plaintiff said it must be due to exposure. He would have thought that electric lamps ought to go outside as well as inside. He did not see why they should not if properly made. He was disposed to think the defendants had made out their case. They could not

recover anything in that case, but the plaintiffs could not recover any of their claim. Defendants would set off the amount of the plaintiffs' claim, and defendants could claim the rest in the plaintiff company's liquidation. It was not a case for costs.

POST OFFICE TELEPHONE GRIEVANCES.

THE Postmaster-General, Mr. Herbert Samuel, sued Mr. W. J. Macmanus, 26, Agate Road, Hammersmith, on Tuesday, in the City of London Court, for £2 6s., the return of telephone apparatus and telephone calls due.

MR. ALLSOPP, plaintiff's solicitor, said that the defendant entered into an agreement to have the telephone service in September, 1910. The period expired and he would not return the apparatus without the Court's order.

DEFENDANT said he had the telephone on January 18th, 1912, and from the moment of the installation there had been nothing but trouble. No proper instrument and no proper service had ever been given him. The workmen were never out of the house. There had been one incessant series of complaints. The telephone was absolutely necessary to his business, and, bad as it was, he had to put up with it, as it was no earthly use to argue with the Post Office Department. Then he was sent a fresh agreement for the old apparatus, and he objected. He had always been prepared to pay his rent. The agreement was most inequitable.

JUDGE LUMLEY SMITH said he had been expecting it to be taken to the Court of Appeal, but no one had done it yet.

Defendant added that the service made his place more like a comic scene in a pantomime than a business house. On the last day of the service it took him 32 minutes to get through to the exchange.

JUDGE LUMLEY SMITH said the defendant only owed 2s 8d. for fees. He would have to pay that, and £1 16s. 5d. in respect of the apparatus. The latter money would not be payable if he gave up the apparatus. Judgment accordingly.

COMPENSATION CASE.

AT the Rochdale County Court, on Friday, Mr. R. D. Mattley, representing Mrs. Eliza Brierley, 103, Peel Street, Rochdale, applied to Deputy Judge Leresche, for an order directing Messrs. R. & T. Howarth, contractors, of Royds Street, to pay £275—an agreed sum—as compensation on account of the death of her husband. Mr. Mattley said the husband was employed by Mr. Geo. F. Endersby, a contractor, to whom Messrs. R. & T. Howarth had sold certain work in connection with an extension at the Rochdale Corporation Electricity Works. Whilst working there on January 3rd, Brierley, who was a journeyman joiner, fell from scaffolding and died the same day from the effects of the injuries he received. The respondents had served notices for the purpose of being indemnified by Mr. Endersby. Mrs. Brierley, however, was entitled to an award.

The JUDGE awarded Mrs. Brierley £275, and, on the application of Mr. Mattley, he granted her an immediate payment of £25, and made an order for her to receive the remainder at the rate of £3 a month.

Messrs. R. & T. Howarth then claimed to be indemnified by Mr. Endersby for the amount they have to pay Mrs. Brierley. Dr. Atkinson (instructed by Mr. C. B. Hudson) represented Messrs. R. & T. Howarth, and Mr. Acton (instructed by Mr. J. Bright Clegr) appeared for Mr. Endersby.

At the invitation of the JUDGE, counsel went into his private room. On returning into court, his Honour said the case could not be finished that day, and he did not think it should be commenced and left for another judge—who might be sitting at the next court—to finish. The adjourning of the case might also enable the parties to come to some arrangement.

All engaged in the case agreed to it being adjourned to May 23rd. It was accordingly adjourned to that date.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Automatic Earthing Device.

A new pattern of disk type earthing device, made by MESSRS. A. REYROLLE & CO. LTD., is illustrated herewith. It consists of an isolating switch combined with a paper disk earthing device. The latter part is of special interest at the moment, particularly in view of the discussion which followed the paper recently read before the Institution of Electrical Engineers by Mr. J. S. Peck.

It consists of a paper-insulating disk A, fig. 1, which can be made of any thickness or material according to the voltage at which it is required to spark over. The terminals T are enclosed in an insulated box B, and dropped into a carrier C. The carrier is in the form of a change-over switch so arranged that when the disk is temporarily removed a direct earth connection takes its place. It is, therefore, possible to have three positions—

1. Isolating switch open, in which position the neutral point is insulated.
2. The isolating switch closed, insulating disk in place (fig. 2). In this position the neutral point is again insulated, but in the event of

a disturbance on the system occurring, which would cause potential difference between the neutral point and earth, the disk would be pierced, and the neutral point thereby automatically earthed.

3. In the third position, the neutral point is earthed direct, and in this position the disk box can be conveniently removed for inspection or replacement (fig. 1).

The principal demand for this arrangement is from those systems where the neutral point is earthed at the power station and, in accordance with the Board of Trade regulations, it must not be permanently earthed at any other part of the system.

It may so happen that main switches are open, and certain parts of the system become isolated from the section where the neutral point is earthed. At the same time, the sections whose neutrals are thereby insulated remain in commission, possibly on account of

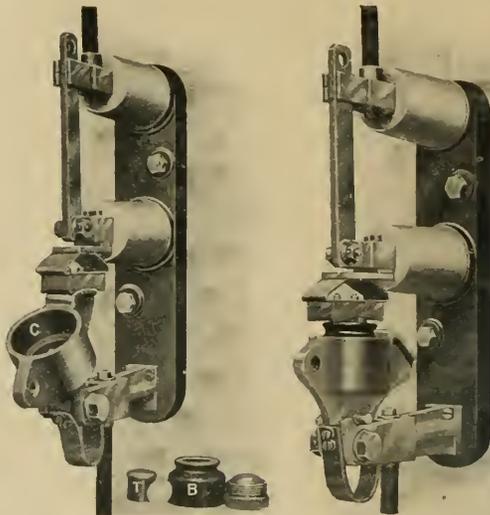


FIG. 1. FIG. 2. REYROLLE AUTOMATIC EARTHING DEVICE.

step-up transformers, or because they are connected to another power station. When such a contingency occurs, the use of the above earthing device at the neutral point of the static transformers provides for automatic earthing, and, in the event of an accident, for instance, an earth on one phase occurring, the device would ensure the proper operation of the main switches, and so avoid the risks which might be attendant upon a line conductor being accidentally earthed on what would be, but for the use of the earthing device, an insulated system.

As a safety device, the arrangement has a further use in a modified form on the secondary of step-down static transformers, in those cases where it is necessary to provide some means for isolating the static transformer in the event of a failure of the transformer occurring, which would tend to raise the potential of the secondary, for instance, a contact between primary and secondary winding.

Focusing Reflector Lamp.

The object of the BRITISH THOMSON-HOUSTON CO.'S new concentrated-filament "Mazda" lamp is to get a filament approximating as closely as possible to the theoretical point source of light. The

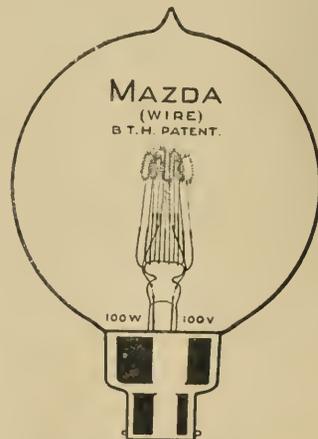


FIG. 3.—B.T.H. "MAZDA" LAMP WITH CONCENTRATED FILAMENT

lamp is made in three sizes—50 watts, 100 watts and 200 watts—and in voltages ranging from 12 to 200. The filament is made of drawn tungsten wire wound in a very narrow spiral, which is formed into a series of loops bunched closely together. By this means it is possible to get a very high candle-power filament in a small compass. For example, the 100-volt 100-watt lamp (giving approximately 100 c.p.) has a filament which could be contained in a cubical space measuring  $\frac{1}{2}$  in.  $\times$   $\frac{1}{4}$  in.  $\times$   $\frac{1}{4}$  in. (see fig. 3). This new "Mazda" lamp has been designed for use with parabolic reflectors in motor headlights and searchlights, and in optical lanterns, photographic enlarging lanterns and small cinematograph projectors. For these purposes this lamp has all the advantages of the ordinary incandescent electric lamp in regard to cleanliness and safety, and in addition gives the concentrated light source necessary for accurate reflection with parabolic reflectors, or projection by means of lenses and condensers.

**The Aston Ball Body.**

We illustrate in fig. 4 the "Aston" three-light adjustable ball body, which is supplied by MESSRS. VERITYS, LTD., London, for use with 3 $\frac{1}{2}$ -in. lip Holophane reflector bowls and open glassware. It is claimed that this device enables the glass reflector to be taken off for cleaning without unwiring and removing the body; and that

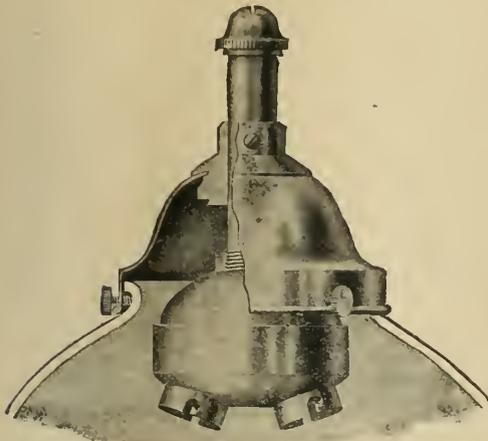


FIG. 4.—ASTON BALL FITTING.

it allows the lamps to be placed in their correct position inside the bowl by means of the set screws (on collar), which hold the adjusting tube as required. The body is supplied wired for two circuits, one and two lights, ready for fixing, and it can be equally well used for large Holophane bowls or open shades having a 3 $\frac{1}{2}$ -in. lip.

**Recording Blast-Furnace Charges.**

Ironworks managers will not need to be told that the sooner the operation of charging blast furnaces is over, the better. Obviously the longer the furnace bell is lowered, the longer does gas escape which can be utilised advantageously, and

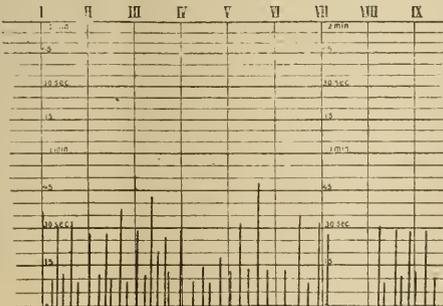


FIG. 5.—FURNACE-CHARGING CHART.

hence it becomes of importance to have some check on the periods of charging, not only as regards the time when the charge took place, but also the actual time consumed in completing the charge. In order to meet these requirements, a very ingenious and yet simple device has been developed by MESSRS. WORKS CONTROL, LTD., of St. Margarets-on-Thames. This consists of a recording drum, on which is placed a time chart such as is shown in fig. 5. On this time chart the pen moves uniformly upwards at a fairly rapid rate so long as the electrically-controlled mechanism of the recorder allows it to do so. When current is shut off from the recording

mechanism, the pen drops out of contact with the chart, and falls back again to its lowermost or zero position. On examining the chart which is shown, it will be seen that the pen marks intersecting horizontal lines are not strictly vertical. This is caused by the fact that while during a certain interval the pen is moving upward at a fairly rapid rate, the time chart is also being moved forward at a slow rate, so that the lines become diagonal. Now, supposing that the vertical distances are ruled to a very open spacing, so that the total height of the paper corresponds to, say, a two-minute vertical travel of the pen, while the horizontal travel of the drum chart is made a 24-hour circuit, it will be seen that on the same chart can be recorded the times at which the bell was lowered by examining the horizontal distances, while by examining the vertical distances one can obtain the interval in fractions of a minute that the bell was kept lowered.

The electrical mechanism in the recorder is operated by the closing of a circuit having switch contacts, which are closed when the furnace bell is lowered. The current necessary for operating the instrument may be supplied by a small battery or the supply used for lighting the plant. The actual size of the chart which is shown in the illustration is 5 $\frac{1}{2}$  in. high and 7 $\frac{1}{2}$  in. long, so that accurate measurements can be obtained.

**BUSINESS NOTES.**

**Condensing Plant Contracts.**—The following is a list of some recent orders received by the MIRRIEES-WATSON CO., LTD., of Glasgow:—

- Surface condensing plant with Mirriees-Leblanc rotary air pumps.—Two sets for the County of London Electric Supply Co., per the British Thomson-Houston Co., Ltd. Two sets for auxiliary machinery for H.M.S. *Queen Elizabeth*, per Peter Brotherhood, Ltd. One set for Aberdeen Corporation, per Mr. G. Wuthrich. One set for Sheepbridge Coal and Iron Co., per the British Thomson-Houston Co., Ltd. One set for Fleetwood U.D.C., per Messrs. Jas. Howden & Co., Ltd.
  - Surface Condensing plant with Mirriees-Edwards air pumps.—One set for the Lancashire Electric Power Co., and one set for New Zealand, per Messrs. Hendry Bros.
  - Mirriees multi-jet condensing plant.—Two sets for the Summerlee Iron Co., and one set for the Cambrian Collieries, per the A.E.G. Electric Co. One set for Flemington Coal Co., and one set for Tinsley Park Colliery, per Messrs. Greenwood & Batley, Ltd. One set for Moorbrook Mills, per the British Thomson-Houston Co., Ltd. One set for Bargoed Colliery, and one set for Glasgow Iron and Steel Co., per Messrs. Fraser & Chalmers, Ltd. One set for the Weardale Steel, Coal and Coke Co. (repeat order). Two sets for the Londonderry Collieries, Ltd., per Mr. Wm. C. Mountain. One set for the Powell-Duffryn Steam Coal Co., Ltd. One set for J. Whiteley & Sons, Ltd., per Messrs. Daniel Adamson & Co. One set for the Glangrannoch Iron and Steel Co., per Messrs. Jas. Howden & Co.
  - Barometric Condensing Plant with Mirriees-Leblanc Rotary Air Pumps.—One set for Birtley Colliery, per Messrs. C. A. Parsons & Co. One set for the Powell-Duffryn Steam Coal Co.
  - Mirriees-Leblanc Simple Jet.—One set for the Denton Colliery Co., Ltd.
  - Low Level Jet Plant.—Two sets for the Sheepbridge Coal and Iron Co. and one set for Dinnington Main Colliery, per the British Thomson-Houston Co., Ltd.
  - Barometric Plants with Reciprocating Dry Air Pumps.—Four sets for Peru and one set for the Argentine.
- The above represents a total steam duty of over 1,000,000 lb. per hour.

**Hydro-Electric Contracts.**—MESSRS. BOYING & CO.'S recent contracts include 17 km. of welded-steel pipe for the 1912 extensions of the Victoria Falls and Transvaal Power Co. The line consists of pipes of 27 $\frac{1}{2}$ , 22 and 16 in. diameter, the pressure being 100 lb. per sq. in., while the temperature of the compressed-air is as high as 80° C. They are also supplying a further 11,000 ft. of 15-in. pipe for the Rand Water Board. Other orders include two water turbines of 225 H.P. for the Kawasugawa Hydro-Electric Co., of Japan, and one of 70 H.P. for the Wheel Jewell & Marytavey Mines (Cornwall). Orders for pumps include one 3,000-gallons Victoria pump for Messrs. Hulett, Durban; two 8,950-G.P.M. pumps for Messrs. Willans & Robinson, for Sydney; one 100-G.P.M. pump for the Soudanese Irrigation Department; eight Victoria pumps of various capacities for the Papéteries de Rethel, Ardennes, France, to which company the firm are also supplying a complete 110-in. paper-making plant.

**Catalogues and Lists.**—THE EASTERN ELECTRIC CO., LTD., 11, Queen Victoria Street, London, E.C.—Catalogue, consisting of a number of lists containing illustrations and prices of a variety of electrical accessories. These include switches, lampholders, ceiling roses, cut-outs, fuseboards, wall plugs, opal shades, wood blocks and casings, wires and cables, bells and bell accessories, and ironclad switches.

THE ELECTRICAL CO., LTD., London, W.C.—Stock list of A.C. and C.C. motors, and other machines.

**Bankruptcy Proceedings.**—SAMUEL SMITH (trading as Smith & Sons), 22A, 24 and 26, Victoria Square, Widnes, Lancs., electrical engineer, &c.—The public examination of the above-named debtor was held at the Court House, Government Buildings, Victoria Street, Liverpool, last Monday, when the liabilities were put at £270, and there was an estimated surplus of £648. It appeared that the debtor started trading at Widnes about 23 years ago, and until recently the business had proved very successful. Two of his sons had been in the business, but he had declined to make them partners while they were under 21 years of age. Last August debtor consulted a solicitor who advised him to execute a deed of assignment for the benefit of his creditors. He agreed to this course, and ultimately two trustees were appointed

under the deed, the business in the meantime, pending sale as a going concern, being carried on by him at a weekly salary of £2. His liabilities at that time were about £401, and he estimated that his assets were worth £1,550. Creditors to the extent of £114 odd did not assent to the deed within the time specified, and were now scheduled as unsecured creditors for that amount. Since the deed liabilities had been incurred amounting to £156 odd. Debtor was questioned by the Official Receiver as to his estimate of the value of his assets, and was reminded that the trustees had been put to considerable expense in resisting a claim made in the Chancery Court by his sons, who asserted that they were partners in the business. The Official Receiver further stated that he understood that the debts were understated at the time of the assignment. Debtor maintained that if the estate were properly dealt with there should be a large surplus for him. After further questions had been asked the examination was ordered to stand adjourned.

E. J. CROSIER (Crosier, Stephens & Co.), engineer and merchant, Newcastle-on-Tyne.—April 26th is the last day for the receipt of proofs for dividend. Trustee: Mr. J. A. Gardner, 145, Pilgrim Street, Newcastle-on-Tyne.

**Electric Clocks.**—We are informed that the great house of Whiteley's, Westbourne Grove, is to be equipped throughout with a service of uniform and accurate time by the SYNCHRONOME CO., LTD., of 32 and 34, Clerkenwell Road, E.C. The installation will comprise a very large number of their "one-wheel" electrical impulse dials, and will include handsome turret clocks on the galleries under the domes. The same company have also in hand their fourth extension of the time circuit in Waterloo Station. Railway companies have a reputation for caution and conservatism, but from a list before us of "Synchronome" installations in railway stations in all parts of the world, it appears that this system of time-keeping is appreciated by them. The Buenos Ayres and Great Southern Railway is among the latest to go in for this system.

**Willans & Robinson, Ltd.**—The scheme of capital re-arrangement recently proposed to and accepted by the shareholders of this company, was duly confirmed by the High Court last week. The company has always been so closely identified with the electrical industry, and has carried out so much excellent work, that we feel our readers will join with us in the hope that its trading may continue for the benefit of the industry at large, and that the company itself may now enter upon a renewed stage of prosperity. It is interesting to learn that the business now in hand, especially in steam turbines and Diesel engines, shows a larger volume than for some time past.

**Dissolutions and Liquidations.**—MELDRUM BROS., LTD., Timperley.—A second dividend of 3s. in the £ is payable April 7th at the office of Mr. Theodore Gregory, 3, York Street, Manchester.

S. T. ROBBINS & CO., automobile, electrical and general engineers, 19, Port Street, Evesham.—Messrs. Stanley T. Robbins and H. S. Hunt have dissolved partnership. Mr. Hunt will attend to debts.

MESSRS. SIMPSON, SCOTT & CO., electrical contractors, Cape Town, have dissolved partnership. Mr. Simpson is carrying on business as district agent for Messrs. Orenstein and Arthur Koppel, Ltd, and Mr. Scott is joining the local agency of the A.E.G. Co. as technical adviser.

**For Sale.**—The Darlington Corporation has for disposal a 35-KW. steam dynamo. See our advertisement pages in this issue.

Messrs. Wheatley Kirk, Price & Co. will offer for sale by auction on April 30th the plant, machinery, stock, &c., at Falcon Works, Bedford Street, Greengate, Salford, under instructions from Mr. T. R. H. Tetley, who is discontinuing manufacturing. See our advertisement pages to-day.

**Trade Announcements.**—THE ELECTRIC BATTERY CO. has removed to more extensive premises at 62, Eagle Street, High Holborn, W.C. (Telephone No. "Holborn 1080"), where they have a floor area of over 6,000 sq. ft., which will be equipped with modern plant for the manufacture of E.B.C. (patent) dynamos for car lighting, accumulators, &c.

MESSRS. POWLEY BROS., electric lighting engineers, &c., of 32, Park Road, Kingston-on-Thames, have opened additional premises at 1, Ditton Road, Surbiton.

Mr. Donald Smeaton Munro, M.I.E.E., acquired, in March, 1912, that section of the electrical business of Anderson & Munro, which was formerly worked from Edinburgh. To avoid confusion, this Edinburgh section is now carried on by, and under the name of, DONALD SMEATON MUNRO, 11, Randolph Place, Edinburgh, and all communications should be so addressed.

## LIGHTING and POWER NOTES.

**Accrington.**—The refusal of the Rishton District Council to allow the Accrington Corporation to supply electrical energy to Messrs. Peebles & Sons' Works, Rishton, has led the Accrington Electricity Committee to the decision to apply to the B. of T. for an Order permitting it to give the supply desired. It has also been decided to apply to the L.G.B. for sanction to borrow £2,000, the estimated cost of laying and supplying the necessary mains and transforming plant in connection with the supply.

It is proposed to give domestic consumers the option of an assessment tariff—viz., a fixed rental of 12½ per cent. per annum on

the net rateable value, to be apportioned over the various quarters of the year as follows:—First quarter, two-sixths; second, one-sixth; third, one-sixth; fourth, two-sixths, together with a charge of 3d. per unit, with a discount of 5 per cent. from all accounts paid on or before a specified date. It has been decided to adopt a charge for all purposes other than for power from April 1st of 4d. per unit, subject to discounts on accounts paid before a specified date varying from 10 to 25 per cent., according to consumption.

**Atherton.**—The U.D.C. has confirmed a proposal of the Electricity Committee to apply to the L.G.B. for sanction to borrow £5,500 to meet the cost of a new transformer station, feeder cable, &c.

**Australia.**—The report of the Electric Supply Committee of the Melbourne City Council for the year 1912, according to the *Australian Mining Standard*, shows that in spite of (perhaps because of) reductions in the price at which current is supplied to consumers, and in spite of large new expenditure on plant, there is still a credit to profit and loss account, though of about a third less than for 1911. The gross revenue for 1912 was £130,276, and the working expenses amounted to £65,130; the gross profit, therefore, was £65,146. Charged against this was interest on capital, commission and exchange, £19,357; sinking fund, £5,615; depreciation and renewals, £23,458; on account of loans, £844, making a total of £49,274, and leaving a net profit for the year of £15,871. The revenue from the sale of current for private lighting purposes increased from £59,679 to £68,936, and the revenue from heating and power by nearly £8,000. In allocating the amount to be set to the various accounts, a sum of £8,750 was contributed to the town fund, and £5,615 to the sinking fund, making that fund now £99,184. The depreciation and renewals account amounts now to £163,514; during the current year this fund will be drawn upon extensively for the cost of plant which is being scrapped to make way for new plant of a larger capacity and greater efficiency. The net profit in 1911 was £22,000.

It is stated that the Commonwealth Government has decided to equip the Federal Woollen Mills at Geelong, Vic., with a complete electric power plant.

**Banbridge (Co. Down).**—Mr. G. B. Deane, B. of T., has held an inquiry into the application of the Urban Council for a prov. order. Mr. Gordon explained the scheme, which would cost about £3,300. The borrowing powers of the Council ran up to nearly £30,000, and the gross valuation of the town was £14,456. Mr. Pleasance, of the firm of Messrs. Woodside & Co., Belfast, having given evidence of the projected scheme, the inquiry was adjourned.

**Bath.**—The L.G.B. has sanctioned the borrowing of £1,789 for district mains, services and transformer pillars in the Weston area; £2,250 for prospective expenditure on mains; £2,250 for prospective expenditure on services; and £5,000 for prospective expenditure on transformers—each for a period of 15 years, and has authorised the allocation of the sum of £1,210 out of the Diesel engine loan, which is not required for the purpose, to make up the balance required for the mains, &c., in the Weston area.

**Bootle.**—The T.C., on the 2nd inst., approved of the scheme recommended by the Electric Power and Lighting Committee, for extending the electricity mains, at an estimated cost of £4,375. It was decided to apply to the L.G.B. for sanction to borrow a sum of £3,750 for defraying the cost of a portion of the scheme, and the remainder will be defrayed out of loans already sanctioned.

**Bradford.**—The Chamber of Trade is in negotiation with the Corporation Electricity Department, with a view to the possibility of reductions in electricity charges, and the payment of discount by taking an amount off accounts instead of the Corporation giving free lamps. The provision of these free lamps, in lieu of discount, is stated to be an injustice to the local electrical contractors. It is also stated that last year the Corporation placed an order for a quarter of a million such lamps.

**Braintree.**—The U.D.C. has decided to obtain expert advice on the question of lighting the town by electricity.

**Brighton.**—A fairly large electrical cooking installation has now been running for a few weeks at Messrs. Staffords, in Western Road. This is used for preparing meals for a staff of some 70 hands, and consists of a Jackson range, with eight heating plates and two large ovens, in which several big joints can be cooked at the same time. The control board is mounted behind, and fitted with indicating lamps showing exactly what heater is in use. We gather that experience with the range has been highly satisfactory, its cleanliness, efficiency, and the improved cooking being much appreciated.

**Canada.**—The municipal electrical department of Ottawa last year made a profit of \$35,000, as shown by the statement presented by the Electric Commission. Since the plant was taken over in 1907, the profits have totalled \$132,652.28—this after reducing the price of electric current in the city to one-half of the former rates.

**Colwyn Bay.**—An inquiry has been held by the L.G.B. relative to the application of the U.D.C. for sanction to borrow, among other sums, £5,300 for additional generating plant at the electricity works, to meet the growing supply. It was pointed out that the load on the works last season came up to the maximum capacity of the machinery installed, so that the increase was essential for the safety of the supply. No opposition was raised to the proposals.

**Dartford.**—The U.D.C. has instructed the electrical engineer to proceed with the preparation of plans and specifications for a H.T. generating set, as the demand is likely to soon necessitate the generation of H.T. current direct. The Council has declined to entertain a suggestion from consumers at Crayford that the supply to that district should be treated as a whole, and that the charges for power should be based on the united demands of all the works connected to the new main.

**Doncaster.**—The T.C. has adopted a new scale of charges for electricity for power and domestic purposes, by which 1½d. per unit will be charged for the first 500 units per annum, 1½d. per unit for the second 500, 1½d. per unit for the third 500, and 1d. per unit for the fourth 500.

It was reported that the Electricity Committee had finished the past financial year with a surplus of £1,055, although some of the charges had been considerably lowered. For the extension of electricity mains and plant an expenditure of £13,206 is estimated to be necessary in the coming year.

**Dewsbury.**—At the T.C. meeting, last week, a long discussion ensued upon the subject of the Corporation's municipal trading undertakings, the rates, and the financial position generally. Sir Mark Oldroyd said that the development of the tramways, if carried out, might cost another 10d. rate. He complained of the extensive appropriation trading profits for relief of rates, maintaining that the purpose of these undertakings was the convenience of the public. Mr. T. Myers criticised the action of the Council in taking £500 from the electricity department for relief of rates when it had just borrowed £8,000 for works extensions.

**Dover.**—The T.C. has received from the L.G.B. sanction to a loan of £300 on account of transformers.

**Dromore (Co. Down).**—A B. of T. inquiry was held on the 5th inst. into an application on behalf of the Urban Council and a number of ratepayers to provide electricity for lighting and power purposes in that town. The application was opposed by some ratepayers and the local gas company. Evidence was given of the finances of the town, by which it appeared that it had borrowing powers up to £10,000, and its debts and liabilities were under £2,000. Nine of the 10 members of the Council were in favour of the scheme. Two schemes had been submitted, one costing £3,998 and the other £3,400. Mr. H. V. Pegg, consulting engineer, of Belfast, gave the details of the schemes, after which the inquiry adjourned.

**East Ham.**—At the last meeting of the T.C., a letter was read from Woolwich B.C., stating that the limited consent given to it for supplying current to the L.C.C. pumping station at North Woolwich only, would be quite useless, as it would be unable to incur the expense unless allowed to supply properties on the route of the main, and stating that it would be prepared to pay a percentage upon the total revenue received from the supply if allowed to do this. The T.C. is agreeing to the suggestions put forward, subject to the payment of 5 per cent. upon the total revenue received from the supply.

**Gillingham (Kent).**—With reference to the Corporation's contract with the Augsburg-Nurnberg Co. for the installation of a new Diesel engine at the electricity works, the T.C. has entered into a supplemental agreement with the company to enable the British Westinghouse Co. to at once proceed with the construction of the alternator, the cost of which will be £1,019.

**Grasmere.**—The question of electric lighting in the Council's area has been introduced by a company. The Council is giving preliminary support to the scheme, which it is proposed shall include street lighting.

**Halifax.**—A L.G.B. inquiry into an application by the Corporation to borrow £18,180 for the purchase of plant at the electricity works, and for extensions of the electric mains, has been held. Mr. Haley, chairman of the local Ratepayers' Association, opposed the application.

**Leeds.**—At a recent meeting of the T.C., on the presentation of the Electricity Committee's minutes, Mr. D. B. Foster moved an amendment to refer back a recommendation to defer further consideration of the question of instituting a scheme of motor hiring in order to give time for trial of a scheme submitted by Mr. H. S. Ingleby. He urged that it would be more to the interests of the manufacturers of the city if steps were taken to get into touch with other motor manufacturers, than to consider the scheme of Mr. Ingleby, who had written stating the terms upon which nine Leeds firms were prepared to supply motors on hire or hire-purchase. Mr. Hugh Lupton pointed out that by the terms of the Committee's recommendation the Council would not be in any way pledged to the firms mentioned. Mr. R. Armitage said the letter contained a suggestion that officials of the Corporation canvassed the city solely, or to a large extent, with a view to pushing the sale of certain makes of motors to the prejudice of other makes equally good. He thought in the interest of the officials these charges ought to be investigated. Alderman Tetley intimated his willingness, on behalf of the Committee, to insist on the withdrawal of these passages in the letter. Mr. Hugh Lupton said the sub-Committee concerned would undertake to investigate the matter raised with regard to the officials. The amendment was carried.

The proposed reduction in charges, more particularly to large power consumers, referred to last week, was also agreed to; it is estimated that power users will benefit to the extent of £4,000 per annum under the new rates.

**Leyton.**—The U.D.C. has applied to the L.G.B. for a loan of £6,156 for mains, feeders, &c.

**Liverpool.**—In his annual report which has just been issued, the city lighting engineer states that a great improvement has been effected during the year in the centre of the city by the fixing of 70 flame arc lamps in lieu of open type and metallic-filament cluster lamps, the light being increased thereby at least fourfold. An extension of electric lighting by metallic filament lamps has also been carried out during the year on the Edge Lane tramway route with 50 and 100-c.p. lamps. At the end of the year there were in use 921 electric lamps, 192 arc, and 729 incandescent metallic-filament lamps.

**London.**—**BATTERSEA.**—With reference to the motion for an injunction taken by the Council to restrain the County of London Electric Supply Co. from laying mains in the borough, the Council has received a letter from the solicitor of the company forwarding copy of notice of appeal and copy of a letter which had been addressed to the B. of T. on the company's proposal. The Council decided to ask the Board to postpone taking action in the matter until the application of the Council to the High Court had been dealt with.

**WOOLWICH.**—In order to be able to give a supply of current to the new hostels in course of erection at Eltham for the L.C.C., the Borough Council has decided to borrow £1,448, the estimated cost of providing transformers and switchgear at the High Street sub-station; also for the provision of a duplicate main to New Eltham, which will provide for a general supply also being given, if required.

**ST. MARYLEBONE.** The Electric Supply Committee has considered a letter inviting the Council to join in a general conference to consider the decision of the L.C.C. to again revise the maximum periods which it will sanction for the repayment of electricity loans in respect of buildings, mains and machinery, and with the object of representing to the L.C.C. the advisability of reconsidering and amending such decision. The Committee did not think that any useful purpose would be served by the Council joining the proposed conference, and recommended accordingly.

**Lossiemouth.**—The B. of T. has approved of the order for the electric lighting of the town.

**Macclesfield.**—The New Electricity Co. of Macclesfield, Ltd., has informed the T.C. that the response to the invitation to various persons to take shares in the concern, has not been such as to justify the company making a start on the proposed electricity works. The company was formed about two years ago, and obtained a prov. order for electric supply, and this expires by effluxion of time on August 11th next. A new syndicate has come forward and taken over the company's powers and responsibilities, and has taken a disused dyeworks in George Street as a site for a generating station.

**Manchester.**—Mr. S. L. Pearce, the chief engineer of the electricity department, and Mr. J. G. Newbigging, engineer of the gas department, were recently instructed to consider the question of street lighting, and they have prepared a report which has been approved by the Lighting Committee of the Corporation—a Committee which consists of members of the Gas, Electricity and Finance Committees. The report states that the two engineers are agreed on certain recommendations. One is that a further extension on a moderately large scale of the lighting of the principal thoroughfares in the city be made with high-pressure gas, and electric arc or metal-filament lamps. The total length of the streets to be lighted by the first-named system is 13,500 yards, and that of the streets to be lighted by electricity is 11,835 yards. In arriving at the allocation of streets, the engineers have had regard to the thoroughfares in which special arc lighting cables are already laid, and the suitability or unsuitability of the streets scheduled for centre suspended lighting or side lighting, it being their opinion that, broadly speaking, one set of streets are best dealt with by means of electricity, whilst others are more suitable for the high-pressure gas system. They have not attempted to deal with secondary thoroughfares or with the lighting of courts and passages, and they recommend that this be deferred pending the result of the present proposal.

**Mexborough.**—A L.G.B. inquiry has been held in connection with the application to borrow £11,500 for extensions of the electricity undertaking. Mr. J. Senior (electrical engineer) stated that the amount was made up as follows:—Turbo-generator, £4,200; buildings, £3,200; boiler foundation, £800; water cooling tower, £800; pipe work, £100; balancer-booster, £330; three years' prospective services, £300; three years' public lighting, £300; contingencies, £170; builder's tender in excess of estimate, £750; and travelling crane, £250. There was no opposition to the application, and the inquiry was closed.

**Newport (Mon.).**—We understand that the recommendations of Mr. A. Nichols Moore, the borough electrical engineer, for extending the electricity plant, have been unanimously adopted. It is intended to install a 2,500-kw. turbo-alternator, with condensing plant, and a 600-kw. D.C. generator, with switchgear.

The engineer's proposals for lowering the single-phase frequency were also approved, but will not be carried out for another year.

**New Zealand.**—On February 20th, a poll of the Christchurch ratepayers resulted in a vote of 2,874 for, and 492 against, the proposal of the City Council, to raise a loan of £120,000 for equipment in connection with the utilisation of electric power to be supplied in bulk from the hydro-electric installation now being erected at Lake Coleridge. The amount is to be expended

in:—Sub-stations and plant; transforming plant and buildings; mains and services; meters; poles, lamps, &c., for street lighting. The Mayor congratulated the ratepayers on the magnificent support given to the proposal. The Wanganni borough is about to extend the tramways, the amount involved being about £9,000.

At Wellington, the engineer has been requested to report on the advisability of combining the lighting and tramways stations. The lighting supply is rapidly increasing, and it is anticipated that additional generating plant must be purchased at no distant date; the supply is single-phase at 80 periods transformed from 2,000 to 100 volts.

**Newcastle-under-Lyme.**—The T.C. has decided to apply to the L.G.B. for sanction to borrow £20,000, being the estimated cost of certain electricity extensions.

**Nuneaton.**—The T.C. has resolved to replace 25 gas lamps in the town by electric lamps.

**Newton-in-Makerfield (Lancs.).**—The U.D.C. has had under consideration a communication from Messrs. McCorquodale and Co., asking whether there was any immediate likelihood of the Council's obtaining powers for the supply of electricity, and further stating that if there was no prospect of the order being granted, it was the company's intention to proceed with the scheme it had had before it for some considerable time, for the generation of its own electric power for driving and lighting purposes. It was resolved that the question be considered with the estimates.

**Orsett (Essex).**—The B. of G. has decided not to let the proposed electric lighting scheme for the workhouse drop. The L.G.B. recently intimated that the premises were too small for an installation, but the Guardians have ascertained that at Buckingham the Board of Guardians has installed a small electric plant at a cost of £187, with satisfactory results. This has been inspected by two of the Guardians from Orsett, with the result that the firm who carried out the installation—Messrs. Johnson and Phillips—have been communicated with. Consequently further steps are to be taken in the matter.

**Royton.**—The Oldham Corporation has applied to the District Council for power to supply the Industry Mill with electricity for power purposes. There is a strong feeling in the Royton district that the Oldham Corporation should get the necessary provisional order to supply the whole of the district.

**St. Helens.**—The T.C. has adopted an assessment tariff for private houses, viz., a fixed quarterly charge based on the net rateable value of the house, and 3d. per unit for all current used for lighting, heating, cooking, and other domestic purposes.

**Salford.**—The T.C. has adopted a recommendation to approve the settlement of the Corporation's claim against the insurance companies for damage caused by the recent fire at the electricity station for £11,383, which covers the whole of the damage.

**Scarborough.**—The Corporation has under consideration the question of the purchase of the local electric supply undertaking. A special sub-committee has been appointed to carry on the negotiations. The borough engineer has been instructed to obtain the consent of the Electric Supply Co. to the examination of its plant by Mr. Wyld, of Birkenhead. The borough accountant has reported as to the financial position of the Electric Supply Co., and the further consideration of the matter has been deferred.

**Sevenoaks (Kent).**—The U.D.C. was recently informed by Mr. Frank Reeves, acting secretary of the Sevenoaks and District Electricity Co., Ltd., that all objections to the company's application for a prov. order for electric lighting had been removed, and it was advised that no doubt the order would be granted. He added that orders for oil engines had been provisionally placed, and arrangements were being made with Messrs. Crompton & Co. to supply the electrical equipment of the generating station. It was hoped that the cables would be laid almost immediately, and that by means of a temporary plant a supply of current might be made available without waiting for the completion of the permanent generating station, which would be erected at Sundridge. The company's operations will include not only the urban district, but practically half of the rural district, and Limsfield, Oxted, and other parishes in Surrey.

**Sheffield.**—The Corporation is proposing to offer domestic electricity consumers the alternative of an assessment tariff, based on a fixed charge of 10 per cent. of the annual rateable value of the premises, payable quarterly, plus 3d. per unit used, with no meter rent. Consumers in premises other than private houses using electricity throughout for lighting purposes, and who sign a minimum payment form, are to be charged 3d. per unit for heating and cooking purposes. Under the latter scheme, between 700 and 800 consumers will benefit immediately.

With a view to improving the lighting of Norfolk Street and Barkers Pool, at present lighted by gas, a trial is to be made with electricity, subject to the cost of supplying and fixing the lamps being borne in equal proportions by the electricity supply department and the Watch Committee, and to the cost of maintenance and energy not exceeding the cost for gas.

**Stockport.**—A carters' strike has been in progress at Stockport for several days, and there were fears at one time that the electricity supply would be seriously diminished, owing to the uncertainty of securing supplies of coal. Last Saturday, however, a fresh supply of coal was obtained, wagon loads being escorted by police from the sidings to the works.

**Stockton-on-Tees.**—The T.C. has arranged with the Cleveland and Durham Electric Power Co. for a supply of current between 10 p.m. and 6 a.m., or, if necessary, between 6 p.m. and 6 a.m. This will obviate the expense of installing additional plant.

**Tonbridge.**—The Kent County Education Committee has decided to have the electric light installed at Sussex Road Schools, Tonbridge, at a cost of £56.

**Torquay.**—The question of electrically illuminating the gardens immediately adjoining the new pavilion is under consideration. The engineer has been directed to report as to the general use of electric cookers; also to obtain four sample street lighting lamps from certain firms, and to fix them for experimental purposes. The results will be compared with the 1,000-c.p. Osram lamps now in use. Current is to be supplied to flame arc lamps outside shop premises on the following scale, subject to the type of lamp and the conditions of supply being approved of by the engineer in each instance:—1,600-c.p. lamps, 1d. per lamp per hour; 2,400 c.p., 1½d.; 3,300 c.p., 1½d.

**Tunbridge Wells.**—The E.L. Committee proposes to convert a further 50 gas lamps into electric lamps in those streets in the town in which electric cables are laid.

**Watford.**—The Northwood Electric Light and Power Co. having applied to the B. of T. to dispense with the consent of the R.D.C. to its extension order, the B. of T. deemed it advisable for the promoters of the Order and the objectors to attend a conference in London. This took place on April 1st.

The T.C. has decided to alter the assessment tariff from the present rate of 12½ per cent. plus 1d. per unit, to 12½ per cent. plus 3d. per unit.

**Wimbledon.**—The Sub-Committee appointed to consider and deal with any questions arising in connection with the supply of electrical energy by the Council to the Fixed Price Light Co., Ltd., reports that it has instructed the borough electrical engineer to prepare and submit a report upon the fixed-price light system of supply, and the actual and probable results of the working of such system in Wimbledon and Merton, including the question of transformer losses.

**York.**—The electricity department has decided to reduce the price of electricity to consumers who are charged on the flat rate system, and from April 1st the charge is to be 3½d. per unit for all consumptions not exceeding 4,000 units per quarter, instead of a sliding scale of 4½d. per unit to 3½d. per unit, according to consumption. The reduction has been brought about by the increasing demand for current, and the more economical means of generation in vogue at the electricity works.

## TRAMWAY and RAILWAY NOTES.

**Australia.**—According to the *Board of Trade Journal*, the Victorian Government has authorised the chief railway commissioner to make a five months' tour of Europe and America in order to study the working of electric railways. He was to leave Australia for England at the beginning of this month.

We are informed by Mr. W. G. T. Goodman, general manager of the Adelaide Municipal Tramways Trust, that the gross revenue for the half-year ended January 31st last amounted to £154,013, or £10,655 more than in the preceding half-year. The capital cost of the revenue earning portion of the undertaking was £1,279,710, and the surplus revenue over operating expenses, £52,610, or 8.33 per cent. per annum on the capital. We gather that the revenue was sufficient to meet the normal expenditure on the completed electric traction system as well as all statutory charges, including also interest on purchase money.

**Bexley.**—A reorganisation of the tramway service, suggested by the manager, has been agreed to by the Council.

**Bingley.**—The Shipley U.D.C. has given consent to an extension of the Bradford Tramway system from Nab Wood to Bingley, on condition that the Bingley U.D.C. pays it £150 per annum for the privilege. The Bingley Council has communicated this fact to the Bradford Corporation, which has approved the terms of the Shipley Council, and has agreed to pay the £150 annually to the Bingley Council during the term of the lease of the Bingley tramway to the Bradford Corporation.

**Birmingham.**—The year's working of the Corporation tramways resulted in traffic receipts amounting to £573,000, or £150,000 above those of the previous year. As concessions in fares amounting to over £70,000 were given during the year, it is not anticipated that the amount given to the rates will exceed that in the previous year, viz., £46,000.

**Bournemouth.**—A scheme for running railless trolley vehicles from the Square to Bournemouth Pier, and along the Undercliff Drive to Boscombe, has been before the T.C. The estimated cost is £13,600, and a net profit of £1,500 per annum is anticipated. The scheme was opposed, and has been referred to a Committee for consideration.

**Bradford.**—The general manager of the Corporation Tramways Department has had an interview with an inspector of the B. of T. in reference to the overturning of a tramcar at Allerton during a gale, and as a result the Tramways Committee has decided to provide wind gauges to indicate the prevailing wind pressure at various parts of the tramway system.

The Tramways Committee has also decided to accede to the suggestion of the Watch Committee that constables in uniform should be allowed to ride on the Corporation tramcars without payment of fares.

The preliminary statement of the working of the Corporation tramways for the year ending March 31st, show that the total receipts amounted to £289,616, an increase on the previous year's figure of £7,239. The number of passengers carried has been 62,000,000, an increase on the previous year of 6 millions. The increase is largely attributed to the establishment of the 3d. fares on cars boarded before 9 o'clock in the morning.

**Burnley.**—The tramway receipts for the year ending March 31st, 1913, are £7,190 more than last year, representing an increase of 1,481,000 passengers.

**Bury.**—Alderman Collinge announced at the T.C. meeting last Thursday that the tramway profits, Bury and Ratcliffe combined, for the year just ended, would reach £10,800. Of this, £9,500 was from the Bury system, and £1,300 from the Radcliffe system. Last year there was a combined profit of £8,550. Traffic receipts showed an increase of £1,250, and the working expenses a decrease of £1,000.

**Canada.**—Among Canadian railroads none are making more progress in the electrification of their lines than the Canadian Northern. This road is now making application for permission to take water from the Nicolum River, British Columbia, which joins the Coquahalla, about 11 miles from Hope, for the purpose of developing hydro-electric power. If sufficient power can be generated to operate the Rocky Mountain division by electricity, it is stated that the company will prepare plans for the construction of a power plant at Yale. It is also the intention of the company to tap Jones Lake in the mountains, to the south of the main line below Yale. From this they will be able to generate 50,000 H.P.

**Continental Notes.**—**ITALY.**—La Società Elettrica Transivaria Litorena Viareggio-Versilia has secured a concession in respect of a projected electric tramway between Viareggio and Forte-del-Marmi, with a branch to Pietrasaito, a total distance of about 11½ miles.

**GERMANY.**—The Mersburg Ueberlandbahnen Gesellschaft is the name of a new company, with a capital of £65,000, which has been formed to work the new light electric railway, which is being built between Merseburg and Mueheln, Saxony, by the A.E.G. The line will be about 11½ miles long.

**Dewsbury.**—A communication has been received from the Batley Corporation to the effect that it cannot undertake the construction of a tramway line from the borough boundary.

The decision of the Corporation with regard to a physical junction between Shaw-Cross and Westborough tramways is to be forwarded to the Batley Corporation, and the latter is to be asked whether it is prepared to submit an amended proposition.

**Doncaster.**—It was reported to the Council last week that Lieut.-Col. Drunit, of the B. of T., had inspected the new tramway extension to Bentley, and expressed satisfaction with it, and that the latter had been opened for service at a fare of 1½d. for the whole distance, the route being divided into two penny overlapping stages. In his Budget statement, Alderman Bentley, chairman of the Finance Committee, pointed out that the tramways had done well last year, coming out with a surplus of £471, after providing out of revenue £657 for a motor tower wagon. The Royal Show was a great help to the tramways. The estimated capital expenditure for the coming year included £43,186 for the extension of the tramways.

**Halifax.**—The receipts of the Corporation Tramway Department during the year ended March 31st, show a decrease in the profits of £3,839, as compared with 1911 (£14,182, as against £18,021). The total receipts were £105,970, as compared with £101,893 in 1911, while the expenditure had increased from £83,873 to £91,788. The number of passengers carried was 19,456,928, as compared with 18,749,456; the miles run were 2,152,391, as against 2,102,757. Amongst the expenses was included an item of £661 in connection with the abandonment of the Parliamentary Bill.

**Hastings.**—There seems no prospect of any agreement being arrived at between the Corporation and the tramways company in connection with the latter's Bill before Parliament for the adoption of overhead traction along the front line of the town in lieu of the Dolter system, which the B. of T. will only allow for a few months longer. The Bill is expected to be reached in the course of a few weeks, and present appearances point to a keen fight. The frontagers are backing up the Corporation in its opposition to overhead wires. In some quarters self-propelled tramcars are being advocated, and in others the preference is given to motor-buses. There is general agreement on one point—that the existing system, with its noise and "flashing," is most undesirable.

**Leeds.**—The returns for the year ending March 31st, according to a comparative statement just issued, show that the Corporation tramways have had another prosperous year. Following an increase in receipts last year of £24,900 (as a result of certain extensions), the increase upon the 1912 total has in the

year just ended (when there have been no extensions) been £16,212. The receipts were £111,533. The number of miles run has been 8,795,456, an increase of 267,508. The number of passengers carried has increased by 3,644,242, having been 89,668,165, as against 86,021,943. The amount paid in fares per head of population had increased from 15s. 6d. to 16s. 3d.

The opening of the Lawnswood extension of the Corporation tramways has been delayed owing to the necessity of carrying out the recommendation of the B. of T. Inspector as to widening a portion of Otley Road to 60 ft.

**L. and Y. Railway Electrification.**—The Lancashire and Yorkshire Railway Co. has inaugurated new electric train services to Ormskirk, thus completing a through electrified system from Liverpool to Ormskirk. With the completion of the erection of the new battery station at the latter town a full service of express and stopping trains will shortly be substituted for the present limited number of trains.

**London.**—**CAMBERWELL.**—The Borough Council has received a reply from the L.C.C. to its letter drawing attention to the dangerous condition of the tram tracks in the borough, more especially between Camberwell Green and Rye Lane, to the effect that it is proposed to lay the lines in Peckham Road within the next six months, but that in the meantime steps would be taken to maintain the existing lines safe for vehicular traffic. This reply is not considered satisfactory.

**HACKNEY.**—The L.C.C. has advised the B.C. that it proposes at an early date to commence the reconstruction, for electrical traction, of the existing horse tramways in a portion of Ball's Pond Road.

**Manchester.**—The question of traffic congestion in Manchester has engaged a great deal of attention recently, and a report by the Lord Mayor at the Council meeting last week contained a recommendation that the Chairmen of the Improvement and Buildings Committee, the Watch Committee, and the Tramways Committee, together with the Surveyor, the Chief Constable, and the Tramways Manager (assisted by the tramways permanent way engineer) be instructed to visit, at an early date, either collectively or separately, and make full inquiries in other large cities in this country and abroad, and report the result for the benefit of the committees concerned, who could then prepare a joint report and recommendations to the City Council. The question was discussed for an hour, and several members strongly protested against the proposal to send deputations abroad. Ald. Bowes (Chairman of the Tramways Committee) said it might be that they would have to have 100 more cars, and they would have to consider the type of car best suited for the city. It would be reckless to build 100 double-deck cars, for it might be that in a few years they would have to scrap them for a small single-deck car. A resolution confirming the visits to cities in this country was adopted, but eventually it was decided to refer the whole report back for further consideration.

**Merthyr.**—The tramways aggregate receipts during the past quarter show an increase of £378.

**Nelson.**—A record in revenue in connection with the Corporation tramway undertaking is reported. The Committee estimated a profit of £450, but this has been exceeded by £1,000. During the 12 months 267,271 more passengers were carried than in 1911, in spite of the abnormally wet summer.

**Newport (Mon.).**—Mr. F. J. Young, manager of the Corporation tramways, has drafted a report in which, amongst other recommendations for increasing the revenue of the service, he suggests an increase of a ½d. in the fares on each of the stages of the various routes. It is also suggested that there should be an alteration in the charges for supply of electric power.

**South Shields.**—At a meeting of the T.C. on the 2nd inst., Alderman Wylie, in bringing up the report of the Tramways Committee, mentioned that quite recently they had completed seven years' working of the tramways. The last year, ended on March 31st, had been a record year, the revenue, which was over £30,000, was £1,500 more than it had ever been before. During the past seven years they had carried more than 50,000,000 passengers. During the past 12 months the traffic receipts amounted to £33,516, an increase of £1,472. The passengers carried numbered 8,456,688, an increase of 124,200, and the receipts per car-mile were 9'8d., an increase of 1'4d.

**Swansea.**—The aggregate tramway receipts total £14,546 for the past quarter, showing an increase of £1,089.

**Wallasey.**—The T.C. is to receive a recommendation of the Parliamentary Committee that a scheme should be prepared for promoting a Bill in Parliament with the object of effecting a number of improvements. It is proposed, among other things, to extend the promenade to Harrison Drive, and to link up New Brighton and Wallasey Village by means of a tramway along the sea front. Powers will also be sought to run motor-omnibuses.

**Wath.**—The inhabitants of Wath appear to be very keen upon a system of railless traction being taken up by the Councils of Wath and the surrounding districts—Wombwell, Darfield, Bolton and Thurnscoe. The Council has agreed to a suggestion that the scheme should be under the control of the municipalities, and is agreeable to the expenses being equally divided between the five Urban Councils.

**Wigan.**—At a meeting of the B.C. on April 2nd, Ald. Ashton reported that, for the year, the total receipts from tramway fares had been £71,290, as against £66,328 for 1912, or

an increase of £4,961. The total receipts were £73,004, as compared with £67,664, an increase of £5,339. The total payments were estimated to be £72,452, and the estimated profit £551. That position was very satisfactory to the Committee and to the management. Councillor Bradshaw said he hoped the present position would be the beginning of better days for the tramways. Last year they lost over £1,000, and to have turned that into a profit of £500 was a splendid achievement.

## TELEGRAPH and TELEPHONE NOTES.

**Aids for Deafness.**—It is said that deaf persons can hear better in one definite pitch than in others, and an instrument has recently been devised for the purpose of finding the exact pitch at which a partially deaf person's hearing becomes sensitive. It consists of a series of microphones, each having carbon balls of different size and quality, and a different internal resonance, in conjunction with a number of ear-pieces.

**Australia.**—The Commonwealth Court of Conciliation and Arbitration has resumed the hearing of the claims made by the Postal Electricians of the Federal Public Service, which was commenced as far back as August, 1912. The wages and conditions asked for are:—Mechanician, £450 per year; exchange foreman, maximum £400, minimum £250; foreman mechanic, maximum £400, minimum £250; inspector, maximum £400, minimum £250; senior mechanic, £222; mechanic, £192; junior and cadet mechanic, from £48 at 14 years of age, to £180 at 23 years of age. For batterymen, the wages claimed are:—Foreman batterymen, £222; batterymen, £172. Amongst the conditions asked for are that, where continuous day work is in existence, 44 hours shall constitute a week's work. Where time is worked over the stipulated hours it shall be paid for at the rate of time and a half for the first five hours and after the first five hours double time. Where an officer is obliged, through no fault of his own, to remain in a grade for a period longer than five years, he shall be entitled to long-service increments of £10 for each five years he may remain in that grade. Entrance to the staff shall be by examination.—*Australian Mining Standard*.

**Imperial Wireless System.**—Mr. Harold Smith, Mr. Terrell and Mr. Harvey having resigned from the Select Committee on the Marconi Agreement, Sir F. Banbury, Mr. Butcher and Sir W. Essex have been appointed in their stead.

The scientific committee appointed to report on the merits of the existing systems of long-distance wireless telegraphy was at Copenhagen on Friday last, and visited the Poulsen station at Lyngby.

On Wednesday last week the Select Committee on the Marconi contract again examined Mr. Herbert Samuel, mainly with regard to the dealings in American Marconi Co. shares. He stated that the Treasury objected to the payment of a fixed royalty to the Marconi Co., regardless of the number of the company's patents in use, but the company would not agree to any reduction. Throughout the period between the acceptance of the tender on March 7th and the signing of the contract in July, communications were passing between the Government Departments and between them and the company with regard to the precise form of words to be adopted in the contract; that was the sole reason why the contract was not signed earlier than July 19th. Mr. Samuel stated that he had not personally met Mr. Godfrey Isaacs until December 11th, 1912, and that every interview between them had been muffled and sent to the Committee. He had no reason to suppose that his subordinates had been "got at" or approached by interested parties in any way. He could not account for the origin of the rumours that had been circulated alleging corruption on the part of his department and other Ministers. The British Marconi Co. had a licence for transatlantic communication, and recently a licence for an experimental station in Ireland had been granted to the Poulsen Co. Licences were granted for one year only, but there was a reasonable expectation of their renewal. He first heard of the purchase of American shares about the end of July; he never attached any importance to it, regarding the companies as quite distinct.

On Thursday the Committee sat again, and took the evidence of brokers with regard to the America purchases, and on Monday further evidence of this nature was given.

Mr. Samuel made a statement regarding his previous evidence, explaining that a discrepancy as to the date when he first met Mr. Godfrey Isaacs was due to an oversight, whereby the report of an interview in August had not been included in the Blue-book which was presented to the Committee. It was an error on the part of a clerk. The Committee sat again on Wednesday.

**Telephone Transfer.**—The Court of Appeal has fixed April 15th for the hearing of cross-appeals arising out of the arbitration between the National Telephone Co. and the Postmaster-General, relating to the transfer of the telephone system to the Government.

**Wireless Alarm.**—Mr. Raymond Phillips, the inventor of a system of steering airships by wireless telegraphy, last week gave a demonstration of an instrument which distributes a danger signal capable of cutting out all wireless messages passing over a circle of 20 or 30 miles radius. Should there be no one on duty in the operating room, a siren is made to operate, arousing the officers and wireless experts to the fact that a neighbouring ship is in need of assistance.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" to-day.

**VICTORIA.**—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

April 15th.—1,020,000 arc lamp carbons, 26,900 carbon-filament incandescent lamps, and bare hard-drawn copper cables, for the Melbourne City Council. See "Official Notices" March 28th.

April 29th.—20,000 yd. of 3-in. fibre conduit, for the Melbourne City Council. See "Official Notices" to-day.

**SYDNEY.**—May 12th. Fibre conduit for the City Council. May 26th.—Meters and glazed stoneware bridges. July 7th.—Arc lamp carbons. Specifications 10a. 6d. for each section, from City Electrical Engineer's Department. —*Australian Mining Standard*.

**TASMANIA.**—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

**QUEENSLAND.**—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" to-day.

**Batley.**—April 16th. The Electricity Committee invites tenders for general stores for the electricity works for 12 months. Mr. S. Derwen Jones, engineer.

**Belford.**—April 23rd. Carbon and metallic-filament incandescent lamps, for a year, for the Corporation. See "Official Notices" to-day.

**Belgium.**—April 26th. The Belgian Post and Telegraph authorities (Salle de la Madeleine), Brussels, are inviting tenders for the supply of 1,200 m. of subfluvial and 240 m. of submarine electric cables.

April 29th.—The municipal authorities of Schaarbeek, near Brussels, are inviting tenders for the supply of a large quantity of armoured high-tension cable, and for the establishment and equipment of 11 static transformer boxes. Particulars may be obtained from the Service de l'Ingenieur, 30, Rue de la Ruche, Schaarbeek.

**Bradford.**—April 17th. Three-phase and continuous current switchgear for two sub-stations, for the Corporation. See "Official Notices" April 4th.

**Bristol.**—April 16th. Arc lamp carbons and incandescent electric lamps for a year, for the Bristol Docks Committee. Mr. W. W. Squire, engineer, Cumberland Basin.

**Canada.**—WINNIPEG.—May 15th. City Light and Power Department. Two three-phase generators of 5,000 kw. for direct connection to 6,800-h.p. water turbines; also spare parts. Chairman, Board of Control. Deposit, £205. Particulars, Board of Trade Com. Intel. Department in London.

**Dover.**—The T.C. has decided to invite tenders for coal for the electricity works until April, 1914.

**Dublin.**—April 24th. High-tension and low-tension switchgear, cables and accessories, for the Corporation. See "Official Notices" to-day.

**France.**—SAINT JUERY, TARN DEPARTMENT.—April 27th. The Municipality requests tenders for the supply of two groups of electric lifts (elevateurs electriques) and accessory piping (conduite d'aspiration). Particulars at the Mairie.

**RENNES.**—April 18th. Supply and erection at the port of St. Malo-St. Servan of two centrifugal pumps, two electric motors and accessory lines; also for electric plant for opening and closing sluice gates and sewer outlets, and for working a footbridge over the same. Particulars from the Ingenieur-en-chef des Ponts et Chaussées, 3, Rue de Fougères, Rennes, France.

**Lisnaskea (Co. Fermanagh).**—April 14th. Gas engine and suction gas plant, dynamo and booster, battery, wood poles, overhead mains, &c., and switchboard, for the Lisnaskea Electric Light Co., Ltd. See "Official Notices" March 28th.

**Liverpool.**—April 18th. Electric light and power installation at the Highfield Infirmary, Knotty Ash, for the Select Vestry. See "Official Notices" to-day.

**London.**—L.C.C.—April 15th. Electrical installation at Jeffryes' Almshouses, Shoreditch. See "Official Notices" April 4th.

April 23rd.—Electrical installation at Shadwell High Street Special School. See "Official Notices" April 4th.

**FULHAM.**—April 23rd. 6,000 tons of nutty slack coal, for the B.C. Electricity Works. See "Official Notices" April 4th.

**SOUTHWARK.**—April 23rd. Two boilers, with fan, economiser and conveyors, two 1,500-kw. generators, four converters, switchboard, barometric condenser, cooling tower and steel structure, for the B.C. See "Official Notices" to-day.

**METROPOLITAN ASYLUMS BOARD.**—April 23rd. Electric light installation in the Laundry Block and Block No. 12 at the Grove Fever Hospital, Tooting Graveney. See "Official Notices" to-day.

**Manchester.**—April 15th. (a) Tramway rail bonds; (b) Hard-drawn copper trolley wire; (c) Steel tramway poles; (d) Span drive brackets for tramway poles; (e) Granite sets. Mr. J. M. McElroy, General Manager. For (c) and (d) a deposit of £1 ls. is required.

April 23rd.—E.H.T. switchgear, low-pressure steam and water pipe, hot-well, valves, &c., and two 50-h.p. three-phase motors for cooling towers, for the Corporation. See "Official Notices" to-day.

(Continued on page 607.)

**ELECTRICITY SUPPLY IN THE POTTERIES.**

As many of our readers are, no doubt, aware, the modern Stoke-on-Trent came into being officially just three years ago, when the several contiguous towns, commonly known as the Potteries, and extending for a distance of about 10 miles along the Trent valley, were, by Act of Parliament federated into one county borough.

From the point of view of electricity supply, the amalgamation of the local government of these several adjoining towns, which comprise Burslem, Fenton, Hanley, Longton, Stoke and Tunstall, introduced a rather involved problem, not only because four of the towns had electricity undertakings in existence, three giving direct-current supplies in each case at a different pressure—(viz., Burslem, 220 and 440 volts; Longton, 230 and 460 volts; and Stoke, 240 and 480 volts)—

provisions of the Federation Act and the local conditions existing in the area.

As regards the Federation Act, a clause was inserted which compels the Gas and Electricity Committees in that area to so conduct the various works that no profit shall be made which can be handed over in reduction of the rates, and, in point of fact, each of the undertakings is conducted as a distinct business financially, not only the technical features but the charges for electricity varying in each concern, although, of course, the management of all is centralised under Mr. C. H. Yeaman, who took charge when the federation became an accomplished fact.

The Burslem works are about 3 miles north of the Hanley works, and the latter are  $1\frac{3}{4}$  miles north of those at Stoke, and 3 miles north-west of those at Longton.

From Burslem the district of Wolstanton, outside the federated area, is supplied, and Tunstall, while Fenton, lying between Stoke and Longton, is supplied from both these places, pending the completion of a scheme for H.T. supply which has been agreed on.



FIG. 1.—THREE-PHASE E.H.T. SWITCHBOARD, NEW POWER STATION, STOKE-ON-TRENT.

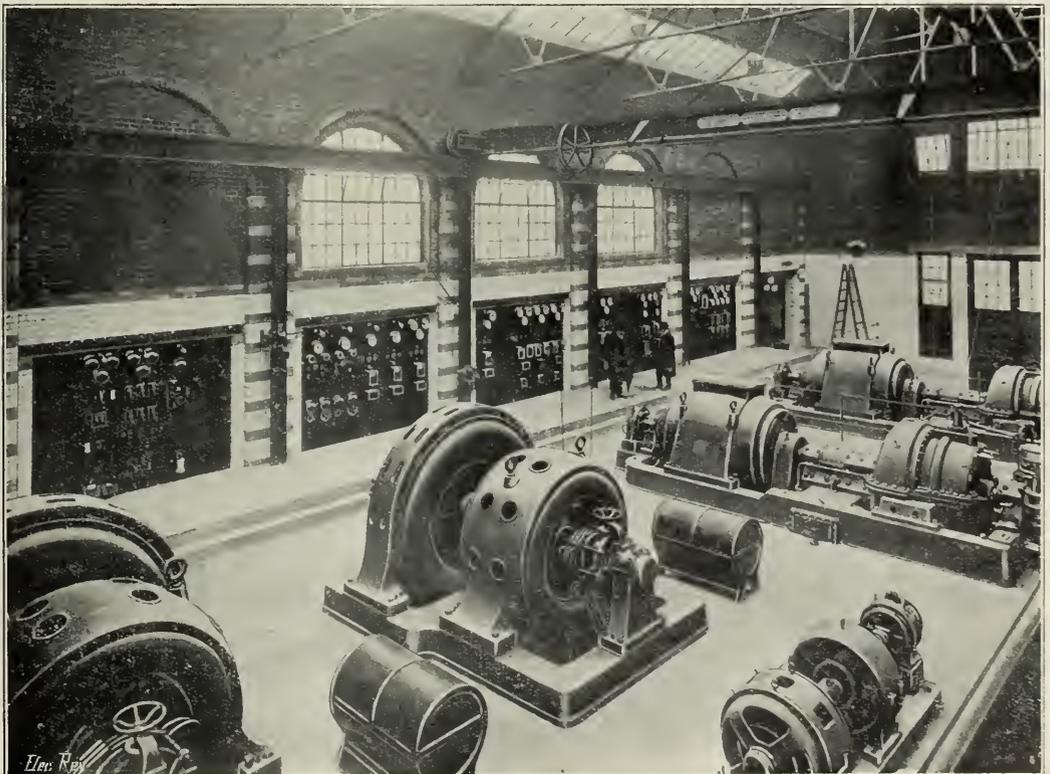


FIG. 2.—INTERIOR OF THE NEW POWER STATION, STOKE-ON-TRENT, SHOWING THE TURBINE PLANT, MOTOR-GENERATORS AND SWITCHBOARD.

and one an alternating-current supply (Hanley, single-phase, 100, 200 and 400 volts), but also by reason of the

The population of the combined area is 235,000, but despite this it has a comparatively low rateable value, and

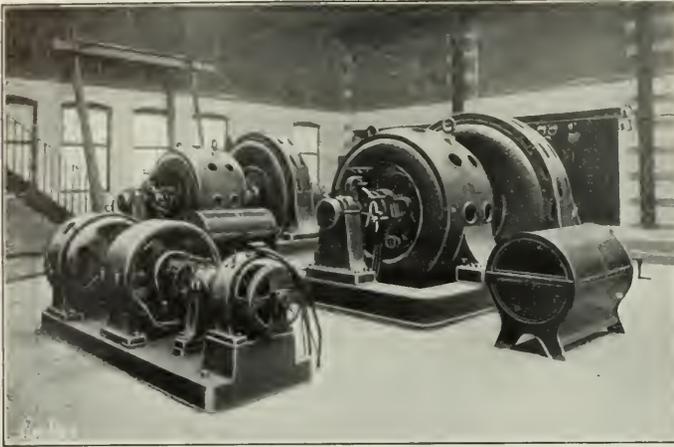


FIG. 3.—THREE-PHASE TO SINGLE-PHASE MOTOR-GENERATORS FOR SUPPLEMENTING THE HANLEY SUPPLY.

growth of the demand, and this by no means easy task fell to Mr. Yeaman, who, after considering various schemes, eventually recommended the provision of a central power station to supplement by means of bulk supplies delivered to the existing stations, the generating capacity of the latter. This arrangement enables the most economical adjustment of load as between the bulk supply and local stations to be made, each local station being debited with the actual cost of the supply given to it.

The bulk supply scheme which has been carried out on these lines at a cost of £60,000 approximately, was officially inaugurated yesterday; it includes a central power house, which has been built on land adjoining the original Hanley generating station, and contains turbo-generating plant supplying three-phase current at 50 cycles and 6,000—6,600 volts; three-phase transmissions to the original stations at Stoke,

does not offer either in its inhabitants, who are mostly employed in the local pottery works, or in its industries, which employ a comparatively small amount of power, the scope for extensive electricity supply, which is found in some industrial boroughs having smaller populations. But once the federation scheme came into effect, it became necessary to settle on some definite future policy in regard to electricity supply in the area, in view of the future

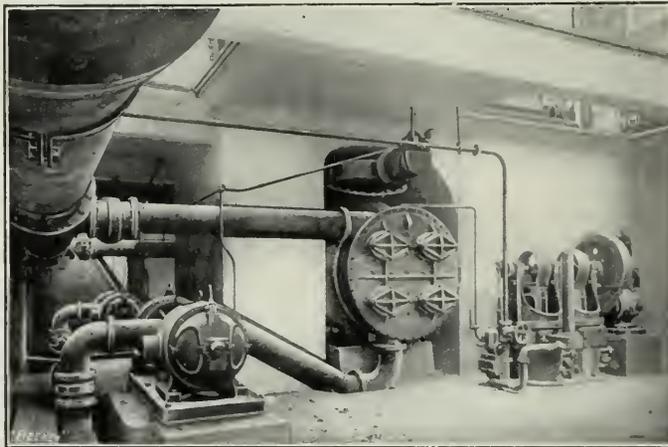


FIG. 4.—CONDENSING PLANT, NEW POWER STATION, STOKE-ON-TRENT.

Burslem and Longton, where H.T. transforming and converting plant has been installed; also the provision of three-phase to single-phase converting plant in the power station itself for feeding the Hanley network through the adjacent station.

The plant installed at the new power station consists of three standard pattern five-drum Stirling boilers, each of 18,900 lb. evaporative capacity and designed for a working pres-

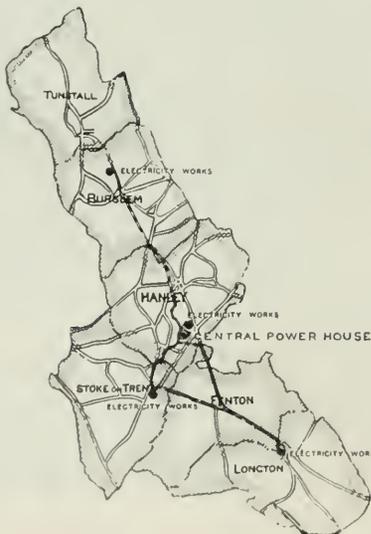


FIG. 5.—SKELETON PLAN OF THE FEDERATED AREA, SHOWING EXISTING GENERATING STATIONS.

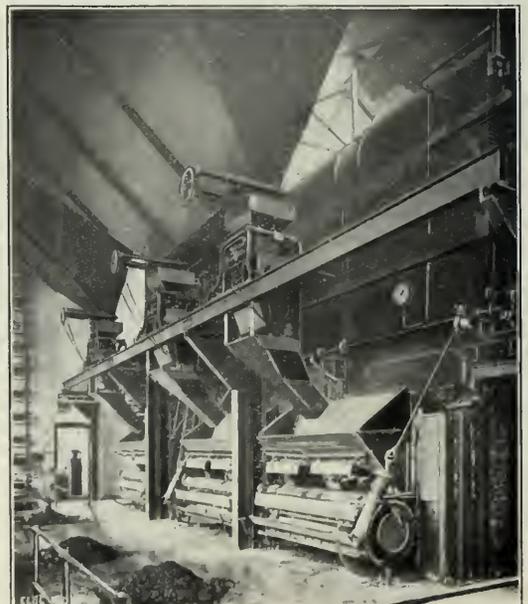


FIG. 6.—VIEW OF THE STIRLING BOILERS, COAL BUNKERS, &c., AT THE NEW POWER STATION.

sure of 200 lb. per sq. in.; the boilers are fitted with integral superheaters to impart a superheat of 120-150 F., travelling stokers by the Underfeed Stoker Co., and forced fan draught, and the burnt gases discharge through steel stacks standing 90 ft. high above grate level. Fuel for the station is obtained from local pits, the carts from which discharge into a hopper outside the boiler house; from the hopper the coal passes through a two-roll crusher on to a short tray conveyor leading to a filler, which feeds an ordinary endless bucket-pattern coal and ash conveyor running through the ash basement and over steel bunkers erected over the firing floor. The bucket conveyor has a capacity of 25 tons per hour.

From the bunkers, the contents of which will run the station for 48 hours, the coal falls by gravity through automatic weighing machines and spouts to the stoker hoppers in the usual way. The conveyor gear and bunkers were supplied by the

feed-pump (5,000 gals. per hour) and a Westinghouse electrically-driven pump, also stores and offices.

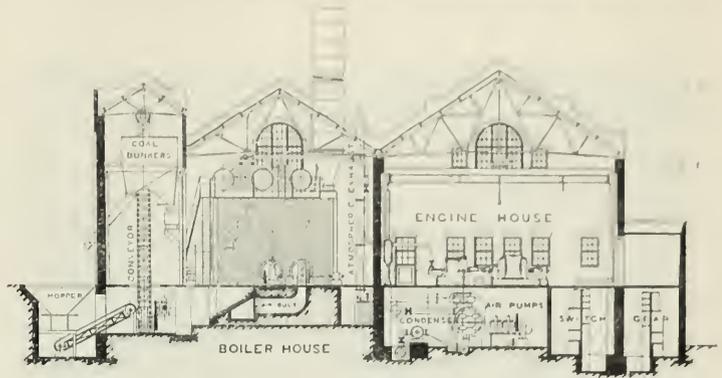


FIG. 7.—SECTIONAL ELEVATION OF THE NEW POWER STATION.

In the engine room are installed two 1,500-kw. Howden-Siemens turbo-alternators, the turbines being of the Zoelly

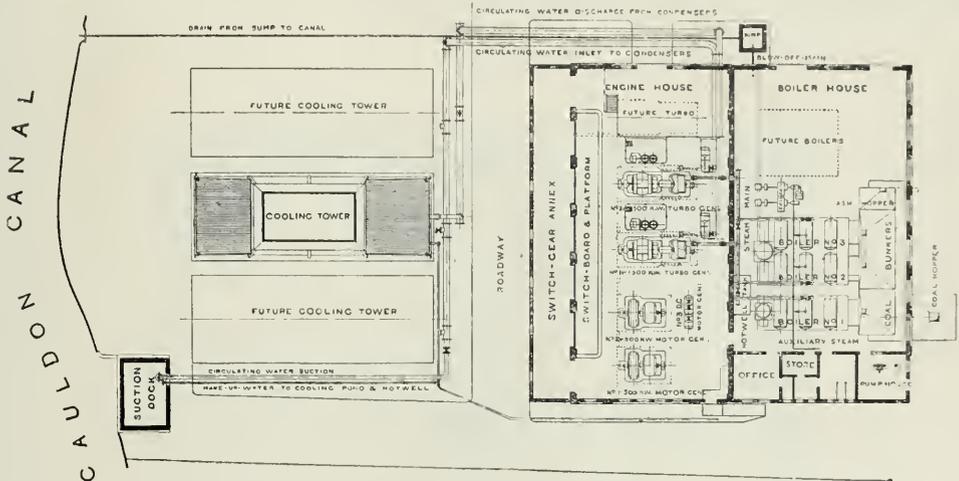


FIG. 8.—PLAN SHOWING THE GENERAL LAY-OUT OF NEW POWER STATION, STOKE-ON-TRENT.

New Conveyor Co. Our view, fig. 6, gives a good idea of the boiler plant at present installed; the building

impulse type (steam consumption, 16.8 lb. per kw.-hour on full load) coupled to three-phase totally enclosed generators constructed for forced ventilation with rotor fans and to run at a speed of 3,000 R.P.M.

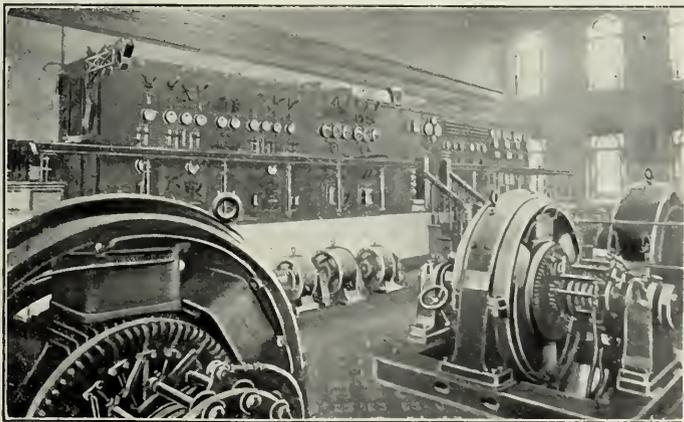


FIG. 9.—SWITCHBOARD, WITH CONVERTERS IN FOREGROUND, LONGTON.

will accommodate two further boilers with the necessary bunker capacity, the ash hopper coming midway between the existing and future bunkers as shown in the plan, fig. 8.

At the permanent end of the boiler house (one end being temporary) is a pump room containing a Weir steam

Air filters in connection with these machines are situated in the basement and coupled up by means of ducts, and the cool air, which is drawn through the H.T. switch chambers, is, after passing through the machines, discharged into the engine room.

Each generator is rated at 1,500 kw. at .8 power factor, and running at 3,000 R.P.M. delivers three-phase current at 6,000-6,600 volts, and 51.5 cycles. An overload capacity of 25 per cent. for two hours, or 50 per cent. for 10 minutes, and short circuit running on full-load excitation for one minute was specified.

With constant speed and excitation the inherent regulation is such that the pressure rise above 6,600 volts when full load is thrown off will not exceed at unity power factor, 8 per cent.; and at .8 power factor, 22 per cent.

The exciters are of the overhung type, shunt wound and designed to work at 100 volts.

Each turbine exhausts direct into a surface condenser

situated in the basement below, where also are electrically-driven Mirrlees-Edwards twin air pumps and Rees Roturbo centrifugal circulating pumps. The former are combined

station and local stations is of Westinghouse standard pattern, with remote-controlled solenoid-operated oil switches installed in masonry cubicles of the type shown in fig. 11.

It has been designed and is guaranteed to break on a dead short with 9,000 kw. (*i.e.*, the ultimate capacity of the station) behind it.

The board consists of 15 panels, including two alternator panels equipped with the necessary switchgear, induction-type ammeters, polyphase indicating wattmeters, power-factor indicators, and integrating watt-hour meters. Two E.H.T. summation panels are fitted with Bristol recording voltmeters, frequency indicators, wattmeters, watt-hour meters and recording ammeters. An E.H.T. bus-bar coupler panel is fitted with a synchroscope and the necessary gear for paralleling the alternators.

A Brown-Boveri automatic pressure regulator is provided and arranged to control one, two or three turbo-alternators; it is provided with three double-pole change-over switches suitable for use in the exciter field circuits; one pressure and one current transformer.

There are four outgoing feeder panels, each fitted with polyphase overload and inverse time-limit relays; four further panels are provided for controlling the H.T. and L.T. sides of the two 600-kw. motor-generator sets installed in connection with the Hanley supply.

Fivesets of Merz-Price protective gear are provided in connection with the E.H.T. transmissions to the other stations.

An auxiliary board controls the station battery, the secondary station transformers and distribution.

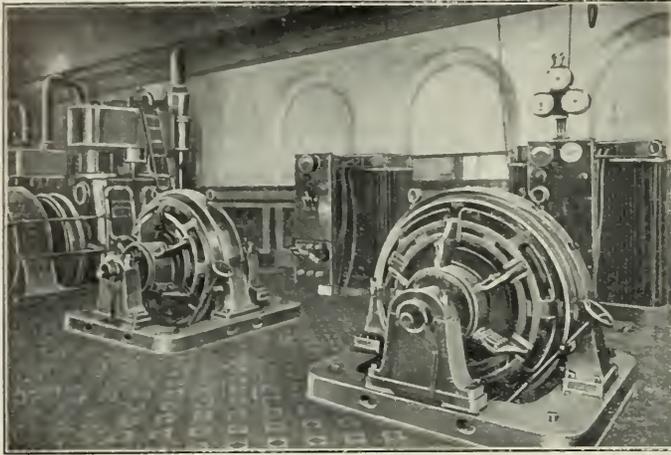


FIG. 10.—WESTINGHOUSE ROTARIES AND TRANSFORMERS, LONGTON STATION.

with double-acting hot-well pumps, and are gear driven from 9-H.P. three-phase motors, while the latter are coupled to 48-H.P. three-phase motors, each delivering 132,000 gallons per hour over the cooling tower mentioned below. The condenser system is worked in conjunction with a Davenport cooling tower, one of three which can be accommodated between the existing buildings and the Caudon branch of the Trent and Mersey Canal, which is situated about 150 ft. behind the station.

A special suction dock, fitted with an electrically-driven "Brackett" screen, has also been constructed on the canal side, so that circulating water can be drawn from the canal or cooling tower pond as required; a separate motor-driven pump is installed for supplying make-up water to the cooling pond and hot-well.

As previously mentioned, the new station also contains what is in effect sub-station plant for supplying the Hanley single-phase network. This consists of two 600-kw. Siemens induction type motor-generators; the motors run on the 6,600-volt 50-cycle three-phase supply, and drive single-phase machines with exciters, generating current at 100 cycles and 2,200 volts for supplementing the plant in the adjoining Hanley station.

The whole of the three-phase switchgear installed both in the new power

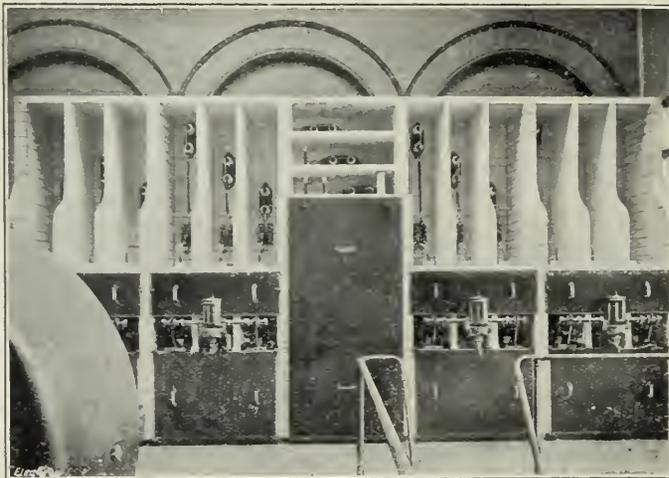


FIG. 11.—E.H.T. SWITCH CUBICLES AT THE OLD STOKE GENERATING STATION.

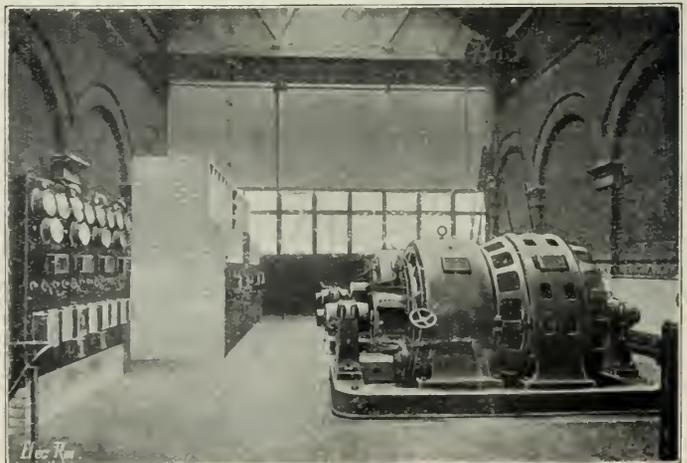


FIG. 12.—LA-COUR MOTOR-CONVERTERS, E.H.T. SWITCH CUBICLES AND CONTROL PANELS, AT THE OLD STOKE STATION.

The switch and bus-bar cubicles at the power house occupy two parallel basement chambers beneath the operating switch-board, as shown in fig. 7; the auxiliary current for excitation and operating the remote control is supplied by a battery of 60 D.P. cells, and 300 ampere-hours capacity, in connection with which a 50-kw. Peebles motor-generator is installed for charging purposes. Our view (fig. 2) gives a good idea of the interior of the engine room, a feature of which is the arrangement of the switch panels flush with the wall, and on a platform raised only slightly above the general floor level; as will be seen, the engine room is excellently lighted, while the arrangement adopted also enables ample light to be obtained in the boiler house, and particularly on the firing floor, which is lighted by large side windows, and leaves nothing to be desired in this respect.

The whole of the three-phase E.H.T. mains running to the old stations were supplied and laid by Messrs. Callender's Cable Co.; they are of the paper-insulated, lead-sheathed, wire-armoured type, laid on the solid system in stoneware troughing.

Outside the generating station, the cables were drawn into 3-in. pipes, and a number of spare pipes are provided for future requirements.

The ends of the feeders in each station are finished off in cast-iron dividing boxes, the connections to the bus-bars being made by single-conductor rubber-insulated lead-sheathed cables. Some 23,000 yd. of E.H.T. main have been laid, as well as a considerable number of L.T. distributor cables for 230-460-volt service.

As regards the original stations, the Burslem works were opened in 1905, and supply at 440 volts for power and 220 volts for lighting on the three-wire continuous-current system. The plant, in combination with a Heenan & Froude three-cell destructor, comprises four water-tube Babcock boilers, three Howden-Dick, Kerr generating sets respectively of 100, 200 and 350-kw. capacity and an exhaust and live steam Belliss-Siemens turbo-dynamo of 600 kw., with one Storey condenser.

The Hanley works were opened in 1894, and supply on the alternating-current system at 2,000 volts, 100 cycles, single-phase, and distribute from some 60 sub-stations at 400 volts for power and 100 or 200 volts for lighting. The plant consists of two Ferranti alternators with rotating armatures, respectively of 300 and 600-kw. capacity, and two Howden-Westinghouse 500-k.v.a. sets with rotating fields, each fitted with a condenser. Steam is raised in nine Lancashire boilers, three fitted with Bolton superheaters and three with Bennis mechanical stokers. Some of the plant in regular use has been at work nearly 19 years.

The Longton works are in the local gasworks yard and commenced supply in 1901. Supply is given at 460 volts for power and 230 volts for lighting. The system is a direct current one with three-wire distribution. The plant comprises three steam generators, two two-pole machines of 150 kw. each, and one multipolar machine of 300 kw., all of E.C.C. make and driven by Belliss engines; three Babcock boilers fitted with chain-grate stokers. The station is run non-condensing. A Chloride battery takes the light loads.

The Stoke works were started in 1904, and supply power at 480 volts and lighting at 240 volts on a direct-current three-wire system. The plant consists of four Willans-Dick, Kerr generators, two of 150 kw. and two of 250 kw., with two condensing sets and a Tudor battery. Steam is supplied from one Lancashire boiler heated by the gases from three cells of a Meldrum destructor and two Babcock coal-fired boilers.

As regards the latter station, the engine room has been extended, and two 500-kw. La Cour motor-converters have been installed, together with three-phase and direct-current switchgear. Our views, figs. 11 and 12, show the general layout of this plant, fig. 11, in particular, giving a good idea of the cubicle work which is similar to that in the other stations.

The direct-current panels for the converters have been added to the original switchboard, situated on a gallery at the other end of the building. At Longton, two 300-kw. Westinghouse rotary converters with three-phase oil-cooled transformers have been installed, as shown in

fig. 10; the necessary switch panels have been added to the original switchboard shown in fig. 9, the three-phase panels, as in the other cases, being of the remote-control pattern, with the oil switches in cubicles in this case in an annexe to the station.

The Burslem plant extensions consist of two 600-kw. Westinghouse rotary converters with starting motors, boosters, and exciters, and the necessary transforming apparatus, three-phase and direct-current switchgear; this plant is arranged to run inverted in regular service, while the converting plant at Stoke could in emergency be similarly used.

Under Mr. Yeaman's management the commercial and technical control of the various undertakings has been centralised at St. Peter's Chambers, adjoining the Stoke-on-Trent Town Hall, where a complete suite of offices has been provided; it is almost unnecessary for us to add that so far as detail organisation can be provided to ensure the efficient control of the various undertakings which, as previously mentioned, are financially independent, this has been provided by Mr. Yeaman.

The scheme which has been successfully carried to completion aroused very great interest locally. The Electricity Committee, of which Alderman Lecce has been an indefatigable chairman, and Mr. Yeaman, its engineer, visited some of the best known electricity works in the country before submitting their proposals to the Council, and at a later date these were endorsed by Mr. J. F. C. Snell and thoroughly investigated by Mr. H. Ross Hooper at a Local Government Board inquiry, which resulted in the scheme being sanctioned.

It offers a satisfactory solution to a problem fraught with many difficulties, and undoubtedly places the federated towns in the best possible position, under existing circumstances, to develop their electricity supply undertaking on rational lines.

Our congratulations are due to Mr. C. H. Yeaman, the chief engineer, to whom we are indebted for facilities for preparing this short description.

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## CONTRACTS OPEN.

(Continued from page 602.)

**Newcastle-on-Tyne.**—April 23rd. E.H.T. three-phase lead-covered paper cable and single conductor L.T. lead-covered paper cable, for the Corporation Tramways Committee. See "Official Notices" to-day.

**Newport.**—April 26th. One 2,000-2,500-kw. steam turbo-alternator, surface condensing plant, one 600-kw. D.C. generator, and E.H.T. and L.T. switchgear, for the Corporation. See "Official Notices" to-day.

**Salford.**—May 19th. Tenders invited for 10 car bodies and 10 Brill trucks. General Manager, 32, Blackfriars Street, Salford.

**Servia.**—April 26th. The Servian telegraph authorities in Belgrade are inviting tenders for the supply of 125 km. (about 78 miles) of insulated copper wire.

**South Africa.**—DURBAN.—May 28th. Electric meter-testing equipment for the Council. Copy of specification, &c., may be seen at Board of Trade Com. Intel. Dept. in London.

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## CLOSED.

**Argentine.**—The Argentine Government has accepted the tender of the Augsburg Maschinenfabrik Gesellschaft, of Augsburg, for the supply of no less than 75 electric cranes for the port of Buenos Ayres, with six sets of spares, at a total cost of £18,500.

**Belgium.**—Eight German firms and only one Belgian submitted tenders last week to the municipal authorities of Ixelles for the supply of a large quantity of low-tension armoured cable, the lowest offer being that of Messrs. Felten & Guilleaume, of Mulheim-am-Rhine.

**Bury.**—The T.C. has accepted the following tenders:—  
W. T. Glover & Co., Ltd. Cable.  
British Westinghouse Co., Ltd.—Equipment for four cars.

**Canterbury.**—The T.C. has decided to purchase 13 of the General Electric Co.'s "Angold" electric arc lamps for main street lighting.

**Barrow.**—The T.C., on April 7th, approved of the acceptance of the tender of the B.I. and Helsby Cables, Ltd., for cable, at £1,324; also the offer of the British Westinghouse E. & M. Co., Ltd., for an additional 150-kw. rotary converter, together with the necessary rheostats, at £658; and for additional switchboards, at £183.

The Electricity Committee has accepted the following tenders:—

Engine and cylinder oils.—Jas. Light & Son, Ltd.  
Crank chamber oil.—Stern-Sonneborn Oil Co., Ltd.  
Metal polish.—Glaro Metal Polish Co., Ltd.  
Shellac varnish, &c.—W. Geipel & Co.  
Prepared tape.—A. Artaise.  
Insulating compound, &c.—Dusseck Bitumen Co.  
Switches, &c.—H. C. Barlow & Co.  
Tin lead fuse wire, &c.—Baxendale Bros.  
Carbons.—Ship Carbons, Ltd.  
Arc lamp globes, &c.—Falk, Stadelmann & Co., Ltd.  
Joint boxes, &c.—Sykes & Sugden, Ltd.  
Switch cut-outs.—B.I. and Helsby Cables, Ltd.  
Electric meters.—Chamberlain & Hookham, Ltd.  
Electrolytic midge meters, &c.—Reason Manufacturing Co., Ltd.  
Tantalum, &c., lamps.—Drake & Gorham, Ltd.  
Carbon-arc lamps.—Radium Electric Co.  
Earthenware pipes, &c.—Doulton & Co., Ltd.  
Linen tape and rubber gloves.—L. Andrew & Co.  
Brass saddles and pins.—Veritys, Ltd.

**Cape Town.**—The following tenders were received for wiring the new factory of Lever Bros. (South Africa), Ltd., at Salt River:—

	Screwed conduit.	Close joint conduit.
R. M. Ross & Co. . . . . (accepted)	£225	—
Woods, Westerton & Co. . . . .	292	£251
Edward A. Shaw & Co. . . . .	322	201
Cunningham & Gearing . . . . .	394	350
Clyde Engineering Works . . . . .	398	350
R. G. Jack . . . . .	459	451

The tenders of Messrs. E. A. Shaw & Co. have been accepted for wiring the new factory and offices of the Premier Gate Fence and Wire Co., Ltd., also for wiring the Council Chamber and the new offices of the Cape Rural Council.

**Colchester.**—The T.C. has accepted the following tenders:—

H. G. Merry & Co.—200 tons of Shirebrook nutty slack, at 15s. per ton, and 200 tons of Digby fiddling nutty slack, 14s. 4d. per ton, for the electricity works.  
Joslins, Ltd.—Electric lighting fittings, &c.  
Williams & Co.—Rubber, fibre, &c.  
Stanford & Co., Dick, Kerr & Co., Ltd., and Malleable Steel Castings Co.—Tramcar fittings.

The T.C. has accepted Messrs. Chamberlain & Hookham's tender for ordinary and P.P. meters.

**Doncaster.**—The Tramways Committee has accepted the tender of the United Electric Car Co., Ltd., for supply of four covers to existing cars, at £143 each.

**East Ham.**—The T.C. has accepted the tender of the Engineering and Equipment Co. for the supply of about 6 miles of figure-8 trolley wire, at 8½d. per lb.

**Glasgow.**—The Tramways Committee recommends acceptance of the following:—

Copper trolley wire.—E. Le Bas & Co.  
Copper strip.—Leslie & Hall.  
D.U.C. wire.—London Electric Wire Co. and Smiths, Ltd.

**Godalming.**—Messrs. Rawlings & Co., of Lee, S.E., have secured the contract for installing plant and 400 to 500 lights and laundry motor and electric pump at Peper Harrow, Godalming, the residence of the Right Hon. Viscount Midleton.

**Heckmondwike.**—The U.D.C. has accepted the tender of the White Lea Colliery Co., Ltd., for 2,000 tons of coal for the electricity works, at 8s. 9d. per ton.

**Leeds.**—The offer of Messrs. Willans & Robinson, Ltd., for a turbo-alternator, condensing plant, pipes, &c., for £20,399, has been accepted by the Corporation.

**London.**—MAYLEBONE.—The tenders of the following have been accepted by the B.C.:—

Babcock & Wilcox.—Superheater, £500.  
British Insulated & Helsby Cables, Ltd.—High-tension cable, £107 per 220 yds.  
Union Cable Co., Ltd.—Ordinary underground cable.

The following tenders have been accepted for annual supplies to the Electricity Supply Committee:—

The London Electric Wire Co.—Fuse wires.  
Sloan Electrical Co.—Arc lamp carbons.  
Union Cable Co., Ltd.—Cables and pilot wires.  
Dusseck Bitumen Co.—Compounds.  
Siemens Bros. & Co., Ltd.—Tapes, &c.  
W. Lucey & Co., Ltd.—House service and main joint boxes, &c.  
Sykes & Sugden, Ltd.—House fuse boxes.  
Callender's Cable & Construction Co., Ltd.—Frames and covers.  
British Electric Transformer Co., Ltd.—Transformers.  
Ferranti, Ltd.—Meters and prepaying meters.  
British Insulated & Helsby Cables, Ltd.—V.I.R. cables.  
Edison & Swan Co., Ltd.—Accumulators.  
Geipel & Co., Ltd.—Arc lamp carbons.

**BATTERSEA.**—The B.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £1,920, for a water-tube boiler, fitted with superheater, chain-grate stoker and pipework, at the electricity station. The tender of Callender's Cable Co., Ltd., has been accepted for an annual supply of troughing and bends for cables, &c.

The contract for an automatic electric passenger lift in Admiralty House, Whitehall, the official residence of the First Lord of the Admiralty, has been secured by Messrs. A. W. Penrose and Co., Ltd.

**Luton.**—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for two 1,000-kw. turbo-alternators, complete with condensers, &c., at £4,600 each.

**Manchester.**—The Corporation Rivers Committee has accepted the quotation of Electromotors, Ltd., for a 6-B.M.P. motor for the Withington works.

The Tramways Committee has accepted the tender of Messrs. Walter Scott, Ltd., of Leeds, for 2,500 tons of steel girder tramway rails.

The tender of Messrs. Thomas Anderson, Ltd., for the electric lighting of the George Leigh Street Municipal School, has been accepted.

Amongst a very large number of tenders for general stores and services, as required during the ensuing year, which have been accepted by the Tramways Committee, are the following:—

Dyer & Young.—Assembled commutator segments.  
British Thomson-Houston Co., Ltd.—Motor and controller spare parts, motor cases.  
L. Andrew & Co.—Fibre barriers and circuit-breaker handles, &c.  
Dick, Kerr & Co., Ltd.—Motor and controller spare parts, &c.  
British Westinghouse Electric and Manufacturing Co., Ltd.—Motor and controller spare parts, &c.  
Estler Bros.—Controller fingers, &c.  
Kay & Co., Ltd.—Motor brush-holders.  
Manchester Armature Repair Co.—Armature and field coils.  
P. R. Jackson & Co., Ltd.—Armature and field coils.  
Electro-Mechanical Brake Co., Ltd.—Grid resistances.  
H. Wallwork & Co., Ltd.—Grids for resistances.  
Brecknell, Munro & Rodgers, Ltd.—Trolley poles, &c.  
General Electric Co., Ltd.—Incandescent lamps, bells, lighting material, telephones, testing instruments, &c.  
Commercial Electric Co., Ltd.—Incandescent lamps, traction type.  
B. Gutzwiller, Junr., & Bro., Ltd.—Bell presses, arc lamp globes, sundry glass, &c.  
C. Macintosh & Co., Ltd.—Cells, insulation tape, goloshes, rubber gloves and gaunlets, &c.  
Ecksteudt, Heap & Co., Ltd.—Spare parts for Gilbert arc lamps.  
Meliorowsky & Co.—Amber mica segments for commutator bars, &c.  
Suffice (Crumpton), Ltd.—Fibre sheets and stick fibre.  
Spicer Bros., Ltd.—Red fibre paper, leatheroid strips, insulation paper and cloth.

British Xylonite Co., Ltd.—Celluloid.  
Connolly Bros., Ltd.—P. and B. tape, power and lighting cables.  
I.R., G.P. and T.W. Co., Ltd.—Linen tape.  
Pinchin, Johnson & Co., Ltd.—Insulation varnish.  
R. W. Blackwell & Co., Ltd.—Insulating compound.  
Morgan Crucible Co., Ltd.—Carbon brushes, &c.  
Baxendale & Co., Ltd.—Arc lamp carbons, turpentine, &c.  
Alfred Wiseman, Ltd.—Overhead equipment insulating material, pole switches.

General Patents Co.—Trolley heads.  
Fleming, Birby & Goodall, Ltd.—Trolley wheel bushes and spindles.  
Souper & Callaghan.—Automatic sanding devices.  
John Taylor.—Tubular sand controllers.  
Hudson & Bowring, Ltd.—Automatic side-guards.  
Phillipson & Co.—Folding side-guards.  
T. Bolton & Sons, Ltd.—Copper wire, copper strip and sheet copper.  
C. Clifford & Son, Ltd.—Brass wire.  
F. Smith & Co., Ltd.—Steel wire.  
Richard Johnson & Nephew, Ltd.—Galvanised steel wire cable and rope.  
I. Bentley & Co., Ltd.—Lubricating oils, &c.  
J. Stoddart & Son.—Paraffin oil.  
British Petroleum Co., Ltd.—Motor spirit.  
Hardman & Holden, Ltd.—Castor oil.  
Newton, Chambers & Co., Ltd.—Disinfecting fluid and powder.  
Reliance Manufacturing Co.—Liquid metal polish.  
Till & Whitehead, Ltd.—Sundry workshop tools, plant and appliances, &c.  
Carborundum Co., Ltd.—Special blocks for grinding steel rail, &c.  
London Emery Works Co., Ltd.—Special wheels for grinding steel rails, &c.  
West Bromwich Spring Co., Ltd.—Truck springs, &c.

J. Billingham.—Brake chains.  
Brampton Bros., Ltd.—Gear chains for brakes.  
Milnes, Voss & Co., Ltd.—Car fenders.  
Cammell, Laird & Co., Ltd.—Tramcar axles.  
J. Brown & Co., Ltd.—Tramcar wheel tires.  
F. W. Rowlands & Co.—Gear and pinion wheels.  
National Rail and Tramway Appliances Co., Ltd.—Iron castings, brake block castings.  
Interchangeable Brake Block Co., Ltd.—Chilled iron brake block castings.  
Moston Malleable Castings Co.—Malleable iron castings.  
Leys Malleable Castings Co., Ltd.—Gear-case castings.  
E. Peace & Sons, Ltd.—Steel castings.  
Armstrong Oiler Co., Ltd.—Lubricant pads for axle boxes.  
J. Carr & Sons, Ltd.—Trolley cord.  
Chamberlain & Hookham, Ltd.—Ampere-hour tramcar meters.  
British Oxygen Co., Ltd.—Oxygen gas and acetylene gas.  
Thermit, Ltd.—Thermit welding material.

**Warrington.**—The B. of G. has accepted the tender of Mr. H. Bibby for electrical fittings and sundries for six months.

**Nelson.**—The T.C. has accepted the tender of Messrs. Briggs, Jones & Gibson, of Manchester, for uniforms and caps for the Light Railway men.

**Newport (Mon).**—A contract for carbon-filament lamps and radiator lamps for the Corporation Electricity and Tramways Department for the ensuing 12 months, has been placed with Messrs. Siemens Bros. Dynamo Works, Ltd.

**Plymouth.**—The Electricity and Street Lighting Committee has accepted the following tenders received for the supply of stores and materials during the ensuing financial year:—

Carbons.—Crompton & Co.  
Engine waste.—Northern Waste Co.  
House meters.—Ferranti, Ltd.  
Oil, &c.—A. Hoppis & Sons, Ltd.; Stern-Sonneborn Oil Co.; and M. Wells and Co.

The chairman and the electrical engineer were authorised to purchase one ton of electrolytic copper and half a ton of sheet copper.

**Russia.**—ST. PETERSBURG.—It is stated that the municipal council of St. Petersburg has placed an order with the Russian A.E.G. for the supply of tramcars of the value of 905,000 roubles (£90,500). Orders have also been allocated to the firm of Fitzner and Gambert, which is closely associated with the German Borsig Works, of Tegel, for the sum of 371,930 roubles (£37,193), and with the Russian Westinghouse Co. for the amount of 315,427 roubles (£31,542).

**Sheffield.**—The City Council has accepted the tender of Messrs. R. White & Sons, at £587, for the construction of an aerial ropeway at the Neepsend power station.

Quotations have been received from the Post Office, amounting to £965 15s. per annum, for installing 50 fire alarms with boxes, and to £999 15s. per annum for 50 fire alarms with pedestals, on a ten years' agreement. The consideration of the quotations has been deferred pending the result of further inquiries about the "Ganewell" system.

**Southend-on-Sea.**—Mr. G. Branlik has received a contract for his current limiters for the Corporation for the next two years. He has been supplying these limiters to the Corporation for several months past.

**Stretford.**—The U.D.C. has accepted the tenders of the Union Cable Co., amounting to £706 and £67, for supplies of cable.

**Watford.**—The U.D.C. has accepted the tender of the Union Electric Co. for a motor-generator, at £190, and that of the Electric Construction Co., for new machine panels and reconstructing existing panels.

**Woolwich.**—The B.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £7,865, for two boiler units, with chain-grate stokers, for the electricity department. With reference to the supply of current to the L.C.C. hotels at Eltham, referred to elsewhere, the tender of the British Electric Transformer Co. has been accepted, at £114, for four air-cooled transformers.

NOTES.

**Reduction in German Wire Lamp Prices.**—After the lapse of a year and a half since the last reduction in the prices of metallic-filament lamps was made by the principal makers in Germany, further concessions have now been granted in that country. As on previous occasions, the initiative in the matter has again been taken by the A.E.G., which states that the new prices are 1s. 1d. for lamps of 5 to 10 c.p., as compared with 1s. 6d. hitherto, 1s. 9d. for lamps of from 10 to 50 c.p., as against 2s. 6d., and 2s. 6d. for lamps of 100 c.p., as contrasted with 3s. 6d. The company explains that the very considerable increase in the sales both at home and abroad, as well as the introduction of the drawn metallic wire, has brought about a cheapening of the cost of production, which permits of sale prices being reduced. Merchants require reliable gross prices and a rebate, which as far as practicable is to represent their profits. The company wishes to place a limit on the present uncertainty of the market by regulating the rebates in connection with the reduction in the gross sale prices. It will perhaps be remembered that the previous price concessions were made in October, 1911, when the right of use of the wire lamp patents of the United States General Electric Co. was secured by the A.E.G., the Siemens & Halske Co. and the German Incandescent Gas Light (Auer) Co., and this privilege was subsequently extended to the Bergmann Co. The action of the A.E.G. on the present occasion has been speedily followed by the Siemens & Halske Co., which also announces a reduction of 25 per cent. in the prices of Wotan and tantalum lamps, whilst a lowering of the net prices charged by the Incandescent Gas Co. has likewise been made, although not to the same extent.

The price reduction on the Continent will not be followed by a price reduction in England, as the patent situation here is entirely different.

**Inquiries.**—A correspondent asks where "mann marble" can be obtained. Another correspondent asks for addresses where model electric laundries may be seen.

**Electric Lighting Installation.**—In reference to the case of Watson v. Claytons, reported in these columns on March 21st, the plaintiffs, Messrs. Watson, Marsh & Co., 347, High Road, Brondesbury, write to say that the claim of £60 was for a complete inside installation of incandescent lighting, together with four outside arc lamps with special covers. Messrs. Claytons claimed that the contract had not been carried out, inasmuch as the special arc lamp covers were not as per Messrs. Lockwood and Bradley's pattern, whereas Messrs. Watson, Marsh & Co.'s case was that Messrs. Lockwood & Bradley's covers were not specified by them, and that in any event those covers, being an extra charge over and above those ordered by them, had nothing to do with the amount claimed by them.

**Foreign Trade in March.**—Last month's trade returns show an increase of £180,531 in imports, and one of £975,976 (2'3 per cent.) in exports, but it is not possible to make a fair comparison with 1912, for last year the coal strike was in progress. We may, however, select the electrical and machinery figures from the published reports, as below. From these it appears that although there are two working days less in the 1913 reckoning, the export figures are very substantially higher:—

*Imports.*

Electrical goods and apparatus, excluding machinery & un-insulated wire	Month of March.	Inc. or dec.	Three months, 1913.	Inc. or dec.
Machinery...	£117,190	— £19,080	£374,339	— £36,922
	639,942	+ 31,975	1,833,892	+ 201,409

*Exports.*

Electrical goods and apparatus, excluding machinery & un-insulated wire	Month of March.	Inc. or dec.	Three months, 1913.	Inc. or dec.
Machinery...	£815,675	+ £153,015	£1,510,256	+ £349,518
	2,764,960	+ 34,212	8,590,063	+ 777,593

**The Batti-Wallahs.**—At the informal meeting of the Batti-Wallahs' Society, on Wednesday last week, during the evening, between the other turns, stanzas caricaturing certain members were read, much to the amusement of the company. The next function—a smoking concert—will be held at the Holborn Restaurant, on Friday, April 18th, and not April 28th, as stated in the official programme. This is the last smoking concert of the season.

**Fatality.**—**USHAW MOOR.**—An inquiry was held at Ushaw Moor, Co. Durham, on the 3rd inst., by Mr. R. A. Shepherd, Deputy Coroner, into the circumstances of the death of Clarence Herbert Allen, 18, an electrical improver, who was killed at Ushaw Moor sub-station on the Monday preceding. Norman Vincent Raven, of Eldon Place, Newcastle-on-Tyne, supervising electrical engineer for the Newcastle Electric Supply Co., said he was in charge of a contract which Messrs. R-yrolle & Co., of Hebburn-on-Tyne, were carrying out for his company at Ushaw Moor, and he gave instructions for the carrying-out of the work. There were three chambers, and the 20,000-volt chamber was reached from the transformer chamber by a wooden staircase. He had told the joiner that he must not go into the 20,000-volt chamber, and gave instructions that the pilot cable was not to be drawn into that chamber unless the inspector was present. Alphonsus Lawton, joiner, of Sunderland, said that on Monday he was told by the foreman to proceed with work on a 3,000-volt cable, and that if

FORTHCOMING EVENTS.

**Junior Institution of Engineers.**—Friday, April 11th. At 39, Victoria Street, B.W. Paper on "Methods of Regulating and controlling Working of Electric Accumulators," by Mr. G. C. Allingham.

Saturday, April 19th.—At Caxton Hall, Westminster. Bohemian smoking concert.

**Physical Society.**—Friday, April 11th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "Some Errors in Magnetic Testing due to Elastic Strain," by Messrs. A. Campbell and H. C. Booth, and "Note on Cathodic Sputtering," by Dr. G. W. C. Kaye.

**Institution of Electrical Engineers (Scottish Section).**—Tuesday, April 15th. Annual general meeting.

(Newcastle Section).—Monday, April 14th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "The Formation of Deposits in Oil-Coated Transformers," by Dr. Michie.

(Students' Section, London).—Wednesday, April 16th. At 7.45 p.m. At the Institution, Embankment, W.C. Paper on "Alternating-Current Railway Signalling," by Mr. T. J. Hornblower.

**Illuminating Engineering Society.**—Tuesday, April 15th. At 8 p.m. At the Royal Society of Arts. Paper on "Standard Clauses for Inclusion in a Specification of Street Lighting," by Mr. A. P. Trotter. Discussion open to members of the I.E.E., I.G.E. and I.M. and C.E.

**Electrical Trades Benevolent Institution.**—Wednesday, April 16th. At 7 p.m. At the Trocadero Restaurant. Festival dinner. Tickets from the Secretary, 18, Park Mansions, Vauxhall Park, S.W.

**Institution of Mechanical Engineers.**—Friday, April 18th. At 8 p.m. Address by the President.

**Royal Institution.**—Friday, April 18th. At 9 p.m. Discourse on "Applications of Polarised Light," by Dr. T. M. Lowry.

**Association of Engineers-in-Charge.**—Saturday, April 12th. At 6.15 p.m. At the Holborn Restaurant. Annual dinner.

**Association of Electrical Station Engineers (Bradford Section).**—Tuesday, April 15th (Wednesdays, April 14th). At 7 p.m. Meeting at the Mechanics' Institute, Bradford.

(Manchester Section).—Thursday, April 17th. At 7.30 p.m. Meeting at the Exeter Café, Deansgate, Manchester.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer.—LIEUT.-COL. H. M. LEAF.

The following orders have been issued:—

Monday, April 14th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, April 15th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, April 17th.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Friday, April 18th.—"D" Company. Company training, 7 to 10 p.m.

Saturday, April 19th.—Headquarters will be opened for regimental business from 10 a.m. till noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adj. For Officer commanding L.E.E.

**Radium Treatment.**—Dr. Saubermann, of Berlin, lecturing before the members of the Röntgen Society, recently stated that water containing radium emanation had great possibilities. The water was artificially charged with radium emanation to a much higher degree than the water found in any natural spring. On the Continent remarkable results had been attained by this treatment in the whole range of diseases of metabolism, including gout, rheumatoid arthritis, nephritis, and arteriosclerosis.

necessary he was to get assistance. Finding he could not get assistance, he proceeded with the drawing of the pilot cable into the 20,000-volt chamber. He knew that certain parts of the switchgear were "alive." Allen had to pull the pilot cable through a hole, and witness told him not to go near where the live contacts were, and not to go higher than the switch, but just to stand on the floor of the chamber. After Allen had pulled the cable partly through, he asked, "Have I got enough?" Witness replied that he would be there in a minute, and went upstairs, when he heard a hissing noise. On getting into the 20,000-volt chamber, he was surprised to see the youth on top of the switch, in a kneeling position, with his head about 5 in. from the "live" contact. He gave Allen a slight pull by the coat, and saw the sparks pass from the contact to his head. There was no need for Allen to get on the top of the switch. What he should have done was to have knelt underneath the switch, and pulled the pilot cable through. Allen was badly burned, and although artificial respiration was applied, it was unsuccessful. Witness had a danger pass with him, but it was not signed, as there was no one there to sign it. Mr. Robinson (representing Messrs. Reyrolle) complimented witness for his brave act in attempting to pull Allen away from contact with the electric current. The Coroner said it would appear to have been easier to pull the cable above the switch rather than underneath. Apparently the deceased had got on top of the switch, and in pulling the cable through probably he had tilted his head, and caught one of the contacts. He expressed the opinion that they could not attach blame to anyone, as it seemed to have been a pure accident. The jury returned a verdict of "Death from accidental electrocution," and recommended that there should be more safeguards at the sub-station, and that the rules should be more stringently enforced. Although Allen was employed by Messrs. Reyrolle, he was not at the time of the accident working upon switchgear of their make.

**SHEFFIELD.**—According to the *Sheffield Daily Independent* an explosion occurred at the Devonshire Works at Staveley on Wednesday last week. From facts elicited at the inquest it appears that when the accident occurred several men were engaged in turning steam from an engine into an exhaust turbine. In order to do this they had to close one valve and open another. The men stood on the top of an oil separator, about 12 ft. from the ground. Martin Stops, 20, a fitter, happened to step back, and got pinned between two parts of the valves. Mr. Ronald Power, the engineer-in-charge, said that when the deceased was pinned, he called out to another man to tell the engineman to stop the engine. Whilst witness's back was turned a man named Wilson closed another valve, with the result that there was no outlet for the steam. They had no time to jump from the separator before an explosion occurred, and they were all thrown to the ground. Being pinned, Stops received the full force of the explosion, and he died soon afterwards. The Coroner said that Wilson seemed to have lost his head in closing the valve on his own authority. The jury returned a verdict of "Accidental death."

**Annual Dinners and Socials.**—LONDON.—At the Pier Hotel, Cheyne Walk, Chelsea, on March 15th, the third annual dinner and concert of the Underground Electric Railwaymen's Sick Benefit Club was held. Mr. J. W. Towle, chief engineer, presided, and he was supported by Mr. P. R. Wray, sub-station engineer, Mr. T. O'Reilly (club secretary), Mr. A. McCutcheon (treasurer) and others, the company numbering nearly 100. The toast "The Power Station" was proposed by Mr. S. L. Phillips (shift engineer) and responded to by Mr. Wray. "The Club" was proposed by Mr. McCutcheon, and the club secretary replied, thanking all who had contributed to the success of the annual dinner and referring to the continuous increase in membership since the club was started in 1906. The number of members for 1912 was 168; the sick pay was £43 19s. 6d. and funeral allowance £15 8s., leaving a surplus returned to each member at the end of the year of £1 8s. 4d. After the toast of "The Chairman" had been disposed of the gathering enjoyed a programme arranged by Messrs. Cooper and Nash.

The fourth annual Bohemian Concert in connection with the Electrical Installations, Ltd., Athletic Club, was held on April 7th, at the Oval Hall, Kennington. Before an audience of some 300 to 400 people, consisting of the staff and their friends, an able body of entertainers carried through a most excellent variety programme. At the opening of the proceedings Mr. Stanley C. Russ, president of the Club, alluded in a few suitable words to the successful development of the club, and informed the members that he had been successful in his negotiations with the City of London Cricket Club, in renting a portion of their exceptionally fine ground at Acton on behalf of the staff, and also that the E.J., Ltd., Cricket Club had entered for the Western League.

**Institution and Lecture Notes.**—ASSOCIATION OF CONSULTING ENGINEERS.—The report of the Committee for the year 1912, which has just been issued, recapitulates the circumstances under which the Association came into existence, and gives the qualifications and duties of members, as well as the definition of a "consulting engineer." An International Congress of consulting engineers and engineering experts is to be held at Ghent during the running of the Exhibition there this year, and the creation of an International Federation of Associations of Consulting Engineers is contemplated. The Association numbered 80 members at the close of the year, and is the largest society of its kind in existence. The Committee was unable to accept the Standard Conditions of Contract prepared by the B.E.A.M.A., holding that it is not possible to frame one set of conditions applicable to all contracts. The Committee was requested to draw up a scale of professional fees for the use of members, but decided that

it would not be advisable to attempt to stereotype rates of remuneration. Referring to a recent incident in Parliament, relating to the employment of Government officers to give advice as consulting engineers in their private capacity, the Committee comments on the disadvantages of the practice, which in future is not to be followed without the consent of the head of the Department concerned. The fact that the obligation to pay an engineer's fees is outside the jurisdiction of taxing masters is pointed out by the Committee. It is proposed to issue reports to the members from time to time, dealing with subjects of interest to them. The accounts for 1912 show income £130, expenditure (covering also 1908-11, £38) £113, balance £17. A full list of members is appended to the report, together with the code of ethics of the American Institute of Consulting Engineers and their schedule of fees. A little booklet containing the rules and practice of members of the Association has been issued, to enable them to put these before their clients and others.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS (EAST OF SCOTLAND BRANCH).**—At the last monthly meeting, at Dunfermline, a paper by Mr. H. G. Humphry (H.M. Junior Inspector of Mines) on the "Supervision of Electrical Plant," was discussed. In reply to criticisms, Mr. Humphry said that sets of printed instructions similar to those suggested in his paper would tend to lighten rather than increase the responsibilities of managers. In reply to a remark that persons authorised to work switchgear under Rule 11 should not be allowed behind a switchboard for the purpose of cleaning, the Inspector thought that this was a question that must be decided by each manager for himself.

**SOCIETY OF ENGINEERS (INC.).**—An essay on "How to Improve the Status of Engineers and Engineering, with Special Reference to Consulting Engineers," was read by Mr. W. Ransom on Monday, April 7th. This was awarded the second prize in the Status Prize Competition last year, no first prize having been awarded.

**GREENOCK ELECTRICAL SOCIETY.**—This Society held its business and social meeting on March 28th, with Mr. J. A. Robertson, the honorary president, in the chair. After tea the chairman congratulated the company upon the success of the Society since it was formed last year. He knew of no business or profession in which it was more necessary that there should be a free interchange of opinion among the members than electrical engineering, for it had more problems requiring discussion than any other branch of engineering. The Society was primarily intended for the benefit of the younger members of the profession, who would obtain knowledge from the experiences of older members. The syllabus showed that subjects dealing with nearly every branch of applied electricity, from wireless telegraphy and electric cooking down to the more prosaic worries of a shift engineer, were dealt with. The chairman concluded with a reference to the services of the president (Mr. J. H. Parker) and the secretary (Mr. W. B. Smith). The secretary's report showed that there were 17 hon. members and 77 ordinary members. Twelve meetings were held, with an average attendance of 37. Six visits were paid to works. Mr. W. A. Toppin has been appointed this year's president, and Mr. A. Hurry secretary, Mr. Robertson continuing as hon. president.

**INSTITUTION OF MECHANICAL ENGINEERS.**—The summer meeting of this Institution will be held in Cambridge from Monday, July 28th, to August 1st. A provisional programme has been issued regarding receptions, a garden party, excursions to Ipswich and Bedford, and visits to works, laboratories, &c., in Cambridge.

**IRON AND STEEL INSTITUTE.**—The programme of the annual meeting of this Institute shows that the proceedings will open on Thursday morning, May 1st, at the Institution of Mechanical Engineers, Storey's Gate, S.W. The daytime will be occupied with papers and discussions, and at night the annual dinner will take place at the Hotel Cecil. Mr. Arthur Cooper, the president, presiding. The meeting will continue on May 2nd. Among the papers that are down for reading is one by Mr. Andrew Lamberton, on "A New Form of Electrically-driven, Two-high, Continuous-running, Reversing Mill"; also one by Dr. J. Puppé entitled "Rolling-Mill Practice in the United States, Part II." The autumn meeting of the Institute takes place at Brussels, from September 1st to 5th.

**INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).**—The annual meeting of the above Section was held on Tuesday last, when voting took place for the chairman, vice-chairman and Committee for the next session, which resulted as follows:—

Chairman.—Dr. E. W. Marchant.

Vice-chairmen.—Dr. E. Rosenberg, Mr. P. P. Wheelwright.

Committee.—Messrs. C. C. Aitchison, C. J. Beaver, K. Faye-Hansen, H. J. Hawkins, E. L. Hill, G. Layton, A. E. Mackenzie, E. M. Hollingsworth, B. Thomas, B. Welbourn, F. H. Whysall, Prof. Miles Walker.

Votes of thanks were accorded to the Vice-chairmen, Secretary, and Committee for their work during the session, also to the Council of the University for kindly granting the use of the Physical Laboratory for holding the meetings of the Section.

After the formal business of the meeting was concluded, Prof. E. Rutherford, of the Manchester University, gave a lecture on "The Electrical State of the Atmosphere." The lecture was illustrated by lantern slides and was listened to with great interest.

Prof. Marchant, in proposing a vote of thanks to the Chairman, stated that Mr. Day had suffered a relapse, and that it seemed certain he would not be able to resume his active duties for some time.

The report of the Committee states that the Section comprises 813 members, an increase of 23.

At a meeting of the HUDDERSFIELD ENGINEERING SOCIETY on Thursday last week, Mr. J. E. Schofield (Bradford) read a paper on "Electricity in Textile Mills."

**INSTITUTION OF ELECTRICAL ENGINEERS.—EXAMINATIONS.—**Regulations for the examination of candidates for Associate Membership have now been issued. Examination will be required on and after June 1st, 1913. In lieu of examination, candidates will be allowed to present a thesis, paper, or other contribution to electrical knowledge, but they will be liable to be examined orally thereon. The examinations will be held in London twice annually on two days (Friday and Saturday) about the end of April and end of October. Examinations may also be held at other centres, if the number of local entries warrants such arrangements.

Applications to enter for the examination must be made not later than March 1st for the April examination, and not later than September 1st for the October examination. The examination fee will be two guineas for the first entry, and one guinea for any subsequent entry. Fees will not be returned.

The subjects of examination will be as follows:—Part I: An English essay; or translation into English of passages in one of the following languages, to be selected by the candidate; French, German, Italian or Spanish. Applied mechanics; and either general elementary physics or chemistry. Part II: Two papers on one of the following subjects, to be selected by the candidate:—Electricity supply; electric lighting and power; electric traction; telegraphy; telephony; application of electricity to mines; electro-chemistry and electro-metallurgy; manufacture of electric machinery (including works management); design of electric machinery and apparatus. No detailed syllabus of the subjects of examination will be published.

Exemption from the whole of the examination is secured by any Engineering Degree of any University in the United Kingdom or in the British Dominions over seas; by Whitworth Scholarships, and by the Diplomas or Certificates in electrical engineering granted by the following bodies:—The City and Guilds Engineering College; City and Guilds of London Institute (Honours Grade); Faraday House; Finsbury Technical College (day course); King's College, London; University College, London; Heriot-Watt College, Edinburgh; Royal Technical College, Glasgow; Municipal School of Technology, Manchester; Armstrong College, Newcastle-upon-Tyne.

Candidates who have obtained a Science Degree from any University in the United Kingdom or the British Dominions will be exempted from Part I of the examination.

**I.E.E. PARIS VISIT.**—Particulars have now been issued regarding the Paris meeting, to be held on May 21st to 24th next, in conjunction with the Société Internationale des Electriciens. Members will leave London at 11 a.m. on Tuesday, May 20th, arriving in Paris at 6.45 p.m. On Wednesday morning the inaugural meeting will be held at the Conservatoire des Arts et Métiers, when there will be a discussion on the electrification of railways, or, alternatively, an inspection of the exhibits at the Conservatoire. In the afternoon there will be alternative visits to the generating stations of the Electricité de St. Denis and of the Triphasé at Asnières, and to the Sèvres porcelain factory. In the evening the Société Internationale will give a reception and banquet at the Palais d'Orsay.

On Thursday morning there will be a discussion on Long-distance Transmission of Electrical Energy by (a) Continuous Current, Thury System (paper by Mr. J. S. Highfield); (b) Three-phase Current (paper by M. Maurice Leblanc), and a number of alternative visits to places of interest. In the afternoon, M. Eiffel will hold a reception at the Eiffel Tower, and there will be an inspection of the wireless installation. An alternative visit has been arranged to the electrical installations of the Métropolitain, the Nord-Sud and the Compagnie des Omnibus.

On Friday morning, the discussion at the Conservatoire will be continued, and alternative visits will be arranged. In the afternoon there will be an excursion to Chantilly.

On Saturday morning, M. Claude will read a paper on "Lighting by Means of Vapour-Tube Lamps" (illustrated by experiments), and there will be a lecture by Commandant Ferric on "Wireless Telegraphy." The rest of the day will be spent in visits to Versailles, the Aerodrome at Buc, and the Ouest-Etat Railway, returning to Paris by special electric train.

The cost, exclusive of hotel expenses, will be five guineas each.

**ROYAL SOCIETY OF ARTS.**—On Wednesday evening, a paper on "Electric Supply in London" was read by Mr. Frank Bailey, M.Inst.C.E., M.I.E.E., joint managing director, City of London Electric Lighting Co., Ltd. The chair was taken by Mr. A. A. Campbell Swinton.

**INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS.**—A paper on "Telegraphic History," read before the above Institution last year by Mr. H. R. Kempe, has just been printed. It covers the period since the year 1837, in which Sir Charles Wheatstone, the pioneer of modern practical telegraphy, took out his first patent. As a former pupil of Wheatstone's, and the oldest representative of the Postal Telegraph Engineering Branch, the author was able to relate a series of extremely interesting reminiscences and to illustrate his subject with numerous examples of apparatus and systems, tracing the development of the science through its earlier stages.

**THE PRODUCTION MANAGERS' ASSOCIATION.**—The inaugural dinner of this Association was held on Tuesday night at the Holborn Restaurant. The subject of the evening was "Labour Problems," introduced by Mr. W. Gamble, managing director of Messrs. A. W. Penrose & Co., Ltd., who was in the chair.

**Electricity Supply Rifle League.**—A post match between teams representing Hackney Electric Rifle Club (Hackney Borough Council) and the Brompton and Kensington Rifle Club in the above League resulted in a win for the latter by 41 points. The scores were:—Hackney 520 (best score, Hilling 94); Brompton and Kensington 561 (Beale 97).

**Appointments Vacant.**—Meter superintendent (£104), meter tester and erector (30s.), jointer-wireman (32s.), arc lamp trimmer (27s.) and junior shift engineer (28s.), for the Guildford Electricity Supply Co. Ltd.; charge engineer, for the Ilford U.D.C. Electricity Works (£78); sub-station shift engineer, for the Bristol Corporation (30s.); switchboard attendant for the Portsmouth Corporation (25s.); station assistant and mains engineer for the City Electricity Works, Londonderry (£2); junior assistant electrical engineer for the Oldham Corporation (£80); tramways manager, for the Southport Corporation (£200). See our advertisement pages in this issue.

**Football.**—During the football season down to date, the Beeston Ericsson Club have played 26 matches, winning 19, while five were drawn and two lost. They scored 100 goals to 33. This is for all matches, League, Cup and friendly. The club won the Notts. Intermediate Cup, scoring 11 goals to 1, and they are runners-up in the Notts. Combination League. The League record is—Played 17, won 11, drawn 1, and lost 2, scoring 58 goals against 19.

**Association of Electrical Station Engineers.**—A meeting was held on Friday last at Grimsby. Mr. A. Nattall was in the chair, and the questions of increased salaries, six day week and certificates for qualified electrical engineers were discussed, after the reading of a letter from the hon. sec., replying to some queries on these points. The replies of the hon. secretary being considered satisfactory, the meeting passed a few resolutions with regard to future policy to be considered by the London Committee. It was suggested that the views of chief electrical engineers be ascertained with regard to the A.E.S.E. Mr. W. M. Fowler was elected delegate to attend the London conference, and it was decided to hold another meeting before the conference to instruct the delegate on matters which the Grimsby district wishes to lay before the conference.

**Late Legal.**—**BATTERSEA BOROUGH COUNCIL v. COUNTY OF LONDON ELECTRIC SUPPLY CO.**—In the Chancery Division on Wednesday, April 9th, Mr. Justice Joyce heard a motion in this action for the purpose of obtaining a decision as to whether the defendants were entitled to lay electric mains through the streets of the plaintiff Council.

Mr. Hughes, K.C., and Mr. Meyer appeared for the plaintiffs, and Sir Alfred Cripps, K.C., and Mr. Tyldesley Jones for the defendants.

Mr. Hughes said that the real question was whether these defendants had the right to break up streets within the plaintiffs' area, and by the notice of motion the plaintiffs asked for an injunction to restrain the defendants from laying their mains in the Wandsworth Road, Nine Elms Road, Battersea Park Road, York Road or any other street or place within the Metropolitan Borough of Battersea. What the defendants wanted to do was to lay their mains along the main roads right through Battersea. They had already got provisional orders in respect of some districts.

Sir Alfred Cripps said they had yet to get the consent of the Board of Trade, but the question was whether the defendants had the right to lay the mains at all. Mr. Hughes said that if the defendants had the right, then in respect of any difference as to route or the way the mains should be laid, it was to be settled by the Board of Trade, but the only question was whether the defendants had any right to do it at all. If they had the right, then the further question would arise as to how the right should be exercised. That was to be settled by agreement with the local authority, and failing an agreement by an arbitrator appointed by the Board of Trade. The defendants had no power to do what was complained of under their provisional orders or the Confirmation Act, and the question was whether they had under a subsequent Act which related to various other metropolitan companies as well. The defendants had certain defined areas of supply.

Mr. Justice Joyce asked whether they claimed a monopoly in these areas.

Mr. Hughes thought not, but that did not matter for the purposes of the Act.

Sir Alfred said that in some districts there were one or two companies supplying.

Mr. Hughes said the defendants had a large area of supply on the south of the Thames, which included Wandsworth, Camberwell and north of that to the Southwark boundary. Wandsworth was detached from the other two by a short intervening space of about a quarter of a mile. They had an area on the north side of the Thames with a generating station at Clerkenwell. They had also a generating station at Wandsworth, just where the Wandle flowed into the Thames. They had no right of supply in Battersea, but what they were proposing to do was to lay a main along the high road through the Borough of Battersea, and the plaintiffs, as the highway authority, objected to their breaking up the streets. It was not necessary for him to point out that the importance of the question was very great. This main street was honeycombed with pipes, and if additional powers were given to any power company to break up the street it would be a very serious matter indeed. There were already there electric light companies' wires, telegraph and telephone wires, sewers, water pipes and what not. If the defendants, therefore, had not the right they claimed, it was very important for the Council to prevent them from doing what they were proposing to do. The point in the case was that the Wandsworth area was already connected with Camberwell area at a point close to West Norwood and that they desired further to connect those two areas was the key to the whole matter. Recently, under powers given by the County of London Electric Supply Act, of 1908, the defendants had connected up their south

areas with the generating station at Clerkenwell by cables carried over London Bridge. The whole of their areas were, therefore, now connected together, and each area was connected with both of their generating stations. What they now wanted to do was to have this further connection, which they did not allege was necessary, but only alleged that it was convenient. It was most important to bear in mind that all their areas were already connected, and that both generating stations were connected with all the areas, as his case would be that they were only entitled to necessary connections. The Act of 1908 for the first time enabled the suppliers of electrical energy in the Metropolitan area to enter into agreements with one another, and in order to enable such agreements to be carried out, power was given to connect one area with another, and also to connect generating stations with outlying areas. In their own areas the method of carrying it out was to be governed by each company's own Acts, coupled with the general sections of the Electric Lighting Act of 1882, and special sections of the Act of 1893, and where the mains were laid outside the area the right was to be subject to the provisions of those Acts and agreement with the local authority interested. Failing agreement with the local authority, the matter was to be submitted to an arbitrator appointed by the Board of Trade. The route which defendants were proposing to follow was the most inconvenient possible, because it went along the main street of Battersea from one end to the other. That would, of course, be a matter for the Board of Trade, but what the defendants wanted was a second or alternative connection between their Wandsworth and Southwark areas, and that the plaintiffs contended they were not entitled to. If they were entitled to more than one, then counsel supposed they might have three, four, five, or, in fact, any number they chose.

His Lordship asked when the existing connection was made. Sir Alfred said about 16 years ago by agreement with the local authority, but it was outside Battersea.

Mr. Hughes submitted that the Act did not give them any power except to make a connection where they had not got it already.

Mr. Justice Joyce: You admit that but for this existing connection the company would be entitled to do what was proposed.

Mr. Hughes thought that probably they would. If they were not connected, he said, they would probably be entitled to make a connection. The section, however, seemed to be carefully limited. The words were "to make a connection," and he contended that that meant to make one and one only. If the plaintiffs' contention was right they might make any number of connections they liked. They said this proposed connection was convenient, but they did not say it was a necessity.

His Lordship: What order do the plaintiffs ask for?

Mr. Hughes said that they wanted a declaration that under the section the defendants were not entitled to make the proposed connection.

His Lordship said he could not do that on an interlocutory motion. He might grant an injunction restraining the defendants from making any connection, but could not grant an injunction to restrain the breaking up of the roads.

Mr. Hughes said an injunction to restrain the making of the connection would satisfy them, and, of course, so far as they were concerned, it would be confined to Battersea.

Sir Alfred said that, assuming the Court was against him, which he did not anticipate, he would offer every assistance for getting the declaration or injunction in the proper form.

Mr. Hughes said that if the plaintiffs were right, they could break up every street in Battersea.

Mr. Justice Joyce said no doubt the Board of Trade would have something to say to that. Without calling upon counsel for the defendants, his Lordship dismissed the motion. He was not impressed, he said, with the arguments of the plaintiff Council, and he did not see why the company should not be entitled to connect now two or more of their areas merely because they had some 16 years ago managed to get a connection which was more or less convenient. It might, or might not, be sufficient, and it might be either in good or bad repair. There were no words in the section which said the company was not to make a connection in places where they had one before the passing of the Act, and he could not grant an interim injunction. The motion must, therefore, be refused, and the costs of the motion would be costs in the action.

Sir Alfred hoped that, if the Council had any idea of proceeding to appeal, they would press it on.

Mr. Hughes thought his clients would probably do so.

His Lordship said the sooner the question was settled the better.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The staff of the Dundee Corporation electricity department gave a dinner at the Queen's Hotel to Mr. H. RICHARDSON, in honour of his tenth anniversary as engineer and manager. Bailie J. M. Nairn, the present chairman, and Bailie W. Don, ex-chairman of the Electricity Committee,

were present as guests, and both the bailies congratulated Mr. Richardson on his able management, also upon the remarkable success of the department within the last decade, and commented on the close friendship that existed between the manager and the staff. In reply, Mr. Richardson spoke of the encouragement he had received from both gentlemen, and also thanked the staff for their loyalty to the department, especially the older members who were with him in the early days. After dinner a most enjoyable programme was sustained.

The Accrington Electricity Committee has advanced the salary of Mr. H. PILLING, tramways manager, from £200 to £225 per annum, with a further increase of £25 next year; and that of Mr. A. W. CLEGG, electrical engineer's assistant, from £200 to £225 per annum, with a further increase of £25 next year. Mr. H. GRAY, electrical engineer, is to be paid £50 for overtime and extra services in connection with the recent extensions at the electricity works.

Mr. C. S. TAYLOR has resigned the post of deputy engineer and manager to the Hankow Light and Power Co., and has accepted an appointment as a sub-station and power engineer to the Shanghai Municipal Council's electricity department.

Mr. H. W. REEKS (formerly of London) has resigned his position as switchboard attendant to the Mersey Power Co., Ltd., at Runcorn, having been appointed to a similar position under the London County Council.

The Committee of the Worthing T.C. has increased the salary of Mr. C. BROADHURST, assistant electrical engineer, from £160 to £170 per annum.

The Carlisle Electricity Committee on the 4th inst. selected Mr. FREDERICK WALTER PURSE, of Watford, for appointment as electrical engineer, at Carlisle, at a salary of £500 per annum. There were 148 applicants.

**Tramway Officials.**—The Birkenhead T.C., on April 2nd, confirmed the recommendation of the Tramways Committee, to increase the salary of Mr. WYLD, manager and electrical engineer, from £600 to £650 per annum. An amendment that the increase be not granted was rejected by 21 votes to 9.

**General.**—Mr. THOS. B. L. NEWSTEAD has joined the engineering staff of Messrs. Marconi's Wireless Telegraph Co., Ltd. as assistant in the estimating department at Marconi House, Strand, W.C. He was previously for over three years with the Westinghouse Cooper-Hewitt Co., Ltd., as engineer-in-charge of their factory at 151-152, Great Saffron Hill, E.C., and upon leaving them recently was presented with a silver tea-kettle and cut-glass claret jug from the office staff and employés, together with an expression of cordial wishes for his future success.

Mr. WM. BAXTER has resigned his appointment with Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, and opened an office at 90, Pilgrim Street, Newcastle-on-Tyne, as an agent. He will represent Messrs. Daniel Adamson & Co., Dukinfield, for turbines, boilers, pumps, &c.; Messrs. Eckstein, Heap & Co., Ltd., Manchester, for switchgear; Messrs. Newton Bros., Derby, for motors, dynamos, gas engines, &c.; also the St. Helens Cable and Rubber Co., Warrington, for cab-tire sheathed and other cables. Before leaving Messrs. A. Reyrolle & Co.'s works he was presented by Mr. Reyrolle with a handsome filing cabinet, which was subscribed for by the members of the office and works staff.

The marriage took place at the Church of St. Peter-Advincula, Coggeshall, Essex, on April 3rd, of Mr. C. SANDYS BALL, A.M.I.E.E., only son of the late Mr. Chas. Ball, of St. Leonards-on-Sea, Hastings, and who is a director of Messrs. Brown & Green, Ltd., electrical and general engineers, of Windsor Street, Luton, and Miss Mary Bright, second daughter of the late Mr. Wm. Bright and of Mrs. Bright, of Cromwell House, Coggeshall.

The telephone staff at Chesterfield have presented a tea service to Mr. A. B. IMPEY, assistant manager for the district, on his marriage.

Mr. PHILIPP LAUBACH has resigned his position as manager of the switchgear department of the Electrical Engineering and Equipment Co., Ltd., in order to join the firm of Mr. J. A. Law, chartered patent agent, 331, Birkbeck Bank Chambers, Holborn, W.C.

Mr. WM. BENJAMIN PINCHING, electrical engineer, was on Monday elected on to the Southgate U.D.C. for the Winchmore Hill Ward.

**Obituary.**—Mr. JAMES TANGYE.—We regret to record the death of Mr. James Tangye, one of the founders of the well-known firm of Tangyes, Ltd. He was born in 1825, and was the eldest of the Tangye family of nine. He died on 4th inst., at Illogan, near Redruth, Cornwall.

Prof. ADOLF SLABY.—The *Times* publishes from its Berlin correspondent, a report stating that Prof. Adolf Slaby, of the Slaby-Arco wireless telegraph system, died at Charlottenburg on Sunday last at the age of 63. He received a second paralytic stroke a fortnight previously, and never recovered consciousness. Our contemporary states that from 1884 to 1902 the deceased professor was director of the electrical laboratory at the Technische Hochschule, and there began the experiments which led to the perfection of the "Telefunken" system. He attended Mr. Marconi's experiments in England in the year 1897. The Emperor William gave him frequent encouragement and support. In the Royal gardens, on the banks of the Havel, he worked the whole of the summer of 1897, sometimes 10 hours a day attempting to establish wireless communication between the Pfauen 1-land, in Wannsee and the Pfingstberg. In October of that year he established wireless connection between two captive balloons at a distance of 21 km.

## CITY NOTES.

**Brentford Electric Supply Co., Ltd.**

The annual meeting of this company was held at the office of the company, 16, Stratford Place, W., on Tuesday last, Mr. F. Leverton Harris presiding. The following report of the proceedings has been received:—

The Secretary, Mr. E. Cunliffe Owen, having read the notice convening the meeting, the Chairman stated that of the authorised capital of £10,000, 3,757 shares had been issued. During the year £3,656 had been expended on capital account in laying a system of distributing mains throughout the area of supply and in providing house services and meters. With regard to the revenue account £507 had been paid to the Metropolitan Electric Supply Co., Ltd., under the bulk supply agreement for purchase of current; repairs had cost £19, and management expenses and general establishment and other charges £181. The sale of current had brought in £768 and other receipts £51, the financial result being a balance carried to net revenue account of £112, which the directors recommend should be carried forward. He thought the shareholders would consider this a satisfactory result for the first year's working. On December 31st last the number of consumers was 57, their requirements amounting to 168.5 kw., 96.2 kw. being for power. The maximum demand during the first half of the year was 51 kw., and during the second half this had risen to 85 kw. He referred to the prospects of the present year as being very satisfactory, the number of new consumers showing a steady increase. The accounts were adopted.

**Lancashire Dynamo and Motor Co., Ltd.**

The directors in their report for the year ended December 31st, 1912, state that, after providing for debenture and bank interest and charging full depreciation, the accounts show a profit for the year of £15,150. Adding the sum of £1,990 carried from the previous year, there is a disposable balance of £17,140, which it is proposed to appropriate as follows:—Dividend on preference shares for the year at the rate of 5½ per cent. per annum, less tax, £2,434; interim dividend on the ordinary shares at the rate of 5 per cent. per annum, free of tax, paid October 1st, 1912, £2,125; final dividend on the ordinary shares at the rate of 10 per cent. per annum, making 7½ per cent. for the year, free of tax, £4,250; directors' fees, £700; to reserve account, £6,000; carry forward, £1,631. In view of the coal strike and disturbed labour conditions, which have restricted the output of the year, the results are considered satisfactory. The orders on hand are at better prices than last year, and if there are no labour disturbances the result for 1913 should be quite equal to, if not better than, the past year.

The Manchester *Daily Dispatch* publishes the following figures showing three years' comparisons as follows, after deduction of debenture and loan interest and depreciation:—

	1910.	1911.	1912.
Profits .. .. .	£6,268	£10,009	£15,150
Preference dividend .. .. .	2,434	2,434	2,434
Directors' fees .. .. .	700	700	700
Opening foreign agencies .. .. .	2,074	6,875	12,016
Ordinary dividend .. .. .	103	5,100	6,875
Reserve .. .. .	103	1,775	5,641
Brought forward .. .. .	103	1,775	—
Carried forward .. .. .	112	215	1,990
	215	1,990	1,631

Owing to exceptional circumstances, including the development of new types and opening of foreign agencies, the company for the year 1910 paid no dividend on its ordinary shares, for the first time since its formation, 14 years ago.

It is stated that the company is issuing the balance of the unissued ordinary capital, amounting to £15,000, which will bring the total ordinary capital up to £100,000.

We congratulate the company upon the excellent improvement shown in the above figures for 1912.

**Stock Exchange Notices.**—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Birmingham District Power and Traction Co., Ltd.—£51,463 additional 4½ per cent. first debenture stock.

Consolidated Cities Light, Power and Traction Co.—\$4,000,000 first lien 5 per cent. gold bonds of \$50 each (Nos. 1 to 8,000), in lien of the script.

Consolidated Diesel Engine Manufacturers, Ltd.—87,470 shares of £1 each, fully paid (Nos. 527,077 to 594,546).

Pacific Power and Light Co.—\$5,904,000 5 per cent. first and refunding mortgage 20-year gold bonds, international series (Nos. 1 to 5,904), for \$1,000 each.

**Canadian General Electric Co.**—The report states that the year to December 31st was one of marked expansion. The accounts, according to the *Financier*, show a profit of \$2,011,700, from which have been written off for depreciation \$456,400, and for interest on borrowed capital \$158,900, leaving \$1,396,500. Out of this the usual 7 per cent. dividend has been paid on the preferred capital, and 7 per cent. on the common shares, together with a bonus of 1 per cent., while \$700,000 has been added to the reserve fund, giving a total of \$2,360,500 at credit of this account.

**North of Scotland Electric Light and Power Co., Ltd.**

The directors' report for 1912 states that satisfactory progress has been made during the year. The gross profit, including £1,653 brought forward, is £8,018, and after meeting interest paid on debentures and loans, amounting to £2,799, and writing off £28, part cost of street lighting alterations, and 10s. loss on meters transferred, there remains a net profit of £5,221. The directors recommend a dividend at the rate of 2 per cent. for the year, which will absorb £1,000, that £2,000 be placed to renewal reserve account, and that the balance, £2,221, be carried forward.

	Montrose.	Brechin.	Inverness.
Units generated .. .. .	287,478	202,104	628,504
Units sold—Public lamps .. .. .	60,563	82,878	—
Private consumers by meter .. .. .	176,484	116,931	465,270
Total sold .. .. .	237,047	199,713	465,270
Used on works .. .. .	49,263	40,659	100,130
Total accounted for .. .. .	278,660	190,261	645,590
Not accounted for .. .. .	18,813	11,840	43,914
Total maximum supply demanded .. .. .	178 kw.	110 kw.	827 kw.
Lamps connected, January 1st .. .. .	73,882	18,950	39,000
Lamps connected, December 31st .. .. .	21,765	19,907	32,810

**Prospectus.**—*International Light and Power Co., Ltd.*

—This week there has been offered for sale \$1,000,000 6 per cent. cumulative preference stock, in shares of \$100 (£20 10s. 8d.), with a bonus of \$60 in common stock, at \$18 per share. The list was to close yesterday. The company has acquired the stock and debentures of companies owning electric light and gas plants and distribution systems in Caracas, Venezuela, and Parana, in the Province of Entre Rios, Argentina, together with £30,000 for working capital. The Venezuela Electric Light Co. is registered in Canada, and its \$900,000 ordinary capital and \$900,000 in 5 per cent. debentures are all held by the International Co. It serves Caracas, which has a population of 80,000, with electric supply, and purchases power from a hydraulic company, so that further generating stations beyond those now possessed are not at present needed. The Parana Co.'s \$500,000 shares and \$295,000 debentures are held by the International Co. Parana has a population of 42,000, and the company has a 640-kw. generating station operated by producer gas, also a gas supply plant. The receipts and expenses of both undertakings are quoted in the prospectus, and a report is also given therein by Messrs. J. G. White & Co. Ltd., who will act as managers of the properties. Mr. W. C. Burton and Mr. A. N. Connett, directors of that company, are on the board of the International. The International Co. is negotiating for further similar properties, and has entered into a conditional contract for the purchase of the shares and debentures of one other electric lighting undertaking. The London offices are at 9, Cloak Lane, E.C.

**Milford-on-Sea Electric Light Co., Ltd.**—Dr. V. D. Harris (chairman) presided on March 29th over the annual meeting of this company. The directors reported that the progress during the year had been satisfactory, and the amount of revenue showed an increase from £808 to £906. After charging all working expenses, writing £25 off preliminary expenses, and placing £149 aside for depreciation of plant, there remained a net profit of £353, which had been carried to net revenue account. This had been charged with the interest on debentures and depreciation on investment, and with the balance brought forward from last year, there remained £290, out of which the directors recommended a dividend of 5 per cent. for the year on the ordinary shares, the balance being carried forward. The report was adopted.

**Reading Electric Supply Co., Ltd.**—The directors report a net revenue for 1912, after setting aside £3,500 for depreciation, and including £120 brought forward, of £7,363. They recommend a dividend of 3½ per cent. £517 is to be carried forward.

**Sao Paulo Tramway, Light and Power Co.**—The directors have declared a dividend of 2½ per cent.

**Rio de Janeiro Tramway, Light and Power Co., Ltd.**—The directors have declared a dividend of 1½ per cent.

**United River Plate Telephone Co., Ltd.**—The directors have declared a dividend on the ordinary share capital for the nine months ended December 31st at the rate of 8 per cent. per annum, free of income-tax; £5,804 is carried forward.

**Anglo-Argentine Tramways Co., Ltd.**—The directors have declared a final dividend of 4½ per cent. on the £2,500,000 ordinary share capital for the half-year to December 31st, less income-tax, making 8½ per cent. for the year. £135,000 is placed to depreciation, renewals funds, &c., and £9,253 is carried forward. The dividend for 1911 was only 7½ per cent.

**Electrolytic Alkali Co., Ltd.**—According to yesterday's papers, a notice was issued by the Electrolytic Alkali Co., Middlewich, summoning an extraordinary general meeting to pass a resolution voluntarily winding up the company's business. The year's accounts, which accompanied the notice, show a debit balance of £11,894. The directors state that the negotiations for power schemes, which would have placed the company in a sound position, have failed, and they feel that until modern power plant has been installed they can hold out no prospect of the company earning a profit. The company's issued capital is £301,869.

**Direct United States Cables Co., Ltd.**—Final dividend, 2s. per share, less income-tax, payable 30th inst., making with the three interim dividends already paid a total distribution of 4 per cent. for the year ended March, 1913. The transfer books will be closed from April 15th to 29th.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, April 9th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	6/-	..
" Nitric .. .. ..	22/-	..
" Oxalic .. .. .. per lb.	23d.	..
" Sulphuric .. .. .. per cwt.	6/6	..
a Ammoniac Sal .. .. ..	42/-	..
a Ammonia, Muriate (large crystal) per ton	£29 10	..
a Bleaching powder .. .. ..	£6 5	..
a Bisulphide of Carbon .. .. ..	£18	..
a Borax .. .. ..	£17 10	..
a Copper Sulphate .. .. ..	£23 15	..
a Lead, Nitrate .. .. ..	£29 10	..
" White Sugar .. .. ..	£27 10	..
a Peroxide .. .. ..	£32	..
c Methylated Spirit .. .. .. per gal.	9/6	..
a Potassium, Bichromate, in casks per lb.	93d.	..
a Potash, Caustic (88/90 %) .. .. per ton	£22 10	..
" Chlorate .. .. .. per lb.	84d.	..
" Perchlorate .. .. ..	44s.	..
a Potassium, Cyanide (98/100 %) .. (for mining purposes only)	74s.	..
a Shellac .. .. .. per cwt.	80/-	5/- dec.
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. ..	£6 10	..
" Recovered .. .. ..	£6 10	..
" Lump .. .. ..	£5	..
a Soda, Caustic (white 70/72 %) .. ..	£10 5	..
" Chlorate .. .. ..	83d.	..
" Crystals .. .. .. per ton	£8 5	..
a Sodium Bichromate, casks .. .. per lb.	8d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. .. per ton	£96	..
b " Wire, in ton lots (1 to 14 S.W.G.) .. ..	£112	..
b " Sheet, in ton lots .. ..	£120	..
b Babbit's metal ingots .. .. ..	£88 to £145	..
c Brass (rolled metal 2" to 12" basis) per lb.	10 1/2d.	1/4 inc.
c " Tube (brazed) .. .. ..	9d.	1/4 inc.
c " (solid drawn) .. .. ..	8 1/2d.	1/4 inc.
c " Wire, basis .. .. ..	11 1/2d.	1/4 inc.
c Copper Tubes (brazed) .. .. ..	10 1/2d.	1/4 inc.
c " (solid drawn) .. .. ..	£24	1/4 inc.
c " Bars (best selected) .. .. .. per ton	£24	1/4 inc.
e " Sheet .. .. ..	£24	1/4 inc.
e " Rod .. .. ..	£24	1/4 inc.
d " (Electrolytic) Bars .. .. ..	£69 15	..
d " " Sheets .. .. ..	£85 10	..
d " " Rods .. .. ..	£75	..
d " " H.C. Wire .. .. .. per lb.	93d.	..
f Ebonyite Rod .. .. ..	4/6	9d. dec.
f " Sheet .. .. ..	4/-	9d. dec.
n German Silver Wire .. .. ..	1/10	..
h Gutta-percha, fine .. .. ..	7/- to 8/-	..
h India-rubber, Para fine .. .. ..	3/5	5 1/2d. dec.
i Iron Pig (Cleveland warrants) .. .. per ton	65/6	1d. inc.
l " Wire, galv. No. 8, P.O. qual. .. ..	£14	..
g Lead, English Pig .. .. ..	£17 15	£1. inc.
m Manganese Wire No. 28 .. .. .. per lb.	6/6	..
g Mercury .. .. ..	£7 10	..
c Mica (in original cases) small .. .. per lb.	6s. to 8s.	..
e " " medium .. .. ..	8/6 to 9/-	..
e " " large .. .. ..	7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. .. ..	3/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings .. ..	1/2 to 1/3 1/2	..
p " " rolled bars & rods .. .. ..	1/2	..
p " " rolled strip & sheet .. .. ..	1/2 1/2	..
o Platinum .. .. .. per oz.	185/-	..
d Sillicium Bronze Wire .. .. .. per lb.	11d.	..
r Steel, Magnet, in bars .. .. .. per ton	£56	..
g Tin, Block (English) .. .. ..	£232 to £234	£16 inc.
g Wire, Nos. 1 to 18 .. .. .. per lb.	9/7	..
p White Anti-Rust Metals .. .. .. per ton	£46 to £228	..
z Zinc, Sh't (Vielles Montagne bnd.) .. ..	£28 10	..

Quotations supplied by—

- a G. Boor & Co.
- b The British Aluminium Co., Ltd.
- c Thos. Bolton & Sons, Ltd.
- d Frederick Smith & Co.
- e F. Wiggins & Sons.
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- h Edward Till & Co.
- i Bolling & Lowe.
- k Morris Ashby, Ltd.
- l Richard Johnson & Nephew, Ltd.
- m W. T. Glover & Co., Ltd.
- n P. Ormliston & Sons.
- o Johnson, Matthey & Co., Ltd.
- p W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

THE Balkans business seems to get more oppressive instead of less. We seem to have been standing on the eve of peace over and over again, but something has intervened at the last minute to intercept the conclusion of the war, and markets are in a sensitive and nervous condition, not knowing from day to day what will be the next turns of events. On Monday, matters seemed to be drifting once more in the direction of a general European *impasse*, but on Tuesday a partial recovery followed rumours of the Servians having abandoned their intention of taking Scotari.

Every now and then comes one of these little flashes of bright-

ness, to be dimmed, as a rule, within all too short a time. Fresh borrowing is no more than checked, for new issues of substantial amount appear with unpleasant frequency. Fortunately, the acute stringency in the money market stands somewhat relaxed, but the expectations that the Bank of England would this week reduce its rate are at the moment considered nebulous, in view of the unsettledness of the outlook abroad.

Prices had to give way everywhere in the Stock Exchange where a bull account of any sort existed, and the Home Railway market has already suffered severely. The Underground proved incapable of resisting the tendency, and Metropolitan shed 1 1/2 after their substantial rise of last week, while the Surplus Lands stock fell 1, and the two Preference issues both lost a point. Districts went back 1 1/2. Underground Electric shares fell 1/2 and the Income Bonds 1/2. City and South London 1891 Preference went back to 99 1/2. The spurt in East Londons, which carried up the price of the stock to 10 1/2, became exhausted under the pressure of the bulls to realise their profits, and the price has fallen back to 9 1/2, notwithstanding the electrification. North Londons at 93 1/2 are 2 down. Traction issues remain fairly steady, but British Electric 7 per cent. Preferred is again 1/2 lower. Yorkshire 6 per cent. Preference shares at 3 1/2 show 1/2 rise.

In English Electricity Supply shares, the only rises are one of 1/2 in Edmundsons' 6 per cent. Non-Cumulative Preference, and another of 1/2 in Bournemouth and Poole Second Preference. London Preference are the turn easier, but Westminster and Bromptons have retained their advances. The prior charge issues are firm, a point rise in Midland Electric 4 1/2 per cent. Debenture stock being the only quotable change.

After the rise in Marconi's last week there has been some reaction, both Ordinary and Preference going back. Canadians eased off to 16s., Americans to 1 1/2, and Spanish to 18s. 9d. The dealings of the three Cabinet Ministers remain the subject of the liveliest interest in the Stock Exchange, where members, while disclaiming political bias, have only one opinion as to the discretion shown by responsible members of the Government in investing their money at 100 per cent. premium in shares of a company like the American Marconi.

National Telephone Deferred has fallen to 18 1/2, some of the previous holders evidently getting timid with regard to the probable payment that will be made in respect of this stock. Great Northern Telegraphs have again mounted, putting on another 10s. on top of the rise of 50s. which took place in them last week—due, of course, to the increase in the dividend. The hardening process in Eastern Telegraph Ordinary is once more noticeable, and Globes have risen 1/2. New York Telephone bonds continue to be bought by the investor, and the quotations have again reached par. Improvements have been scored by Monte Video Telephones and Oriental Telephones. Mackay Common and Preference picked up in response to New York advices, the American Railroad market being so firm as to lead Industrials in its train. American Telephone stock and bonds are both better.

The Latin-Canadian market is comparatively hard, considering the dullness ruling elsewhere. Mexico Trams and Mexican Light and Power Common shares have gone back, which is not very surprising, seeing that they both had big improvements a week ago. The bonds of both companies, however, continue to advance, and those of the Mexico Tramways Company are in demand from the Provinces as well as London. British Columbia Electric Deferred stock rose 2 on the day that the lists closed for sending in applications for the new shares offered by the Company. These latter had been quoted at 1s. 6d.-2s. 6d. premium for cash, and an incessant stream of selling took place during the past fortnight by holders who elected to accept their profit rather than to take up the shares and wait for something more substantial. That the new shares will improve seems virtually assured, unless anything very unexpected should happen. British Columbia is going ahead rapidly, but, as is the case with many other parts of Canada, the stringency of the money markets of the world has made itself felt even as far West as this.

Shawinigan Water lost a point, though the 4 1/2 per cent. Debenture stock is 1/2 higher. Brazil Tractions, after touching 102, went back to 100, the price being swayed considerably by the tenour of the foreign political news. Canadian General Electric Common strengthened to 117. Outside this group the market is quietly dull. Buenos Ayres Trams lost 1/2, and Bombay Electric Preference went back to 11 1/2, a fall of 1/2. No changes have occurred in the Anglo-Argentine quintet.

British Westinghouse Preference shares and Debenture stock are both better, and British Aluminium 5 per cent. Prior Lien Debentures put on another point, attention being directed to them by reason of the soundness of the security offered by the stock. Henleys are a little lower. Armaments shares, after being strong, went back again. Armstrongs rose smartly upon the decision of the board to give proprietors one new share for every four old at present held, but part of the rise was lost later, when it was announced that the board intended to apply for powers to issue a couple of million pounds new capital in 5 per cent. Preference shares. Vickers, too, have been a little erratic leaning somewhat to the dull side. Babcocks at 3 1/2 have failed to recover from their small shrinkage of a week ago. The rubber share market enjoyed a brief spell of strength upon the conclusion of the fortnightly auctions, but this evaporated, and prices have once more fallen back into weakness, with buyers of the shares distinctly scarce. There is now a fairly big bear account in many of the leading rubber issues, so that if the price of the commodity were to take an upward turn, there is a ready-made element of strength. Still, at the moment, there does not seem much chance of a sustained revival occurring in raw rubber.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations April 8th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations April 8th.	Rise + or Fall	Present Yield p.c.	
Bournemouth & Poole, Ord.	10	1911. 6 1/2	1 1/2 - 1 1/2 x d	..	5 18 5	Kensington & Knightsbridge, Ord.	6	9 81	7 1/2 - 8	..	5 12 6	
Do. 4 1/2 % Prof.	10	4 1/2	8 1/2 - 8 1/2	..	4 14 9	Do. 4 % Deb.	Stock	4	90 - 90	..	4 6 0	
Do. 2nd 6 % Prof.	10	6	10 - 10 1/2	..	5 11 3	Do. 4 1/2 % Deb.	Stock	4 1/2	75 - 80	..	5 12 6	
Do. 4 1/2 % Deb. Stock	Stock	4 1/2	96 - 98	..	4 11 10	London Electric, Ord.	8	2 1/2	1 1/2 - 1 1/2	..	4 0 0	
Brompton & Kensington, Ord.	6	10	8 1/2 - 8 1/2 x d	..	5 6 8	Do. 6 % Prof.	6	8	6 - 6 1/2	..	4 6 1	
Do. 7 % Cum. Pref.	6	7	8 1/2 - 8 1/2 x d	..	3 18 10	Do. 4 % First Mort. Deb.	Stock	4	91 - 94	..	4 5 1	
Central Electric Supply, 4 % Guar. Deb.	100	4	95 - 98	..	4 1 8	Metropolitan	6	4	41 - 42 x d	..	5 3 2	
Charing Cross, West End & City	5	5	61 - 41	..	5 2 7	Do. 4 1/2 % Cum. Pref.	6	4 1/2	4 1/2 - 4 1/2	..	4 17 4	
Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2 - 4 1/2	..	4 14 9	Do. 4 1/2 % First Mort. Deb.	Stock	4 1/2	97 - 100	..	4 10 0	
Do. "City Undertaking" 4 1/2 % Cum. Pref.	5	4 1/2	3 1/2 - 4 1/2	..	5 2 10	Do. 3 1/2 % Mort. Deb.	Stock	3 1/2	81 - 86	..	4 1 5	
Do. 4 % Deb.	100	4	91 1/2 - 92 1/2	..	4 5 7	Midland Electric Corporation	100	4 1/2	99 - 102	+1	4 8 8	
Obolens, Ord.	6	5	41 - 6	..	5 0 0	4 1/2 % First Mort. Deb.	6	5	6 - 6	..	5 5 8	
Do. 4 1/2 % Deb.	Stock	4 1/2	96 - 99	..	4 10 11	Newcastle-on-Tyne 5 % Prof.	100	5	99 1/2 - 102 1/2	..	4 17 7	
City of London, Ord.	10	8	16 - 17 1/2	..	5 6 8	North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	6	92 - 104	..	6 11 7
Do. 8 % Cum. Pref.	10	6	12 - 13	..	4 10 7	Notting Hill, 6 % Non-Cum. Prof.	10	5	6	92 - 102	..	6 11 7
Do. 5 % Deb.	Stock	5	116 - 120	..	4 3 4	Oxford	6	7 1/2	61 - 64	..	5 13 9	
Do. 4 1/2 % Second Deb.	100	4 1/2	100 - 102	..	4 8 3	St. James' and Pall Mall, Ord.	6	10	101 - 84	..	5 11 1	
County of London, Ord.	10	6	10 1/2 - 11 1/2	..	5 6 8	Do. 7 % Prof. Non-Cum.	6	7	7	..	4 16 7	
Do. 8 % Prof.	10	6	11 1/2 - 12	..	4 4 11	Do. 5 1/2 % Deb.	100	5 1/2	84 - 87	..	4 10 6	
Do. 4 1/2 % Deb.	Stock	4 1/2	104 - 106	..	4 8 3	Smithfield Markets, Ord.	6	2	2 - 2	..	7 7 8	
Do. 4 1/2 % Second Deb.	Stock	4 1/2	99 - 102	..	4 8 3	South London, Ord.	4	5	6	2 1/2 - 2 1/2 x d	..	5 0 0
Edmundson's, Ord.	£3	Nil	..	..	Nil	Do. 5 % First Mort. Deb.	100	6	5	97 - 100	..	5 17 11
Do. 6 % Cum. Pref.	5	Nil	..	..	..	Do. 4 1/2 % First Deb. Stock	100	4 1/2	94 - 97 x d	..	4 11 3	
Do. 6 % Non-Cum. Pref.	5	..	..	..	..	Urban, Ord.	£3	Nil	..	..	..	
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	81 - 84	+ 1/2	5 7 2	Do. 5 % Cum. Pref.	6	2	1	..	..	
Folkstone	6	5	6	..	6 0 0	Do. 4 1/2 % First Mort. Deb.	100	4 1/2	89 - 86 x d	..	6 2 3	
Do. 5 % Cum. Pref.	6	5	6	..	5 0 0	Westminster, Ord.	6	10	10	..	5 11 1	
Do. 4 1/2 % First Deb.	100	4 1/2	90 - 92	..	4 17 10	Do. 4 1/2 % Cum. Pref.	6	4 1/2	4 1/2 - 5 1/2	..	4 9 9	
Hove	6	9	8 1/2	..	5 12 6							

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Prof.	5	8	6	5 - 5 1/2	..	6 14 3	Monterey Rly. Light & Power,	100	5	6	83 1/2 - 86 1/2	+ 1/2	6 15 7
Calcutta, Ord.	5	8 1/2	7 1/2	6 1/2 - 7 1/2	..	5 19 4	5 % 1st Mort. Deb.	100	8	9 1/2	225 - 230	..	8 13 3
Do. 5 % Prof.	5	5	5	4 1/2 - 5 1/2	..	4 17 7	Montreal, Lt., H. and Power	\$100	8	9 1/2	225 - 230	..	8 13 3
Calgary Power, 1st Mort. Bds.	100	5	5	93 - 95	..	6 5 8	Northern, Lt., Power and Coal,	\$500	6	5a	10 - 20	..	..
Canadian Gen. El. Com.	\$100	7	7	116 - 114 x d	+2	5 17 8	5 % 1st Mort. Bonds	Stock	10	..	217 - 227	..	4 8 0
Do. 7 % Prof.	\$100	3	3	119 - 123 x d	..	6 13 10	River Plate, Ord.	6	5	..	105 - 110	..	5 9 1
Do. 6 % Prof.	100	5	5	113 - 123 x d	..	6 14 3	Do. 5 % Deb. Stock	6	5	100 - 102	..	4 18 0	
Do. 4 1/2 % Deb.	100	6	6	93 - 95	..	6 6 4	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	4 1/2	4 1/2	98 - 100 x d	..	4 10 0
Elec. Lt. and P. of Cocobamba, 5 % Bonds	100	6	6	90 - 98	..	5 7 6	Shawinigan Water, Capital	\$100	5	6	159 - 144	-1	3 9 5
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	6	6	92 1/2 - 94 1/2	- 1/2	5 5 10	Do. 5 % Cum. 1st Mort. Bonds	\$500	5	6	107 - 103	..	4 11 9
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	6	5	92 1/2 - 94 1/2	- 1/2	5 5 10	Do. 4 1/2 % Per. Deb.	Stock	4 1/2	4 1/2	101 1/2 - 103 1/2	+ 1/2	4 7 0
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	..	..	Nil	Toronto Power, 4 1/2 % Deb.	Do.	4 1/2	4 1/2	97 1/2 - 99 1/2	..	4 10 6
Do. 6 % Prof.	1	6	6	..	..	9 15 2	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	6	5	91 - 94	..	6 6 5
Kamistiquia Power, 6 % G. Bs.	\$500	5	5	101 - 103	- 1/2	4 17 1	Victoria Falls Power, (Ord. & Lt.)	1	11 1/2	17 1/2	..	..	
Madras, Ord.	5	Nil	..	..	..	..	West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 - 108	..	6 11 1
Melbourne, 6 % 1st Mort. Deb.	100	5	5	101 - 104	..	4 16 2							
Mexican El. Lt., 6 % 1st M. Bds.	..	5	5	82 - 85	+1	5 17 8							
Mexican Lt. & Power, Common	\$100	4	4 1/2	78 - 81	-1	4 18 9							
Do. 7 % Cum. Pref.	\$100	7	7	104 - 107	+1	6 10 10							
Do. 6 % 1st Mort. Gold Bds.	..	5	5	92 1/2 - 94 1/2	+ 1/2	5 6 10							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4 1/2	7 - 7 1/2	..	6 0 0	Monte Video Telephone, Ord.	1	6	6 1/2	1 - 1 1/2	+ 1/2	5 6 8
Do. 5 % Deb. Red.	Stock	5	5	97 - 99	..	5 1 0	Do. 5 % Prof.	1	6	6	..	..	5 14 8
American Telep. & Teleg., Cap.	\$100	4	4	91 - 136 x d	+1	4 5 0	New York Telep., 4 1/2 % Gen. Bnds.	100	4	4 1/2	99 1/2 - 103 1/2	+ 1/2	4 9 9
Do. Collat. Trust	..	4	4	91 - 93	..	4 6 0	Do. 6 % Cum. Pref.	1	8	6 1/2	1 1/2 - 2	+ 3/8	4 0 0
Anglo-American Telegraph	Stock	8	8	61 - 68	..	4 8 3	Do. 4 % Red. Deb.	Stock	4	4	88 - 90	..	4 8 11
Do. 6 % Prof.	Do.	5	5	111 1/2 - 112 1/2	..	5 6 8	Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97 1/2 - 99 1/2	..	4 0 5
Do. Def.	Do.	80/-	80/-	24 1/2 - 24 1/2	..	6 1 10	Renter's	10	10	10 1/2	11 1/2 - 11 1/2	..	8 10 2
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	99 1/2 - 101 1/2	..	4 18 6	Do. New Shares	10	..	..	127 1/2 - 131 1/2	..	4 12 4
Chili Telephone	5	7	7	7 1/2 - 7 1/2	..	5 1 1	Submarine Cables Trust	Cert.	6	8	104 - 180	..	4 12 4
Commercial Cable, 8 1/2 % Deb.	Stock	4	4	80 - 82 x d	..	4 17 7	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	Stock	4 1/2	4 1/2	96 - 98	..	4 11 10
Cuba Telegraph	10	6	6 1/2	8 - 9	..	6 9 9	United River Plate Telephone	5	8	..	7 1/2 - 7 1/2	..	5 4 11
Do. 10 % Prof.	10	10	10	16 - 17	..	5 17 8	Do. 5 % Cum. Pref.	5	5	5	6 1/2 - 6 1/2	..	4 9 0
Direct Spanish Telegraph, Ord.	6	4	4 1/2	8 1/2 - 8 1/2 x d	..	6 8 8	West Coast of America	2 1/2	2 1/2	..	14 - 15	..	4 3 4
Do. 10 % Cum. Pref.	6	10	10	6 1/2 - 7 x d	..	7 2 10	Do. 4 % Debs., 1 to 600 gnar. by Braz. Sub Tel.	100	4	4	96 - 98	..	4 1 8
Direct United States Cable	10	6	4	6 1/2 - 7 1/2	..	5 10 4	West India and Panama Telep.	10	2 1/2	1 1/2	3 1/2 - 10 1/2	..	5 14 3
Direct W. India Cable, 4 1/2 % Reg. Deb.	100	4 1/2	4 1/2	99 - 101	..	4 9 0	Do. 8 % Cum. 1st Pref.	10	6	6	9 1/2 - 10	..	6 0 0
Eastern Telegraph, Ord. Stock	Stock	7	7	135 - 138	+ 1/2	6 1 5	Do. 6 % Cum. 2nd Pref.	19	6	6	101 - 103	..	4 17 1
Do. 3 1/2 % Prof. Stock	Do.	3 1/2	3 1/2	78 1/2 - 80 1/2	..	4 6 11	Western Telegraph, Ltd.	10	7	7 1/2	13 - 18 1/2	..	5 3 8
Do. 4 % Mort. Deb.	Do.	4	4	95 - 97	..	4 2 6	Do. 4 % Deb.	Stock	4	4	96 - 97	..	4 2 6
Eastern Extension	10	7	7	12 1/2 - 13 1/2	..	5 4 8	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	4 1/2	97 1/2 - 100 1/2	..	4 10 0
Do. 4 % Deb.	Stock	4	4	96 - 97	..	4 2 6							
East and S. Africa Tel., 4 % Ms. Deb. Mauritius Sub.	96	4	4	98 - 101	..	3 19 8							
Globe Telegraph and Trust	10	6	6	103 - 111	+ 1/2	5 6 8							
Do. 8 % Prof.	10	8	8	12 1/2 - 13	+ 1	4 12 4							
Great Northern Telegraph	10	18	20	82 - 84	+ 1/2	5 17 8							
Indo-European Telegraph	26	13	6 1/2	58 - 60	..	5 8 4							
Mackay Companies Common	100	5	5	83 - 86	+ 3/8	5 16 3							
Do. 4 % Cum. Pref.	\$100	4	4	69 - 72	+ 1/2	5 11 1							
Marconi's Wireless Telegraph	1	20	..	4 1/2 - 4 1/2	- 1/8	4 11 6							
Do. 7 % Cum. Partic. Pref.	1	17	..	3 1/2 - 3 1/2	- 1/8	4 10 8							

\*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ Bs. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical companies in the Home section, including Bath Trams, Brit. Elec. Trac., Central London Railway, and Metropolitan Railway. Columns include Name, Stock or Share, Dividends for, Closing Quotations, Rise + or Fall, Present Yield p.c., and Name, Stock or Share, Dividends for, Closing Quotations, Rise + or Fall, Present Yield p.c.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical companies in the Colonial and Foreign section, including Anglo-Arg. Trams, La Plata Elec. Trms., Lisbon Elec. Trams, and various international tramway systems. Columns include Name, Stock or Share, Dividends for, Closing Quotations, Rise + or Fall, Present Yield p.c., and Name, Stock or Share, Dividends for, Closing Quotations, Rise + or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table listing manufacturing companies, including Aron, Babcock & Wilcox, British Aluminium, Crompton & Co., Dick, Kerr, and various electrical manufacturing firms. Columns include Name, Stock or Share, Dividends for, Closing Quotations, Rise + or Fall, Present Yield p.c., and Name, Stock or Share, Dividends for, Closing Quotations, Rise + or Fall, Present Yield p.c.

\* Unless otherwise stated, all share are fully paid, † Interim dividend, ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

**PROCEEDINGS OF INSTITUTIONS.**

**Recent Developments in the Street Lighting of Manchester.**

By S. L. PEARCE, M.I.E.E., and H. A. RATCLIFF, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Manchester, February 25th, and London, Birmingham and Glasgow.)

(Concluded from page 583.)

Experiments were also made in equipping the lamps with enamelled iron reflectors of various shapes, but it can hardly be said that the results were very successful, at any rate from the point of view of the distribution of the light. Reflectors were really tried in order to remove the shadows under the lamps cast by the ash-trays; but for this purpose they were only partially successful, and the resulting distortion of the polar curve was very unsatisfactory. One objection to the use of reflectors is the dark shadows cast above an angle of about 80° to the vertical, as a result of which the blackness of the buildings and the darkness above the lamps are very much intensified. This is particularly noticeable in foggy weather. There is no doubt that it is a distinct advantage to illuminate as large an area of buildings as possible, provided always that it can be done without a reduction of the light flux in a more useful direction. If the elimination of shadows can therefore be effected by more legitimate means, there is no advantage to be gained by the use of reflectors. It is very evident, from the results, that the most satisfactory curves of light distribution are obtained either with suitably frosted outer globes or with dioptric inner globes used in conjunction with partially opalescent outer globes. There is very little to choose between the two methods on the score of light distribution. The dioptric globes undoubtedly have a slight advantage in this respect, but when it comes to the consideration of general advantages and disadvantages, there is much to be said in favour of the partially-frosted outer globes.

The advantages are:—  
 (a) Comparatively inexpensive to produce.  
 (b) The degree of frosting may be easily varied or graded as required.  
 (c) They have no optical centre, and consequently slight relative displacement of globe and arc is of no serious consequence. (This must not be confused with relative displacement of arc and economiser.)  
 (d) Intrinsic brilliancy of the light source is considerably reduced with a corresponding reduction of the glare effect, provided that the lamps are fixed sufficiently high.

(e) Shadows under the lamps are entirely eliminated, and the sharpness of the shadows cast by objects is toned down very considerably.  
 Compared with these advantages dioptric globes have the following disadvantages:—  
 (f) They are rather expensive.  
 (g) They have a very definite optical centre, and slight alteration in the relative position of arc and globe produces large changes in the light distribution.

(h) A completely uniform distribution of light does not appear to be obtainable without the use of special outer globes.  
 The numerous tests referred to in this paper have at least vindicated the lighting of city streets by means of flame arc lamps, not only on the dual basis of equal cost and illumination, but also on the ground of light distribution.

As there is a substantial difference between the cost of the flame arcs and the high-pressure gas lamps for the same minimum illumination, it would be possible to improve the arc lighting, if considered desirable, by reducing the distances between lamps in the case of future extensions. If fixed at the present height, and 100 ft. apart, the minimum illumination would be not less than 0.75 foot-candle. No attempt has been made to obtain perfectly uniform illumination, since it is very doubtful whether such a scheme would be desirable, even if possible. A variation factor of 3.75 is not excessive, if the change is fairly gradual; and in this respect the partially frosted globes give results quite as favourable as the dioptric ones.

**APPENDIX A.—MANCHESTER CORPORATION ELECTRICITY DEPARTMENT.**

Statement of Cost of Supplies during the Year ended March 31st, 1912.

Generation costs, distribution costs, rents, rates, and taxes, management expenses, interest charges, depreciation account, reserve funds, rate aid ... ..	Total.	Division.	
		Running costs.	Fixed costs.
£447,498	£87,431	£360,067	
Deduct: Cost of traction supplies taken in accordance with the Model Form drawn up by the I.M.E.A. and M.T.A. ... ..	109,389	25,078	84,311
	£338,109	£62,353	£273,756

(a) Running costs: £62,353 ÷ number of units sold (other than traction), 64,166,224 = 0.232d. per unit.  
 (b) Fixed costs: £273,756, divided on following assumptions:—  
 (i) That the costs are due to the maximum demands of consumers.

(ii) That these (known only in total of 31,175 kw. from station records) are estimated to be made up thus:—

70 per cent. of lighting connections,		
24,031 KW. ... ..	16,821 KW.	£147,371
The balance as power ... ..	14,661 KW.	12,385
	31,175 KW.	£273,756

(c) Lighting "fixed costs" spread over total kilowatts connected:—  
 £147,371 ÷ 24,031 KW. = £6.133 per KW. connected.

**APPENDIX B.—STATEMENT SHOWING COST OF CURRENT PER UNIT.**

Cost of current = £6.133 per KW. connected, plus 0.232d. per unit metered.  
 (a) The all-night lamps run on a 45 per cent. load-factor, or 4,015 actual burning hours per annum. Cost of current per unit = 0.6d.  
 (b) The 11 o'clock lamps run on a 23 per cent. load-factor, or 2,017 actual burning hours per annum. Cost of current per unit = 0.97d.

**APPENDIX C.—STATEMENT SHOWING COST PER ANNUM OF LIGHTING PORTLAND STREET.**

Lamp watts = 550.  
 Carbon costs = 0.2d. per lamp per hour.  
 Trimming and maintenance charges = 0.05d. per lamp per hour.  
 Current consumption per annum (all-night lamps = 4,000 × 55/100 = 2,200 units + 11 o'clock lamps = 2,000 × 55/100 = 1,100 units) = 3,300 units.

All-Night Lamps.	Cost per lamp per annum.
Current, 2,200 × 0.6d. ... ..	£5 10 0
Carbons, 4,000 × 0.2d. ... ..	3 6 8
Trimming and maintenance, 1,000 × 0.05d. ... ..	0 16 8
	£9 13 4

11 o'clock Lamps.	Cost per lamp per annum.
Current, 1,100 × 0.97d. ... ..	£4 9 0
Carbons, 2,000 × 0.2d. ... ..	1 13 4
Trimming and maintenance, 2,000 × 0.05d. ... ..	0 8 4
	£6 10 8

**Summary.**

Cost of 8 "all-night" lamps ... ..	£77 6 8
" 8 "11 o'clock" lamps ... ..	52 5 4
	£129 12 0

Capital expenditure on installation, £564.	
Capital charges per annum (8½ per cent. on £564)	48 0 0
Annual acknowledgments for building attachments and use of tramway poles ... ..	1 4 0
Annual cost of painting poles ... ..	3 6 6
	£182 2 6
Averaged over 16 lamps, the cost per lamp per annum equals £11 7s. 8d.	

Capital spent on installation of the 16 arc lamps in Portland Street.

Wages of men ... ..	£88 18 5
Material, viz.—	
Arc lamps, poles, wire, carbons, hangers, &c. ... ..	342 0 4
Meters ... ..	4 17 6
Paid to Tramways Committee for erecting side poles, wall rosettes, and span wires ... ..	128 6 7
	£564 2 10

or, say, £564.

**APPENDIX D.—STATEMENT PREPARED BY MR. ABADY, SHOWING THE COST PER GAS LAMP (11 O'CLOCK) PER ANNUM.**

Cost of gas, uncompressed ... ..	12.69d. per 1,000 cb. ft.
Cost of compression ... ..	1.2d. " "
Cost of gas, compressed ... ..	13.89d. " "
Mantles ... ..	1s. 1½d. each.

Wages—Proportionate part of time of one man (whole time at 28s., and one man for six hours a week at 25s.): £1 7s. 2d.  
 Each lamp consumes 80 cb. ft. of gas per hour for 2,000 hours per annum.  
 One mantle lasts about 100 hours, therefore each three-burner lamp takes 15 mantles per annum.  
 Lamps attended to and maintained at a wages cost stated above.

	Cost per lamp per annum.
80 cb. ft. by 2,000 hours = 160,000 cb. ft. at 13.89d. per 1,000 ... ..	£9 5 2
Lighting, extinguishing, cleaning and maintenance ... ..	1 7 2
15 mantles at 1s. 1½d. each ... ..	0 16 10½
	£11 9 2½

Equivalent to 1.37d. per hour lighted.

Nothing is included in the above for interest and depreciation on capital spent on installation, or for globes.

*Capital spent on Installation of the Four Gas Lamps in  
Princess Street.*

Wages ... ..	£12 6 6
Lamps ... ..	49 17 6
Poles ... ..	33 0 0
Suspension gear and rosettes ... ..	26 16 10
Barrel and fittings... ..	2 1 2
Tramway account for work done ... ..	70 9 4
	£194 11 4

Nothing is included in the above for high-pressure mains or compressor plant.

DISCUSSION AT BIRMINGHAM.

MR. R. A. CHATTOCK said the comparative figures of the cost of electric arc lighting and of high-pressure gas lighting were very valuable, especially as they were obtained by experts appointed by the Manchester Corporation to report on both classes of lighting. They demonstrated that high-pressure gas lighting was considerably more costly than electric arc lighting. The cost of the high-pressure gas lighting amounted to £11 9s. 2½d. per lamp per annum without including anything for interest and depreciation on capital spent on the installation, and without globe renewals, while the cost of the electric arc lighting amounted to £11 7s. 8d. per lamp per annum, including all capital and other charges. In Birmingham practically the whole of the street lighting was carried out by low-pressure incandescent gas mantles, and this was now under the control of a special Lighting Committee. In the Handsworth and Aston areas, which were recently incorporated in Greater Birmingham, there was a small amount of electric arc lighting, which had recently been considerably cheapened in cost. Taking the Handsworth district as an example, there were originally 120 open-type 11-ampere arc lamps which required recarboning every 18 hours. These were replaced by 50 magazine flame-arc lamps taking 8 amperes each, and requiring retrimming every 70 hours, and 70 twin-carbon flame-arc lamps taking 7 amperes each, and requiring retrimming every 50 hours. In the table below are given particulars of the consumption of energy, cost of energy, carbons and trimming, and illumination in candle-feet, the lamps being spaced approximately 400 ft. apart. The 8-ampere magazine flame-arc lamps showed a saving of 25 per cent. in running costs, and gave approximately four times the light given by the old open-type lamps, each lamp costing £5 2s. per annum for energy, at 1d. per unit, carbons and trimming, from dusk

which they had had on trial at Handsworth, he had been able to obtain a balance almost, if not quite, as readily as with gas lamps. Lamps with direct electrically-driven feeds gave the steadiest burning. By this he meant lamps in which the feeding was effected by an auxiliary shunt coil, which came into action when the volts across the arc were above the normal, so regulating the feed that the drop across the arc was not more than 1 volt, and thus maintaining steady burning. With a feed which depended upon the slip of a chain or band brake, or piece of metal on a wheel controlled by a lever operated by a main and shunt coil, one could not depend upon a 1-volt feed. Generally, the variation was 2 or 3 volts or more, and this affected other lamps in series, especially if these were themselves on the point of feeding. His experience with flame-arc lamps was that they required cleaning, and the deposit from the carbons brushing out, after 60 to 70 hours' burning at least; and if the lamp had to be lowered for this purpose, it might just as well be carboned at the same time. Another important point with regard to the choice of magazine lamps for street lighting was that there should be no extinction of light when a new pair of carbons came into operation.

MR. M. SOLOMON said that although the data contained in the figures were very valuable, their value was diminished by the fact that some of the figures were not referred to at all in the text, and the shading was different in the two sets of contour figures, so that the actual impression created was a wrong one. The comparative table showed the arc lamps to be, roughly speaking, twice as good as the gas lamps, but it was admitted that the gas-lamp figures were not really representative of the best that could be done with high-pressure gas lighting. He did not think that it was of any benefit to create the impression that arc lighting had a walk-over as against high-pressure gas, when, as a matter of fact, it was a very close race between the two rival illuminants. Improvement in the distribution curves (apart from that due to the graded frosting) was attributed to the alteration of the spinings and of the shape of the outer globe; the shape of the inner globe was also altered, and a very considerable amount of the improvement in the 20° rays was due to this alteration, as the new inner globe was designed so that the light reflected from its inner surface should be reflected at an angle of 20° with the horizontal. He had been struck by the very close correspondence between the light distribution curve obtained by the authors and his own curve, obtained under laboratory conditions, while theirs was made under practical working conditions in the street; this not only confirmed the accuracy of both sets of readings, but also showed that flame lamps and carbons were now so standardised that the results obtained might be relied on with considerable certainty.

MR. A. M. TAYLOR thought the most important thing in the

HANDSWORTH STREET LIGHTING.

	Consumption in units per annum.	Cost of energy at 1d. per unit.	Cost of carbons.	Cost of labour.	Total cost.	Illumination in candle-feet, measured on road surface.		
						Max.	Min.	Average.
<i>Main Road—</i>								
Original installation—50 open-type arcs, 11-ampere, 18 hours.	44,750	£186 10 0	£17 10 0	£116 0 0	£350 0 0	0.51	0.02	.14
Present installation—50 magazine flame arcs, 8-ampere, 70 hours.	33,000	£137 15 0	£50 0 0	£72 15 0	£260 10 0	2.35	0.05	.66
<i>Side Roads—</i>								
Original installation—70 open-type arcs, 11-ampere, 18 hours.	65,000	£271 10 0	£25 0 0	£204 0 0	£500 10 0	0.51	0.02	.14
Present installation—70 twin-carbon flame arcs, 7-ampere, 50 hours.	40,000	£166 10 0	£79 10 0	£100 10 0	£346 10 0	1.0	0.04	.327

to 11.15 per p.m. The 7-ampere twin-carbon flame-arc lamps showed a saving of 30 per cent. in running costs over the 11-ampere open-type lamps, and gave over twice the light, each lamp costing £5 per annum for energy, at 1d. per unit, carbons and trimming, from dusk up to 11.15 p.m. The shadows caused by the ash-trays in the lamps fitted with converging carbons are not found in the case of the twin-carbon lamps fitted with vertical carbons.

MR. E. CROCKER said the great problem in connection with street lighting appeared to be to make the variation factor as small as possible, and the change from maximum to minimum illumination as gradual as possible, and to do this not regardless of cost. In this connection the design of the globes played a most important part, and the information given in Mr. Pearce's paper was exceedingly valuable. He had experimented on much the same lines, with very similar results. He had not, however, tried frosted globes, and it was with these that the authors had obtained their best results. Their variation factor of 3.75 with frosted globes was an enormous improvement. The variation factor of the gas lighting in Bristol Road was as high as 18 over a distance of only 20 ft. from the lamp post. He agreed with the authors' remarks re the use of outside reflectors, and the importance of illuminating the buildings on the sides of the road. Steadiness was a most important thing to be aimed at in street lighting, and this was the most striking feature of high-pressure gas lighting, although, as the author remarked, the candle-power varied considerably from day to day. When testing some of the arc lamps

paper was the table which comprised a *résumé* of the principal features of the two systems, gas and electricity. He suggested that the variation factor for the two systems might be added, and an additional basis for comparison, which would be known as the "Maximum variation of the candle-feet per foot run." The gas people could not and should not take any exception to the division of the total costs into "Running Costs" and "Fixed Costs" nor to the deductions on account of the cost of traction supplies. Mr. Pearce had, however, carried the distribution of costs further, and allocated a certain proportion to lighting and to power respectively. He had worked out what the fixed charge would be if the whole had been simply divided up by the total number of kilowatts; it came to £8.76 per kw. connected, per annum. This added an amount of approximately 25 per cent. to the charge for energy for the "All-night lamps," and approximately 33 per cent. to that for the "11 o'clock lamps." This was obviously an extreme view to make, and it might be taken as certain that Mr. Pearce's figure of £6.133 per kilowatt was substantially correct. The cost per mile per annum (for presumably equal minimum illumination) was given as £675 for the gas and £254 for the arcs. Gas according to this statement was 2.65 times as dear as the electric light for equal illumination, so that it would be obvious that any trifling divergencies from Mr. Pearce's figures for the cost of energy which might be suggested by the gas people, could not to any material degree affect the great superiority of the figures for the electric supply on the basis of cost.

## Colliery Cables.

By W. T. ANDERSON, M.J.E.E., M.INST.M.E.

*(Abstract of paper read before the INSTITUTION OF MINING ENGINEERS, at Manchester, February 11th, 1913)*

The first question that confronts the mining man who proposes to install electric light or power below ground is the choice of cables. Under normal conditions rubber is undeniably the best both from physical and from electrical points of view. On account of cost, its use is almost prohibitive for large cables. In small lengths, however, rubber cable (generally treated with fire-resisting braids and compounds) is nearly always used for making off, or tailing, cables of other description. Nothing but the very best material should ever be used below ground, say, 2,500-megohm grade for low-tension, and nothing inferior to that specified by the Engineering Standards Committee for high-tension work.

There are also exceptional uses to which rubber cable can be put—principally in connection with breakdown work. An example is given in the accompanying illustration (fig. 1). The cables shown were hurriedly rigged up to follow down a sinking pump in a flooded shaft. Working at a current density of about 3,000 amperes to the square inch, they were slung in the manner depicted to prevent them from becoming unduly hot.

While paper-lead covered cable has advantages as regards withstanding heat from without, and ready dissipation of heat from within, consequent upon overload, paper has the disadvantage common to all fibrous materials of being more or less hygroscopic.

For mining work where temperatures are often high, and more especially for shaft work, the physical consistency of the impregnating compound under working conditions should be such that it has no tendency to flow or creep away from the paper.

Although the results of injury to paper cables are usually serious, it is remarkable how much mechanical stress they will withstand. The writer believes that at Hulton Colliery, not a single cable was



FIG. 1.—RUBBER CABLE SLUNG READY TO FOLLOW DOWN A SINKING PUMP IN A FLOODED SHAFT.

brought to bank after the recent disaster, and that all are now in use. The cables lay under falls, the weights of which have probably never been exceeded, many being crushed into abnormal shapes.

Paper leadless cables are insulated with paper and sheathed with a non-metallic material, which is almost invariably vulcanised bitumen. They have certain advantages in the way of dissipation of heat due to overload, and also as regards internal solidity, because of the comparative incompressibility of the paper insulation. In the event of damage, however, they have the same disadvantages as paper-lead covered cables, and for shaft work are unsuitable.

Bitumen cables are, in the writer's opinion, by far the most suitable for average colliery work—certainly for shaft work. Until quite recently great difficulty was experienced in getting the bitumen insulation to such a consistency that in moderately high temperatures it would not decentralise, while in low temperatures it would not become brittle. As the result of research and of manufacturing improvements, it is now possible to avoid these troubles over a range of temperature which covers all ordinary working conditions, say, 28° to 120° F. Further, whereas it was necessary formerly to introduce in the construction of the cable mechanical reinforcements, such as tapes, braids, &c., the improvements in physical properties of the bitumen and methods of manufacture now enable cables to be made without these hygroscopic,

and therefore electrically undesirable components. For instance, the "solid" three-core bitumen cable, which is familiar to most colliery engineers, is so constructed as to contain no hygroscopic material whatever inside its sheath, so that in effect the conductors are embedded in a solid cylinder of vulcanised bitumen.

A more recent form of construction, called "Cracore" (fig. 2) consists in the laying up of the separately insulated cores on a central cradle of vulcanised bitumen, shaped to receive them. The whole is then sheathed overall with a tube of vulcanised



FIG. 2.—"CRACORE" FORM OF CONSTRUCTION IN A BITUMEN CABLE.

bitumen, which is cylindrical on the exterior, but shaped internally so as to fit the interstices of the laid-up cores. This construction, by distributing the mechanical pressure between the cores over a large area, enables even twin bitumen cables to be made without the inclusion of hygroscopic substances anywhere within the boundary of the vulcanised-bitumen sheath.

In these types of cable the conductors should always have the strand interstices filled with compound, in order to prevent water entering at a damaged part of the cable from passing to another part, where it might settle and cause trouble. It is, of course, very desirable that the compound should be of such a character that it will not melt, or become displaced under the influence of heating effects set up by excessive currents in the conductors. In cable manufactured on these lines, the important advantage is secured that any mechanical damage which may happen to it is quite local in its effects, and in many cases it may be repaired *in situ*, and be little the worse for its misadventure. An instance recently came under the writer's notice where failure to take this simple precaution of strand-filling resulted in water travelling down a bitumen cable throughout its entire length. Unlike paper, however, it was possible to keep the cable in use, it being little the worse, so far as its dielectric was concerned, for the mishap. Bitumen cables should not be installed immediately after direct exposure to frost or very keen winds.

In all of the above-mentioned types, if used for pressures exceeding "low pressure," it is now necessary that the conductivity of the metallic coverings must be at least equal to 50 per cent. of that of the largest conductor which they enclose, and in no case of less cross-sectional area than that equivalent to 0.022 sq. in. of copper. This last-named point would appear to apply to even the smallest size of trailing cables.

Fig. 3, for which the writer is indebted to Mr. C. J. Beaver, shows the approximate relation between the conductivity of the "largest conductor" and metallic sheaths (made according to the Engineering Standards Committee's tables) in several types of cable. From this it will be seen how very slightly it has been necessary for manufacturers to reinforce the sheathings of any but large-sized cables under the new rules. As in most great reforms, however, the new rules are likely to lead to some remarkable situations—none more so than in this very question of armour conductivity.

Taking a high-tension system, with transformers at the shaft-bottom, the high-tension shaft feeder taking, say, a tenth of the current of the low-tension roadway cable or cables, what must the section of the high-tension armouring be? Logically five times the conductivity of the high-tension conductors, if there be only one low-tension distributor, or half the conductivity of the largest low-tension cable if there be more than one distributor. It appears that the spirit of the rules could only be met in this case by running separate and additional conductors at earth potential down the shaft, in parallel with the sheathing of the high-tension feeder.

The importance of efficiently protecting the armouring from corrosion can hardly be exaggerated. Both inner and outer servings of jute, as well as the steel-wire armour, should be heavily and separately compounded with water-resisting mediums. Where particularly bad water is suspected, or known to exist, samples should be submitted to the manufacturer, so that he may design his protective arrangements in accordance with the result of analysis.

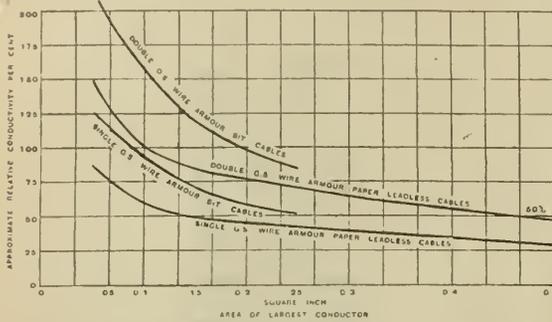


FIG. 3.—DIAGRAM SHOWING THE RELATIONSHIP BETWEEN THE CONDUCTIVITY OF STANDARD WIRE ARMOUR AND THAT OF THE CABLE CONDUCTORS IN BITUMEN THREE-CORE LOW-TENSION CABLES.

A factor which is often overlooked as a cause of corrosion is leakage-current; mines are nearly always wet enough and the water impure enough to provide a sufficiently good electrolyte for leakage currents to effect an almost unlimited amount of damage. This being so, the obvious course is to provide their paths (generally the cable sheathings) with such sound mechanical and electrical connections to earth that corrosion cannot take place.

The chief essentials in the construction of trailing cables are those relating to flexibility and resistance to external abrasion and ill-usage. The former is attained chiefly by making the conductors of a large number of fine wires, and the latter by special coverings, usually of a non-metallic character, such as rope-lappings, leather or whipcord braidings, rubber sheathings left bare, &c. Metallic armourings are now considered undesirable for portable flexible cables (see memorandum on Rule 13, Sec. a).

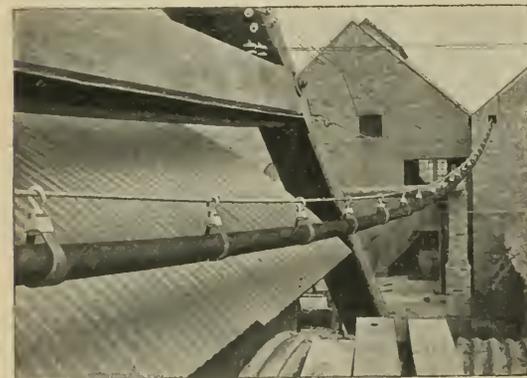


FIG. 4.—CABLE SUPPORTED BY SLINGS FROM A CATENARY WIRE.

The latest construction consists of rubber-insulated conductors laid up with an earth-conductor having a conductivity of not less than 50 per cent. of that of the largest main conductor, with a minimum conductivity equivalent to 0.022 sq. in. of copper. These cores are usually sheathed after laying up with a vulcanised-bitumen or rubber sheath. While it possesses the obvious advantage of excluding moisture from the cores, the mechanical support afforded by the sheath also tends to prevent kinking of the cable. The various forms of mechanical protection mentioned above are then applied as desired.

The space between the generating station and the headgear is, perhaps, the most prolific field of any for cable breakdowns, and too much attention cannot be given to the handling of cable in this area.

A large colliery was completely stopped through two three-phase bitumen shaft-cables breaking down simultaneously at bank, owing to a 1-in. steam pipe being laid across them.

The best means of grappling with this difficulty are either to build a well-ventilated surface culvert (open or covered with chequer-plate), in which the cables can be carried on brackets, or to sling them overhead from a catenary wire (fig. 4). Old haulage-ropes can generally be used for this purpose, made taut with capels and tightening screws. A good type of sling much used by the

writer for this purpose is made on the wedge principle, with a former of sheet lead, braided with compounded yarn. The combination of lead and braid offers prolonged resistance to fumes or atmospheric influence, while the exceptional width provided at the



FIG. 5.—SITTING TYPE OF WOODEN CLEAT FOR SHAFT SUSPENSION, RESTING ON EXISTING BUNTONS.

bearing point protects the dielectric from risk of damage. The hooks slide very readily along the span wire, while the slings cannot slip along the cable.

If the shaft is some distance from the power house, the use of paper lead-covered cable laid solid is worth considering. In such a case, a disconnecting box should be inserted at the pit top. For greater distances, especially on extra-high-tension lines, bare overhead conductors are frequently used.

For the permanent installation of vertical cables, the most desirable arrangement is a cleat of the sitting type resting on the inner or wall sides either of existing buntons (fig. 5), or on segmental H-girders erected for the purpose (fig. 6). The cleat should be of

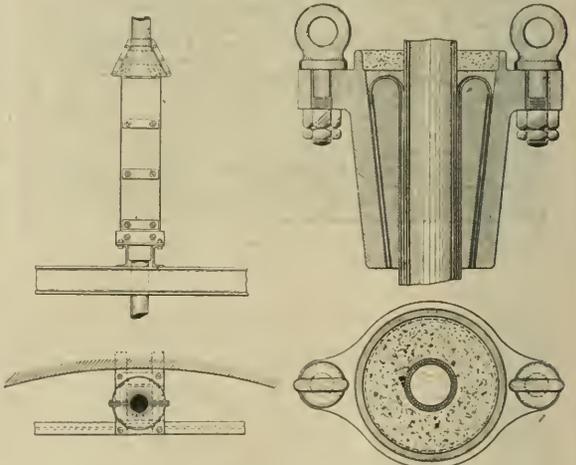


FIG. 6.—SITTING TYPE OF WOODEN CLEAT FOR SHAFT SUSPENSION, RESTING ON H-GIRDERS.

FIG. 7.—FITTING FOR "SINGLE-SUSPENSION" METHOD IN SHAFTS.

some hard wood, creosoted. An average cleat should not be less than 2½ to 3 ft. in length; and should be provided with at least three sets of ¾-in. bolts and iron straps ½ in. thick, back and front. The bores that take the cable should be cut to the exact diameter of such cable. The ¼ or ⅜ in. taken out by the saw when cutting them into halves will allow ample margin for tightening. The grip depends on friction, and direct pressure is only a component thereof. All wooden cleats should be fitted with wrought-iron roofs, so as to throw off water and falling bodies. The distance between the cleats will depend on the weight of the cable. Such a one as

mentioned above should not be loaded with more than 7 to 8 cwt. which, in an average cable, would allow of spacings of about 25 yards.

Many colliery engineers insist on having an absolutely clear shaft, and in shallow pits it is possible to install the cables with a single suspender, built on the capel or wedge principle, with the outermost armour of the cable taking the weight. This certainly has the advantage of offering no obstacle to break the fall of dropping material, but the use of such a fitting (except perhaps for short lengths of paper-lead covered cable) is to be deprecated, as the stresses set up in the cable have sometimes led to breakdown immediately under the suspender, where, of course, the stresses are most concentrated.

In the suspender illustrated in fig. 7, it will be noticed that the cable forms an easy fit through the bore of the cone, over the outer sides of which one layer of armour is bent, and gripped between the cone and the seating as the weight comes on. The top of the fitting is hollowed so as to allow of bitumen being poured in to prevent corrosion of the wires. In this suspender three-quarters of the breaking stress of the armour may be reckoned on, so that if the armour be designed with a breaking stress of eight to ten times the weight of the cable, the safety factor of the installed cable is from 6 to 7.5.

(To be concluded.)

## THE FIRST INTERNATIONAL CINEMATOGRAPH EXHIBITION.

(Continued from page 554.)

**Motor-generators, Converters, &c.**—These machines are of the utmost importance in reducing the energy bill in cinema installations taking current from public supply networks. If supply is available at 100-110 volts, it is hardly worth while installing motor-generators or converters, but generally current has to be taken at 200-250 volts, and where very large projectors are used, at 400-450 volts (from power mains), so that there is no longer any question as to the advisability of employing pressure reducing machinery in place of the equivalent ballast resistance. Where A.C. supply is available, the use of running machinery for pressure reduction may be avoided by employing transformers (of which, and their use, we noticed no example at Olympia\*), or by employing mercury rectifiers. The latter enable the high efficiency of D.C. arcs to be realised simultaneously with the simplicity of static pressure reduction, but the high cost and fragility of glass rectifier bulbs are undeniable disadvantages in cinematograph work.

The various types of motor-generators and converters used by the miniature theatres during the recent Exhibition have already been noted: all these machines ran perfectly during the seven days they were in service, despite the fact that they were set to work after exposure to wet weather, without preliminary drying or testing. Broadly speaking, the advantage of motor-generators lies in the flexibility of their control and the steadiness of their output. Auto-converters are lighter, cheaper and more efficient machines, but they are less flexible while being liable to produce a "sensitive" arc unless considerable ballast resistance is used in the projector circuit (see previous remarks *re* advantage of high voltage supply in the arc circuit).

**Electric Motor Applications.**—Electric motors, of from  $\frac{1}{4}$  to  $\frac{1}{2}$  H.P. output, find many applications in the operations connected with the manufacture and exhibition of cinema films. For instance, in slow speed cinematography—which now plays so important a part in recording the germination and growth of plants, &c.—an electric motor is used to drive, through variable-ratio reducing gearing, the film and shutter of a cinema camera. The Debric apparatus, arranged on this principle and shown at Olympia, enables from one picture per second to one picture per hour to be taken and provides 120 intermediate speeds.

The Pathé film perforator (punching 500 pairs of holes per minute), and the Pathé printing machine (printing from 200 to 250 ft. of positive film per minute) are each driven by  $\frac{1}{2}$  H.P. motors. An all-important part is played by a special form of electric motor in the stencil-cutting machine used by Pathé Frères in the manufacture of their colour films and, since neither this machine nor the Pathé colour process are at all generally known, both may be described in some detail.

The film to be coloured is placed in a projection chamber below the stencil-cutter's operating table, and on to a ground glass screen let into the latter, an image of a single film picture (enlarged about two-fold), is projected by aid of a Nernst lamp and a simple optical system. A pantograph linkwork enables the outline of any part of this image to be reproduced on a blank stencil film. The operator selects certain areas of the picture which have to be coloured—say, blue—and traces round the boundaries of these areas with one style of the pantograph. The reduction ratio of the copying linkwork being identical with the multiplication ratio

of the system used to project the image of the film on the tracing table, it follows that the second style of the pantograph cuts out areas of such size and relative position as to enable the film operated upon to be used as a stencil when applying blue colouring matter to the picture film.

It is in the mechanism used to cut the stencil that the chief interest of the machine lies, from the present standpoint. A pair of vertical electromagnets are used to rotate a horizontal winged plate (pivoted on a vertical spindle), against the control of a spring. Directly the plate has turned through a small angle, it breaks a contact in the magnet field circuit, and therefore returns to its original position; the plate is thus maintained in very rapid oscillation so long as a master contact is closed by depressing the tracing style on to the film image. The oscillation of the winged plate is converted to a vertical reciprocation of a fine stencil-cutting needle by a short connecting rod mounted in spherical seatings in a lug on the winged plate and the outer end of a forked lever engaging with a collar on the needle stem. Normally, the connecting rod is in an oblique position, but, as the winged plate rotates, the connecting rod is raised to a nearly vertical position, and thus thrusts the needle down (through the stencil film into a fibre backing block), against the control of a spiral spring. This action is repeated with extreme rapidity during the whole time the tracing style is moved over the film image and the required stencil is, therefore, demarcated by a series of perforations so closely contiguous that the central portions of each closed area can be easily picked out, leaving the clean cut edges shown in fig. 1, which reproduces an example of the work done by this machine.



FIG. 1.—PATHE STENCILS FOR COLOURED FILM.

A stencil is cut for every picture in the film, and for every colour to be applied to the latter. Less than three colours are never employed in composing the final coloration, and, in the best films, as many as seven distinct colours are applied, so that from 48 to 112 stencils have to be cut for every foot length of the film dealt with. About 100 colour films can be made from each set of stencils, so that, assuming 1,000 ft. of film to provide 20-minutes' entertainment from 2,400 to 5,600 stencils have to be cut to provide each minute's Pathé-colour entertainment in 100 halls simultaneously.

The actual colouring of Pathé films is a purely mechanical process. The film to be dyed is passed through an electrically-driven machine which applies that aniline colour for which the stencil film was cut, through the latter on to the picture film. As many films as possible are thus treated till the stencils begin to show signs of wear. The dye in the machine is then changed to suit the next stencil, and the films are over printed with the second colour, and so on till all the selected component tints have been applied.

The electric driving of projectors is very desirable, since it ensures uniform speed, and leaves the operator free to attend to other matters while relieving him of a duty which, especially in long-hour continuous-performance halls, is very monotonous. In most of the motor-driven projectors now on the market, the regulating rheostat is mounted near the motor on the projector stand. This arrangement is being condemned by the L.C.C. on the ground that it considerably increases the risk of firing broken films.

In cinema halls themselves, the applications of small electric motors, include the driving of "Kinescorders" and similar machines, sign flashers, fans and vacuum cleaners, concerning which more is said in later paragraphs.

**Electric Lamps and Lighting.**—Electric lamps are used almost exclusively in cinema halls and projectors, indeed, electrical energy and apparatus is so intimately associated with every branch of modern cinematography that it may be questioned whether the

\* A.C. arcs are, of course, much less satisfactory than D.C. arcs for cinema work, but a considerable number are used in this connection. It is claimed that, owing to the higher efficiency of the D.C. arc, an A.C.-D.C. auto-generator set enables better results to be obtained than auto-transformers while effecting anything up to 20 per cent. economy as compared with the latter.

electrical aspects of the Exhibition were made sufficiently prominent.

The Elektrophotograph. Ges., of Frankfort-on-Main, exhibited several types of "Jupiter" lamps for ordinary or cine-studio illumination. Each lamp comprises two horizontal arcs arranged along the axis of a semi-circular diffusing reflector which, for cinematograph work, is provided with a swinging-front diffusing screen.

The Westminster Engineering Co. exhibited a new type of studio lamp embodying their standard 15-ampere enclosed arc with a diffusing parabolic back reflector and an extended top deflector plate.

For printing films and for projecting purposes in their stencil-cutting machine, Pathé Frères use Nernst lamps.

Space limitations prevent detailed description of the many types of projector arcs exhibited. The design and manufacture of these lamps has reached a high degree of perfection, and no radical alterations have been introduced in the leading makes during the past year or two. The chief developments have been the provision of additional adjustments and increased mechanical strength to ensure rigidity and to suit the heavy currents now employed in large halls. The German exhibits included some exceptionally heavy designs, but we consider the British products shown to be neither electrically nor mechanically inferior to the Continental lamps. Standard

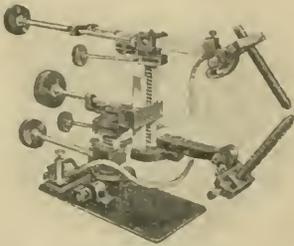


FIG. 2.—TRINITY ARC, SET AT USUAL ANGLE FOR A.C.

first-class projector arcs, as now supplied for cinema work, have usually seven adjustments, viz. carbon feed, top-carbon traverse (back and front or right and left), and tilting, raising and traversing (to and fro or right and left) of the whole lamp. Among the mechanical improvements adopted to prevent back-lash (initial or due to wear) and consequent unsteadiness of adjustment, may be noted square guides for the main carbon feed bars, parallel guides for the adjustable carbon holder, specially wide rack threads and guide pins preventing side play round racks. There is also a notable improvement in the insulation of terminals and leads on all projector arcs.

The "Trinity" projector arc, exhibited by the Cinema-Halles Trading Co., is worth special notice not only on account of its substantial mechanical construction but also by reason of the swinging jaws provided. The lamp has seven adjustments, and the swinging jaws enable the carbons to be set to give best results with either D.C. or A.C. supply (fig. 2). If desired, the carbons can be set at right angles, and in any case the jaws can be brought within 1 in. of each other, thus reducing carbon wastage to a minimum. This lamp is built in various sizes from 10 to 120 amperes.

The Kamm "Universal" projector arc has no fewer than nine distinct adjustments, and "remote control" clamping devices arc

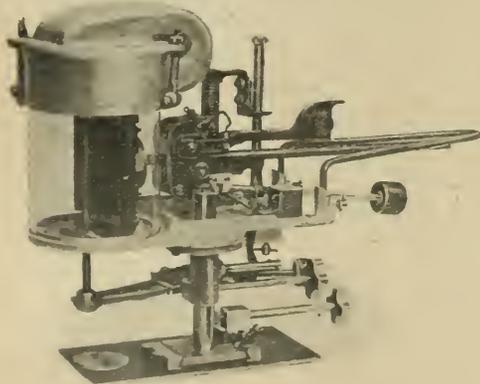


FIG. 3.—WESTMINSTER MINIATURE ENCLOSED ARC.

provided, so that there is no difficulty in re-carboning while the lamp is hot; the expansion of the clamps merely grips the carbons more tightly.

The Westminster Engineering Co.'s miniature enclosed arcs, using carbons at right angles for projection purposes, have been

previously noted in these columns; a 35-ampere model, embodying several new features, has just been placed on the market, and is illustrated in fig. 3. Both carbons are simultaneously fed by a single hand-wheel, feeding being necessary about once in 10 mins. on 200-volt supply. The p.d. required across the arc is 55-65 volts and a maximum of 8,000 c.p. is available in the direction of projection. The lamp is built to enter any standard projector lantern, and the deposition of soot on the front of the enclosing cylinder is prevented by the provision of a top condensing chamber into which gases pass, on rising from the arc, returning behind a vertical dividing plate in the glass cylinder and through passages in the base-plate. As in the smaller sizes of this lamp, the partial enclosure of the arc secures quiet, steady burning and reduced carbon consumption.

For home or school use the "Pathoscope"—employing a hand or pedal-driven magneto-generator—has gained rapid popularity, but if it is preferred to take current from ordinary supply mains, a miniature arc lamp, or a metal-filament lamp, may be used. The 15-20-ampere "Jupiter" lamp, burning 5-mm. carbons, enables 5 ft. × 6 ft. pictures to be shown, while the "Ideal" projector, shown by the same firm and using a 16-volt metal lamp, makes possible satisfactory projection up to 3 ft. × 4 ft. on the screen.

A number of firms now specialise in the supply of high-grade carbons of suitable quality and size for cinema work, and many of their products were exhibited at Olympia. The E.E. & E. Co. exhibited positive carbons, the tips of which were ground at an angle; this slight departure from usual practice enables a steady arc of the desired form to be obtained immediately on starting up.

(To be concluded.)

### Electricity at the Laundry Exhibition.—

Although electricity did not play a very important part in the display of machinery connected with laundries at the International Laundry Exhibition, which was held at the Agricultural Hall, London, last week, there were several items of considerable interest on view. Perhaps one reason why electricity is not more fully utilised as a medium for power transmission and heating is that a plentiful supply of steam is a first essential in large laundries, which necessitates the installation of a steam-raising plant, the consequence being that the majority of laundry owners find it at present more economical to put in a steam engine for shaft-driving purposes. At the same time there were indications that electricity is beginning to play a more important rôle in laundry work, for, as one walked around the Exhibition, one came across a number of machines that were driven by directly coupled electric motors. Thus, MESSRS. JAMES ARMSTRONG & CO., of Queen Victoria Street, E.C., displayed, in addition to an electric bleach-making machine, a huge "Trojan" flatwork ironer, with 120 in. × 48 in. cylinder, which was shown in operation driven by an attached electric motor. MESSRS. T. BRADFORD & CO., of the Crescent Ironworks, Salford, Manchester, exhibited an electrically-driven rotary washing machine of 20-shirt capacity, in which the usual steam for boiling purposes was replaced by a gas heater. MESSRS. T. BROADBENT & SONS, LTD., Huddersfield, displayed a couple of electrically-driven hydro-extractors, one of which—a 26-in. machine—was belt-driven off the motor mounted on the same bed-plate. The second machine, which was of 48-in. diameter, was of the suspended type, in which the armature or rotor of the electric motor is mounted on a sleeve which is independent of, and can revolve round, the centre spindle of the machine. To the upper part of the sleeve are attached friction shoes, which are thrown out by centrifugal force when the armature commences to rotate, and engage with the inner rim of a clutch secured to the centre of the spindle. The weight of the shoes is regulated so that, when the motor attains its normal speed, the friction developed is equal to the torque of the motor, and slipping ceases. By this arrangement the armature is able to develop practically full power and speed immediately the current is switched on, the rotating cage of the machine being quickly brought up to full speed by the action of the clutch. MESSRS. R. G. WHITAKER, LTD., of 22, Southwark Bridge Road, S.E., had on view a new 26-in. hydro-extractor with direct-attached 3-h.p. Crompton motor and an electrically-driven offering machine. A range of electrically-heated hand-irons was exhibited by MESSRS. ISAACS BRAITHWAITE & SON, of Kendal, and one was shown in operation at the stand of the POLYSULPHIN CO., LTD., of Bristol.

### Sterilisation with the Mercury Vapour Lamp.—

The use of the mercury-vapour lamp to sterilise water is well known. A further use has been made of it by Herr Otto Haase to sterilise underclothing. The process favours the polymerisation of the oxygen with the formation of ozone, resulting in rendering the garments thoroughly aseptic and destroying all pathogenic germs, without affecting the texture or suppleness of the stuffs. Experiments showed that 13 of the most virulent bacilli succumbed at various periods from 5 to 60 seconds.—*Revue Pratique de l'Electricité*.

**Electrical Trades Union.**—At the North-Western branch of this Union, Princess of Wales Hotel, corner of Belsize Road and Abbey Road, N.W., on Tuesday, April 16th, at 9 p.m., Mr. Harry Springfield will deliver an address entitled "An Evening with Olive Schreiner."

## RECONSTRUCTION AT BANKSIDE.

We recently paid a visit to the works of the City of London Electric Lighting Co., at Bankside, where the process of removing the old generating plant and the concrete foundations is in full swing, to make room for the new plant which is on order. Three turbo-alternators of 2,500 kw. each have been running for a considerable time, and a new set consisting of a turbine driving two 1,250-kw. direct-current generators in tandem—the largest D.C. set so far constructed—is in position; another D.C. set of the same size, and a 4,000-kw. D.C. set, in which gear-driving will be adopted, are to be laid down in time for the winter load, and as the existing foundations (which carried Willans-B.T.H. A.C. sets) are altogether unsuitable for the new plant, it has been found necessary to clear them out entirely. As the foundations are of solid concrete of excellent quality, which has set very hard, the work of removal is an undertaking of considerable difficulty, more especially as the proximity of boilers and generating plant in operation precludes the use of explosives.

Under these circumstances, it has been necessary to have recourse to more scientific and effectual methods than that of manual labour, in order to break up the huge masses of artificial stone, which appear to have been designed on the lines of bomb-proof fortifications; and bear eloquent testimony to the thoroughness with which the engineers of 20 years ago carried out their duties.

Having regard to the smooth running of the Willans engine, it would seem that lighter foundations would have sufficed to ensure their stability and freedom from oscillation. Perhaps the intention was to prevent the transmission of vibration to neighbouring buildings, for in those days the phenomena of vibration in connection with reciprocating engines were not fully understood, and even now they sometimes give rise to puzzling effects.

The method devised by Mr. Frank Bailey, joint managing director and engineer to the company, to cope with the difficulty is interesting, more especially as the construction of the apparatus was carried out entirely in the company's well-equipped workshops.

An old armature shaft, weighing several tons, is employed as a battering ram, being provided with a lifting eye screwed into one end, and with rings sliding on a pair of iron guides. One of the two travelling cranes with which the long bay is served has been furnished with a trigger hook, by means of which the ram can be lifted a few feet; on pulling a rope attached to the end of the trigger the ram is released and strikes a powerful blow after the fashion of a pile-driver. A hole about a foot deep and a few inches square is drilled in the top of the concrete block by hand, taking a couple of men about two hours to do it; heavy wedges are then knocked into the hole, and the ram is allowed to fall upon them, striking a blow of about 100 inch-tons. A few taps of this kind suffice to crack the concrete in all directions, enabling workmen with crowbars to break it up without difficulty. The tup is then used to pound the blocks into smaller lumps, which are carried on a temporary railway to a stone-crusher and reduced to a size suitable for use in making new concrete.

As the device employed is interesting, and may be of use to other engineers in these days when the work of demolition and reconstruction is going on in so many places, we reproduce photographs of the battering-ram, for which we are indebted to Mr. Bailey.

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"W. S. D." writes:—"A supply of electricity has been given to a consumer having premises on a lease. The lease having expired, the premises are now vacant. Are the undertakers, upon demand by the owner, bound to take out the service from the building back to the footpath? The owner complained that the cut-outs would be in the way, so the cables were sealed and buried under the floor. He now insists on their coming out altogether."

\* \* \* This query raises a point of some interest which it is difficult to answer with certainty, having regard to the somewhat meagre statement of facts. Thus it is not quite clear what is meant by "the service from the building back to the footpath." Is this within the outillage served by the supply, or is it outside? The obligation cast upon the local authority or company supplying electricity is to give, and continue to give, a supply to owners and occupiers of premises within the area of supply situate within 50 yards from any distributing main in which they are required to maintain, or are maintaining, a supply of electricity for the purpose of general supply to private consumers. The consumer must, if



CONCRETE-BREAKER AT WORK AT BANKSIDE.

required, bear the cost of so much of any electric main for the supply to him as is laid on his premises, and of so much of such electric main as it may be necessary to lay for a greater distance than 60 ft. from any distributing main of the undertakers, although not on his premises. If it should turn out on inquiry that in the case under notice the owner in question, or his lessee, paid for the service, it would seem that the cables ceased to be, or never were, the property of the undertakers, who cannot now be compelled to remove them.

**The Imperial Motor Transport Conference.**—The Rt. Hon. Lewis Harcourt, Secretary of State for the Colonies, has consented to become Vice-President of the Imperial Motor Transport Conference, sharing this position with the High Commissioners for the self-governing Dominions. Recent additions to the executive committee of the Conference include Col. the Hon. Sir N. J. Moore, K.C.M.G., Agent-General for Western Australia, the Hon. J. H. Turner, Agent-General for British Columbia, and John Howard, Esq., Agent-General for Nova Scotia. The Army Council has nominated, to serve on the Executive Committee, General F. W. B. Landon, C.B., Director of Transport at the War Office, and the chairman and secretary of the Mechanical Transport Technical Committee. It has now been definitely decided that the exhibition of Industrial Motor Vehicles at Olympia shall open on Friday, July 18th, and the visit of the Conference delegates to the Exhibition is timed for the morning of Saturday, July 19th.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 7,042. "Means for the automatic regulation of the spark from the magneto in electrically igniting and the charge of internal-combustion engines." G. GRAY, Junr. March 25th.
- 7,059. "Electric incandescence lamps." H. ZSCHOCKE. March 25th.
- 7,085. "Electric switches." A. P. LUNDBERG, G. C. LUNDBERG, P. A. LUNDBERG and G. PEGG. March 25th.
- 7,108. "Arc light electrodes." G. SIEMENS & Co. (Convention date, March 25th, 1912, United States.) March 25th. (Complete.)
- 7,125. "Test circuit arrangements for telephone systems." SIEMENS BROS. AND CO., LTD., and W. H. GRINSTEAD. March 25th. (Complete.)
- 7,127. "Circuit arrangements for telephone exchanges with automatic selecting devices." SIEMENS BROS. & Co., LTD., and T. PETTIGREN. March 25th. (Complete.)
- 7,128. "Circuit arrangement for telephone exchanges provided selecting devices." SIEMENS BROS. & Co., LTD., and T. PETTIGREN. March 25th. (Complete.)
- 7,130. "Devices for showing when junction lines to selecting devices in telephone installations are engaged." SIEMENS & HALSKE ART.-GES. (Convention date, March 25th, 1912, Germany.) March 25th. (Complete.)
- 7,146. "Combined dynamos and governors." A. CHURCHWARD. March 25th. (Complete.)
- 7,151. "Control of alternating-electric currents." BRITISH THOMPSON-HOUSTON Co., LTD. (General Electric Co., United States.) March 25th. (Complete.)
- 7,156. "Voltage regulators." W. J. MELLERSH-JACKSON. (M. Eyquem, France.) March 25th. (Complete.)
- 7,192. "Electric accumulators." J. A. WALSHEW. March 26th.
- 7,221. "Automatic telephone." G. AHLEMEYER. (Convention date, December 27th, 1912, Germany.) March 26th. (Complete.)
- 7,226. "Electrical alarm locks." A. LEWIS. March 26th.
- 7,232. "Ignition and starting systems for internal-combustion engines." L. LANGNER. March 26th.
- 7,243. "Electric-plug contacts." A. SCHUCHARDT. March 26th. (Complete.)
- 7,244. "Supports for electric lamps." H. WADE. (Schneider & Naujoks Elektricitäts G.m.b.H., Germany.) March 26th.
- 7,245. "Lighting apparatus." H. WADE. (Schneider & Naujoks Elektricitäts G.m.b.H., Germany.) March 26th.
- 7,246. "Lighting apparatus." H. WADE. (Schneider & Naujoks Elektricitäts G.m.b.H., Germany.) March 26th.
- 7,252. "Charging accumulators from a variable-speed dynamo-electric machine." J. G. P. THOMAS. March 26th.
- 7,257. "Electric clocks." F. BÄRNKO. (Convention date, April 1st, 1912, Germany.) March 27th. (Complete.)
- 7,266. "Electric lighting of vehicles." W. G. LEE and P. J. OLDFIELD. March 27th.
- 7,288. "Automatic fire alarm systems." E. GARRETSON. March 27th. (Complete.)
- 7,298. "Battery compounds." J. W. MACKENZIE. (Cook Railway Signal Co., United States.) March 27th. (Complete.)
- 7,302. "Ignition methods for internal combustion engines." H. ROYER. (Convention date, March 30th, 1912, France.) March 27th. (Complete.)
- 7,305. "Overhead conductors for electric traction systems." K. D. BOWEN and GEORGE ELECTRIC TRACTION, LTD. March 27th.
- 7,311. "Manufacture of electric cables." W. S. SMITH and H. J. GARNETT. March 27th.
- 7,328. "Electro-deposition of metals." N. H. M. DYKKE. (Divided application on 17,336, 1912, August 1st.) March 27th. (Complete.)
- 7,348. "Telephone receivers and the like apparatus." M. S. CONNER. March 28th.
- 7,360. "Incandescent electric lampholders." C. G. A. ERIKSON. March 28th.
- 7,365. "Sparking plugs." H. G. LONGFORD, W. W. LONGFORD and W. A. CLARK (trading as Sphinx Manufacturing Co.). March 28th.
- 7,369. "Switches for electrically operating planing machines and the like." LANCASHIRE DYNAMO AND MOTOR Co., LTD., and W. HARGREAVES. March 28th.
- 7,374. "Lens attachments for electric pocket lamps and the like." H. NEUBORER. March 28th.
- 7,376. "Telephones." A. STERRY. March 28th.
- 7,382. "Electric insulators." E. BROWALSKI. (Convention date, March 30th, 1912, United States.) March 28th. (Complete.)
- 7,411. "Flame arc lamps." G. E. TATE and F. O. MONKHOUSE. March 28th.
- 7,461. "Attachment for telephone instruments." G. H. SCHEMAL. March 29th.
- 7,469. "Electric liquid heaters." E. A. RAYES. March 29th.
- 7,502. "Wireless telegraphy." E. S. HEURTLEY. March 29th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 3d. (in stamps).

1911.

ELECTRICALLY-ACTUATED TAXIMETERS FOR CABS AND LIKE VEHICLES. C. Robinson. 27,656. December 8th.

1912.

MEANS FOR TRANSFORMING ELECTRICAL ENERGY INTO HEAT ENERGY, PARTICULARLY APPLICABLE TO HAIR-DRYING APPARATUS. Loddon Electrical Trading Co. and C. O. Bastian. 5,723. March 7th.

SWITCH ARRANGEMENT FOR ELECTRIC INCANDESCENT LAMPS. J. F. Smith. 5,814. March 8th.

APPARATUS FOR THE ELECTROLYTIC REFINING OF IRON. G. Tischenko. 5,855. March 8th.

VARIABLE-SPEED DYNAMOS FOR USE IN STARTING INTERNAL-COMBUSTION ENGINES AND THE LIKE. H. LEIDERT. 6,120. March 12th.

SYSTEMS OF ELECTRICAL DISTRIBUTION. British Thomson-Houston Co. (General Electric Co.) 5,212. March 12th.

ELECTRICALLY-CONTROLLED LIFTS OR ELEVATORS. A. RZIEC. 6,504. March 13th.

INSULATING SCREWS FOR THE CONDUCTOR RAILS OF ELECTRIC RAILWAYS. E. T. Brook. 6,473. March 16th.

DEVICE FOR SUPPORTING CONDUITS, PIPES OR THE LIKE FOR ELECTRIC CONDUCTORS AND OTHER USES. J. B. Blake and W. Kilburn. 6,562. March 16th.

AUTOMATIC APPARATUS FOR OPERATING ELECTRIC STARTING SWITCHES AND THE LIKE. W. A. CLAWORTHY. 6,599. March 16th.

ELECTRIC MEDICAL APPLIANCE. E. T. BRASLUP. 6,645. March 18th.

ELECTRIC INDICATING APPARATUS SPECIALLY, THOUGH NOT EXCLUSIVELY, APPLICABLE FOR USE ON BOARD SHIP. W. D. KILROY and EVERSHED and VIGNOLES, LTD. 6,792. March 19th.

ELECTRIC LIGHTING SYSTEMS FOR AUTOMOBILES. J. BIJUR. 6,803. March 19th.

METHOD OF SETTING OR ADJUSTING FROM A DISTANCE THROUGH THE MEDIUM OF PERIODIC OSCILLATIONS OF DIFFERENT FREQUENCY. ERICH F. HUTH GES. and H. BEHRE. 9,181. April 18th. (April 18th, 1911.)

ELECTRIC RESISTANCE FURNACE. L. UBBELOHDE. 9,203. April 18th.

CONSTRUCTION OF ELECTRIC BELL PUSH. A. BONDELLA. 10,360. May 1st.

ALTERNATING-CURRENT GENERATORS. C. R. SHAW, J. G. SHAW and H. G. SHAW. 10,417. May 2nd.

FORM OF ELECTRIC FIRE-ALARM APPARATUS. H. NEAL and E. E. MOORE. 10,927. May 8th.

MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES. B. BROOKS and W. HOLT. 10,996. May 9th.

MACHINES FOR MAKING ELECTRIC INCANDESCENT LAMP BASES. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 13,788. June 12th.

TERMINAL MOUNTING AND CORD-GRIPPING MEANS FOR ELECTRIC LAMP HOLDERS, ADAPTORS OR THE LIKE. G. ST. J. DAY. 14,306. June 15th.

PROCESS AND DEVICE FOR INCREASING THE LIFE, UNIFORMITY AND ECONOMY OF ELECTRIC DISCHARGE TUBES HAVING AN INCANDESCENT CATHODE. R. VON LIEBEN, E. REIZ and S. STRAUSS. 15,975. July 8th. (July 7th, 1911.)

APPARATUS FOR UNIFORM ELECTROLYTIC TREATMENT OF METAL STRIPS, WIRE AND THE LIKE UNDER CONTINUOUS ACTION. F. WERTH. 16,535. July 15th.

DEVICES FOR ADJUSTING THE TIME OF IGNITION IN INTERNAL-COMBUSTION ENGINES PROVIDED WITH MAGNETO-ELECTRIC IGNITION MACHINES. A. G. BLOXAM. (Robert Bosch, Firm of). 17,489. July 27th.

HIGH TENSION INSULATORS FOR OVERHEAD LINES. W. FELLNBERG. 17,761. July 31st. (July 31st, 1911.)

ELECTRODES FOR ELECTROLYTIC MEASURING INSTRUMENTS. H. E. HATFIELD and Chamberlain & Hookham, Ltd. 18,341. August 9th.

ELECTRICALLY HEATED THERAPEUTIC APPLIANCES. J. de Bernard and J. Ebb Smith. 19,267. August 22nd.

ROTARY ENGINE WITH ELECTRICAL POWER TRANSMISSION GEAR. A. BALDIMAN. 19,787. August 23rd. (September 23rd, 1911.)

ELECTRIC POCKET LAMPS. W. KNOPF. 24,093. September 28th.

TWO-RATE ELECTRICITY METERS. LANDIS & GYR. 24,503. October 26th. (October 27th, 1911.)

THERMO-ELECTRIC BATTERIES. H. O. GROSS. 25,372. November 5th. (November 5th, 1911.)

CONTROLLERS FOR ELECTRIC MOTORS. L. G. RILEY. 25,591. November 7th. (November 8th, 1911.)

SPREADERS FOR TELEPHONE RECEIVER CASINGS. P. M. COX. 26,474. November 18th.

DRY ELECTRIC BATTERIES. J. BOHLE and "Volta" Commanditgesellschaft für Elektrische Kleinbeleuchtung. 26,699. November 20th.

ELECTRICAL HEATING APPARATUS. E. G. BYDG and J. H. COLLIGRS. 28,542. December 11th. (Divided application on No. 6,763 of 1912, March 19th.)

**Book Notices.**—*The A B C Guide to Patents for Inventions.* By R. E. Phillips and A. M. Flack. London: Butterworth and Co. Price 2s. 6d. net.—There are few subjects on which so many guide-books are written as that with which this work deals, and necessarily the differences between the treatises are found mainly in the method of treatment. In the book before us, the matter is thrown into paragraphs, arranged under alphabetical headings, with a view to enabling the user to find the point he wants with the minimum of trouble. So far as we have tested it, we have found the arrangement satisfactory.

*A First Book of Electricity and Magnetism.* By W. Perren Maycock, M.I.E.E. London: Whittaker & Co. Price 2s. 6d. net.—This is the fourth edition of a work which is intended to provide a really easy introduction to the subject; it is written in very simple language, and illustrated with very clear drawings and diagrams, some of which are admirably devised to convey correct ideas, as, for instance, the horseshoe magnet on page 17, in which each of the external lines of force shown is continued throughout the body of the magnet. Starting with the magnet, the author passes on to voltaic cells and electric currents, electromagnetism and electrolysis, and the induction of currents, up to the principles of dynamos and motors; he then commences electrostatics, and eventually shows the connection between this subject and electrokinetics by explaining the action of the condenser. A number of questions is given at the end of each section, and a list of experiments bearing upon the subjects dealt with is appended, together with a priced list of all the apparatus required for carrying out these experiments and many others. The book is exceptionally well printed on good paper.

"Science Abstracts." Vol. 16, part 3, March 31st, 1913. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Proceedings of the American Society of Civil Engineers." Vol. 39, No. 3, March, 1913. New York: The Society.

"On the Temperature Rise and the Deterioration of the Covering Material of Wire by the Carrying Current." By T. Hirobe. August, 1912. Tokio, Japan: The Electro-Technical Laboratory.

"Atti della Associazione Eletrotecnica Italiana." Vol. 17, No. 6, March 31st, 1913. Milan: Stucchi, Coretti & Co. Price L. 1.60.

"Bulletin Mensuel Société Belge d'Electriciens." Vol. 30, January, 1913. Brussels: E. Bruylant. Price 1 fr. 75.

**Russian Platinum Tax.**—A Reuter dispatch from St. Petersburg states that the Council of the Empire has adopted a resolution of the Duma regulating the conditions of export in the platinum industry. It decided, however, instead of prohibiting the export of raw platinum, as proposed by the Duma, that raw platinum should be liable on exportation abroad or to Finland to a tax of 30 per cent. *ad valorem*.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

APRIL 18, 1913.

No. 1,847.

## ELECTRICAL REVIEW.

## TWENTY YEARS OF ELECTRICITY SUPPLY.

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THE paper read before the Society of Arts last week by Mr. Frank Bailey was of exceptional interest, as a review of the progress made in London during the 20 odd years which had elapsed since he read his previous paper before the Society—a period which covers practically the whole history of electricity supply on the commercial scale. It is almost exactly a quarter of a century since the passing of the second Electric Lighting Act removed the prohibitive restrictions which had been placed upon the embryo industry, and enabled capital to be adventured in this new field with a reasonable prospect of securing an adequate return. If we transport ourselves back in imagination to the date of the first paper—1890—what a striking contrast is presented between then and now!

At that time we were emerging from what Mr. Swinburne aptly described as the “postage-stamp paper and sealing-wax” stage of electrical engineering, when a 300-kw. dynamo was a monster, the Willans engine was asserting its supremacy, and various “battles of systems” were raging—between direct coupling and belt-driving, high speed and low speed, two-pole and multipole types of dynamo, A.C. and D.C.; high voltage was then 2,000 volts, and transformers were commonly installed on consumers' premises, while alternators were run on separate feeders, as parallel operation was considered, if practicable at all, too risky. The supply of electricity for motive power was practically non-existent, and there were no trolley tramways in the country—though there were electric railways!

To-day, on the other hand, we hear of the construction of a 25,000-kw. Parsons turbo-alternator without raising an eye-brow, and the cutting-off of the electricity supply of London for a single hour would be a disaster of national importance.

No better exponent of the past 20 years' progress in London's electricity supply could be found than Mr. Bailey, who, as engineer to both the City of London Co. and (formerly) the Metropolitan Electric Supply Co., has a unique acquaintance with the history, published and unpublished, of the subject, and himself was responsible for a very large share in the development of the industry in London. It is interesting to note that, by introducing the Parsons turbine into central-station practice in London, in order to overcome the vibration nuisance arising from the use of reciprocating engines in a residential quarter, Mr. Bailey gave a great impetus to the development of the turbine at a time when it was viewed with suspicion and incredulity by many of his *confrères*, and thus rendered timely service of the utmost value to Sir Charles Parsons—besides solving his own difficulties. That his confidence in the ability and genius of

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

## 1913 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,  
4, Ludgate Hill, London, E.C.**

that great inventor is unabated is well illustrated by the fact that he has ordered for the Bankside works a geared turbo-generator of the largest output yet constructed for direct-current supply.

The importance of the industry to London may be gauged from the tabular statement of the capital expended upon it and of the annual output which is given in our abstract of the paper on another page. That this huge business, engaging a capital of 21 millions sterling, should be split up between no fewer than 14 local authorities and 13 companies is, to our mind, a misfortune, attributable partly to the fact that the industry is of so recent origin that it has not yet grown out of the chaos of systems and supplies that reigned at the commencement, partly to the craze for municipalisation which overwhelmed the country towards the end of last century, and partly to the allied jealousy of private enterprise which gave rise to the ill-omened Act of 1882, and to the establishment of competition by the Government throughout the Metropolitan area in 1889. In the latter portion of his paper, Mr. Bailey contrasts the London conditions with those obtaining in Berlin, Paris and Buenos Ayres, to which might be added many other great cities, such as Chicago, Montreal, &c.

The advantages of centralisation of management and uniformity of system in the hands of a single authority, under statutory control, are hardly if at all less patent in the case of electricity supply than in that of the telephone system; and while we do not advocate the municipal management of any great commercial undertaking such as these, we believe that unification of the supply of electricity in London would tend to lower the price to the consumer, while ensuring an adequate return to the investor and guaranteeing a continuity of supply unattainable under existing conditions. But it will be the work of many years, and we hardly anticipate that it will be complete even when Mr. Bailey reads his third paper before the Society of Arts in 1933—as we sincerely hope he will do. May we be there to hear him!

#### Smoke Abatement.

THE annual meeting of the Coal Smoke Abatement Society was held on April 10th at the Royal United Service Institution.

There was a time when this Society displayed something other than affection for electric generating stations, and we were inclined to feel that in pursuing its policy of relentless persecution of electrical undertakers, it was blind to the support that electricity supply was lending to its movement by providing power which would render multitudinous furnaces and factory chimneys unnecessary. To-day, however, the Society appears to be full of appreciation of the work of the London electricity suppliers. Indeed, reference to a note elsewhere in this issue will show that "the value of this, their ally, in the work of cleansing the atmosphere" is now gratefully acknowledged. In regard to the general course of smoke abatement, it cannot be said that the progress towards better ideas on matters of combustion is very rapid, yet in some way or other black fogs certainly seem to be less frequent than they were 20 years ago. It is a matter for regret that the income of the society should be less than £300 per year, for the society deserves encouragement from us all. What is needed by way of better methods for burning coal is not the use of anthracite, which some seem to think is the one and only way, but the use of methods for burning all fuels in a cleanly manner. It is to be hoped, however,

that the semi-coke made from bituminous coal may, before long, be a regular article of sale. Coalite seems to have gone altogether. But what of that system by which ordinary gas coke was annealed in some way when freshly drawn from the retorts? To our knowledge that coke was an excellent fuel; it ignited as easily as coal, made a nice clean fire, produced no smoke, and yet gave a fire more like coal than coke. It was also economical. Of course, coal should never be burned until it has been at least partially coked and the by-products saved. But that is a large question. The domestic chimney should be less an offender to-day in consequence of the developments of gas and electric heating and cooking, and hopeful electrical men look in this direction, perhaps, more than in any other, for the clean and sweet, because smokeless, city of the future.

AN American contemporary recently gave some interesting particulars of the electric heating load connected to the mains of the New York Edison Co. In 1900, this load amounted to 200 kw.; by 1907 it had increased to 800 kw., and, at the present day, it amounts to some 3,000 kw.—a figure which has, however, been exceeded in the Marylebone (London) area. Naturally, it is the electric iron which has come into favour most readily, and such is its popularity that the average energy consumption per iron used in tailoring establishments in 1912 reached the remarkable figure of 350 kw.-hours—an amount greater than the total annual consumption of many, if not most, middle-class lighting consumers in this country.

Our Chicago namesake states that nearly 700 additional electric irons were placed in New York factories last year by the Edison Co. alone, and it is known that 98 per cent. of these are in regular use. An installation of six irons is reckoned to be a small one, yet it secures a very acceptable annual revenue, and there are many larger installations bringing in from £100 to £300 per annum. With such figures before us, there can be no doubt that electric irons are as valuable to users as their demand is to the central station.

Prominent among the other industrial heating loads supplied by the Edison Co. are several large japanning ovens, the efficiency of which has been greatly increased by the adoption of electric heating. During January, 1912, the ovens in one establishment consumed 882 kw.-hours. Recently electric heating has been adopted in connection with celluloid button dies, and in the better millinery and dry goods establishments there are a number of electrically-heated boilers used for steaming velvet and feathers.

Similar installations have recently been put in by large theatrical companies using a multitude of costumes. Electric sealing-wax heaters are working six days a week in many large offices, electric branding irons have gained greatly in popularity within the past year, and soldering irons and pitch kettles make a steady, if not startling, progress. Cinema film companies are now using electric heaters for their developing baths.

In domestic service in New York the electric iron averages 14 hours' use per month; the 6-lb. iron usual in resident flats averages 84 kw.-hours per annum. Special provision is made for the use of electric irons in the newer apartment houses; in one case, 35 tenants are each provided with two irons and an ironing board in an elaborate basement laundry, and complications are avoided by placing each iron on its own meter and locking the outlets. Among all kinds of domestic heating appliances, that for which the greatest increase in demand developed in New York during 1912 was the "combination grill," comprising a series of cooking utensils capable of being used with a single heating unit,

The Washington Water Power Co. (Spokane) has an industrial heating and power load of 77 per cent. daily load factor, to which, as we gather from the American *Electrical Review*, there has recently been added an electric heating installation in the banana ripening rooms of the Chas. Udden Co. Each of two rooms, 16 x 18 x 7 ft., accommodates 200 bunches of fruit, and is heated by four 500-watt heaters mounted in an asbestos-lined wall box. In addition, a 500-watt heater is placed in a bucket of water to provide the requisite atmospheric moisture. A circulating fan is placed in each wall box at the outlet of an air duct, which has its inlet at the floor line on the opposite side of the room. Cool air is thus drawn in and blown through the heaters on to a distributing board. Experience shows that this system of heating enables a uniform temperature to be maintained in every part of the room without the aid of a thermostat. At night, the fan and half the heaters are shut down, an even temperature within 0.5° F. being then maintained during the night. In summer, the heat generated by the ripening fruit is greater than is required for best results, hence ventilating ducts are opened, and (the heaters being idle) the fan is used to circulate cool air through the ripening rooms. By working the rooms alternately, a high load factor is obtained, and 200 bunches of fruit are available for market every two days. The nature of the load, from the central station standpoint, will be seen from the following data:—

1912.	Max. demand. k.w.	k.w.-hours.	Load factor.
March ... ..	1.7	1,100	87 %
April ... ..	1.2	800	92.5 %
May ... ..	1.2	840	94 %
June ... ..	1.2	90	10.2 %
July ... ..	1.2	60	6.7 %
August ... ..	1.2	75	8.4 %
September ... ..	1.5	240	22.2 %
October ... ..	1.4	450	43.3 %
November ... ..	1.9	900	65.8 %
December ... ..	2.3	1,150	67.2 %

In the case of *Crosfield v. Techno-Chemical Laboratories, Ltd.*, which was really a contest between the two great firms of Mond and Lever, Mr. Justice Neville had something important to say about the functions of the expert witness. One has only to peruse the headline or summary of the case which appears in the *Times* "Law Reports," published last week, to see that it was a dispute in which the services of experts were urgently needed. That summary is as follows: "The plaintiffs, as legal owners of letters patent granted to one N. for 'a process for converting unsaturated fatty acids, or their glycerides, into saturated compounds,' alleged that the defendants were infringing their letters patents, and they claimed an injunction and the usual ancillary relief. The defendants denied the validity of the letters patent, on the ground that N.'s specification did not sufficiently describe the manner in which the process was to be carried out. It was held that the specification was insufficient in this respect, and that the action failed." It is obvious that a dispute about such a patent must have involved the employment of experts—if only to explain to the Court the meaning of the technical words used; but it is evident that in the view of the learned Judge the experts engaged exceeded their functions. In the course of his judgment he said:—

"It is not competent in any action" for witnesses to express their opinion upon any of the issues, whether of law or fact, which the Court or a jury has to determine. The assistance of expert evidence in patent actions is generally essential. It is required for the purpose of explaining words, or terms of science or art, appearing in the documents, or to inform the Court in case the import of a word or phrase differs from its popular meaning. Further than this, in some cases it is impossible for the Court to understand a document without in-traction with regard to the laws of the science with which the patent may be concerned, without expert assistance. Moreover, the Court cannot inform itself as to the state of public knowledge with regard to the matters in question at the date of the patent. The above category may not, indeed, be exhaustive; but in no case, in my judgment, is it per-

missible to seek the opinion of a witness upon any of the issues in the action, or the construction of any document relied on. Yet I believe if the records of patent actions during the last 20 years were examined, it would be found that a very large proportion of their contents, I should say at least nine-tenths, is devoted to questions which, either openly or under more or less skilful disguise, are directed to eliciting the opinion of the witnesses upon one or other of the issues in the case, or the construction of documents relied upon.

Anyone who has been concerned in a patent case will readily admit the force and truth of these observations. The expert witness necessarily becomes imbued with the merits of the case he is asked to support, and finds it difficult to avoid the expression of an opinion as to whether a particular invention has or has not been infringed or anticipated. But while it is easy to point out the symptoms of a disease, it is not always easy to prescribe a remedy. Under our present system of judicature by which technical cases of the highest order must be tried before a tribunal which may, scientifically speaking, be wholly ignorant, the assistance of expert witnesses is essential. For some reason which is difficult to explain, the judges almost invariably refuse to summon a scientific assessor whose opinions on technical matters would be of the utmost value. True, the parties to a patent action can retain the services of counsel who have much scientific knowledge; but the opinion of the counsel is only argument when heard in court. Some of us, perhaps, may live to see the day when there will be a special tribunal for the determination of patent cases before which the services of expert witnesses may be entirely dispensed with.

**Invention  
in 1912.**

THE annual report of the Comptroller-General of Patents shows that among the predominant lines in which there was

evidence of inventive activity during 1912 were the following:—Internal combustion engines and other motor-car matters, including the construction of small dynamos for motor-car lighting; life-saving appliances for use at sea, inventive ingenuity apparently being markedly encouraged by the *Titanic* disaster (means for preventing collisions and detecting the presence of ice, also arrangements for enabling wireless signals to be received when the operator is off duty are mentioned in this class); and automatic telephone exchanges—especially the difficult problems of junction and trunk line working, and semi-automatic and other methods for facilitating the gradual introduction of automatic systems. Legislation which gave rise to a great public controversy also led inventors to find new appliances for obviating the necessity for wholesale stamp-licking being carried out on the orthodox lines; while the public appreciation of the cinematograph made this comparatively new department a popular one among patentees. In regard to the general figures of the year, the number of applications was 30,089, as compared with 29,353 in the previous year; provisional specifications were 19,825, and complete 18,853, while 15,814 were sealed, these figures in 1911 being 19,524, 18,662 and 17,164 respectively. The receipts from patents fees were £293,529, showing an increase of £10,325 for the year. In designs and trademark fees there were increases of £441 and £3,369 respectively. There was a decrease of £379 in the sale of Patent Office publications. The total expenditure on behalf of the Office showed a decrease of £3,140, and the net financial result of its entire operations is a surplus of receipts over expenditure amounting to £131,627; this is an increase of £16,896, as compared with the 1911 surplus. It appears that there is an increase in the number of applications received from the United Kingdom and from Canada, India and the West Indies, but those received from the Australian Commonwealth, New Zealand and the South African Union, showed a considerable decrease. In respect of ten foreign countries (included here is the United States), there were increases, but six Continental countries—Belgium, France, Germany, Hungary, Russia and Sweden—sent fewer applications than in 1911.

## ELECTRODES FOR ELECTRIC FURNACES.

By G. BASIL BARHAM, A.M.I.E.E.

For some reason in electric furnace work, not only the actual electrodes themselves, but also the end connections which are used to connect the cables from the supply to the heating resistance are frequently termed electrodes, although this term could only be applied in the correct sense to these terminals when the resistance was of an electrolytic nature. Generally speaking, the name is given to the carbon or metal bodies which, together with the charge, form the primary essentials for almost every form of electric furnace yet devised.

The best material for electrodes from the point of view of conductivity is graphite. Usually ordinary carbon is employed, as all forms of carbon decrease in resistance as the temperature to which they are heated increases, being in this respect the exact opposite of most of the so-called rare metals—such as those used for lamp filaments. Carbon, further, can be raised to a higher temperature than can any other substance suitable for use as electrodes. Unfortunately at high temperatures it will readily enter into combination with certain metals—tungsten and molybdenum in particular—forming carbides. Carbon electrodes at high temperatures also act as reducing agents unless they are properly cooled, and it may be said that the problem of effectively cooling electrodes without allowing heat to flow from the hot end of the electrode to the exterior of the furnace is not an easy one to solve. If metal electrodes are employed in order to avoid the troubles which may result from the use of carbon, they also must be effectively cooled or they will dissolve or volatilise. When metal electrodes are used it is customary to form them of similar metal to that about to be treated, so that should any part of them be dissolved, the melted metal would still be in its original form and not in that of an alloy. It will be remembered that Ferranti, Héroult and Kjellin devised means whereby the work of smelting could be carried out without electrodes or without such electrodes as were used coming into actual contact with the metal which was being dealt with.

It has been mentioned that one method of preventing the escape of heat to the outside of the furnace is by cooling, but it will be evident that much depends on the proper proportioning of the electrodes themselves to the current which will be passed through them, and by which the interior portion is raised to the required temperature. This question was thoroughly gone into a short time ago, and it was found by experiment that many of the rules formerly used for designing electrodes were quite incorrect. It was proved that current density was not a determining factor in the design of these parts, and that the resistance was determined by the conditions and not to be considered as merely a matter of choice. The conditions determine either the length or the section of the electrode, and it is only the ratio of the section to the length which is the determined factor. Neither the thermal conductivity nor the electrical resistivity is a governing factor, but it is their product and quotient which are the true measures of the qualities of electrodes. The quotient of the thermal over the electrical conductivity is proved to determine the loss, while the product of the two resistivities determines the proportions, hence it is not necessary to know either one or the other of these properties, but only their quotient and product. It was furthermore shown that these are more easily determined than the others. These two quantities lead to some new quantities not hitherto used, but by means of which the calculations of electrodes become simple in the extreme. These two quantities are termed the loss and the size factors.

Hering has tabulated these for each of various temperature ranges. The loss factor, called "watts per ampere," when multiplied by the current, will give the loss in watts directly, whilst the size factor, called "section per ampere per sq. in." when multiplied by the current and by the length, gives the cross-section in sq. inches.

A problem, which has been the subject of considerable attention, has been in regard to the terminal connections to the electrodes. It appears useless to clamp the electrodes

into metal holders, or to use clamping bands, plates, couplings or caps. The metal expands much more than does the carbon as the temperature rises, with the result that the metal attachment works loose, and local heating, which may have disastrous results, sets up. A metal rod, carrying a terminal attachment, can be used for the purpose, one end being morticed or sunk into the carbon electrode. It is important, however, that this should not be too tight a fit, as otherwise, when the metal expands, it will burst the end of the carbon rod or block. In one form of terminal a metal rod, which is enlarged at its bottom end, is passed into a hole in the carbon which has been undercut so that whilst it is large inside, the mouth of the hole will only just permit the thickened end of the rod to pass. When the thick end of the rod is pushed to the bottom of the hole, thin metal plates are slipped down beside it, with the result that when an attempt is made to withdraw the rod, the plates jam it in place. This makes a sufficiently good electrical connection, and one further which allows of expansion, the metal rod sliding slightly down the inclined plane made by the metal strips, as it expands under the heat conducted through the electrode.

Common coke, as obtainable at any gas works, is quite suitable for electrodes in the majority of circumstances, and has the advantage of costing but little. In the production of calcium carbide, aluminium, or carborundum, such electrodes answer the purpose admirably in every way, especially if the coke is first picked over, and the light and more porous portions removed. A good carbon for low-tension work is made of a mixture of 25 per cent. of gas coke, and 75 per cent. of petroleum coke. This latter is a by-product of the oil distilleries, and at one time was the only kind that was largely used in the manufacture of carbons for electrical purposes. The only other constituent for the best quality of electrodes is pitch, obtained from the distillation of tar. A common pitch obtained from blast furnaces, but which is far from pure, being contaminated with iron compounds, can be used, but it is not nearly so suitable. At the same time it is not easy to get the desired quality of pitch from the distilleries. The quality depends on the freedom of the pitch from anthracene oils, as when it contains these it is what is technically termed "wet," an expression the meaning of which is self-evident. To get it properly dry all the oils must be driven out, and few still owners care to expose their plant to the high temperatures, which have to be kept up for a long period, in order to drive off the whole of these oils.

In the manufacture of electrodes the coke is first crushed to the size of coarse gravel, after which it is heated to incandescence in a sealed retort, which is provided with a few vents to permit occluded gases to be driven off. After withdrawal from the retorts the coke is ground to fine powder and conveyed into storage bins. The pitch is first broken by hand and then passed through machines which break it up into fine granules. The coke and pitch are then accurately mixed, and it is on this mixing that the quality of the resultant electrode depends. It is carried out in a cast-iron cylinder containing an independent shaft, which is fitted with arms which drag the material from the sides of the drum as fast as it is thrown there by centrifugal action, and bring it back to the centre. After undergoing this treatment for some time, the mixture is spread out and allowed to solidify, after which it is again broken up and pulverised in a mill. It is then finally pressed into moulds, which are the shape of the required electrodes, and baked to render the pitch-coated particles of coke thoroughly adhesive. As soon as the required degree is reached the mould is placed in a hydraulic press, and a pressure of several hundred tons brought to bear upon it.

**Electric Laundry Irons.**—In view of recent correspondence on the subject of laundry irons, the BRITISH PROMETHEUS CO., LTD., of Birmingham, inform us that they are now making a speciality of a new type of laundry iron, which has been expressly designed to obviate the defects mentioned. They are so confident of the utility and long life of this iron that they are willing to submit samples for approval to laundry engineers, some of whom have already tested them with complete satisfaction. The guaranteed life of the new Prometheus laundry iron is three years.

## THE LIGHTING OF SMALL COUNTRY HOUSES.

By J. CALDWELL.

It is now generally recognised that electric lighting cannot be surpassed for use in large country houses, and in the technical Press many interesting descriptions of extensive installations for electric lighting and power duty appear from time to time.

The expense of carrying out such comprehensive schemes is, however, considerable, and often exceeds average requirements in the country where castles and large mansions—many of which are already provided with electric light—form a very small proportion of the residences where the installation of private lighting plants is now being considered.

It is in these small or moderate-sized country houses that one sees the keen rivalry between petrol air gas and electricity for supremacy. The exponents of each system endeavour to convince the prospective customer as to the advantages of their system, and also to give all information of disadvantages and dangers, whether real or non-existent, that are reported regarding the rival system. Figures are given to prove the superiority and wonderful economy of either illuminant, and as these particulars are often misleading with reference to the standards of comparison they prove damaging to both systems, as the customer ultimately finds out the true facts for himself, and although the results of work may be entirely satisfactory, they prove disappointing in view of previous assurances.

Both illuminants are particularly satisfactory and efficient, and can claim to be convenient, cheap and simple to operate when compared with oil lamps, coal or acetylene gas. Electrical plants have already proved durable and reliable in the performance of their duty, and although petrol air gas plants have not yet ceased to get out of gear periodically, it may be expected that this trouble will soon be eliminated when manufacturers realise the advisability of increasing the strength and improving the design of the machine parts with a view to providing efficient service rather than cheap equipments.

Hereunder we give comparative particulars of two existing typical installations of petrol gas and electric light. These were erected two and four years ago respectively, and are chosen from amongst installations representing the nearest similar capacity and duty in which the writer is interested. The gas plant has practically no storage accommodation, but operates automatically to supply the lighting demand, whereas the electric plant has a storage battery which is charged for a few hours each day, and a longer period on Saturdays in winter, but less frequently in summer months. The maximum capacity of the gas plant is 100 burners, whilst the electric plant when working under the same conditions with combined supply from dynamo and battery could be connected to 82 lamps for 10 hours and a maximum of 112 lamps for one hour without recharging the battery.

These conditions, however, do not occur in usual practice, and the average number of lamps in use at any one time in the two small installations under consideration does not exceed from 30 to 50 lights.

**Petrol Air Gas.**—The necessary quantity of petrol is introduced into a tank in the generator containing water, which is aerated by a revolving stirrer during admission of the spirit; petrol air gas is emitted and distributed to burners throughout the house by pressure obtained from a weighted gas-holder fitted to the machine. The correct proportion of petrol admitted to the tank is measured in a small bucket placed inside the generator, which admits the desired quantity into the water, depending on the rate of gas consumption.\* The distributing pipes are made of iron or block tin, sufficiently large to pass the requisite amount of

\* In other air gas machines the petrol is contained in a small closed storage tank, from which it is automatically passed into a carburetter, when it is brought into intimate contact with air which has been dried by means of calcium chloride and is drawn through the carburetter by a small pump. The carburetter consists of a series of pipes arranged in zigzag form, and the petrol when admitted is passed through wire gauze, where it is broken up into fine particles and mixed with the dried air.

gas to the burners without loss of pressure, and taps are connected to the bottom of vertical pipes as found advisable to drain away any condensed water that accumulates. The initial cost of this installation was as follows:—

Generating plant with accessories ... ..	£102	10	0
Piping, &c., in house ... ..	63	0	0
Fittings ... ..	0	0	0
	£165	10	0

**Electric Lighting.**—The generating and storage plant is accommodated in an outhouse, and consists of a petrol-paraffin engine direct coupled to a shunt-wound dynamo with switchboard and a storage battery.

The "Rational" engine, manufactured by the Heatley Gresham Engineering Co., Ltd., develops 1.6 B.H.P. at constant working load, with fuel consumption of .8 pint per B.H.P.-hour, on paraffin fuel having a specific gravity of .825 at 62° F.

The engine is fitted with magneto ignition, and when started cold, is run on petrol until the vaporiser is sufficiently heated—in about five minutes—to allow of paraffin being used.

The interconnecting pipes between the engine, oil and water tanks and exhaust silencer are laid in trenches in the floor neatly covered with checker plating fitted with iron frames. The dynamo gives 40 amperes, 2.5-4.0 volts at 800 R.P.M., and is mounted with the engine on a combined bell-plate.

The switchboard is recessed into the partition wall between the engine and battery rooms, thus providing easy connection to the cells, whilst the back of the switchboard is enclosed as a protection against acid fumes.

The battery, made by the Chloride Electric Storage Co., consists of 14 cells capable of supplying 32 16-c.p. metal-filament lamps continuously for 10 hours.

**Wiring, &c.**—Bitumen cables, contained in wood troughing filled in with pitch and covered with tiles, are laid underground from switchboard to house and two avenue lights.

The branch wiring throughout the house is of V.I.R. 2,500-megohm grade conductors contained in solid-drawn steel tubes sunk behind walls and ceilings.

The work was carried out by Messrs. Steel & Wilson, Glasgow, to the specification of James E. Sayers & Caldwell, Glasgow, and the total cost is summarised below:—

Generating and storage plant ... ..	£90	12	9
Switchboard and connections ... ..	17	0	0
Underground cables ... ..	11	11	0
Wiring for 68 lamps and 62 switches ... ..	57	16	0
74 metal-filament lamps ... ..	9	5	0
Alterations and extras ... ..	11	10	5
Fittings ... ..	10	0	0
	£207	15	2

The fittings for gas and electric light are not included in the above comparative costs, as the amount spent on these depends on the design and class of fittings selected, which varied in both these installations.

The gas consumption for each burner is 9 cb. ft. per hour. Petrol of .68 specific gravity at 62° F. as recommended by the makers of the gas plant is at present 2s. 1d. per gallon, and as this quantity generates 1,300 cb. ft. of gas, the cost of petrol per 1,000 cb. ft. will be 1s. 8d.

To start the engine, petrol of .825 specific gravity is used which can now be obtained at 1s. 4d. per gallon, and paraffin for 7d. per gallon, equivalent to an average fuel cost of 8d. per gallon. As .2 gallon of fuel is required per B.H.P.-hour, which is equivalent to about .3 gallon per unit, the oil required per 16-c.p. lamp will be .006 gallon per hour.

It is difficult to obtain reliable information for intelligent comparison of the upkeep of these respective plants on the same basis, but if we assume that 30 lamps are in use for 1,500 hours per annum, the annual charges will be:—

Petrol Air Gas.—30 × 1,500 × 9 = 405,000 cb. ft. gas at 1s. 8d. = £33 14s. 8d.
Electric Lighting.—30 × 1,500 × .006 = 270 gallons fuel at 8d. = £9.

The proprietors of both plants have indicated that the accounts for petrol and oil during the last six months (September to March, 1913), which include the darkest days of the year, were £24 for the petrol-gas plant and £6 for the electric plant, so that it may be assumed that the above figures are substantially correct.

## FILING ARTICLES FROM TECHNICAL JOURNALS.

By "WHISTLEFIELD."

ANYONE who has made a practice of keeping his technical journals for future reference soon finds that the pile begins to assume unwieldy proportions, and when any article is wanted, it is a very difficult and often times dusty business to lay hands on it.

There is so much that is of purely momentary interest in most papers, that it is not worth the expense of binding them even if the amount of room required for storing the volumes was not a consideration. To make a neat job of a scrap book requires two copies of each paper to be bought, otherwise pages which are gummed down one side, or along the top to allow the letterpress on both sides of the page to be visible, will become torn in handling. In addition to the trouble of cutting out and mounting, is the further one of indexing, and unless the reader is of more than ordinary methodical habits, and has more time than he knows what to do with, the scrap book is sure to get behind and degenerate into a folder full of torn-out pages without method or index.

Another way is to take out the pages containing the letterpress that is wanted, score out with blue or red pencil the columns not required and bind the whole pages in some form of clip file or spring-back folder, numbering each page with blue pencil for the purpose of indexing.

This method is an improvement on the scrap-book from the time-saving point of view, but does not get over the difficulty of indexing, and unless the indexing is thorough and well done, the usefulness of the file is greatly reduced.

The following method for dealing with articles and other interesting matter published in the *ELECTRICAL REVIEW* is one which works well and requires so little time to keep up to date that perhaps it may prove of interest to those who have not yet got a working system.

A Stolzenberg or other similar file, foolscap size, with a loose flap, so that the first paper filed always remains on top, is procured, and each week every page of the *REVIEW* which has anything of permanent value is torn out and inserted in the file, care being taken that the numbers of the pages run consecutively—that is, if pages 300, 304 and 310 are kept one week, they are filed in the order given.

In the first or second week of January and July there is a very complete index of the contents of the paper for the previous six months, published as a supplement to that week's issue; this is removed intact, and placed in front of the file containing all the pages referred to in that index.

All the articles retained and filed are now underlined in ink in the index, and, of course, the page number given in the index corresponds with the number on the page filed, and these numbers run in consecutive order in the file. A careful examination of the index will also show if any papers of value have been overlooked, and these can now be added to the file, and the remains of the issues destroyed.

It does not take more than half an hour every six months by this method to get a completely indexed useful file of technical data; and as the *REVIEW* index is grouped under sub-headings also, the system is as thorough as one could wish for.

The same method, of course, could be adopted with regard to the articles of any periodical which issues an index to each volume.

**Anglo-German Exhibition in London.**—From May to October, 1913, there will be an Anglo-German Exhibition in progress at the Crystal Palace. We have received a copy of a pamphlet prepared for the instruction of prospective exhibitors, and full particulars can be obtained from the administrators of the Exhibition, Empire House, 175 and 176, Piccadilly, London, W. The list of exhibits includes machinery and tools; lighting, electricity, gas, &c.; mining; transport, railways, tramways, &c. Money prizes, aggregating £2,500, are to be awarded for the best decorated stands. There will be an Anglo-German club in the grounds, and various sports and other amusements will be arranged for. One of the great objects of the promoters will be to cultivate a more friendly feeling between the two nations.

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

### Failure to Excite.

In reply to "Speedometer's" letter on the above subject in your issue of April 4th, I would suggest that the trouble is due to the shunt winding being reversed.

It is a well-known fact that a shunt wound generator will only excite, if the field winding is so connected that current generated in the armature assists the residual magnetism, and builds up the field.

To find if this is the cause of the trouble, the generator should be run in the reverse direction. Should the machine still fail to excite it will be due to the field being totally demagnetised, or slightly magnetised in the wrong polarity.

The machine should be run for a short period as a shunt motor, after which if it is run in the opposite direction as a generator, it cannot fail to excite.

H. P. Bramwell.

Glasgow, April 12th, 1913.

[We must point out that a shunt machine runs in the same direction whether as motor or as generator. Still, Mr. Bramwell may have put his finger on the trouble; possibly "Speedometer" drove the machine in the wrong direction.—Eds. E.R.]

### Long-Scale Instruments.

My attention has been drawn by several friends to advertisements and descriptions in various electrical journals of the long-range ammeters and voltmeters of Messrs. Record & Co., and I would ask your kind permission to express my view with regard to long-range instruments generally.

In this expression I do not desire to reflect in any sense on the design of the instruments of Messrs. Record. Writing purely from a personal point of view, I wish the firm success in their endeavour. There is, however, another aspect of this matter that must be taken into consideration, and it is this: that others also are manufacturing long-range instruments.

I think engineers will realise that the instruments now manufactured by Messrs. Record & Co. are essentially of the same type as those made as long ago as 1895 by Messrs. Muirhead & Co., and more recently by Messrs. Gambrell and Co.

It is not pleasing to me to have to write in this strain, but in justice to others now making these meters, it is well that your readers should know how the matter stands. I will be brief.

For the long-range type of meter, letters patent were granted to me in 1893. This type was subsequently described in a paper before the Physical Society of London, February 10th, 1899. Descriptions appeared also in the *Philosophical Magazine* for August, 1899, and in text-books and electrical journals. The instruments appeared in various forms, but all had scales varying in length from 220° to 295° of arc.

A long-range instrument was patented also by Mr. W. P. Thompson in 1897 (No. 22,851) having a range of 270° of arc. There is, therefore, nothing novel in long ranges. Letters patents were granted to Mr. Record in 1912, Nos. 3,454, 26,241 and 26,242.

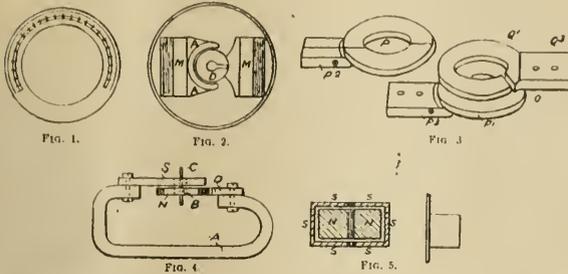
The range of one of the 1893 meters is shown in fig. 1. It is in degrees, being an instrument designed for laboratory purposes. The length is 240° of arc. The figure is taken from Messrs. Muirhead's catalogue.

Moreover, the 1893 instrument was by no means the first meter possessing a long range. Prior to this there existed a French instrument of a similar type designed, I believe, by M. Carpentier. I was not aware of this till 1899, when Prof. Ayrton sent me a sketch of it drawn to scale. I cannot now put my hand on this, but my recollection is that the scale length was 250° of arc at least.

Mr. Record makes a claim in one of his specifications for the "ring-shaped" pole-piece. The "ring," however, is an

essential feature of all the 1893 instruments, as well as the Thompson instrument of 1897. Figs. 2, 3 and 4 show the pole-pieces of the three meters. Fig. 2 is taken from Mr. Aspinall Parr's book; fig. 3 is from the Thompson patent specification, and fig. 4 is from the Record patent specification No. 26,242 of 1912. All these possess the "ring-shaped" pole-piece, and all have long ranges.

Mr. Record, in one of your contemporaries (*Electricity*, January 10th, 1913), quite rightly lays stress on the plan of making two sides of his moving coil active, and then makes a comparison with the 1893 instrument, in which only



one side was active. He will find, however, on referring to the *Philosophical Magazine* for August, 1899, that I had arranged for the active use of even three sides of the coil. Fig. 5 is a reproduction of a cut published in that journal.

Again, in Mr. Record's patent specification the formation of a gap in one of the pole pieces, with the object of avoiding waste of magnetic flux at a certain area not swept through by the moving coil, is raised to the dignity of a claim. This gap, as every engineer would see at once, is purely a constructional necessity. In one of the forms of the 1893 meters, owing to its particular construction, that same gap was used, and is shown in the *Philosophical Magazine* for August, 1899, page 205. The gap is such an obvious necessity that one is somewhat astonished that it could ever have been thought of as a sufficient basis for a claim in a patent specification.

Benjamin Davies.

Enfield, April 11th, 1913.

### Electric Laundry Irons.

It was with great interest that we read the remarks contained in your columns last week by "Ironical."

We have had considerable experience in electric, domestic and laundry irons, and we have tried all the well-known makes, but cannot find one that will give satisfaction for any length of time.

The troubles we experience are either the copper contact loosening inside the iron from the element, which seems to lose its nature by the close proximity of the heat, or the pins connecting the cable connector lose their tension and continually have to be renewed.

The flexible wire immediately on leaving the connector in a very short time frays and the rubber perishes and short circuits occurs if these are not attended to periodically.

We have tried all kinds of flex with the exception of brass flexible mentioned by your correspondent, and we certainly think there is a vast amount of room for some heating firm to devote their greatest attention to put on the market an electric iron that will get over this difficulty.

We shall be pleased to hear from any makers that they are in a position to supply us with these goods when the troubles complained of have been overcome.

J. E. Lester & Folwell.

Leicester.

## THE PREVENTION OF ACCIDENTS IN ELECTRIC LIFTS.

[COMMUNICATED.]

A CONSIDERABLE number of cases which have recently occurred where passengers in electric lifts have been killed or injured has led to a stirring of interest in the question of the safety or otherwise of the electric lift, and it may, therefore, be worth while reviewing very briefly the conditions of the problem and the means which are adopted in order to secure as far as possible the safety of those using the lifts.

Considering, first of all, the method of control, the electric lift is operated either by hand rope, a switch in the cage or push buttons, and in each case there is the liability to trouble unless suitable means of securing safety are provided. Further, in any type of lift, especially where high speeds are adopted, there are dangers which can only be overcome by most accurate controls, preferably of an automatic nature. For example, it is very difficult to bring a high-speed lift accurately to rest in its proper position in line with the landing, and it is easy to see that a difference of an inch or two might, under certain circumstances, make the owner of the lift liable for any accident caused to passengers or intending passengers. Again, on a high-speed lift, unless automatic means for slowing down and stopping the lift at the top and bottom of its travel are installed, there is the danger that it might slightly overrun its path and cause damage either to the cage, the supports or the passengers. Due provision must also be made against the breakage of the rope, the failure of the motor or the brakes and any mechanical or electrical breakdown which would interfere with the safety and convenience of working.

A most important and serious class of accident arises in connection with the gates. If adequate precaution is not taken to have these properly closed when the cage is not in position on the landing, there is the danger of a passenger falling down the shaft or meeting the top of the gateway while the cage is rising, and thereby suffering severe injury. To ensure safety, automatic means must be devised for the closing of gates before the cage begins to move away from the landing, and it is towards this point that a great degree of attention has been directed.

Considering, for the moment, the problem raised in the former series of possibilities, it may be pointed out that strain on the ropes, over-running and similar troubles can be overcome by means of a suitable method of electrical control. The method of starting and stopping the lift by hand rope is, of course, the simplest and least costly, and can be applied either by hand ropes passing through the cage and controlled by an attendant, or by one rope passing through the cage and one rope placed outside the lift shaft altogether, and controlled by anyone desiring to use the lift. Safety is assured with this latter system, provided that the cage is fitted with barrier gates which either lock the starting rope mechanically or are electrically interlocked to prevent the cage from being started when loading or unloading is taking place. Where the lift is controlled by means of a reversing switch in the cage, terminal blocks are usually fixed one in the cage and the other half way up the shaft, to which is attached a multiple wire cable connecting the switch to the controlling apparatus, which operates electromagnetically, and is designed to effect a smooth starting and stopping of the cage at landings with the ordinary movement of the handle by the attendant, while, at the same time, the motor and apparatus are protected against breakdowns, even on heavy or frequent service, by good and substantial design and construction. At the top and bottom landings automatic stopping is provided.

In the case of push-button control it is customary either to use a panel of buttons at each floor, enabling the cage to be dispatched from any one floor to any other floor from either inside or outside the cage; or alternatively, there is only a single button at each floor, enabling the cage to be brought to that floor by touching the button and dispatched to any other floor from the inside of the cage only. In addition to the push-button panel in the cage containing the corresponding push buttons of the floors, there is also a lighting switch and emergency stop, while the control apparatus for starting, reversing and stopping the motor is

**Magnetic Survey.**—The Terrestrial Magnetism Department of the Carnegie Institute is beginning a magnetic survey of New South Wales, which will be linked up with Dr. Mawson's work in Adélie Land.

fixed near the machine itself. The emergency switches are actuated automatically if for any reason the cage overruns the top or bottom levels. Reference was made above to the possibility of the main ropes failing, and this is overcome by using duplicate adjustable slack additional wire rope to arrest the cage and the balance in the event of the main right ropes failing; while in some cases safety apparatus is adopted, which arrests and grips the cage tightly in the event of failure or undue stretching of any of the hoisting ropes.

The most likely form of trouble is in connection with the gates, and various designs of collapsible and swinging gates have been produced, in order to avoid accident. Interlocking between the cage and the gate is essential, and may be accomplished either mechanically or electrically. A construction very frequently adopted depends on the grip which is obtained on the hand starting rope. This is adaptable to all hand rope-operated lifts; and as one hand rope can be fixed outside the gate and one in the cage, it is not necessary to reach through the gate to start the lift. The gate is automatically locked across the opening when the cage is away, and it can only be opened by hand to admit of entrance to the cage when the cage is stopped approximately level with the floor. When the cage is stopped on any floor the handle of the rope grip is moved to a horizontal position in front of the collapsed gate, and, at the same time, it grips the starting rope on the inside, preventing the lift from being started from either the inside or outside. When the rope grip is released the gate automatically closes across the opening, and automatically locks. Another useful locking device in connection with rope control may be mentioned. Occasionally a lift is overloaded and refuses to rise when power is applied. Someone steps out to lighten the load, but, before he can get entirely clear, the relieved cage starts away, and a serious accident results. Moreover, the cage may have been properly stopped, but it is operated by the hand-rope method of control; and if any part of the hand rope is accessible from another floor, a person other than the attendant could incautiously start the cage while a passenger was entering or leaving. In order to overcome this trouble, a hinged barrier bar can be coupled to a rope gripper. When the cage is in motion the bar lies across the doorway of the cage and the gripper is free. On stopping the lift, however, no person can enter or leave the cage until the bar is raised out of the way, and this opening of the bar simultaneously closes the grip on the hand rope and locks it in the closed or standing position. It therefore follows that as long as the bar is open the lift cannot be started, and passage into and out of the cage is automatically rendered safe. Moreover, as the bar must be closed to release the hand rope, no person can pass while the power is on, even though it is standing owing to overloading. If the bar is improperly raised while the lift is travelling either up or down the power is automatically cut off and the lift is brought to rest.

An alternative form of interlocking is an electrical one, which is suitable for electric lifts operated either on the push-button control, switch-in-cage control, or hand-rope control. This type of gate is hand-opened and closed, and only with the lifts having the switch-in-cage control is an attendant necessary. Each gate is provided with an electric switch, and all these switches are connected to the controlling apparatus, so that the lift cannot be started until every gate in the lift shaft is closed across the opening when the cage is away, and no gate can be opened until the lift is stopped at a floor. In the locking of automatic lifts, it should be noted that three things have to be done. First of all, the door or gate has to be shut; it should then be latched, and then current has to be given to the machine. In some such locking systems, trouble arose owing to an attempt to make these three things occur simultaneously. If the closing of the gate happened to be completed first the gate was not latched, nor was current given to the machine. That fault was then corrected by allowing the latch to act and the switch to be closed before the gate was completely closed. This is obviously a dangerous procedure, for the gate may be pulled back and an arc drawn out without stopping the machine. If the switch happens to be closed first the machine can start with an unsecured gate, a contingency which has given rise to the largest number of accidents. A lock has, however, been designed

for the purpose of performing the three requisite functions in a definite sequence. First, the gate or door must be completely closed; until this is done nothing further can be effected; then follows the latching of the door, and until that is securely done it is impossible to give current to the machine. Finally, the circuit is closed and current is applied. On opening the door the reverse order is equally definite: first, the current is cut off; and then only can the gate be unlatched, and finally opened. In some safety locks a counter-locking action is operated by springs as the cage moves away from the door. Breakage of springs has sometimes rendered the counter-locking inoperative. In recent designs of safety locks this difficulty has also been removed.

Reference may be made to a type of automatic gate lock which has been largely applied to lift purposes. The automatic cage lock consists of a vertical spring plunger fixed in the floor immediately under the doors or gates giving access to the lift. This plunger is withdrawn by a cam fixed on the lift cage operating the lever by a small roller. When the cage leaves the floor level the plunger is forced into the bottom of the doors, and this action securely locks them. Inasmuch as the operating levers are inaccessible from the outside, it is impossible to open the doors unless the cage is at the floor level.

It will probably be objected that, however carefully the means of automatic control and safety provision is designed, there are always to be found persons of sufficient ingenuity to render all provisions for their safety of no use. This is undoubtedly the case, and he would be a bold designer of lift machinery and accessories who would be prepared to say that under all conditions and circumstances his apparatus was absolutely foolproof. At the same time, a great deal has been done to mitigate the possibility of accident due to ordinary carelessness, and in the above description it has been attempted to show as briefly as possible the main features of design, as shown in the work of such firms as Messrs. Rawlinsons, Ltd., of Leeds; Messrs. J. C. Etchells & Co., Ltd., of Manchester; Messrs. Smith, Major and Stevens, Ltd., of Northampton; Messrs. Holt and Willetts, &c. Inasmuch as the reliability of the electric lift is, apart from its undoubted economy of operation, a most potent factor in securing its adoption for commercial purposes, it is considered advisable to point out the means and methods which have been adopted to secure the safety of the public.

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## CHICAGO LABORATORIES AND CANADIAN TRADE.

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MR. F. A. CAMBRIDGE, city electrician of Winnipeg, recently wrote the following interesting letter to the *Canadian Electrical News*, respecting the report of Mr. Hamilton Wickes on the Chicago Underwriters' Laboratories and Canadian Electrical Trade, which was printed in our issue of January 3rd, 1913. He refers to an editorial comment made by our contemporary.

"While you are in the main correct as to the high standard of British manufactured articles, there are still a number of appliances and articles of manufacture of British make that are not in many respects up to the standard of American or Canadian goods intended for similar purposes. I know of what I speak as I have been in this work for the last 18 years and have repeatedly had to refuse to accept British made appliances and material, although this city does not, in spite of the statement of Mr. Wickes, insist upon the Laboratories' label. It seems to me that in this question two points have to be considered, namely; first, the standard of quality and the fitness for the duty and, second, the standardisation of dimensions of certain appliances, such, for instance, as cut-outs or fuses. You will remember the years of effort that were necessary before a simple matter like the standardisation of enclosed fuses was reached and similar action in regard to lamp sockets and lamp bases.

"Mr. Wickes seems to be afraid that under the present arrangements the Laboratories impose no restrictions as to the 'danger to life' factor. It is true that the Underwriters are largely represented on the National Code Committee, but all the other interests are also represented, and during the last few years the question of 'danger to life' has been increasingly emphasised in the Committee's rulings, and there are numerous rulings in the code that not only protect against fire, but also enforce the necessary safeguards for the protection of life, as, for instance, the grounding of the neutrals of the low-tension system. It is rather remarkable that Mr. Wickes should lay stress on this point, as in his own

country the requirements have been extremely lax on this point up to a very recent date, in fact, until recently apparatus and appliances have been sold and used in Great Britain that would not be allowed in this country where a properly organised Inspection Department existed; for instance, a long-skirted Edison base lamp having a live projection of 1½ in. below the socket. Such crude and unsafe methods were eliminated years ago on this side of the water, and inspection departments of this country find this form of lamp to-day (constantly imported from European points) to be one of the most serious menaces they have to deal with.

"While the British manufacturers are, no doubt, handicapped by the present conditions, and while as an Englishman myself I am doing everything I can to facilitate the placing of their goods on this market, the whole trouble is due to the fact, to use the words of your editorial, 'The Englishman does not feel the need of the same progressive step until he comes into direct contact with the United States' product in this continent,' and, judging by the increasing number of fatalities in the British Isles, due to electrical causes, it will not be long before public opinion will force the authorities to take a progressive step and call for the standardisation of electrical fittings generally.

"I believe that we should in Canada have a laboratory for testing purposes either under the Government or Underwriters' auspices, whose rulings would be accepted by the American laboratory, we in turn accepting theirs, so that a uniformity of ruling would exist. I understand that there have already been some proposals along this line, and with the institution of such an examining body the British manufacturers would not be under any disadvantage in exporting goods to Canada. I have at times come in contact with some of the leading members of British firms, who have been over here looking up trade possibilities, and in most cases they have expressed their readiness to adapt their goods to Canadian practice; on the other hand, there are Britshers of the well-known stubborn variety who will think that 'what is good enough for John Bull is good enough for Johnny Canuck,' but the latter has a habit of suiting himself. I imagine that a form of British standard that would be recognised the world over, will hardly come about.

"I cannot refrain from expressing my indebtedness to the American laboratories for the excellent work they are doing. It is of the very greatest value to the department over which I preside, in fact I do not know how we could get along without the valuable assistance they render from time to time. We are especially pleased with the way they are handling the rubber-covered wire situation to-day. Canadian manufacturers have found no difficulty in complying with the Laboratories' tests. Canadian manufacturers are to-day turning out wire with the Laboratories' labels, and I was only the other day requested to collect samples of wire found in the field and forward same to Chicago, when they would be tested and reported upon free of charge. The value of this service is, as I have said, very great, and I do not think it is sufficiently appreciated."

## LEGAL.

### JOHNSON v. JOHNSON-BILLINGTON ELECTRICITY METERS, LTD.

MR. WILLIAM HARRY JOHNSON, of Teddington, an engineer, and the inventor of the Johnson-Billington electricity meter, brought an action in the King's Bench Division on April 9th before Mr. Justice Horridge and a common jury, to recover a sum of money, amounting to about £140, which he alleged was due to him as salary by Johnson-Billington Electricity Meters, Ltd.

Mr. Patrick Hastings said the plaintiff was the inventor of the electricity meter which the defendant company was formed to acquire and exploit. The company was formed in 1910, and in August of that year the agreement was entered into under which the present action was brought. The agreement was for a period of five years, and apparently the company could get rid of the plaintiff, but he could not get rid of the company. His salary was £200 for the first year, and £250 a year afterwards. Plaintiff was the largest shareholder in the company, and he worked for them from August to the time this action started. His salary was paid for a certain period, and then stopped.

The other directors of the company were Mr. Billington and Mr. Spiller, and there appeared to have been some difference between them. The company had set up a number of defences. One was that the company, being in want of funds, they suggested that plaintiff should waive his rights until he was successful in raising fresh capital, when the arrears of his salary would be paid. Another defence was that the company had said they would not pay, and that that put an end to the agreement, and that he accepted and adopted this because he did not issue a writ at once. A third defence was that the plaintiff voted against an increase of capital, and thereby prevented the arrears being paid, and a fourth defence was that the plaintiff was not entitled to arrears because he had been negligent in not telling the company that the Beck Flame Lamp Co., which company was under contract to make all the mechanical parts of the Johnson meter, was insolvent, and that by not informing defendants of that fact they lost possession of moneys in the possession of the Beck Flame Co., which were the property of the defendant company. Counsel said, as a matter of fact, the plaintiff had nothing to do with the financial aspect of his com-

pany's dealings with the Beck Flame Co. and that further, the directors of the defendant company and the Beck Co. being the same, the defendants knew as much about the affairs of the Beck Co. as plaintiff did.

Plaintiff in the witness box bore out the opening statement of counsel.

On April 10th, Mr. SAUNDERSON, opening the case for the defence, said Mr. Johnson had nothing to complain of, as he had 2,000 shares in the company, while Mr. Spiller and his friends had to find the capital. It was the plaintiff himself who had brought disaster on the company by refusing to agree to the raising of further capital.

Mr. SPILLER, a director of the defendant company, and one of the original promoters, said he told Mr. Johnson he must not rely on his agreement, but he (witness) would do all he could for him, and that, if they could find more capital, he would do all he could to pay him. Witness said that his grievance was that the plaintiff did not tell the Meter Co. about the insolvent condition of the Beck Co. At the time of the liquidation of that company, witness wanted to buy it, but it was acquired by a Mr. Davis. Witness went to Davis, and asked him to continue to make the meters for the Meter Co. and to give Johnson employment.

After further evidence, and the counsel and Judge had summed up, the jury, without retiring, returned a verdict for the plaintiff for the agreed sum—£131, plus £12 10s.

His LORDSHIP entered judgment for the plaintiff for this amount, with costs.

### RELIGHTING OF ELECTRIC LAMPS IN MINES.

AT Chester-le-Street (Co. Durham) Police Court, on the 9th inst., Robert Smith, 16 years old, a driver, was summoned for an offence against the Electric Lighting Regulations for Coal Mines at Haddon Hold "Busty" Pit, on March 7th. The accused pleaded guilty. Mr. J. Turnbull, who prosecuted, said that statutory regulations had been made for controlling the relighting of electric lamps in mines, and the apparatus for relighting them was kept in a locked box down the mine, and only officials were supplied with keys, or were entitled to open the box or relight the lamps. The defendant was found in possession of a contrivance by which he was able to open the box. It was an exceedingly simple thing, and the owners had been shocked to find that the apparatus was so easily opened, and they had made an arrangement with the manufacturers to have a patent lock put on.

THOMAS WHITAKER, a driver, said he saw the defendant open the relighting apparatus with a nail. He put in an electric lamp to have it relighted, but the under manager arrived, and the operation was not completed.

A fine of 10s. and costs was imposed.

### BIRKENHEAD TRAMCAR CONTRACTS: SLANDER ACTION.

AT the Liverpool Assizes, Mr. Justice Bankes heard an action to recover damages for alleged slander, in which the plaintiffs were Messrs. G. C. Milnes, Voss & Co., Ltd., railway carriage and tramcar builders, of Birkenhead, and Thomas Voss, and the defendant Councillor E. T. Coston, J.P., chairman of the Tramways Committee of the Birkenhead Corporation.

Mr. Rigby Swift, K.C., M.P., and Mr. William Proctor appeared for the plaintiffs, and Mr. F. A. Greer, K.C., and Mr. A. Kennedy represented the defendant.

MR. RIGBY SWIFT, in opening the case, said the action had been brought against Mr. Towler Coston in respect of a series of defamatory attacks he had made upon the plaintiff company and upon Mr. Voss at a meeting of the Birkenhead Town Council on July 10th last in regard to certain tenders for new tramcars making allegations of a most serious character against the plaintiffs. He had alleged that they were incompetent in their work; suggested that their financial position was not sound; that they were not able to carry a sufficient amount of stock for their business, and that they were living from hand to mouth. He said that they (plaintiffs) had improperly obtained knowledge of rival contractors' tenders, and he charged them with using underhand and discreditable means in order to get their own tenders accepted. Defendant, counsel added, did not now suggest that any of these allegations were true. What he said was that he had not used the words complained of, that his statement could not be said to have the meaning now put upon it, also that he made the remarks upon a privileged occasion, and was making comments upon a matter which was of important public interest. Counsel added that public men should not be allowed to take advantage of their position and a privileged occasion to say things about other persons for which there was no foundation. The speech was not fair comment, but rather a malicious statement of facts. Mr. Coston, in his desire to get Messrs. Hurst Nelson's tender accepted for the supply of new tramcars, had made charges suggesting that the plaintiffs, or one of them, had been guilty of conducting their business by improper and dishonourable methods; that they had attempted to persuade, and did persuade, a member of the Committee to use his position for his own personal gain; that, as manufacturers, they were incompetent and unable to execute any large orders; that the plaintiff company were a firm of a precarious financial stability, and consequently unable to keep a sufficient supply of timber in stock. The plaintiffs had brought this action in order to show that Mr. Coston's charges were unfounded.

THOMAS VOSS, in giving evidence, said he had never at any time received a complaint about the cars he had converted for the Co-

poration that he not remedied. Dealing with the complaint about leaky roofs, he stated that the cars were made to carry 64 passengers each, and he now knew that as many as 130 had been carried. He could quite understand why trusses and bolsters were required, in view of the overcrowding. He was asked in January, 1910, to send in new tenders, and later heard that those of another firm had been accepted. Whilst being invited to tender, there was never any suggestion that the work he did in 1909 was bad work. In regard to his transactions in connection with the tenders, he did nothing that was either unbusinesslike or disgraceful tactics. There was no foundation for the suggestion that Mr. Dickie, timber merchant, advocated plaintiff's contract in order that he might get something out of it himself.

By MR. GREER: Plaintiff said he had between January, 1909, and July, 1912, distributed orders in Birkenhead amounting in value to over £5,262. He had never discussed with Mr. Dickie the position of plaintiff's tenders and the efforts he (Mr. Dickie) might make to get local tenders accepted.

COUNCILLOR DICKIE, a member of the Birkenhead Tramway Committee, emphatically denied that he had given information to Mr. Voss of what was going on in the Committee. He had committed no breach of conduct as a councillor.

MR. GREER: Was it discreet in your opinion to take part in the discussions when you knew that if Mr. Voss's tender was accepted you would make money out of it through supplying that firm with timber?—It was not until I had consulted my solicitor in regard to the allegations that I knew that I could have supplied the timber.

MR. GREER: At the committee meeting on June 26th, Mr. Coston said "Mr. Dickie has conveyed to Voss the business that has been transacted in this Committee." How is it that you did not contradict him at that meeting?—I believe that I did.

COUNCILLOR W. M. FURNIVAL, another member of the Tramways Committee, said there was no ground for the suggestion that he had improperly supplied Mr. Voss with information as to what took place at the Committee meeting.

For the defence, MR. GREER said there could be no doubt that the question of these tenders for new tramcars was a matter of great importance and interest to the members of Birkenhead Town Council, and to the ratepayers generally. If Mr. Coston, believing what he did in reference to the work done by Messrs. Milnes, Voss and Co., had not drawn attention to the matter, he would have been failing to perform his duty as a councillor. The report of the tramways manager in respect to the tramcars which had been altered and refitted by Messrs. Milnes, Voss & Co., contained a series of complaints that could not have been made if the work had been adequately and properly done. Mr. Coston could not but believe the manager's report, and in doing so he could not come to any other conclusion than that this was a disgraceful piece of work. There was nothing in Mr. Coston's speech that could be construed as an attack on the financial stability of the plaintiffs' firm. Referring to the tenders, Mr. Greer said it had been shown that plaintiffs had reduced their estimate when none of the other contractors had been invited to do so, and the defendant thought that information was being passed to the firm from the Committee. Under those circumstances, he was of opinion that he would have been lacking in his public duties if he had not expressed his views.

MR. COSTON, in his evidence, said that when he heard the tramway manager's report read in the committee he was astounded. It was the first time that he had heard of any serious complaints in regard to these tramcars. Mr. Furnival at that meeting described the report as prejudiced and ridiculous, and that led him (witness) to visit the depot, and after seeing the superintendent's reports and books relating to the matter, he came to the conclusion that the report was accurate. Assuming the report true, it was his candid opinion that it was the most disgraceful piece of workmanship that could be turned out.

By MR. SWIFT: He knew that Voss's for 12 months had to keep these cars maintained, and that with the exception of the superintendent's report of July, 1910, and November, 1911, there was not a solitary complaint after the 12 months had expired. He knew that the cars had been subjected to a very great strain. He did not make any inquiry as to whether the charges against Messrs. Voss were true or not. He was convinced they were true. He did not want the Council to believe that the firm were incompetent, but that they had done bad work. Witness admitted that the plaintiffs had been invited to reduce their tender.

At the conclusion of defendant's evidence, MR. GREER informed the Court that the defendant was now satisfied, after the investigation that had taken place, that upon the real facts of the case there was nothing which entitled him to say that there was anything discreditable in relation to Messrs. Milnes, Voss & Co.'s business transactions, and he did not now allege that there was any disgraceful work done by them. Mr. Coston therefore withdrew the charges, expressed his regret, and agreed to pay costs as between solicitors and clients.

MR. RIGBY SWIFT said that there was never, from the very first, any desire on the part of the plaintiffs to make any money out of the allegations made against them. What they desired was that the charges should be withdrawn in the fullest and most public manner, and that it should be made plain to everybody that there was no foundation for them.

MR. JUSTICE BANKES thought that Mr. Coston had taken the right course. He felt considerable sympathy with Mr. Coston, because he believed that the report from the tramway authorities had been most misleading. While he (the Judge) was sitting there he would honestly maintain the right of a member of a properly constituted authority to speak boldly and fearlessly when he honestly believed that there was something going on which was

wrong. It was because of the false impression created by the report that Mr. Coston had been led to suggest things which he had no right to suggest. The investigation had made it quite plain that Mr. Coston had gone too far—further than the occasion really allowed—and it was now only right that Messrs. Milnes, Voss and Co. should be absolved from those charges.

## OSRAM LAMP LITIGATION.

MR. JUSTICE SWINFEN EADY, on Friday, April 11th, in the Chancery Division, had again before him the motion of the Osram Lamp Works, Ltd., v. the Yorkshire Incandescent Electric Co., but, with his Lordship's consent, the matter stood over for another week, in order that the evidence might be completed.

In Mr. Justice Eady's court on the same day an application by the Osram Lamp Works, Ltd., that a motion against the Electrical Manufacturing Co. to restrain infringement should stand over for a week, was also granted.

## HARRIS v. LONDON UNITED TRAMWAYS, LTD.

BEFORE Mr. Justice Bailhache, sitting in the King's Bench Division, with a common jury, on April 9th, Mrs. Esther Harris, a widow, sued the London United Tramways, Ltd., under Lord Campbell's Act, for damages in respect of the death of her husband, who was thrown from his bicycle while riding in the Victoria Road, Surbiton, and killed by a passing motor-omnibus. The accident was caused through the wheel of the bicycle catching in one of the tramway grooves at switch points near Surbiton Station. It was alleged that the defendants were negligent in allowing their line to be in a state dangerous to general traffic. The negligence alleged was that the grooves of the line at the switch points, either from wear or other causes, were too wide, and that the bicycle dropped its front wheel dead into the groove in consequence. Evidence was called to show that the groove at the spot where the tragedy occurred was sufficiently wide to allow a bicycle wheel to drop in, and before the plaintiff's expert evidence on that point had closed, a brief consultation took place between counsel, resulting in the announcement that there would be judgment for the plaintiff by consent, on terms agreed, which it was not thought desirable to mention publicly. Mr. Geo. Elliott, K.C., appearing for the plaintiff, mentioned that the case was one of great interest quite apart from the individual circumstances, for which reason it had been taken up by the Cyclists' Tourist Club.

## BRITISH WESTINGHOUSE ELECTRIC CO. v. THE ELECTRIC PALACES CO.

THIS action came before the Divisional Court of King's Bench, composed of Mr. Justice Channell and Mr. Justice Coleridge, on Monday, April 14th, on an appeal by the defendants from a judgment of the Judge of the Salford County Court.

The action was one which concerned the supply of an engine and dynamo, &c., by the British Westinghouse Co. for an electric theatre in Northumberland, and a counterclaim was set up by the defendants, based upon an allegation of delay in delivery.

MR. POWELL, K.C., who appeared in support of the appeal, stated that after negotiations with a Mr. Worley, the British Westinghouse gave an estimate for the supply of an engine and apparatus for working a picture exhibition, the price being £131 10s., which they said they could dispatch complete within a few days from the receipt of the order. They guaranteed the whole of the equipment for 12 months, and offered to accept deferred payments if 5 per cent. were added to the contract price. Mr. Worley, as agent of the Electric Palaces Co., said that the tender would be accepted, subject to the gas supply from the local gas company being sufficient to enable them to get the requisite power. A correspondence followed, and the letters which passed, together with certain verbal statements it was said constituted the contract. The County Court Judge at the hearing believed the witnesses called on behalf of the Westinghouse Co. in regard to the terms of delivery, which was that the delivery was contingent upon the engine being in stock. There seemed to have been delay in giving the final order, with the result that when it was given the gas engine which they had in stock had been sold. It was then arranged that the engine should be supplied according to the defendants, within six weeks, but, as a matter of fact, it was not delivered until eight weeks afterwards.

MR. JUSTICE CHANNELL: On what grounds do you appeal?

MR. POWELL, K.C., said that he appealed on the ground that there was no evidence to support the Judge's finding, that the contract was really made with the Palaces Co., and that the Westinghouse Co., or their representatives, had no knowledge of Mr. Worley's financial position. The terms of the contract were that the engine should be supplied within six weeks "or thereabouts," and "thereabouts" could not possibly mean eight weeks. The claim was only for £11 odd for one instalment. Having regard to all the circumstances of the case, he contended that the judgment of the County Court Judge was unsatisfactory, and submitted that there ought to be a new trial. The delivery in eight weeks instead of six weeks did not satisfy the terms of the contract.

MR. JUSTICE COLERIDGE said that the words were "six weeks or thereabouts," and the extra two weeks could not be said to be a matter of law. It was simply a matter of fact.

MR. ATKINSON, for the plaintiffs, said it was a question of what the words meant as applied to particular facts. He argued that

the six weeks did not begin to run until the plans and documents had been furnished by the defendants. The plans were not furnished until September 21st, although the order was given on 15th, and the engine was, in fact, delivered within six weeks and one day from the time the plans were received.

MR. JUSTICE CHANNELL, in giving judgment, said that, upon the assumption that the contract was between the Westinghouse Co. and the Electric Palaces Co., the question was, what were the real terms of the contract as to delivery? If the first tender had been accepted straight off, it would have been a question of the construction of that tender and a question of law. But that was not the case. There were interviews and alterations in the contract which gave the Westinghouse Co. reasonable time in case they had not the engine in stock. The County Court Judge thought that the evidence of those who spoke to the six weeks was so satisfactory that he could disregard what was in the correspondence, and that was entirely a question of fact. The delivery was only one day out, and therefore it was treated at the trial as being within the contract time. That being so, there was no ground upon which the Court could set aside the judgment, and the appeal must therefore be dismissed.

MR. JUSTICE COLERIDGE agreed, observing that the contract being partly verbal and partly in writing, it was for the judge to decide whether what was said in writing was only part of the contract. It was entirely a question of fact, and the Court could not interfere.

The appeal was accordingly dismissed with costs.

#### THE POULSEN PATENTS.

IN the Chancery Division on April 15th, Mr. Justice Warrington had before him a petition in the matter of Valdemar Poulsen, No. 8,961, of 1899, and in the matter of the Patents and Designs Act, 1907. The petition was put into the paper to be mentioned.

MR. BYRNE, for the petitioners, said that it was an application in a case in which a petition was being presented for the extension of the term of certain patents granted to Valdemar Poulsen. The rules under the Act gave the Court an absolute discretion to deal with the matter as should be thought fit. In the present case time for alleging notice of opposition had long since expired, and no notice of opposition had been given. The Board of Trade was the only party interested, and the petitioners had given them notice. Mr. Austen-Cartmell, who had appeared for the Board of Trade, had intimated to him (counsel) that the Board did not propose to offer any objection.

The facts were that Valdemar Poulsen was the inventor of the patent, and the present petitioners were an American company incorporated in Maine, U.S.A., who were the assignees of the rights. A large portion of the shares were held by a Danish company. The purpose of the amendments was to set forth in greater detail the whole history of the foreign dealings with certain patents. They had nothing to do with what had been done with the English patents. In the course of preparing the preliminary proceedings, certain further information had come to the petitioners' advisers in England, which they felt it was their duty to lay before the Court and the Board of Trade. They were now seeking to insert that information, and the reason that information was not obtained earlier was because all the matters had to be dealt with by correspondence with the United States and Denmark. Certain very complicated transactions were carried out in 1905 and 1906 between a certain Stilson Hutchins and one Lindaford, who represented the Danish interests. Mr. Hutchins became quite unable to transact business, and then died, and Mr. Lindaford died on his way to America. No proper record in writing had been kept of the greater part of those transactions and negotiations. When the advisers of the petitioners were preparing their accounts for lodging, a difficulty arose as to getting some of the books from abroad, but eventually it was arranged that a book-keeper should bring the books from America. Lord Parker (then Mr. Justice Parker) then gave an extension of time for lodging those accounts. In the course of going through the accounts the petitioners' advisers in this country first became aware of the extremely complicated nature of the transactions in connection with the foreign patents. The information asked for by the petitioners' advisers was only obtained in part from the United States on April 7th, and two days later a copy of the petition was informally submitted to the Board of Trade for their information, so that there had been no delay so far as anyone on this side was concerned.

The original petition stated that the company was formed in 1899, for the purpose of exploiting the patents, and gave the history of the subsequent dealings, so far as they were known to petitioners. It was believed that the transactions with the American and Canadian patents were of a very simple character, but, of course, that was now known not to be the case.

MR. JUSTICE WARRINGTON: It seems to be a statement of fact by the petitioners, which it may be material to consider.

MR. AUSTEN-CARTMELL: Yes. The view I take on behalf of the Board of Trade is that the general rule is that the Board of Trade would oppose. Here, there is no notice of opposition from any member of the public, and the only party appearing except the petitioners would be the Crown. There is also the point to be taken into consideration that the greatest possible difficulties had been experienced by the legal advisers of the petitioners in this country in obtaining information. We have been informed by the solicitors for the petitioners, in whom we have every confidence that every step has been taken to expedite matters. Under those circumstances, I am prepared to leave the matter in the hands of the Court, but it must not be taken as a precedent, but simply because of the special circumstances of the present case. If the Court allows the amendments, a day had better be fixed for

the petition to come into the list to fix a day for the hearing. I suggest the 24th inst., as the patent expires on the 29th inst.

HIS LORDSHIP: I think I ought to allow the amendment under the circumstances, and I appoint the 24th inst. as the appointed day. This is a very special amendment.

MR. BYRNE: It does not affect any party.

MR. AUSTEN-CARTMELL: It is true that no notice of objection has been given, but the Court has power to allow anyone to come in.

HIS LORDSHIP: I think the petitioner had better give notice in the *London Gazette* of the appointment of the 24th inst. as the appointed day on which the amended petition is to be in the list.

#### NATIONAL TELEPHONE ARBITRATION APPEAL.

THE CROSS APPEALS in the National Telephone Arbitration from the decision of the Railway and Canal Commissioners on the arbitration with regard to the taking over of the National Telephone Co.'s undertaking by the Post Office, came before the Master of the Rolls and Lords Justices Buckley and Kennedy on Tuesday, April 15th.

The notice of appeal given on behalf of the Postmaster-General asked that so much of the judgment of the Court of the Railway and Canal Commission as decided that, in determining the value as on December 31st, 1911, of the plant of the company purchased by the Postmaster-General, the Court might take into consideration—

(a) The cost of raising a sufficient amount of capital to pay for the construction of the company's plant.

(b) Any part of the cost of the company of inducing persons to agree with the company for the supply to them of a telephonic service and for installation upon their premises of telephonic plant for the purpose of applying such service, might be reversed, and that it might be declared that neither of the said matters might be taken into consideration in determining the said value, and that the amount of £10,459,796, ascertained as the depreciated value of the said plant, might be reduced by the sums allowed by the Court being in respect of (a) the sum of £249,189 and in respect of (b) the sum of £150,000.

The cross notice of the Telephone Co. stated that, upon the hearing of the Postmaster-General's appeal from the order and determination of the Court of the Railway and Canal Commission, the company intended to contend (if and so far as an appeal was open to the respondents) that the order of the Court of the Railway and Canal Commission should be varied, and that the amount should be increased to such amount as the Court should seem fit, and that the order and determination might be remitted to the Court below (if need be), with proper directions for arriving at the amount of such increase and all other necessary or expedient directions. In particular, the respondents would contend that the said amount was insufficient on the following grounds:—

1. There was no evidence or legal ground to justify the Court in reducing or excluding from consideration the sums, or any of them, estimated by the respondents as items of cost over and above the "agreed fundamental cost," which would be incurred in constructing and establishing the plant.

2. The method of depreciation adopted by the Court was wrong in law, and/or there was no evidence on which to found its correctness, nor of disallowing the respondents' basis of arriving at this allowance.

3. That an allowance should have been made by the Court by way of an additional sum given in respondents' favour, in view of the fact that substantially the whole of the said plant was suitable for the purpose of the Postmaster-General's telephonic service, and/or was complete, and ready *in situ*, for working and use on December 31st, 1911.

4. That the Court were wrong in their disposal of, and method of dealing with, the respondents' respective claims under the headings of "head office engineering," "contractors' profits," "contingencies," and "separate establishment."

5. That the Court mistook in some of their calculations the meaning of "value."

On the appeals being opened by the Attorney-General for the Postmaster-General, Mr. Dancwerts, for the Telephone Co., took the preliminary objection that no appeal by the Postmaster-General would lie. On this point, after hearing the Attorney-General and the Solicitor-General, their Lordships reserved judgment until the following day.

The Master of the Rolls and Lord Justice Kennedy (Lord Justice Buckley dissenting) then held that the preliminary objection failed, and by agreement between counsel for the respective parties, and with the consent of their Lordships, it was arranged that, pending an appeal by the Telephone Co. to the House of Lords from the decision of their Lordships upon the preliminary objection, the hearing of the main appeals should stand over.

The Attorney-General stated that he would endeavour to get the House of Lords to hear the appeal in question as soon as possible.

#### PROSECUTION UNDER THE FACTORY ACTS.

"As a result of the electricity regulations not being complied with, Thomas James Brownell met his death through a connector socket not being protected," remarked Mr. H. H. C. THOMAS (H.M. Inspector of Factories) in prosecuting the Patent Shaft and Axletree Co., Ltd., Wednesbury, on Tuesday in last week, at the local Police Court. The prosecution was under the Factory and Workshop Act, 1901 and 1907, Sec. 136.

The Hon. R. W. Coventry defended, and Mr. F. A. Platt (Walsall) appeared for Henry Bates (25), who had been summoned under the same Act.

The connector socket, MR. THOMAS explained, was on a wooden horizontal bar near to a drilling machine where Brownell worked.

It was 3 ft. 6 in. from the ground, and 12 in. from the machine. At the time of the accident the socket was connected up and charged with current, which had a voltage of 205 alternating. Some time before the accident there had been a cover on the socket, but this had not been so for a fortnight previously. At the spot the ground was wet, with the result that practically the whole of the voltage would be applied to the man's body. Although a cover had been off the socket for a fortnight, no attempt had been made to replace it.

The evidence called for the defence was to the effect that it was an unwritten law that the men should report breakages. From 20 to 30 of them were reported every day. Men were continuously doing repairs about the works, but this particular plug might not have been seen.

The Stipendiary Magistrate decided that there had been no negligence by the firm, and dismissed the case.

The summons against Bates was withdrawn.

## PARLIAMENTARY.

### Southport Corporation Bill.

MR. MIDDLEBROOK'S Select Committee of the House of Commons commenced the consideration of this Bill on April 8th. The Bill is an Omnibus Bill dealing with a number of proposals affecting the government of the borough, but one of the principal objects is the obtaining of authority to run trolley vehicles and omnibuses. Mr. H. Lloyd, K.C., and Mr. Jeeves appeared for the promoters, and a large number of opponents were represented by counsel.

MR. LLOYD, K.C., in his opening address, said that under a series of orders and an Act of Parliament, a system of tramways had been constructed in the borough which was worked partly by the Corporation and partly by their lessees, the Southport District Tramways Co. In 1900 the Corporation obtained powers to construct a new line along the Promenade; but as they thought on further consideration that the traffic would not be remunerative the powers were allowed to lapse. It had always been considered desirable to give the public further facilities along the route, and it was felt that a system of trackless trolley-cars would give these facilities. The cost of the equipment of the scheme was estimated to be £3,500, with £2,250 for the vehicles. The chief opponents were the Victoria Pier and Promenade Hotel Co., who submitted that the trolley-cars would injure the hotel; the Lancashire and Yorkshire Railway Co., who contended, amongst other things, that the carriage of goods on the tramway would be injurious to the district; and the Cheshire Lines Committee, who opposed on the ground of competition. The Southport Tramways Co. and the Birkdale Electric Supply Co. had also presented petitions against the Bill.

MR. J. B. HAMILTON, general manager of the Leeds Corporation Tramways, gave evidence to the effect that he had carefully examined the proposed route, and considered it suitable for a trackless trolley system. He looked on the route as one upon which people would ride to and fro for a constitutional. He estimated a gross revenue of 10d. per mile, and that there would be a net surplus of £189 per annum.

In cross-examination by MR. RAM, K.C. (representing the Johnson Trustees), witness said the trolley-cars created much less dust than motor-cars. It had not been decided whether the cars would be single or double-decked.

In answer to MR. FORBES LANKESTER, witness said it was proposed to take powers for carrying goods and minerals on the trolley cars. It was true that in the cases of Bradford and Keighley there was a prohibition in this respect.

After some discussion, MR. JEEVES intimated that his clients would agree to a prohibition of the carriage of parcels beyond 56 lb. in weight.

Witness was cross-examined at length by MR. FORBES LANKESTER for the Victoria Pier and Hotel Co. on the point that in a seaside town of the character of Southport it was better to keep the Front free from tramway or trolley, and, in reply, he said that while this was a matter of high policy with which he could not deal, yet from his point of view he thought this was a road on which the poor man's car should be allowed as well as the rich man's.

ALDERMAN T. P. GRIFFITHS (chairman of the Parliamentary Committee of the Southport Corporation) gave evidence in support of the scheme, and said the trolley cars would add another to Southport's many attractions.

MR. R. P. HIRST, consulting engineer to the Corporation, considered there would be no fear of vibration from the running of the trolleys along the Promenade.

Other local evidence was called in support of the Bill.

MR. FORBES LANKESTER, on behalf of the Cheshire Lines Committee, said that having arrived at the limit of 56 lb. for parcels, he would not trouble the Committee further with regard to the trackless trolley proposals.

MR. VESEY KNIX, K.C. (Lancashire and Yorkshire Railway Co.), said the particular route would not affect his clients' interests, but they wanted safeguards introduced having regard to Sec. 31 of the Bill, under which it was proposed to apply to the Board of Trade for prov. orders for new routes. He asked that notices of intention to apply for such prov. orders should be inserted in the *Gazette*, as well as in the local papers.

A large number of witnesses then gave evidence to the effect that the trolley cars would affect property detrimentally.

The Committee decided to approve the scheme, and inserted clauses for the protection of the property of the Cheshire Lines Committee.

On April 15th, having heard the opposition of licensed vehicle owners, the Committee rejected the motor-omnibus proposals.

### Metropolitan Railway Bill.

ON April 10th a Select Committee of the House of Lords, presided over by Lord Sanderson, commenced the consideration of this Bill for purchasing the Great Northern and City Railway, and for making two extensions of that line.

MR. LLOYD, K.C., in opening the case for the promoters, said the Bill was an omnibus one containing a number of provisions, many of which were not opposed. The main features of the Bill were, first, to sanction the vesting in the Metropolitan Railway Co. of the undertaking of the Great Northern and City Railway Co.; and secondly, to authorise the Metropolitan Railway Co. to construct certain new railways as an extension of the Great Northern and City line. The Bill also asked for powers to enable the Metropolitan Co. to enter into agreement with the London and South-Western Railway Co. for the construction and working of one of the extensions, and for the working of through traffic. The first part of the Bill, which was unopposed, was that which sought to vest in the Metropolitan Co. the existing undertaking of the Great Northern and City Co. That was an electrically-worked tube railway of about 3½ miles in length extending from Finsbury Park to Moorgate Street. It was recognised shortly after the line was opened that if it was to serve a really useful purpose, and was likely to be remunerative, it must be carried on beyond Moorgate Street, where it now stopped, and in 1902 the company obtained powers to extend the line from Moorgate Street to Lothbury. Unfortunately the company had never been able to find the money to construct the extension, and the powers had lapsed. The result had been very unfortunate to the Great Northern and City Co., for they had found themselves in a financial position which had prevented them doing that for the public which they desired to do. The line had no connection with any other railway, and the company had not been able to pay its fixed charges, and it could not go on in its present hands. That position had been fully realised by the directors and stock holders of the company, and they had been approached from time to time by many other companies who were interested in their traffic, and after considerable negotiations the Metropolitan Co. had succeeded in arranging terms by which the Great Northern and City Co. was to cease to exist as a separate entity, and was to become amalgamated with the Metropolitan. The result was the promotion of the present Bill. Originally there were four extensions proposed, but two had been struck out. The two proposals that remained in the Bill were first for extending the Great Northern and City line from Moorgate Street to Lothbury, which was practically a re-enactment of the line which was authorised in 1902, and the second proposal was to form a junction with the Waterloo and City Railway at the Bank Station. The result of the construction of these two extensions would be to enable the Great Northern and City line to be carried to the point where Parliament intended it should be carried so long ago as 1902, and it would also bring people from the North of London into direct communication with the London and South-Western Railway. The estimated cost of the first extension was £256,540, and of the second £53,749.

Having proceeded to detail to the Committee the manner in which it was proposed to construct the proposed extensions, counsel dealt with the opposition, which chiefly came from the City Corporation, the Bank of England, the Grocers' Company, the Gresham Assurance Co., and the Northern Assurance Co. He said that the objections of the City Corporation were against interference with streets in the heart of the City and depreciation of property which might result. Those objections could easily be met, and in view of the great public advantage of the scheme, he felt sure that the City authorities were not really antagonistic to the proposals. Dealing with the allegations of other petitioners that damage might be caused to their property from the excavation of the subsoil and the pumping out of water, Mr. Lloyd said they were the same objections as were brought forward in 1902, when Parliament approved the scheme.

MR. RAM, K.C., who appeared for the Bank of England, said that while the Governors and directors of that institution had no desire to oppose a scheme which might be for the public advantage, they felt that the Bank should be granted the fullest possible protection.

MR. R. H. SELBIE, general manager of the Metropolitan Railway, having given evidence in favour of the scheme, the Committee adjourned.

(To be continued.)

**London County Council Tramways.**—The House of Lords' Standing Orders Committee have decided that the Standing Orders not complied with in respect of the London County Council Tramways, Trolley Vehicles and Improvements Bill shall be dispensed with, subject to the omission therefrom of tramways 2, 4, 4A, 5, 5A, 6, 8, 8A and 8B, and to the consent of the Hampstead Borough Council in respect of tramway 3A being proved before the Committee on the Bill. The proposals which are, therefore, to be struck

out of the Bill are the following: A double line between the county boundary in Finchley Road and the existing tramways in Chalk Farm Road, *via* Finchley Road, Avenue Road, Adelaide Road and Chalk Farm Road; a single loop line from Fonthill Road, *via* Evershot Road, Hanley Road, Regina Road and Tollington Park into Fonthill Road again, and then a double line along Fonthill Road to the existing tramways in the Seven Sisters Road; a double line from the existing tramways in Gray's Inn Road to Farringdon Road, *via* Holborn and Charterhouse Street; a double line from Farringdon Road to Ludgate Circus; and the tramway in connection with the proposed new St. Paul's Bridge.

**Ely Valley Gas and Electricity Bill.**—The Standing Orders Committee of the House of Lords have decided that the Standing Orders not complied with in respect of the above Bill, ought not to be dispensed with, and accordingly the Bill will not proceed. The proposal was to incorporate a company with a capital of £45,000 to supply gas and electricity.

**Hove Corporation Bill.**—The Chairman of Committees reports that the opposition to the Hove Corporation Bill has been withdrawn. The Bill contains clauses for the purchase of the electric light undertaking.

**Leeds Corporation Bill.**—The Standing Orders Committee of the House of Lords considered this Bill on April 10th, when the Parliamentary Agent stated that the tramway in regard to which there had been a non-compliance with the Standing Orders, had been struck out. Under these circumstances, it was decided to allow the Bill to proceed.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### The Oldham "Emergency" Electric Lamp.

The Oldham "Emergency" electric lamp, which was recently approved by the Home Office for use in coal mines, is of the bull's-eye type, as shown in fig. 1.

The case is of cast aluminium, with a cover secured by a lead rivet lock. The electrical accumulator is so constructed as to prevent escape of the liquid, whatever the position of the lamp, whilst allowing the escape of gas generated by chemical action in the accumulator. A flame-tight screwed plug of vulcanite encloses the contact made between the insulated lead and the positive

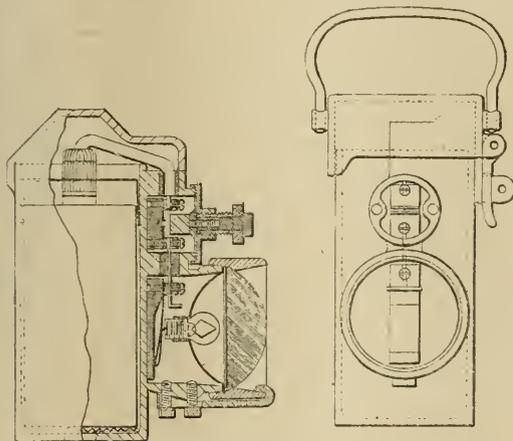


FIG. 1.—THE OLDHAM "EMERGENCY" MINER'S LAMP.

terminal of the cell. The switch is contained in a flame-tight enclosure, the cover of which, with its washer, is secured by screws. The screw-heads are pierced so that a wire may be threaded through, and the ends sealed with lead seals. The lamp bulb and reflector are contained in a second enclosure, which communicates with the switch enclosure. It is made flame-tight by means of a screwed ring containing the lens, and a washer. The ring is prevented from unscrewing by means of a clip secured by screws, the heads of which are pierced as in the case of the switch cover screws. The total weight of the lamp is not more than 4 lb. 8 oz., and it is capable of maintaining a light of 1.5 C.P. throughout a period of not less than 10 hours. The lamp is only to be used for work of rescue or exploration in the case of an accident or other emergency, or by officials, and is made by MESSRS. OLDHAM AND SON, Denton, near Manchester.

### Cinema Theatre Dimmers.

THE ADAMS MANUFACTURING CO., LTD., of Balfour House, Finsbury Pavement, E.C., have brought out the "Adams Igranic" cinema theatre dimmers, to enable changes of illumination from dark to light to be gradual and painless; they can be so arranged that the same movement that gradually dims the white lights will also gradually brighten the reds, and so on, and can be mounted in the operator's room with practically no alteration of the

wiring. Each dimmer consists of a resistance plate having a large number of contacts and an operating handle, so that the resistance in the lighting circuit can be increased or reduced to lower or brighten the lights. The dimmer plates are standardised and so arranged that a number can be mounted together to deal with separate circuits. They are suitable for any lighting voltage A.C. or D.C. Each dimmer is specially arranged with an "off" position, so that the lights may be left fully on or fully off indefinitely.

### A New Lampholder.

MESSRS. JOHN DUGDILL & CO., of Failsforth, are placing on the market a "high-duty lampholder," which has been provisionally protected, and in which "an arch or loop of springy metal" is used supplementarily to, or in substitution of, the ordinary spring plunger contact stud.

In one of the samples submitted, two strips of ribbon metal are looped round the two plungers, being fastened by the holding-in screws under the latter and bent round so as to pass over the tips of the plungers. The connection between the housing and the end of the stud is thus continuous metal, not through a sliding contact, when pressure is applied, as during insertion of the lamp. It is claimed that the springy loop flattens and accommodates itself to the surfaces of the segments, ensuring a broad contact area, instead of the comparatively small contact area of the present type of plunger.

Another sample sent has a conical spiral spring of ribbon metal looped round the plunger stud and rigidly connected at its base; the end turns make contact with the lamp cap, supplementing the ordinary plunger contacts and giving, it is claimed increased current-carrying capacity.

Messrs. Dugdill claim that these lampholders are suitable connectors for radiators, small motors, &c.

## BUSINESS NOTES.

"Plexsim."—MESSRS. SIMPLEX CONDUITS, LTD., have registered the above word for use in connection with their electric heating and cooking system, the increasing importance of this department of their business rendering it advisable to give these manufacturers a descriptive mark differentiating them from "Simplex" lines such as conduits and fittings. In future, therefore, all their heating and cooking appliances will be labelled "Plexsim."

**Reversible Oil Engine.**—MESSRS. BOVING & CO., LTD., of 9½, Union Court, Old Broad Street, E.C., inform us that they are now running a 16-H.P. marine "Avance" crude oil engine, with special reversible propeller equipment, on load at Southampton. Similar exhibitions will be held at various leading seaports in this country.

**Cable Works in Austria.**—The Hungarian Felten and Guilleaume Co., of Buda-Pesth, records net profits of £32,500 for 1912, as contrasted with £29,600 in the preceding year, and the dividend is at the rate of 17½ per cent., as against 16½ per cent. in 1911. A considerable number of orders was incomplete at the end of 1912, and notwithstanding the unfavourable circumstances affecting the political horizon and the money market, the company's degree of employment is said to be very satisfactory at the present time.

The report of Felten & Guilleaume, of Vienna, states that the company was abundantly employed during 1912. It was not easy to predict the prospects for the new year, owing to the uncertain political situation and the monetary stringency, which caused customers to exercise reserve in the allocation of orders. Nevertheless, a considerable stock of orders had been brought over into 1913, and the degree of activity was good. The net profits earned in 1912, after placing £18,000 to depreciation as compared with £17,000 in 1911, amount to £117,000, inclusive of the balance forward, as contrasted with £102,000 in the previous year. It is proposed to pay a dividend of 17½ per cent., as against 16½ per cent. in 1911.

**Book Notices.**—*The Aviation Pocket-Book for 1913.* By R. Borlase Matthews. London: Crosby Lockwood & Son. Price 3s. 6d. net.—This volume is a sign of the times; aviation (why not "flying"?) is now becoming a common-place, the science an industry, and the industry is being equipped with pocket-books, journals, directories, manuals, catalogues and all the other accessories which mark the firm establishment of a new branch of engineering, including an Act of Parliament. The next phase will doubtless be litigation. At any rate, here is the first pocket-book—the work of a well-known electrical engineer, who has now turned his attention to shipping. There is very little in the book, as in the art of direct electrical interest; the ignition of the engines and the use of the magnetic compass at present cover this part of the subject, but wireless telegraphy is practically the only possible means of communication with aeroplanes, and will become of increasing importance in this connection. The contents of the book cover, broadly, the whole field of theory and practice, and will undoubtedly prove very useful to the flying man. A list of "Aero Clubs and Societies" reveals the surprising fact that there are more than 100 of these in existence in this country and the overseas Dominions.

*The Wireless World* for April—the first issue of the new magazine which has replaced the *Marconigraph*—comes out with a striking multi-colour cover showing "wireless" spanning the globe in a series of zig-zag flashes, which might with advantage have

been arranged to form a Morse message instead of what appear to be a random succession of o's and s's. An introductory article explains that the magazine is to be "popular," and that the information given in its pages, while worthy of the attention of the scientist, will not be beyond the scope of the general public. A special feature is to be the subject of wireless telegraphy as a factor in National defence; with this in view, a special course of lectures for "wireless amateurs" will appear in each issue. A biographical notice of Commendatore G. Marconi, whose birthday is April 25th, together with a portrait, appropriately forms the opening article. Other interesting items are articles on the Aden-Berbera wireless stations; the new Atlantic sentinel, the *Scotia*, which is to give warning by wireless of the presence of ice; the qualifications and prospects of the wireless engineer; a short story; the scheme for free instruction in wireless telegraphy for Territorials, &c., already outlined in our article on the Marconi School; and numerous other features, the whole forming an issue which reflects great credit on all concerned in its production.

"Examinations in Science and Technology, 1912." London: Wyman & Sons, Ltd. Price 9d.

"Electric Furnaces in the Iron and Steel Industry." By Dipl. Ing. W. Rodenhauer and I. Schoenawa. 1913. London: Chapman & Hall, Ltd. Price 15s. net.

"The Illuminating Engineer." No. 4, Vol. VI. April, 1913. London: Athenaeum Press. Price 1s.

"Australian Mineral Statistics," 1913. Melbourne. *Mining Standard*. Price 2s. 6d.

"Transactions of the University of Toronto Engineering Society." Vol. VII, No. 5. March 1913. Toronto. The Society.

"Journal of the Western Society of Engineers." Vol. XVIII, No. 2. February, 1913. Chicago: The Society. Price 50 cents.

"Journal of the American Society of Mechanical Engineers." Vol. XXXV, No. 4. April, 1913. New York: The Society. Price 35 cents.

"Annual Report of the Smithsonian Institution, 1911." Washington Government Printing Office.

"Journal of the American Institute of Architects." January, February and March, 1913. Washington: The Institute. Price 50 cents each.

"Third International Congress of Refrigeration, Washington and Chicago, September, 1913." Chicago: J. F. Nickerson, secretary.

"Bulletin of the Association des Ingenieurs Electriciens." Vol. XII, No. 12. December, 1912. Liège: The Association. Price 7 fr.

"Chronique Illustrée du Concours International de Télégraphie Pratique, Turin, 1911." Rome: Il Ministro per le Poste e i Telegrafi.

"Elektrische Kraftübertragung in Zementfabriken." Berlin Allgemeine Elektrizitäts-Gesellschaft.

"Official Wireless Map of the World." 1913. London: George Philip & Son, Ltd. Price 2s. 6d. net.

"Post Office Electrical Engineers' Journal." Vol. 6, Part 1. April, 1913. London: H. Alabaster. Gatehouse & Co. Price 1s. net.

"Electricity and its Practical Applications." By Magnus Maclean. London: Blackie & Son, Ltd. Price 10s. 6d. net.

"Third Annual Report, 1912, of the British Chamber of Commerce in Belgium." Brussels: 2, Rue de la Bonrse.

"Bulletin of the Imperial Institute." Vol. XI, No. 1. January-March, 1913. London: John Murray. Price 2s. 6d. net.

"British Chamber of Commerce Quarterly Trade Journal." No. 21, March, 1913. Constantinople: Offices of the Chamber. Price 2s. 6d.

"Bulletin Mensuel de la Société Belge d'Electriciens." Vol. XXX. February, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

**Bankruptcy Proceedings.**—ROBERT EDWARD JOY (Bristol Electrical Co.), electrical engineer, 143, Cheltenham Road, Bristol.—Application for discharge of debtor to be heard at Bristol on May 23rd.

WILLIAM LONGDEN and VERNON GEORGE COBB (trading as Longden & Cobb), electrical engineers, 101A, Derby Road, Nottingham.—The adjourned public examination of the above-named debtors was held last week at the County Court House, St. Peter's Gate, Nottingham, when the case was formally closed.

JAMES WILLIAM LEWISLEY, electrician, 65, Brierley Street, late 103, Mansfield Road, Nottingham.—The adjourned public examination of this debtor was fixed to take place last week at the County Court House, St. Peter's Gate, Nottingham, before Mr. Registrar Beaumont. It was stated that criminal proceedings had been taken against the debtor in respect of certain matters connected with his failure. The Official Receiver said that in these circumstances it would be best to adjourn the examination, and the Registrar having given his consent, the case was formally adjourned.

J. G. S. CUNNINGTON and H. P. ALLISON (Lain, Wharton and Cunnington), electrical engineers and contractors, Great Newport Street, London.—Last day for receipt of proofs for dividend, April 29th. Trustee, Mr. A. Page, 29, King Street, E.C.

**Electrical Exports from France.**—There was a large falling off last year in the value of the exports of dynamo-electric machinery from France, the returns lately issued showing a total of only £119,620, as compared with £180,700 in 1911. On the other hand, the exports of electrical apparatus increased in value from £371,840 to £423,000.

**Dissolutions and Liquidations.**—The partnership existing between DRENNAN, GLOVER & COOPER, electrical engineers, 427-431, Corn Exchange Buildings, Manchester, and Milburn House, Newcastle-on-Tyne, has been dissolved by mutual consent. Mr. Drennan and Mr. Cooper will continue to trade under the style of Drennan & Cooper, at the same address at Manchester, and Mr.

Glover, in partnership with Mr. Bernard Gaffney, will continue under the style of Glover & Gaffney at 12, Eldon Square, Newcastle-on-Tyne. All accounts of the late firm will be attended to by Messrs. Drennan & Cooper at the old address.

MESRS. E. READER & SONS, LTD., Nottingham.—This company is winding up voluntarily, with Mr. W. R. Hamilton, Victoria Street, Nottingham, as liquidator. A meeting of creditors is called for April 22nd.

WEZDON LAMP CO., electric lamp agents, 22 and 23, Verulam Street, London, E.C.—Messrs. Douglas Robinson and Johan Agnerup have dissolved partnership. Mr. Agnerup will attend to debts.

ADAMS MANUFACTURING CO., LTD.—We are informed that an order was made on Saturday last by Mr. Justice Swinfen Eady appointing Mr. Lewis Hardy receiver and manager on behalf of the debenture-holders of this company. It is stated that no interruption will be caused in carrying on the business, as the Receiver, under leave of the judge is to continue its business. Arrangements for the re-construction of the company are in process of being made.

JOHNSON-LUNDELL ELECTRIC TRACTION CO., LTD.—Creditors should send particulars of their debts, &c., to Mr. A. E. Messer, 14, Old Jewry Chambers, E.C., the liquidator, by May 31st.

**Spain.**—A new company has lately been formed in Madrid with the title La Sociedad Espanola de Construcciones Electricas, to carry on an electrical engineering business.

**Manufacture of Instruments and Meters.**—The United States Department of Commerce and Labour has issued a special report dealing with the manufacture of electrical instruments and meters in the United Kingdom, France, Germany and Italy. The works of 31 leading firms are described, attention being paid to equipment, number of employes, and especially to the nature of the products manufactured. The report may be seen by electrical instrument makers in the United Kingdom at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

**Exhibition in Australia.**—Steps are now being taken by the Victorian Chamber of Manufactures for carrying out the design of the Associated Chambers for holding an "All-Australian" Exhibition in Melbourne, opening in September and closing in November. The scheme of the Associated Chambers of Manufactures of Australia is to hold such an exhibition in the various States of the Commonwealth in rotation, the commencement being made in Melbourne this year. The special feature of this exhibition is to be trade processes in operation, and working exhibits.—*Australian Mining Standard*.

**Water Softener Contracts.**—MESSRS. LASSEN AND HJORT have received orders from the undernoted during the last few weeks for the installation of their automatic water softeners of an aggregate capacity of 1,030,000 gallons per day.

Gas Light and Coke Co., Ltd., 150,000; Imperial Paper Mills, Gravesend, 369,000; Monton Mill Co., Eccles, 72,000; Portland Cement Co., Atherthaw, 48,000; Distillers' Co., Dundalk, 96,000; Chiswick Electricity Works, 24,000; Maxted & Knott, Storey Bros., Lancaster, Premier Portland Cement Co., Wellingborough, Brighton Schools, Brighton, 250,000 gallons per day.

The firm's water softener has been exclusively adopted by Messrs. Babcock & Wilcox Ltd.

**Catalogues and Lists.**—MESSRS. T. & E. WANNBACHER, 5, Appold Street, London, E.C.—Leaflet No. 85, giving illustrated particulars and prices of small centrifugal pumps.

THE INTERNATIONAL ELECTRIC CO., LTD., 111-115, Salisbury Road, Kilburn, N.W.—Leaflet giving illustrations and prices of their domestic "Talkyphone," 1913 model.

MR. HAYDN HARRISON, 11, Victoria Street, London, S.W.—Third edition (nearly 60 pages) of his street lighting pamphlet. This contains excellent art paper illustrations of a variety of designs of bracket arm fittings, tramway and wood-pole brackets and fittings, square type lanterns, &c., also scale drawings of lantern fittings as used at Marylebone, in the City of London, and at Harrogate, as well as similar drawings of time and half-night switches, and patent switch fuses. Other contents include patent anti-vibration lampholders, posts for high C.P. lighting and side street service, the Universal photometer, and the Harrison lightometer for testing illumination and C.P. Several pages are occupied with tables and useful data respecting electric street lighting. A list of places using Harrison street fittings is given.

MESRS. SIEMENS BROS. & CO., LTD., Woolwich, Kent.—Reprint No. 508C, fully describing and illustrating their testing instruments for magnetic measurements in iron and steel works.

MESRS. REINFORCED METAL, LTD., 175, West George Street, Glasgow.—20-page pamphlet explaining their method of steel and concrete construction, known as reinforced metal, and containing a report by Prof. Andrew Gray, of Glasgow. A collection of reinforced concrete steel columns is being shown at the Building Trades Exhibition, now open at Olympia.

MESRS. HARPER & BROS., 45, Albemarle Street, W.—List of books, including technical publications.

MESRS. VERITYS, LTD., London and Birmingham.—Publication No. 741 gives illustrated information respecting "Aston" portable electric lamps—pocket, hand, cycle, motor-car inspection and other types, also "Aston" electric cooking apparatus (the "Utility" cooking set, electric oven, irons, kettles, &c.). Prices are stated.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Fully illustrated catalogue (No. 5) of 44 pages relating to their manufactures for stage and theatre lighting. Among other appliances described in this publication are stage arc lamps and accessories; liquid and metallic dimmers and other resistances; Osram drawn wire lamps and Robertson lamps; cine-

matograph arc lamps and projectors; small motors for cinematograph machine work; various types of batten, electric fixtures, motor-generators, &c. Particulars are given of the "Applebee" patent screen or "Spotlight" shutter, which can be fitted to any stage arc lamp. It is attached to the inside of the lamp and operates from the back. By its use, strong shadows can be avoided, and a gradually diminishing light obtained. A clear mica-slide which is provided, prevents the projection of prismatic colouring upon the focussed object. Other features include the "Hawkins" and "Morehen" plugs. The feature of the former is that by means of detachable pins, male or female contact can be made. The latter is intended to be fixed under the stage level and provides an easy and safe method of taking temporary leads to portable stage properties. Everything mentioned in the list has been designed to meet the L.O.C. regulations. The company maintains a special dispatch department to facilitate the prompt delivery of all theatrical material. Copies of the list will be sent upon application.

MESSRS. FYFE, WILSON & CO, 155A, St. Vincent Street, Glasgow.—Catalogue No. 113 (40 pages) containing description of their Kelvin electric generating sets, specially designed for cinematograph theatres. Portable and stationary petrol or paraffin electric equipments are illustrated, and engine connection and wiring diagrams are included. Illustrations and tabulated prices and code-words appear of rotary transformers for cinematographs, motor-generators, model cinematographs and special arc lamps for same, and resistances, "Sunrae" flame arc lamps, cables and wires, and lamps and other lines are particularised.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—New price lists as follows:—No. 5,531 (8 pages), fully describing and showing their automatic time switches; No. 4,155 (8 pages), similarly dealing with their type O, form E, oil-break switches.

**Electricity at the Clothing and Outfitting Exhibition.**—One does not expect to find a very large array of electrical exhibits at an Exhibition devoted to the clothing trade. As a matter of fact, the only display at the Clothing and Outfitting Exhibition, which opened at the Agricultural Hall, London, on Monday last, which calls for notice, is that of Messrs. Eastman and Warne, of 241, Acton Vale, W., who are showing a range of "Hot Point" electric hand irons, which are, we understand, now being used all over the kingdom in laundries, clothiers', dressmakers', hatters', and similar workrooms. The feature of the "Hot Point" electric hand irons lies in the fact that they offer an exact substitute for the usual stove or gas-heated iron, without the use of the long cord usually employed for conveying the current to the iron, and which often prevents them being as handy as the old-fashioned stove-heated irons. In other words, in place of being continuously heated, they are given a heating as desired by being placed on a shelf covered with fireproof material, and provided with guides to take the irons; short pillars on the latter making contact with springs in contact boxes at the back of the shelves. When contact with the source of current is made, the irons are heated up by converters, consisting of long windings of fine wire round asbestos strips, embedded in the box of the iron, provision being made to cut down the current gradually as the temperature rises, thus securing economy and preventing any risk of burning out. The system was developed in the works of Messrs. Eastman & Sons (Dyers and Cleaners), Ltd., who have used electric irons in their finishing department for the last 12 years, and who are working with Messrs. Eastman & Warne. The electric irons can be heated just as quickly as a stove-heated one, and retain their heat equally as long; when an iron has become cool the operator has merely to push it into position on the heating shelf and pull out a fully-heated one. We are informed that a careful comparative test of the "Hot Point" irons with those heated by gas resulted in the former showing an economy of about 40 per cent. Messrs. Eastman & Warne have also on view an electric branding machine for branding names on anything from furniture to pigs (!) and also an "Eadisk," which is the electric equivalent of a gas boiling or heating ring.

**Trade Announcements.**—MESSRS. BERRY, SKINNER AND CO. announce that they have granted to the Safetee Controlling Appliances Co., Ltd., of Luton, Beds., a limited licence under Berry's patents Nos. 28,546/04 and 13,443/09 to manufacture and vend in the British Isles, under royalty, their apparatus advertised as the "Safetee" switch-fuse.

THE PREMIER ELECTRIC CONTROL, LTD., have removed to Kenmont Works, Harrow Road, Willesden Junction, N.W.

**For Sale.**—The Birmingham Tramways Committee has for disposal the whole of the machinery and plant installed at the Yardley generating station. Messrs. Wheatley Kirk, Price & Co. will, on May 7th and 8th, sell by auction the freehold works premises, the entire plant, stock and goodwill of the business of the Sunbeam Lamp Co., Ltd., (in liquidation).

Messrs. J. & W. Heathcote will, on May 2nd, sell by auction the factory premises of Metalite, Ltd., Derby. See our advertisement pages in this issue.

## LIGHTING and POWER NOTES.

**Aberdeen.**—An installation of electric light is now being made at Craibie Church, on the Lister-Bruston system; improvements in the lighting of Balmoral Castle are also said to be in contemplation, and here also electricity will play an important part.

**Basingstoke.**—At a meeting of the T.C., the draft provisional order for electric supply in the town and neighbouring parishes was received. The order approves of the local proposals with a few additions to the details.

**Bedford.**—The adjourned L.G.B. inquiry into the application of the T.C. for borrowing powers for the purchase of Diesel engine plant was held on the 16th inst., when the allegations of the Hick-Diesel Co. in regard to the manner in which the contract was placed with Messrs. Allen were fully gone into. The Town Clerk pointed out that Messrs. Allen's tender (for a 400-kw. set) including spares, and allowing for the cost of altering the roof incidental to acceptance of the Hick-Diesel tender (for a 500-kw. set) was less costly, also that the Hicks engine not being enclosed did not comply with the specification. It was stated that Messrs. Allen had not made a Diesel engine, and that their London representative had tried to induce the Hick-Diesel firm to facilitate Messrs. Allen's tender going through. The inquiry was concluded.

**Birmingham.**—The Electric Supply Committee of the City Council has decided to recommend that a sum of £250,000 be spent on a new power station at Nechells to supplement the existing one at Summer Lane. This, however, is only an instalment of a scheme which will ultimately cost nearly £1,000,000.

**Burnham (Somerset).**—With reference to the electricity scheme submitted by Dr. Purves, of Exeter, which was referred to in a recent issue of the ELECTRICAL REVIEW, the U.D.C. has decided to grant Dr. Purves an extension of time until May 8th, to register his electric light company under the Council's Parliamentary Order. It is anticipated that this extension will enable the scheme to be carried out without further delay.

**Canada.**—SUPPLY TO FARMERS.—The *Electrical News*, in a recent issue, referred to the development of the Electric Power Co.'s system, from which several pulp and paper mills are supplied. Our contemporary says the peak load on this system has grown very rapidly, and in December, 1912, just three years after the Stephens Dam power house commenced operation with a load of 300 H.P., the peak had grown to 15,000 H.P., with a daily load factor usually exceeding 80 per cent. Although the company has such excellent consumers as pulp mills, yet it apparently does not neglect the smaller classes of supply.

In order to satisfy the growing demand for electric light and power in rural districts the company is now actively engaged in building a number of rural distribution lines. One of these, viz., a 2,200-volt, single-phase line, about 10 miles in length, from Napanee through Newburg to Camden East, has now been in operation for some time. It is fed from the company's sub-station at Napanee. Distributed over the 10 miles of line are now about 60 customers.

Another of these lines, extending about 12 miles in a south-easterly direction from Campbellford, will be in operation before the end of the present month, with between 20 and 25 customers, most of whom have contracted for from 1 to 3 H.P. There is also one customer on this line who has contracted for 25 H.P. The line will be fed from the Stephens Dam power house at Campbellford at 6,600 volts, single phase. Pole type transformers are used, having a ratio of from 6,600 to 120/240 volts. As a rule a separate transformer is installed for each customer.

Other lines are in prospect, and will be constructed in the near future, extending over 29 miles. The farmers along the routes of these lines are having their houses and barns wired for lighting and are installing motors for pumping water, sawing wood, chopping feed and various other purposes.

**Carlisle.**—The T.C. on the 8th inst., authorised the Electricity Committee to apply for sanction to borrow £7,500 for additional plant which is needed for the supply of two large business premises.

**Cheltenham.**—At the last meeting of the T.C., the electrical engineer was instructed to obtain tenders for additional condensing plant at the works. The loan of £1,500 sanctioned in May, 1900, for mains extensions being nearly exhausted, it was resolved to apply for sanction to a further loan of £1,500. It was stated that in the last four months the consumers added had been 103, compared with 35 in the corresponding period last year.

**Colwyn Bay.**—At a meeting of the U.D.C. a communication was submitted from the North Wales Power Co. which owns the power station in Nant Gwynant, stating that it intended to extend its mains to Penmaenmawr, and that it observed the U.D.C. was about to spend £5,000 for additional generating plant. The company suggested that this expense might be saved, and the cost of electricity supply in the town reduced if the company's mains were continued to Colwyn Bay and current were supplied to the Council in bulk. It was decided to refer the letter to the Electricity Committee.

**Continental Notes.**—HUNGARY.—Plant is about to be put down at Zwir to utilise the water-power of the River Reesina in the generation of electrical energy for lighting and power purposes in the town of Fiume. The water will be diverted from the river at Cankovo and conveyed along a canal, about 18 miles long to Zwir, where the existing steam-operated generating plant will be kept as a reserve, when the new installation is completed.

FRANCE.—Owing to the increasing demand for current, La Société Est-Eclairie is extending its central station at Mohon by putting down a new 12,000-H.P. steam turbine and generator. When the new plant is installed, the station will have a total capacity of 24,000 H.P.

**Coventry.**—Mr. HOOPER AND RATE-AID CONTRIBUTIONS.—A L.G.B. inquiry has been held into an application by the Corporation for sanction for a loan of £20,000 for electricity department extensions. The loan was intended to cover an overdraft of £16,357, and to provide for further capital expenditure, principally upon mains. The Inspector (Mr. R. H. Hooper) observed that last year the undertaking made a profit of £16,000, of which £1,000 was paid to the relief of the rates. He pointed out that the outstanding capital was increasing each year, whereas in a good many municipal undertakings the outstanding capital was dropping; and when it began to drop, then they began to get a far more valuable asset for the town. He did not question at all that the undertaking did very well in making a profit of £16,000, but he pointed out that they were placing money to the relief of the rates, and then having to borrow really in order to do so. There were no two ways out of it; it must cost the ratepayers more in the long run, because they would have to pay the interest and charges upon the borrowed money. He also pointed out that the poorer class of people paid their rents and rates in one lump sum, and that money devoted to the relief of rates in an undertaking of that character was of no benefit to that class of people; in fact, it was no relief whatever to the poorer working classes. There were just over 2,000 consumers of electrical energy out of a population of 115,000, so that practically one-fiftieth of the population were making a contribution to the relief of the rates for the benefit of the others, who did not happen to be users of electrical energy. He hoped the City Council would very seriously consider the question of these large contributions to the relief of the rates; it was very much sounder, financially, for the whole of the undertaking and for the city that the whole of the profits should be conserved. Alderman West inquired as to the opinion of the Inspector with regard to other municipal undertakings. The Inspector replied that the principle applied equally to them all, and said he had noticed that in towns where there were no contributions to the relief of the rates from municipal undertakings, the rates were extraordinarily low. The inquiry closed, and the Inspector notified that he would report in due course.

**Cromer.**—Notice of the intention of the Council to transfer its prov. order to Edmundson's Corporation, with the consent of the B. of T., appears in the *London Gazette* for April 11th.

**Dundalk.**—On the 28th inst. a L.G.B. inquiry will be held into the application of the Urban Council for sanction to obtain a loan of £5,000 to extend the electric lighting system of the town.

**Epsom.**—The U.D.C. has decided to offer existing consumers of electricity for outside shop lighting a supply of current at the rate of £3 10s. per lamp per annum, or an alternative charge of 2d. per unit.

**Falkirk.**—The T.C. is considering whether electricity or gas should be adopted for street lighting. An early meeting will deal with the reports of the electrical and gas engineers, and decide as to the best and most economical method.

**Fleetwood.**—The L.G.B. has sanctioned the following loans in connection with the electricity undertaking: £5,240 for 17 years, £1,410 for 15 years, and £500 for 30 years.

**Haiti.**—Electric lighting already exists at Port-au-Prince, Cape Haytien and Gonaives, and every year it is employed more in the streets and to light private houses. One company supplies the current to the first two towns mentioned above. Its station is at Port-au-Prince; the station at Cape Haytien is much less important. Electric lighting at Gonaives is in the hands of the Haiti Lighting Co., which has a capital of £20,000. The station of this company has two engines each of 66 H.P., and 40-kw. dynamos. A German firm intends to develop and improve the electric installation at Port-au-Prince. Power is to be supplied and the tramways electrified in that town, a contract having already been entered into with the Government. Over and above the three towns mentioned above, electric lighting could, says a correspondent, be installed with success at St. Mark, Mole St. Nicholas, Mixagoane, Petit-Goave and Aquin; also at Jacmel, where there used to be an electric lighting company. At Petit-Goave there are large works for the treatment of coffee. These are now worked by steam, but there should certainly be an opening for the use of electricity in them. A large number of small works in Haiti could be operated by electricity without much expense, as there are plenty of waterfalls which could be utilised to supply the power.

**India.**—According to the *Calcutta Englishman*, Howrah (Bengal) will be electrically lighted throughout by August next. At present 800 street lamps are in use; these will be superseded by 1,500 50-c.p. lamps lighting all the streets and roads in the town. The supply is obtained from the Calcutta Electric Supply Corporation, which has laid 6,000-volt cables through the Hooghly.

The *Pioneer* gave some details of the Simla hydro-electric scheme in a recent issue, from which it appears that the power house contains three 250-kw. Pelton wheel units operating under a head of 540 ft., and delivering energy at 2,200 volts, subsequently stepped up to 15,000-volts pressure for transmission to Simla direct, 9 miles, and to a pumping station at Chair, 12 miles; the pumping station is also connected to Simla by a 7½-mile transmission. At Simla the pressure is reduced to 2,300 volts, and subsequently reduced again in small sub-stations to 220 volts for street and house lighting. The additional water required at Simla led to the carrying out of the project; the pumping station is equipped with two induction motors driving slow-speed plunger

pumps, and the older pumping station for the Simla water supply is also to be electrified. The cost of the hydro-electric scheme is put at Rs. 1,320,000.

Arrangements have at last matured for the introduction of electric lighting and power in the three cities of Lucknow, Allahabad, and Bareilly. Tenders for the work will be invited forthwith.

**Kearsley (Lanes.)**—At a meeting of the D.C., held on April 10th, the surveyor reported on the lighting of Kearsley Hall Road and Slackey Brow by electricity, and it was resolved not to go to the expense involved.

**King's Lynn.**—At a recent meeting, the T.C. adopted a report of the Electricity Committee which stated that the electrical engineer had reported that, on account of continued abnormal increase in the demand for current, it was impossible to consider the gas engines, even if improved in accordance with previous suggestions, as an effective stand-by. He therefore asked the Committee to arrange for the installation of an additional 400-kw. steam set, with necessary pipes and apparatus, at an estimated cost of £3,000. The Committee recommended that one gas engine and dynamo be advertised for immediate sale, that the other gas engines and dynamos be sold as occasion arises, and that the necessary tenders be invited for the installation of a 400-kw. steam set.

**Lerwick.**—The T.C. is about to consider the question of lighting the town by electricity.

**Llandudno.**—The U.D.C. has decided to have mains laid in Augusta Street, Madoc Street and Chapel Street, in order that those thoroughfares can be lighted by electricity. The capital cost will be £270, and the annual cost of 400-c.p. lamps, £3 15s. each.

**London.**—**POPULAR.**—Tenders are invited from recognised makers of converting plant for the provision at the Farmgate sub-station at Millwall of one 1,000-kw. converter with the necessary switchgear and connections. The E.H.T. mains are to be extended by the laying of 5,000 yards of 1½ sq. in. 6,000-volt cable from the main generating station to the Millwall sub-station at an approximate cost of £3,533. This work was first recommended by the engineer in March, 1912, but owing at the time to the rapid rise in the price of copper and lead, the proposal was deferred.

**STOKE NEWINGTON.**—Application is to be made to the L.C.C. for sanction to borrow £5,000 for mains, and £1,000 for meters.

**STEPNEY.**—The Electricity Committee reports having had under consideration a communication from the Comptroller of the L.C.C., notifying the following alterations in the maximum periods which will in future be sanctioned by that authority for the repayment of loans for electric lighting purposes:—Freehold land (a) new period 60 years, (b) old period 60 years; buildings (a) 30 years, (b) 50; mains (a) 25 years, (b) 30; plant and machinery (a) 15 years, (b) 20; house connections (a) 12 years, (b) 12; meters (a) 10 years, (b) 10. According to a report, the Committee states, which has been prepared by the borough treasurer and the borough electrical engineer and manager, it appears that the proposed reductions in the periods in question are not justified; and, moreover, are calculated to injuriously affect municipal electricity undertakings in the metropolis. The attention of the Standing Conference of the five East End Boroughs of Poplar, Stepney, Hackney, Shoreditch and Bethnal Green was then drawn to the matter, with the object of a conference of the whole of the local authorities in the metropolis owning electricity undertakings being convened, in order that concerted action might be taken in the matter, with the result that the Conference decided to adopt the course suggested.

**HAMMERSMITH.**—The Electricity Committee reports having considered the general working of the scheme approved by the Council in December, 1911, for hiring and maintaining arc lamps on consumers' premises. This scheme, the Committee states, at present allows only for a maximum guaranteed consumption during 800 hours per annum, but in actual practice, it is found that a number of consumers exceed this to a considerable extent. The Committee is, therefore, extending the scale of charges so that the guaranteed hours' use per annum can be extended to 900 and 1,000 hours, the rental being increased *pro rata*. The Committee is also proposing to give lower rates in consideration of the consumer entering into a contract at the expiration of the first 12 months, to continue the use of the lamps for a further period of four years.

**HACKNEY.**—In view of the large expenditure which has taken place in the capital expenditure of the electricity undertaking, the B.C. is pressing forward the sales and publicity sections so as to make the business take a corresponding step forward, and in view of this have decided to have full-page advertisements in certain papers once a month, the centre of the page to be devoted to an appropriate general popular article, and the margin to be let for traders' announcements.

**Luton.**—The assessment of the Corporation Electricity Works has been reduced from £3,000 to £1,500, without resorting to an appeal.

**Lye and Wollescote.**—The U.D.C. has appointed a Committee to consider the advisability of having the town lit by electricity in place of gas. As an experiment, it is proposed to have one street electrically illuminated.

**Lytham.**—The B. of T. has given its decision as to who shall have power to supply electricity to the district, the application of the local Council having been acceded to. The application of the St. Anne's U.D.C. has been refused.

**Merton.**—The Wimbledon T.C. has offered to provide, erect, and maintain public electric lamp standards at Merton, fitted with 500-550 watt lamps, at £27 10s. per lamp per annum, for a term of not less than 10 years. This offer is being considered by the Merton U.D.C.

**Portrush.**—Mr. G. B. Deane held a L.G.B. inquiry last week in connection with application of the Urban Council for sanction to raise a loan of £6,000 for the purpose of carrying out the long projected electrical lighting scheme.

**Plymouth.**—The secretary of the B.E.A.M.A. has written the Corporation, enclosing the copy of a printed form entitled "Municipal Tenders, Request as to Publication," pointing out that it had been agreed between the Association and the I.M.E.A. that the publication in the Press, local or general, of prices quoted on financial tenders and reports of electricity committees on municipal tenders was undesirable, both in the interests of municipalities and manufacturers. The Corporation was requested to take steps with a view to avoiding such publication. The Electricity Committee referred the matter to the Town Clerk for report.

**Richmond.**—At the last meeting of the T.C. a letter was read from the Richmond (Surrey) Electric Light and Power Co., Ltd., intimating that the company is advised that it is necessary to have the agreement which was made between the Corporation and the company in January last confirmed by an Act of Parliament, and that the Lord Chairman having allowed the company to proceed by a late Bill, the company is taking the necessary steps to deal with the matter this session. In this connection, the General Purposes Committee reported that the agreement referred to provided for its confirmation by Parliament if the company should consider this to be necessary, but the Parliamentary Notice foreshadowed provisions which did not appear to be in accordance with that agreement. Mr. Renwick, the company's general manager, suggested that certain provisions relating to the price of current contained in the original agreement scheduled to the Companies' Act of 1907 are cancelled by the provisions of the recent agreement, and he has submitted a draft supplemental agreement to provide for the repeal of so much of those provisions of the original agreement as relate to the revision of the price of current. The Committee advised the Council to oppose the Bill if necessary, and this was agreed to.

**St. Andrews.**—The Electric Supply Corporation is anxious to obtain a contract for lighting the streets of the city with incandescent electric lamps, and is fitting up lights in Greyfriars Gardens as an experiment.

**Stoke-on-Trent.**—The B. of T. has granted the T.C. a prov. order empowering the Corporation to supply current for public and private purposes at Wolstanton.

**Southborough.**—The B. of T. has granted the U.D.C. a prov. order for electric lighting.

**Swanage.**—The Electricity Supply Co. has applied to the Board of Trade for permission to erect a generating station at Court Hill, under the Electric Lighting Order, 1906.

**U.S.A.**—The Commissioner of Public Works of Boston, Mass., in his annual report, urges the installation of electric lamps in place of the 11,000 gas lamps now in use for city lighting. He says that 60-c.p. tungsten lamps, giving one-third more light than the present gas lamps, cost \$21.14 per lamp per year and their use would save the city \$21,716 a year over the present contract price paid for gas lamps.

**Wednesbury.**—The T.C. has decided to increase the charges for electricity for light and power, by 5 per cent., from April 1st.

**West Bromwich.**—A recent issue of the *Midland Chronicle* illustrates the improved lighting in Birmingham Road, where the Cable Accessories Co.'s "Seaco" sheet steel tungsten lamp fittings have been adopted. The fittings in question apparently contain five 100-c.p. lamps, and are hung direct from the tramway span wires. It may be mentioned that the lamp-holders are mounted on a spring-supported insulating base which gets over vibration difficulties.

The T.C. has received from the L.G.B. sanction to a loan of £6,500 for mains extensions. The Electricity Committee has been authorised to negotiate with the South Staffs. Tramways (Lessee) Co., Ltd., for a further supply of energy.

**Whitehaven.**—The T.C. has received from the L.G.B. sanction to loans of £665 in respect of excess expenditure on plant, £300 for mains extensions, and £600 for house services.

**Whitstable.**—The U.D.C. has decided, by 7 votes to 5, to agree to the installation of the electric lighting in the town on terms to be arranged with a proposed company, and that the latter be given half of the public lighting, subject to a proper agreement being entered into.

**Wolverhampton.**—In consequence of the continued rapid growth of the demand for electrical energy—particularly in the centre of the town and in the Dudley Road area—it is found necessary to again make extensions to the Corporation electrical plants and mains. Just before severing his connection with the undertaking Mr. C. E. C. Shawfield, the electrical engineer, prepared a report setting forth the requirements to meet next winter's load. He recommends the laying of a H.T. ring main from Commercial

Road to the School Street Stores, from the Stores to the Sunbeam Works, returning to Commercial Road. That a sub-station be built at the Stores, with three 250-kw. rotary converters with the necessary switchgear; and to install in a sub-station at the Moorfield Works of the Sunbeam Motor Car Co. one 250-kw. converter. Mr. Shawfield also states that extensions will be required to the E.H.T. switchboard to deal with the proposed ring main. There is no room for further extensions to the existing E.H.T. switchboard without going to very considerable expense. In view of this fact he recommends that a new switchboard be installed. The generating and converting plant will be controlled by this switchboard, the present board being used as an auxiliary switchboard to control feeders only. A further advantage of this scheme is that the switchgear for all the running plant, both A.C. and D.C., will be collected at one point, and will be under the control of one man, an arrangement desirable on the grounds of economy and efficiency. The expenditure required to meet the cost of the scheme is estimated as follows—E.H.T. ring main, £3,300; feeder cables to various points on the network, £550; alterations to existing network, £400; four 250-kw. converters, £3,600; E.H.T. switchgear for three sub-stations, £900; L.T. switchgear for three sub-stations and cable connections, £600; buildings and foundations, £570; cranes for two sub-stations, £150; new E.H.T. switchgear for Commercial Road generating station, £2,000; new cables for connecting existing machines, £150; or a total of £11,620.

Mr. Shawfield concludes his report with the following practical recommendation: "That an application be made to the L.G.B. to borrow a further sum of £15,000 for mains extensions, and £5,000 for sub-station equipment. Also that application be made to them to borrow £2,000 for E.H.T. switchgear and connections at the generating station, Commercial Road."

At the Council meeting following, Mr. Shawfield's report was unanimously adopted, and tenders are to be invited for the necessary work.

**Woodford (Essex).**—The U.D.C., after considering a scheme of obtaining a supply of current from Walthamstow Council, has deferred its decision until the ratepayers have had an opportunity of discussing the matter.

**Worthing.**—In introducing the half-yearly estimates to the T.C. Alderman White referred with pleasure to the fact that the accounts of the electricity undertaking were at last showing an appreciable profit. After placing £500 to reserve, the outcome of the past year's trading had been a realised profit of £748. Electric heating and power were appealing to the townspeople, with the result that it was expected that during the coming year something like 160,000 units would be sold for these purposes, representing an income of something like £1,000. It was proposed that in future this sum should be deducted from the cost of producing the electricity before calculating the charge for public lighting, and this would mean that whereas during the past year the charge for public lighting had approximated 5d. per unit, it would in future be about 4½d. The Committee estimated that 12 months hence there would be a balance of profit of something like £1,500, and he hoped that then not only the public lighting, but also the private consumers would benefit by a reduction.

**York.**—The T.C. has received from the L.G.B. sanction to a loan of £500 for wiring Corporation premises for the electric lighting.

The Electric Light Committee is to prepare a scheme for laying cables in the streets of the city, generally for public and domestic lighting, and other domestic purposes. The capital cost of such a scheme is estimated at £71,000, and it is anticipated that the public lighting could be undertaken at £3,075 a year, including interest on the loan, against £4,600 paid for gas.

## TRAMWAY and RAILWAY NOTES.

**Barking.**—It has been decided to agree in principle to the proposed traction supply from East Ham upon certain terms which were not made public, and the matter was left to the clerk and engineer to arrange the necessary details.

**Bournemouth.**—The financial year of the Corporation tramways undertaking shows that all previous records have been broken. The number of passengers carried was over 15,750,000, showing an increase of about 640,000. The receipts were nearly £95,700, an advance of about £4,340. There has also been a substantial saving in expenditure, and there is, it is stated, a balance of over £10,000 on the net revenue account.

**Canada.**—The *Electrical News* says that the train service operated by the Grand Trunk Railway system through the St. Clair tunnel which connects Sarnia and Port Huron under the St. Clair river is claimed to be the heaviest railway service handled by electricity in the world. This electrification operates within a zone of approximately four miles, the motive power being derived from 1,500-h.p. electric locomotives, each weighing 135 tons with a normal draw-bar pull of 50,000 lb. and a maximum speed of 35 miles per hour. The time taken to change engines is from two to five minutes, and the time of passing through the tunnel which, with its approaches is more than two miles in length, is 13 minutes. Up

to 45 cars per train are hauled through the tunnel, which represents a train more than one-half mile in length.

During the 12 months of 1912 the company's records show that 197,801 loaded freight cars and 88,692 empties passed through the tunnel, in addition to 35,096 passenger cars. Estimated on a basis of 17 tons per car, this gives a total tonnage passing through the tunnel of approximately 3,500,000. These figures do not include any company material such as coal, lumber, ties, &c., which would swell the total to much larger proportions.

**Cardiff.**—The tramway receipts show an increase of £3,263 over the previous financial year, due largely to the Royal visit in June last, and the fact that Easter came much earlier, but Mr. Arthur Ellis and his staff are to be congratulated on the financial result. The number of transfer tickets issued during the year was 3,037,720, which compared with the figures of the preceding year—2,900,700—gives an increase of 137,000. The figures are as follows:—1913, passengers, 28,365,037; receipts, £128,882; 1912, passengers, 27,561,652; receipts, £125,618. The question whether some of the Cardiff thoroughfares should be remade and a portion of the tramway line reconstructed by contract or direct labour was discussed by the Tramways Committee. The Lord Mayor, referring to the decision of the Joint Committee to employ direct labour, said he would like to know whether the statement made by the city engineer that £27,000 could have been saved if the track had been relaid by direct labour in 1902 was accurate. The following resolution was ultimately passed:—"It is the opinion of the Committee that (a) the whole of the works involving reconstruction of the tramway track and repairing of the carriage ways should be carried out by the same agency, and (b) that before deciding the question of contract as against direct labour, tenders be invited by advertisement, and that the city engineer be requested to submit his estimate to be opened at the same time as tenders received from contractors. The whole of the work to be done to a specification, and schedule of prices to be prepared by the city engineer.

**Doncaster.**—Now that the district is growing so quickly through colliery development, an effort is to be made to compel the Corporation to fall in with the desires of the people, and provide a means of transit on the Sabbath. Some years ago the question was submitted to the referendum, but the area of the plebiscite was restricted to the borough, and the majority of the few who voted at all, were against such a service. If a poll were taken now, including the outside districts, there would be an overwhelming majority in favour of Sunday running.

**Edinburgh.**—The convener of the Tramway Committee, along with the town clerk, has had an interview with the War Office authorities with reference to the Colinton Tramway and to the application of the company for running powers in the city. It is stated that negotiations have been proceeding for the acquisition of the tramway by the Corporation, and that £10,000 has been mentioned as the price at which the promoters are willing to sell. The tramway runs between Slateford Station and Redford Barracks. The purchase by the Corporation would solve two questions in which the War Office is interested—the supply of electric lighting to the barracks and the provision of tramway facilities for the soldiers. It has still to be decided whether the city or the War Office will lay the mains from the city boundaries to Redford.

**Hull.**—In connection with the agitation for a tramway service from the centre of Hull to Stoneferry, which is within the city boundary, a largely attended meeting has been held at Stoneferry, when a resolution was passed in favour of the extension of the tramways. A motor-bus service used to be run, but this was discontinued as it entailed a loss of £5,000 per annum. Alderman Hanger said that out of the tramway profits, £190,500 had been contributed to the relief of the rates. Four hundred yards of the double lines were already laid of the 1½ miles required, and he held that the profits should be used for the development of the system.

**Leicester.**—The T.C. has approved the report of the Tramways Committee recommending the provision of repairing shops for tramway cars in the Abbey Park Road, at an estimated cost of £23,000.

**London.**—On Monday last another stoppage of the L.C.C. tramway service, both north and south of the Thames, took place for two hours during the busiest part of the morning. Following on two similar breakdowns, it is not surprising that some discussion took place in the Council on the matter, which appears to have been somewhat unnecessarily hushed up.

A report presented by the Highways Committee on the two tramway breakdowns which occurred on March 10th and 12th respectively, stated that on the evening of March 10th a short-circuit occurred on the switchgear at the Greenwich generating station, causing considerable damage to the switchgear, burning out several coils on a generator, and involving a temporary failure of the whole supply. A partial supply was given within a few minutes, and the normal supply was resumed the same evening. On March 12th, a few coils of another generator failed. These had apparently been weakened previously. By working day and night, the first generator damaged was on load again on March 19th, and a large proportion of the cars which had been withdrawn were put back into service. The repair of the second generator was completed on March 29th, and the full service of cars was resumed on March 30th.

Sir Edward White, chairman, Highways Committee, said they had received tenders for the supply of improved turbine machinery, at a cost of something like £200,000. This would give them considerable reserve power; but they were not depending entirely on this. They had a contract with the Metropolitan Electric Tramway

Co. to supply them with a certain amount of power, and under that contract power was being supplied to them now. They had also a contract with one of the public authorities, and cables were being laid down in order to give them a third string to their bow. They were thus taking every means in their power to meet the difficulties.

Mr. G. H. Hume, vice-chairman, Highways Committee, said none of the three accidents had anything to do with an over-demand on the resources of the generating station. That on March 10th was due to a slight error of judgment. On Monday last a piston was blown out of one of the engines, owing to the breaking of a cotter-pin, and a piece struck a generator. That caused a short-circuit, which in turn caused a short-circuit on the high-tension board. A section of the switchboard caught fire, and the same generator which broke down in March gave way in another place. The whole service had to be stopped while the fire was being put out, and the extent of the damage was being ascertained. It was no use the Council blinking at the fact that they were working with a very small margin at their generating station. After further discussion the matter dropped.

The total traffic receipts of the L.C.C. tramways for the year. April 1st, 1912—March 31st, 1913, were £2,143,190 from electrical lines, and £37,545 from horse tramways. The comparable receipts for the previous year were £2,231,945 and £60,356, showing a decrease of over £111,000.

**STEPNEY.**—The L.C.C. is to be requested to include in one of its General Powers Bills a clause to empower a Council to recover the cost of damage done to street lamp columns from the owner or owners of the vehicle, instead of from the driver as at present.

**Manchester.**—At a meeting of the Tramways Committee recently, the estimates for the ensuing year were considered. By resolution of the City Council, and in accordance with the scheme of the Trading Profits Committee, the tramways undertaking is expected to contribute £100,000 to rate relief purposes, being 5 per cent. on a capital expenditure of, roughly, £2,000,000. The estimated receipts for the ensuing year are put at over £900,000. The capital expenditure account makes provision for £30,000 for buildings, £30,000 for permanent way (new lines), £25,000 for street improvements, and £30,000 for cars and equipment.

**Nelson.**—A record year is reported in connection with the tramways undertaking. The Committee estimated a profit of £450, but this has been exceeded by no less than £1,000. The light railways have carried 267,271 more passengers than in the previous year, notwithstanding the fact that last summer was an abnormally wet one. The most gratifying feature is the great improvement which has taken place in regard to the Scotland Road section, which has hitherto been a great drag on the undertaking.

## TELEGRAPH AND TELEPHONE NOTES.

**Direct Cable to Canada.**—Direct telegraphic communication between the United Kingdom and Canada has been opened, on the Morse system of Mr. John Gott.

**Rural Telephones.**—In answer to a question, the Postmaster-General recently stated that the additional Treasury grant of £20,000 would probably admit of the provision of about 1,300 additional rural party-line telephones.

**United States.**—It has been announced that a contract for eight wireless telegraph stations, to be the most powerful in the world, has been awarded by the American Marconi Wireless Telegraph Co. to the J. G. White Engineering Corporation. The stations will be located in pairs, a receiving and a sending station being 30 miles apart to reduce interference, at Oahu, H.I.; Tamale Bay and Bolinas, Cal.; near Belmar, N.J., and in Eastern Massachusetts. Later on a station will be established in Japan. The range of these stations is estimated at from 4,000 to 6,000 miles, and each will utilise a different wave-length. The antenna will be 400 ft. or more high. Each station is to consist of 12 towers arranged in a semicircle covering a square mile. The power available at each station will be 750 kw.—*Electrical Review and Western Electrician.*

**Wireless Map of the World.**—An admirable map of the world has been compiled by Marconi's Wireless Telegraph Co., Ltd., and is published by Messrs. George Philip & Son, Ltd., at 2s. 6d. net. It shows very clearly the position of all stations open for ship-and-shore communication, high-power public and private stations, the long-distance stations of the Imperial scheme, and other stations for trans-oceanic communication. Lighthouse, light-ship and Naval stations are not shown, and this, perhaps, accounts for the omission of the stations at the Eiffel Tower and Nanen, for example, though we were not aware that these were regarded as "Naval." The distribution of the stations over the world is very interesting; Canada is thickly dotted with them along the St. Lawrence and the great lakes, as well as on the West coast, British East Africa, the Gulf of Mexico, and the East coast of South America are also noticeably well equipped, but the greatest concentration is, of course, in the West and South of Europe. The map is very welcome, and certainly fills a distinct want.

(Continued on page 647.)

# THE ELECTRICITY WORKS OF TROLLHÄTTAN.

The first power station erected by the Swedish Government is the huge undertaking at Trollhättan, which was carried

out by the State Waterfalls Board, under the supervision of the manager of the Board, Col. F. V. Hansen, the chief

is available at Trollhätte Falls. The minimum discharge is 320 m.<sup>3</sup> per second, and the present works are laid out for a flow of 250 m.<sup>3</sup> per second, giving 80,000 h.p.; but by regulating the level of the lake, a total output of 200,000 h.p. can be made available. From the headworks, the water is carried in a canal, 1,300 m. in length, to the forebay, which we illustrate on page 644, whence it is led by eight steel pipes, 4.25 m. in diameter and 60 m. long, through tunnels blasted out of the solid rock, to the power house. Three smaller pipes in a common tunnel feed the exciter sets. Ice-screens and headgates are provided within the intake building, and the former can be heated with electricity to prevent the formation of frazil. The arrangement of the plant is shown in figs. 3 and 6.

The power station, a building designed in keeping with its rugged surroundings, contains six three-phase generators



FIG. 1.—TROLLHÄTTAN POWER STATION AND SWITCH-HOUSE.

out by the State Waterfalls Board, under the supervision of the manager of the Board, Col. F. V. Hansen, the chief

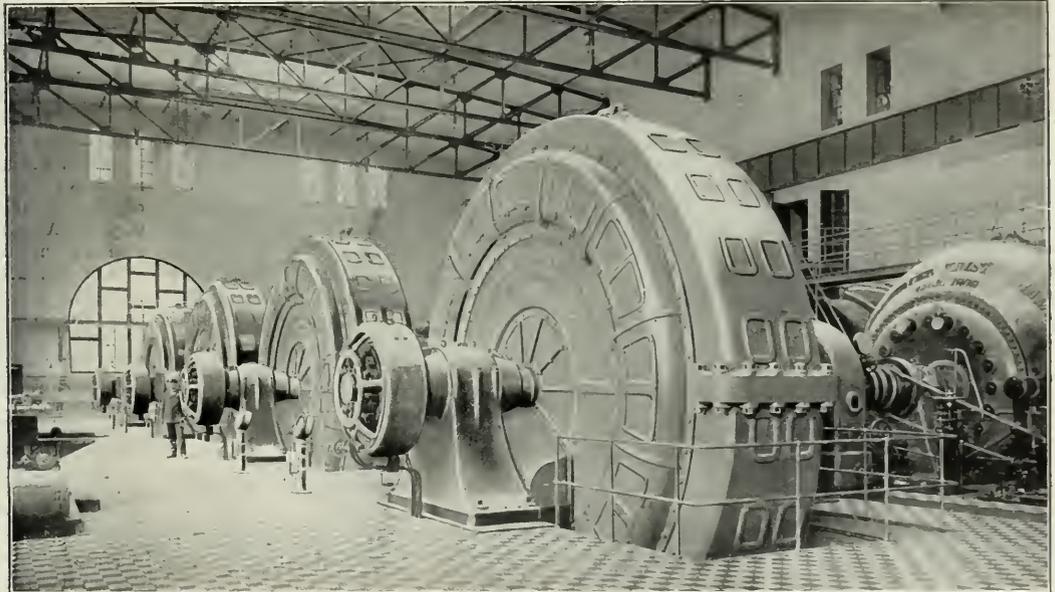


FIG. 2.—INTERIOR OF TURBINE ROOM.

engineers, Mr. T. Holmgren and Capt. G. Malm, and Mr. Holmgren's assistant, Mr. W. Borgqvist. The contractors were the Allmänna Svenska Elektriska Aktiebolaget—the "General Electric Co. of Sweden"—a firm which, founded by Jonas Wenström in the early eighties, has continuously progressed, and has become one of the most capable and successful concerns in Europe. The company recently issued an admirable description of the undertaking, and has kindly provided us with the photographs which we reproduce herewith.

The generating station is situated, amidst wild and picturesque scenery, at the Trollhätte Falls on the Göta River, which carries the discharge from Lake Vänern, the largest lake in Sweden, having an area of 5,570 sq. km. The whole of the water-power of this river became the exclusive property of the State in 1908.

The river is 86.5 km. in length, and has a total fall of 44 m., of which 32 m.

of 11,000 K.V.A. at 10,000 volts, 25 cycles, directly coupled to horizontal turbines running at 187.5 R.P.M., which utilise

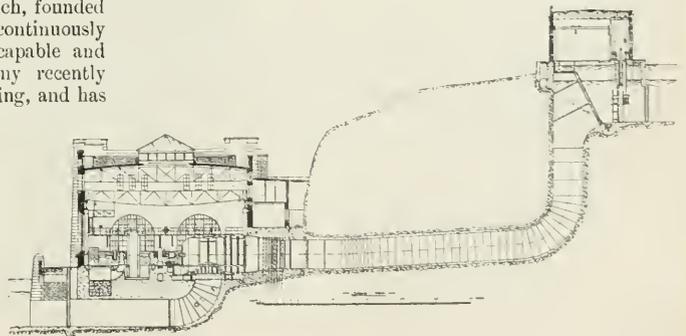


FIG. 3.—SECTION OF POWER STATION AND SLUICE GATES, TROLLHÄTTAN.

an effective head of 30 m. Each turbine consists of two wheels enclosed in a common steel casing, and is provided with automatic regulating apparatus. Eventually the station will contain eight generating sets, in addition to the three exciting sets, of 350 kw. each at 220 volts. A storage battery is used in conjunction with the exciters. The switchgear is housed in a separate building, connected with the works by a cable tunnel 200 m. in length, there being no room for the switch-house close to the power station. The tunnel is divided into four independent corridors, and carries, in addition to the main cables, the signalling and operating lines for the complex system of remote control rendered necessary by the long distance between the two buildings.

In the switch-house are cells for eight groups of transformers, of the oil-insulated water-cooled type, which step up the pressure of part of the supply to 50,000 volts, for transmission to the more remote centres of utilisation.

The alternators have an efficiency of 96 per cent. when giving 9,000 kw. with a power factor of 0·8, and 96·9 when giving 7,200 kw. at unity power factor. The rise of pressure when the full load is switched off is 21 per cent. The mode of excitation is unusual; the three exciters work at 220 volts, and each of the alternators has on the end of the shaft an exciting booster, which is connected in series with the field winding and the main exciter bus-bars, and gives a pressure varying from + 110 to - 220 volts. Thus the resultant pressure of the exciting current can be varied between 0 and 330 volts, by regulating the field of the separately excited boosters. One of the alternators is pro-

vided with damping coils on the poles, to enable it to run as a single-phase generator for traction, the future supply of



FIG. 4.—POWER CANAL AND FOREBAY, TROLLHATTAN.

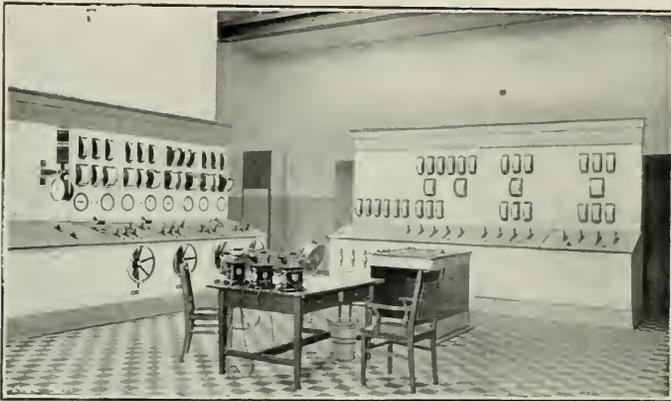


FIG. 5.—INTERIOR OF SWITCH-ROOM.

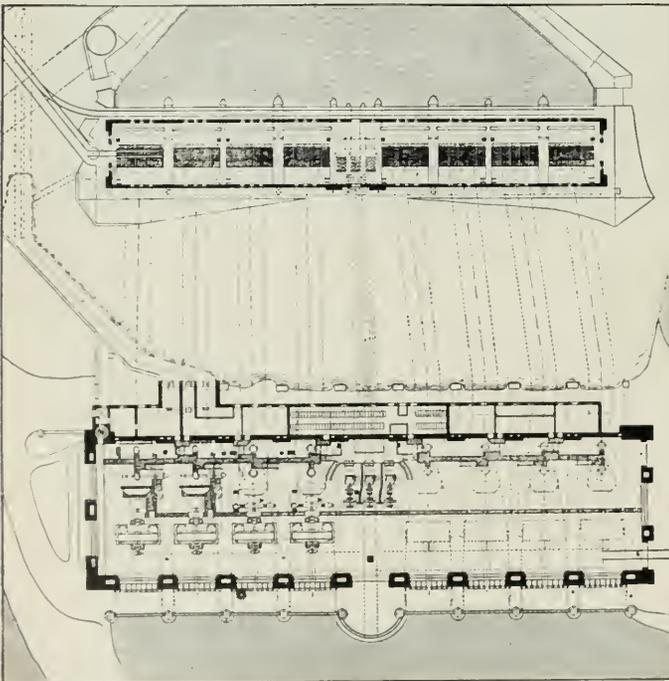


FIG. 6.—PLAN OF POWER STATION AND FOREBAY, TROLLHATTAN.

the State railways being one of the purposes for which the works have been built. The stator can be moved axially sideways, to enable the coils to be easily got at for inspection or replacement, the winding being laid in open slots.

A noteworthy feature of the generators is the system of ventilation employed. As will be seen in the illustration, fig. 2, the rotors are enclosed, and are provided with ducts bringing

air from the outside of the power station, the rotors carrying fans to propel the air, which passes through the stator and is carried away to outlets in the walls of the building. The cooling air required amounts to about 20 m<sup>3</sup>. per second for each machine. In winter the heated air is useful for warming the buildings, and in summer the station is kept cool; an additional advantage is that the machines are absolutely noiseless. The generators can be run as open machines by taking off the central end shields. The stators are of considerable size, measuring 6·65 m. in height from the base, and 4·9 m. from the ground level; the rotor is 4·75 m. in diameter. Each generator weighs about 200 tons, the rotor alone weighing 67 tons. In these days of high-speed turbines, the majestic dimensions of the machines of ten years ago are seldom met with; fig. 2 will give a fair impression of the massive proportions of these fine alternators.

The storage battery has a capacity of 1,000 kw.-hours, or 4,800 amp.-hours at the three-hour rate of discharge.

In the switch-room there are two control-boards of the bench type, for the generators, and for the transformers and feeders respectively. These are shown in fig. 5, with the signal desk provided with telephones and engine-room telegraphs communicating with the power station.

(To be concluded.)

### SOME AMERICAN CEMENT MILL INSTALLATIONS.

As many of our readers are aware, the conditions of service under which electrical motors in cement works are called upon to work, are extremely severe; the atmosphere is heavily charged with dust, and the attention given to the electrical plant is often quite unskilled in character. Yet both in this country and abroad, the electrical drive is now regarded as an indispensable feature of the modern cement mill, and as cement machinery largely runs throughout the day and night, it obviously provides an excellent load factor for electrical generating plant. For work of this description, the A.C. squirrel-cage induction motor is generally considered the best for well-known reasons, and our views illustrate some typical applications of these machines in large American cement works.

Fig. 1 shows two 440-volt 40-H.P. squirrel-cage motors, speed 166 R.P.M., driving ball mills in a raw-material mill of the Universal Portland Cement Co.

The ball mill consists of a heavy cylindrical drum containing heavy steel balls, which grind the material fed in as the drum slowly rotates; the drum speed is only about 20 R.P.M., and two-gear reductions are often adopted, but where a 25-cycle supply is available, good results are obtainable by using a slow-speed induction motor, as shown, with only one gear reduction.

In the works referred to, there are nine of these mills so driven.

Figs. 2 and 7, show Fuller mills driven by vertical type squirrel-cage motors; in these

mills the centrifugal pressure of large steel balls against a heavy steel ring pulverises the material, which is driven out by a fan through a screen which surrounds the chamber immediately above the steel ring. The Fuller mill is sometimes driven by ordinary type motors by means of quarter turn belts, an arrangement which, on account of

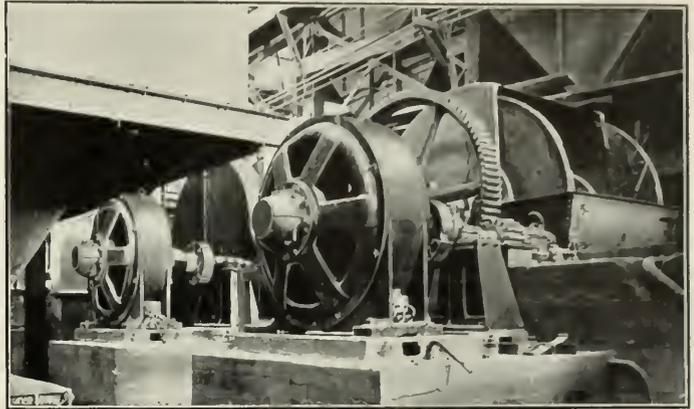


FIG. 1.—TWO 40-H.P. SQUIRREL-CAGE MOTORS DRIVING BALL MILLS.

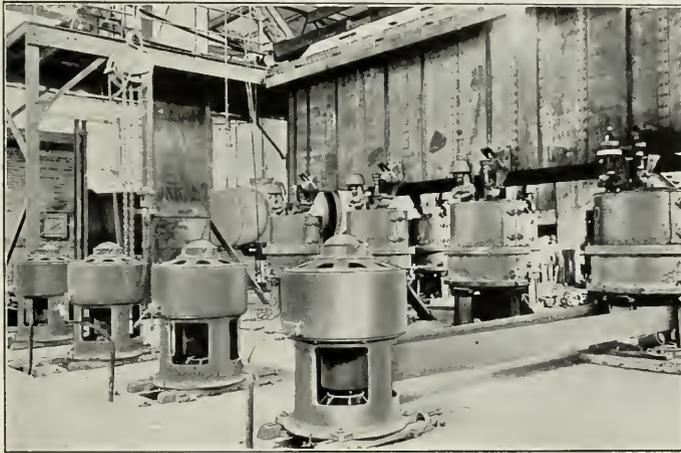


FIG. 2.—VERTICAL MOTORS DRIVING FULLER MILLS; UNIVERSAL PORTLAND CEMENT CO.

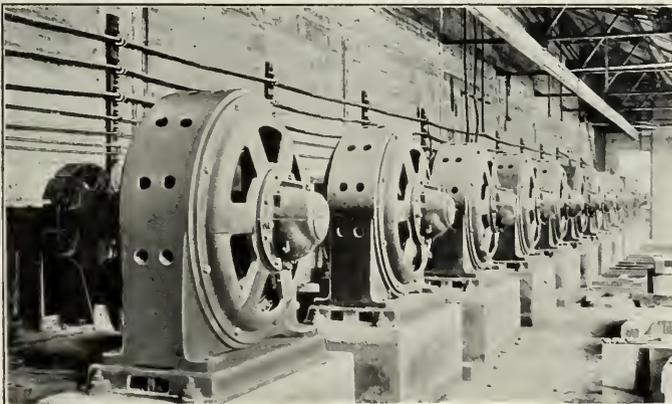


FIG. 3.—TWELVE 100-H.P. MOTORS DRIVING TUBE MILLS.

the belt wear, is not so good as that shown and almost always used. The first view shows four of eight 40-H.P., 500 R.P.M., 440-volt S.C. motors driving Fuller mills at the Universal Cement Co.'s works, and the second 10 550-volt, 25-cycle, 75-H.P. S.C. motors, speed 500 R.P.M., in similar use at the Tidewater Portland Cement Co.'s works.

Our illustrations, figs. 3 and 5, show squirrel-cage induction motors driving tube mills through gearing.

As will be seen in the first illustration, fig. 3, of 12 440-volt 100-H.P. machines, speed 166 R.P.M., driving raw material tube mills, through flexible couplings and countershafts on the mills, at the Universal Portland Cement Co.'s works, the motors are installed in a separate room ensuring much cleaner operating conditions than would otherwise be obtained. Fig. 5—a view in the Sandusky Cement Co.'s works, where six 85-H.P., 375 R.P.M. motors driving tube mills are in use—gives a better idea of the flexible coupling and ordinary operating conditions where tube mills are driven. The tube mill, it may be mentioned, is one of the most extensively employed in various industries where a fine product is required; it consists only of a horizontal rotating steel cylinder lined with hard cast-iron plates and about half filled with flint pebbles.

The modern rotary kiln, which will be familiar to our readers, is used for burning the raw material to clinker, the

flame travelling up the kiln in the opposite direction to the material. Such kilns are driven through both belt and gear

We are indebted to the British Thomson-Houston Co. for the illustrations here given; this company, through their associations and connections, have electrically equipped over 50 cement works throughout the world, including those referred to above.

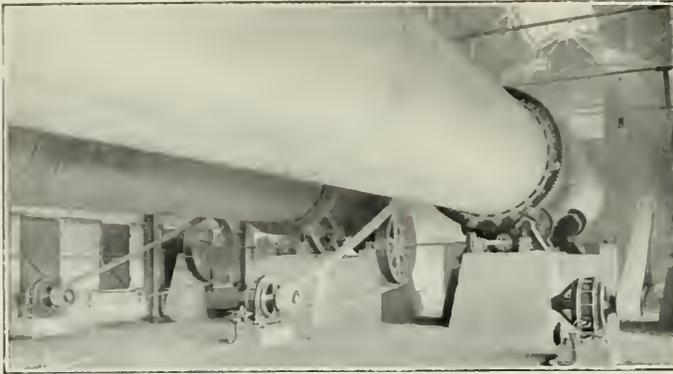


FIG. 4.—75-H.P. MOTORS DRIVING ROTARY KILNS.

drives, although the former type of drive is preferable, as it is possible to place the motor at a greater distance from the hot kiln. In order to regulate the time during which the material is subjected to flame, the speed of rotation requires

regulated by the water. Electric light is used in the mill, barns, office, stables, dairy and residence—40 16-C.P. and some 25-C.P. tungsten lamps being employed, usually half at one time. In addition to the lighting, a motor is installed for driving the separator, pasteurizer, churn and milking machine; a motor-driven saw and

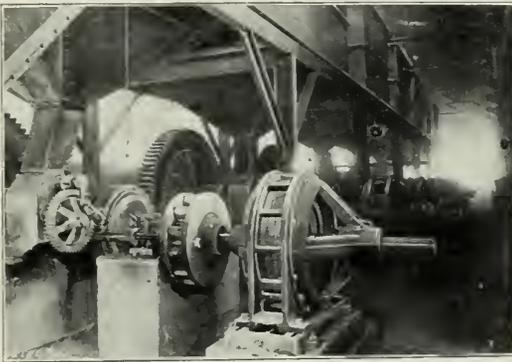


FIG. 5.—TUBE MILL DRIVE, SANDUSKY WORKS, SHOWING FLEXIBLE COUPLING.



FIG. 6.—A 150-H.P. ROCK CRUSHER DRIVE.

to be varied, and slip-ring motors are therefore employed. Fig. 4 gives a good idea of a kiln house at the Knickerbocker Cement Co.'s Works, three 75-H.P. 440-volt slip-ring induction motors, speed 720 R.P.M., being shown with belt-drives on to countershafts, and gear-drives from the latter to the kilns.

The kilns are fired by means of powdered coal, and motor-driven fans are employed for forcing the latter, with the necessary air, into the kilns, as also into the slag and limestone dryers.

Our illustration fig. 6 shows a 150-H.P. S.C. motor running at 750 R.P.M. and driving a gyratory rock crusher used in the preliminary rock crushing operations; it is usually belt-driven, as in the event of the crusher becoming clogged with rock, a gear drive would be subjected to severe strains. The view was taken in the Tidewater Cement Co.'s works.

The subject of electricity in Portland cement works was dealt with fully in our issues on January 20th and 27th, 1911, particularly as regards the probable power requirements.

emery wheel are employed in the joiners' shop and a motor-driven vacuum pump is installed both for cleaning purposes and for use in connection with the milking machine. Arrangements are being made to run a laundry electrically—the ironing, water heating, &c., being already accomplished by electrical methods.



FIG. 7.—GROUP OF TEN 75-H.P. VERTICAL MOTORS DRIVING FULLER MILLS

## TELEGRAPH and TELEPHONE NOTES.

(Continued from page 642.)

**Brazil.**—The Government has authorised the erection of two wireless telegraph stations, one being at Fortaleza, in the State of Ceara, and the other at Porto Murinho, in Matto Grosso. The cost is to be £26,800. Also a special telegraph line is to be erected between Rio de Janeiro and the State of St. Paul, the cost of construction being estimated at £28,000.

**Imperial Wireless System.**—At the resumption of the inquiry into the Marconi agreement by the Select Committee on Wednesday last week, Mr. W. G. Rice, the stockbroker who acted for Mr. Lloyd George, was examined, and said that on April 19th, 1912, he warned Mr. George that the American Marconi shares were not a desirable investment. On May 22nd he purchased 3,000 of the shares for Mr. George. Mr. Percy Heybourn, who dealt in American Marconis, also gave evidence with regard to 350,000 of the shares, which he had from Mr. Godfrey Isaacs. The witness declined to give particulars as to the number and price of shares that he sold before April 19th. On the following day Mr. Heybourn was further examined, but owing to a resolution of the majority of the Committee, a question as to the number of shares sold before April 19th was disallowed, and the minority protested. The witness's refusal to answer other questions was supported by the chairman.

The next witness was Mr. Godfrey Isaacs, who gave evidence regarding the arrangements made between the British and American companies. As the new capital required to purchase the United Wireless Co.'s assets, and to carry out new work, could not be raised in America, the British company agreed to take up 900,000 shares, on condition that Mr. Isaacs made himself responsible for a further 500,000, the total amount being £1,400,000. He gave particulars of the subsequent placing of the shares on the market, and stated that all the profit on the shares had gone to the British company, he himself having made no profit, though he was entitled to do so. He had heard in April that a strong attack was to be made on the Marconi contract with the Government, and that there was a syndicate which was promoting the Poulsen company, with the support of members of Parliament. A prospectus of the Poulsen system dated March 5th, 1912, which he received, bore only the names of Mr. A. A. Campbell Swinton, attached to a report on the system, and of the printer. Mr. Swinton was recommended by Sir Henry Norman as an expert qualified to advise the Committee as to the best system for the Government to adopt. He could not obtain any information as to the source of the prospectus. He heard in July that those connected with the syndicate were arranging an attack upon Ministers to prevent the ratification of the contract.

On Monday Mr. Isaacs was further examined with regard to his evidence-in-chief, and stated that he had been informed from many sources that Major Archer-Shee, M.P., and Mr. Norton-Griffiths, M.P., were concerned in the agitation. It being pointed out that the Committee knew that Mr. Swinton had reported on the Poulsen system, long before Sir Henry Norman mentioned his name, Mr. Isaacs stated that he was not aware of the fact. The net result of the arrangement with the American Co. was that the English Co. had rights to about 1,200,000 shares out of a total share capital of 2,000,000. He offered the American shares to his brothers because he thought the American Co. had the best prospect of all the wireless companies. In 1909 the English Co. was badly in want of capital; it had a substantial business and a large organisation, but no liquid capital. The number of American shares now held by the English Co. was 566,700.

After discussing the fluctuations in the price of the English Co.'s shares, Mr. Isaacs stated that not only the contract with the Norwegian Government, but practically every important undertaking in the world that he had been negotiating for the last two years was standing over, in consequence of the contract with the British Government. The English Co. had resold practically the whole of the assets of the United Wireless Co. to the American Co.

The Committee sat again on Wednesday.

On Monday, Major Archer-Shee and Mr. Norton-Griffiths both published statements that they had no financial interest in the Poulsen Syndicate.

**Wireless Telephony.**—At Dinnington Main colliery, in the South Yorkshire coal area, interesting experiments are being conducted with wireless telephony. An installation is being fitted up in the pit and on the surface, and it is claimed that the system, invented by a German scientist, makes it possible to converse through 1,500 yards of solid rock.

## CONTRACTS OPEN and CLOSED.

## OPEN.

**Australia.**—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" April 11th.

**VICTORIA.**—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

April 29th.—20,000 yd. of 3 in. fibre conduit, for the Melbourne City Council. See "Official Notices" April 11th.

**SYDNEY.**—May 12th. Fibre conduit for the City Council. May 26th.—Meters and glazed stoneware bridges. July 7th.—Arc lamp carbons. Specifications 10s. 6d. for each section, from City Electrical Engineer's Department. *Australian Mining Standard.*

**TASMANIA.**—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

**QUEENSLAND.**—May 21st. Copper wire and accessories for the P.M.G.'s Department. See "Official Notices" April 11th.

**Austria.**—VIENNA.—May 13th. Supply of 1,800 intercalary switches for the central-battery system. Particulars, Postökonomieverwaltung, Vienna.

**Bedford.**—April 23rd. Carbon and metallic-filament incandescent lamps, for a year, for the Corporation. See "Official Notices" April 11th.

**Belgium.**—May 3rd. The Belgian Government, Salle de la Madeleine, Brussels. Supply and erection at the Royal Palace at Laeken, of two rotary transformers.

**Canada.**—WINNIPEG.—May 15th. City Light and Power Department. Two three-phase generators of 5,000 kW. for direct connection to 6,800-H.P. water turbines; also spare parts. Chairman, Board of Control, Deposit, £205. Particulars, Board of Trade Com. Int. Department in London.

**Cheltenham.**—The T.C. has instructed the borough electrical engineer to obtain tenders for additional condensing plant.

**Dublin.**—April 24th. High-tension and low-tension switchgear, cables and accessories, for the Corporation. See "Official Notices" April 11th.

May 1st.—E.H.P. sub-station switchboard and accessories and alteration to existing E.H.P. switchboard, for the Corporation. See "Official Notices" to-day.

**Felixstowe and Walton.**—May 5th. One 150-KW. Diesel-driven D.C. generating set for the U.D.C. See "Official Notices" to-day.

**Germany.**—The Hamburg Finance Deputation is at present in the market for the supply of four electric cranes.

April 24th.—The Lighting Committee of the Municipal Council of Bremen is inviting tenders for the supply and erection of two transformers at the central electric lighting station.

**Hoyle and West Kirby.**—May 5th. One 400-kw. alternator and triple-expansion Belliss engine, and evaporative condensing plant, for the U.D.C. See "Official Notices" to-day.

**Hull.**—April 23rd. Electric light at Stepney Lane and Cleveland Street workshops and stables, for the T.C. Mr. A. E. White, City Engineer, Guildhall.

April 24th.—Electric light installation and fittings, Saner Street School, for the T.C. Mr. J. H. Hirst, City Architect, Guildhall.

**King's Lynn.**—May 5th. One 4,000-kw. steam dynamo with condensing plant and pipework, for the Corporation. See "Official Notices" to-day.

**Liverpool.**—April 18th. Electric light and power installation at the Highfield Infirmary, Knotty Ash, for the Select Vestry. See "Official Notices" April 11th.

**London.**—L.C.C.—April 23rd. Electrical installation at Shadwell High Street Special School. See "Official Notices" April 4th.

FULHAM.—April 23rd. 6,000 tons of nutty slack coal, for the B.C. Electricity Works. See "Official Notices" April 4th.

**SOUTHWARK.**—April 23rd. Two boilers, with fan, economiser and conveyors, two 1,500-kw. generators, four converters, switchboard, barometric condenser, cooling tower and steel structure, for the B.C. See "Official Notices" April 14th.

**METROPOLITAN ASYLUMS BOARD.**—April 23rd. Electric light installation in the Laundry Block and Block No. 12 at the Grove Fever Hospital, Tooting Graveney. See "Official Notices" April 11th.

**ROYAL MINT.**—April 25th. 120 tons of ingot copper. See "Official Notices" to-day.

**Manchester.**—April 23rd. E.H.T. switchgear, low-pressure steam and water pipes, hot-well, valves, &c., and two 50-H.P. three-phase motors for cooling towers, for the Corporation. See "Official Notices" April 11th.

**Newcastle-on-Tyne.**—April 23rd. E.H.T. three-phase lead-covered paper cable and single conductor L.T. lead-covered paper cable, for the Corporation Tramways Committee. See "Official Notices" April 11th.

**Newport.**—April 26th. One 2,000-2,500-kw. steam turbo-alternator, surface condensing plant, one 600-kw. D.C. generator, and E.H.T. and L.T. switchgear, for the Corporation. See "Official Notices" April 11th.

**Rochdale.**—April 24th. Tramways Committee. Stores and materials for a year. Mr. J. S. D. Moffet, Tramway Offices, Mellor Street.



W. T. Henley's Telegraph Works Co., Ltd., £2,850. The tender of Caird & Rayner has also been accepted, at £61, for the supply of a surface water-heater.

ST. PANCRAS.—The B.C. has received the following tenders for the supply of 215,000 pairs of open type arc lamp carbons:—

Geipel & Co.	.. .. .	£862
Sloan Electrical Co., Ltd.	.. .. .	671
London Electric Warehouse Co.	.. .. .	796
Crompton & Co., Ltd.	.. .. .	740
Ship Carbon Co., Ltd.	.. .. .	750
J. & H. Greverer	.. .. .	796
The Electrical Co., Ltd.	.. .. .	800
General Electric Co., Ltd.	.. .. .	831
Braulik & Co.	.. .. .	807
Electrical Engineering Co., Ltd.	.. .. .	911
Siemens Bros. & Co., Ltd.	.. .. .	1,071

The tenders of the General Electric Co., Ltd., at £43, Geipel and Co., at £25, Sloan Electrical Co., Ltd., at £39, and the Union Electric Co., Ltd., at £105, have been accepted for a supply of flame arc lamp carbons; as has also the tender of the British Electric Transformer Co., Ltd., at £118, for a transformer for testing purposes.

**Manchester.**—The Electricity Committee has accepted the following tenders:—

Callender's Cable and Construction Co., Ltd.—For 12 months' requirements of low-tension distribution cables.  
Liverpool Electric Cable Co., Ltd.—For rubber-insulated cable.  
Electrical Engineering and Equipment Co., Ltd.—For paper-insulated cable, B.I. and Helsby Cables, Ltd.—For the purchase of scrap cable.

The Tramways Committee has accepted the tender of the Daimler Co., Ltd., for four motor-omnibuses, and that of Messrs. Bell Bros. for one motor-car.

**Morocco.**—With reference to the call for tenders for insulators and brackets for the Moroccan Post and Telegraph Service, it is notified by the Acting British Consul-General at Tangier, that the contract has been awarded, for the sum of 12,750 fr. (£510), to a French citizen in that city.—*Board of Trade Journal.*

**Neasden.**—Messrs. E. Bennis & Co., Ltd., have received a repeat order from the Metropolitan Railway Co., for their Neasden power station, to relink 36 gears with their Bennis-Miller-Bennett link, including change speed continuous driving gear. This contract follows an initial order for four sets, bringing the number supplied to this station to 40. The Bennis link which is being substituted for those of another make hitherto in use, is specially adapted for slack coals and can now be applied to any existing chain grate frames. The link is particularly valuable where it is essential to burn slack or rough small as well as better class coals, inasmuch as it is so constructed that it is not liable to burn off.

**New Zealand.**—The contract for switchboard for the Auckland Harbour Board, which was noted for some time in the REVIEW, has been let to Messrs. Turnbull & Jones.

**Plymouth.**—The contract with the British Electric Transformer Co. has been renewed for a year at the same price, plus 5 per cent. on account of increased cost of materials. The existing contract with the B.I. and Helsby Cables, Ltd., has also been extended to March, 1914.

**Southampton.**—The T.C. has accepted tenders for annual supplies of cable from the following:—

Vulcanised bitumen.—W. Rickard, Ltd.; Craigpark Electric Cable Co., Ltd.; and B.I. and Helsby Cables, Ltd.  
Paper lead concentric.—Union Cable Co., Ltd.

**Southend-on-Sea.**—A two years' contract for demand limiters has been placed with Venner Time Switches, Ltd.

**Swindon.**—The tender of the Electrical Apparatus Co., Ltd., for the supply of 3-amp. meters for 220 and 440 volts, has been accepted by the Council.

**Walsall.**—The T.C. has accepted the tender of Messrs. E. Green & Son, at £495, for thoroughly overhauling No. 1 economiser and carrying out certain renewals.

The following tenders have also been accepted:—

Babcock & Wilcox, Ltd.—Water-tube boiler, superheater, mechanical stoker, economiser, &c., for the generating station, £3,231.  
Pearson, Huggins & Co., Ltd.—Tunics, trousers, overcoats and caps for the tramway employees for the ensuing two years.  
L. Andrew & Co.—Oilskins and machines.

**West Hartlepool.**—The Corporation has accepted the tender of the Bastian Meter Co., Ltd., for the supply of 2½ and 5-amp. meters.

**Wolverhampton.**—A renewal order from the Wolverhampton Corporation Tramways, for traction type tantalum lamps for the ensuing 12 months, has been received by Messrs. Siemens Bros. Dynamo Works, Ltd.

**York.**—The T.C. on Monday accepted the following tenders:—

Babcock & Wilcox, Ltd.—Two water-tube boilers, with superheaters, chain grate stokers, pipework, &c., £4,213.  
Oerlikon & Co., Zurich.—Turbo-alternator, 8,000 r.p.m., condensing plant, &c., £3,967.  
Tudor Accumulator Co., Ltd.—Storage battery and reversible booster, &c., £3,899, and £188 per annum for 15 years for maintenance.

**Yorkshire.**—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained two further contracts for the supply of tantalum traction lamps for two of the largest Corporation tramways in Yorkshire. They have also received a contract for the supply of Wotan lamps for shed and general tramway lighting other than cars.

## FORTHCOMING EVENTS.

**Institution of Mechanical Engineers.**—Friday, April 18th. At 8 p.m. Address by the President.

**Royal Institution.**—Friday, April 18th. At 9 p.m. Discourse on "Applications of Polarized Light," by Dr. T. M. Lowry.

**Junior Institution of Engineers.**—Friday, April 18th. At 8 p.m. At 80, Victoria Street, S.W. Paper on "Crude Oil Engines," by Mr. W. A. Tookay. Friday, April 25th. At 8 p.m. At 80, Victoria Street. Paper on "Condensing Machinery," by Mr. J. Elliott.

**Institution of Post Office Electrical Engineers.**—Monday, April 21st. At 5 p.m. At the I.E.E. Annual general meeting.

**The 25 Club.**—Wednesday, April 23rd. At 7.15 for 7.30 p.m. At the Connaught Rooms, 63, Queen Street, W.C. Dinner.

**Association of Electrical Station Engineers (London Section).**—Thursday, April 24th. Meeting at 7 p.m. At Salisbury House, E.C.

**Institution of Electrical Engineers (London).**—Thursday, April 24th. At 8 p.m. Paper on "Phase Advancing," by Dr. G. Kapp. (Yorkshire Section).—Wednesday, April 23rd. Meeting at 7 p.m. At the University, Sheffield.

(Newcastle Section).—Monday, April 21st. Meeting at the Armstrong College, Newcastle.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, April 21st.—"A" Company. Recruit training, 7 to 8 p.m.; Hopkinson Cup competition, 7 to 10 p.m.

Tuesday, April 22nd.—"B" Company. Recruit training, 7 to 8 p.m.; Hopkinson Cup competition, 7 to 10 p.m.

Thursday, April 24th.—"C" Company. Recruit training, 7 to 8 p.m.; Hopkinson Cup competition, 7 to 10 p.m.

Friday, April 25th.—"D" Company. Recruit training, 7 to 8 p.m.; Hopkinson Cup competition, 7 to 10 p.m.

Saturday, April 26th.—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.  
For Officer commanding L.E.E.

## NOTES.

**Educational Notes.**—GOLDSMITH'S COLLEGE, New Cross, S.E.—An announcement is made in our advertisement pages regarding special summer classes in May and June. Lectures in wireless telegraphy, with practical work, engineering costs and works management, drawing office and workshop practice, &c., are included in the courses.

CRYSTAL PALACE SCHOOL OF ENGINEERING.—The new course commences on Wednesday, April 30th. See our advertisement pages in this issue.

**Exhibition in Switzerland.**—A Domestic and Industrial Electrical Exhibition is to be held at Basle from August 9th to September 14th, on the occasion of the yearly meeting of the Verein Schweizerische Elektrotechniker and the Verband Schweizerische Elektrizitätswerke.

**The Carléon Train-Lighting Dynamo.**—On Tuesday last we were present at a demonstration of a new train-lighting dynamo invented and patented by Messrs. Gavan Inrig, Ltd., who, it will be remembered, recently brought out a new gas turbine. The dynamo was shown running in conjunction with a storage battery at the works of Messrs. Bryant, Symons & Co., Rawstoner Place, E.C.

The principle which is relied upon to maintain constant voltage over a wide range of speeds—in the ratio of 1 : 6—is one with which readers of the REVIEW are not unacquainted, namely, that of withdrawing the armature core from between the poles of the field magnet as the speed rises, so as to diminish the magnetic flux through the armature. The method by which this is accomplished in the "Carléon" machine is ingenious. An obvious difficulty, if the armature is moved as a whole, is the necessity of having a long commutator, or of moving the brushes with the commutator; Messrs. Inrig, however, provide the armature with two concentric cores, a shallow one carrying the winding and commutator, which is mounted on a spider fixed on the shaft at the commutator end, and an internal concentric core sliding on the shaft. The latter is controlled by a mechanical governor of the fly-ball type, acting against a spiral spring coiled round the shaft. Before moving the armature core, the governor compresses a lighter spring and actuates a cut-in and cut-out switch, which closes when the speed is sufficient to generate the necessary voltage, and opens when the speed falls below that point.

Reversal of motion of the train is provided for in the usual way by moving the brushes; these being carried on a frame with very little friction, the pressure of the brushes on the commutator serves to rotate the frame until its motion is arrested by fixed stops. The latter are provided with magnetising solenoids

in series with the exciting current (which is derived from the battery), to hold the frame steadily against the stop.

In normal working, the makers propose to couple the battery in parallel with the lamps and to charge it from the dynamo without the use of any regulating device. Without wishing to discourage the inventor, or to disparage his work, we feel bound to say that, while concentrating his attention on the dynamo, he has omitted the most essential part of a train-lighting equipment designed for use, as this is, with a single battery. The dynamo part of the equipment presents no difficulty; the regulation of the voltage applied to the lamps—not within a few volts, but within a range of 5 per cent. at most, which is about 1 volt—is the crux of the problem.

**Smoke Abatement.**—At the annual meeting of the Coal Smoke Abatement Society, on April 10th. Sir Wm. Richmond (President), in his presidential address, said the outstanding feature of the year was the International Smoke Abatement Exhibition, when a comprehensive and valuable assortment of apparatus for dealing with factory smoke was on view. It was admitted on all hands that the exhibits of the London electricity companies, who combined to furnish the Electricity Hall with examples of labour-saving and heating appliances, opened the eyes of town dwellers to the fact that in electricity they possessed an invaluable servant for eliminating the smoke fiend. The fact that in a few years the annual output of electricity in the metropolis had reached the total of 242,000,000 units was proof of the value of the services of this, their ally, in the work of cleansing the atmosphere. To the electricity supply companies they desired to tender their expression of grateful appreciation for what they did to help the Exhibition, and were doing to help the cause.

**Fatality.**—EASTWOOD.—On 9th inst. an inquest was held into the death of Alfred Naylor, who received a fatal electric shock at New London Colliery on 7th inst. Mr. Fraser, H.M. Inspector of Mines, was present, and Mr. Elliott Smith represented the colliery company and Mr. Whyte, the manager. According to a full report published in the *Nottingham Daily Express*, Mr. J. H. Fox, deputy, said that deceased was going to the switch box to switch off the current working the conveyer, when he stumbled over a rail and fell across the wire. Witness endeavoured to raise deceased by means of a wooden bar, but failed, and he then switched off the current by pulling out the two wires, and deceased fell on the ground. Witness tried artificial respiration for 1½ hours, without success. In reply to Mr. Fraser, he said he found, on severing the wires, that one was loose and came away easily, but the other was fast and pulled the switch box with it. The plant was inspected every other day. Mr. James E. Dawson, chief electrician at the colliery, said he examined the apparatus after the accident, and found a live wire had come out of the coal-cutter switch-box, but everything else was in order. He also found the earth wire disconnected, and thought deceased broke it in falling. The head of deceased took the full pressure, 450 volts. Witness admitted that after the accident he found three of the eight screws fastening the terminals missing, but could not account for their absence. His brother carried out the examination on Friday. He thought it possible for the screws to have come out between Friday and Monday. He admitted that the regulations affecting earth wires were not carried out, but the company were having the necessary appliances made. Had the earth wire not broken, there would have been no danger. Mr. G. E. Dawson, assistant electrician, also gave evidence.

Mr. Whyte, the manager, said it was the first electrical accident since his appointment. The company were at the present time carrying out alterations in conformity with the report of Mr. Fraser, but were having difficulty in getting the material delivered. They were doing their best to conform to the special rules. Witness said the present installation was strong, but admitted that the earth wire would not have broken (unless defective) with a man's weight leaning on it. Dr. Northwood said the deceased was burned on the face and chest from contact with a live wire, death being due to shock. The jury returned a verdict of "Accidentally killed," and added that the colliery company should take steps to cover or provide better protection for the wires.

**Alleged Stealing.**—Thos. Shuttleworth, metal broker, of 3, Carroll Street, was committed for trial by Preston magistrates, on April 11th, for stealing 7½ lb. of phosphor bronze, the property of Messrs. Dick, Kerr & Co., electrical engineers, valued at £2 16s. 7d. A detective-sergeant said whilst searching for certain property at prisoner's warehouse he found several ingots of phosphor bronze and "anti-friction" bronzes under scrap brass in the coal hole. In the kitchen was about a ton of white metal.

The Bench considered there was a *prima facie* case to answer, but they allowed bail.

**International Building Trades Exhibition.**—This Exhibition, which is the fifth of the biennial series held at Olympia, was opened on Saturday, April 12th, and will close on April 26th.

Practically every inch of floor space is given over to firms immediately connected with the building trade, exhibits of electrical interest being comparatively few and far between. It is rather surprising to note the entire absence of the small internal-combustion engine-driven lighting set, particularly because there are several firms exhibiting petrol air-gas machines suitable for country house lighting.

Messrs. B. Waygood & Co., Ltd., have an electrical passenger-lift operating between the ground floor and the gallery, and models of Waygood's patent "Electrol" and full automatic passenger-lifts. Messrs. Marryatt & Place show a standard pattern passenger lift with push-button control and two speeds. This lift operates in a

lofty steel tower and gives a view over the whole exhibition. Messrs. Medway's Safety Lift and Elevator Co. exhibit a passenger lift suitable for control either by a single switch in the cage or by push-buttons. Messrs. Scholey & Co. are exhibiting a large model of the "Graham" lift with push-button control, and a 6-cwt. passenger lift gear.

Messrs. Ozonair, Ltd., are showing their portable apparatus in a variety of types and sizes, and a show-case contains a model ventilation and air purification plant as installed on the C.L.R.

Messrs. F. & C. Osler, Ltd., show a very fine selection of their well-known metal and cut crystal electric light fittings. Other firms exhibiting electric fittings are Messrs. Tuke & Bell, Ltd., Dryad Works, and the Linolite Co., Ltd.; the last-mentioned firm are showing "Tubolite" fittings and "Woodhose" steel casing. Messrs. Holophane, Ltd., exhibit a selection of their pressed-glass prismatic reflectors. The Carron Co. show an electric kitchen range, and Messrs. Blackstone & Co., Ltd., various types of oil engines. Electrically-driven vacuum cleaners are shown by the British Vacuum Cleaner Co., Ltd. Water softeners are exhibited by Mr. W. Boby; and the Kennedy tube-bender, by Mr. W. Kennedy.

An interesting line of electrically-driven rotary floor-surfacing machines is shown by Messrs. H. R. Wilson. These machines are also adaptable for bench use.

Among other firms might be mentioned the Brilliant Sign Co. (illuminated signs), Messrs. W. H. Wilcox & Co., Ltd. (semi-rotary pumps, lubricating specialties, &c.), Messrs. J. H. Heathman & Co., and H. C. Slingsby & Palmer's Travelling Cradle Co. (tower ladders, &c.), the India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd. (rubber tiling), Messrs. J. B. Stone & Co., Ltd. ("Alligator" and other belt fasteners), &c. Several manufacturers of woodworking, paint, and other milling machinery are fitting their machines with electric motors as standard practice.

**Institution and Lecture Notes.**—ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—A special meeting of the Notts. and Derbyshire Branch of the Association was held at Chesterfield on Saturday evening. It was decided to hold one meeting a quarter at Chesterfield, one during the session at Mansfield, and the other monthly meetings at Nottingham. A discussion took place on a paper on "Cable Jointing and Junction Boxes," by Mr. Chris. Jones.

ASSOCIATION OF ENGINEERS-IN-CHARGE.—The eighteenth annual dinner of this well-known and useful Association was held on Saturday evening last at the Holborn Restaurant. About 300 persons were present, the President of the Association, Prof. H. S. Hele-Shaw, F.R.S., occupying the chair, and Mr. H. E. Neale the vice-chair. The guests included Mr. T. A. Coghlan, S.I.E., Agent-General for New South Wales, Sir Hay F. Donaldson, K.C.B., His Honour Judge Rentoul, Sir A. B. W. Kennedy, F.R.S., Mr. Henry Adams, Mr. Frank Bailey, Mr. H. P. Boulnois, Mr. Philip Dawson, Mr. Frank Broadbent, Capt. Sankey, and the Ven. W. M. Sinclair.

After the loyal toasts had been duly honoured, the toast of "The Engineering Profession" was proposed by Mr. T. A. Coghlan, who referred in the course of his remarks to the engineering needs of Australia, and to the fact that, as the representative of one of the Colonies, he felt that he came not as a stranger, but a friend. In responding to the toast, Sir Hay F. Donaldson emphasised the fact that the problem of Australia was the supply of water. How to irrigate the country was an engineering problem, and there were few countries where the engineer's opportunity was so marked, or the reward so valuable. The adaptability of the engineer made him a very valuable arrival, and he considered that amongst the members of that Association there were few who could not in almost any situation make good use of their engineering skill. They were all well equipped to take advantage of any opportunity which might present itself to them.

Mr. Alfred E. Penn, the honorary secretary of the Association, proposed the toast of "Kindred Institutions and Our Guests." He referred to the help which the Association received from other Institutions, and thanked all the distinguished men who had in many ways helped them, and had often honoured their annual dinner with their presence. The large and enthusiastic assembly was a proof of the vitality of the Association, which was able to act in many ways as a real help to its members. The toast was responded to by His Honour Judge Rentoul, who reminded the audience that he had been present at so many of these annual dinners, that he was beginning to look upon himself as quite an institution. He always enjoyed their company, and hinted that he hoped the time would never come when they would not enjoy being in his company. After referring to the importance of the work carried on by the members of the Association, the Judge said that without in any way touching on political matters, he would ask them a question which had somewhat puzzled him. It related to the time when the value of a Mexican dollar was 4s. in Mexico, and 3s. 10d. in the United States, and the American dollar was worth 4s. in the United States, and 3s. 10d. in Mexico. A Mexican with a dollar in his pocket went to a public-house on the Mexican side of the frontier and bought two-pennyworth of whisky. He received as change an American dollar worth 3s. 10d., and forthwith he crossed the frontier and bought another two pennyworth of whisky at the first public-house. Receiving as his 3s. 10d. change a Mexican dollar, he recrossed the frontier and repeated the process. At last he was found dead drunk with the Mexican dollar in his pocket. There was no doubt the man had bought, paid for and drunk the whisky. He had the same amount of money at the end of his venture as at the start! Query—who had paid for the whisky?

Mr. Sydney Brooks proposed the toast of "The Association," which was responded to by the President, Prof. H. S. Hele-Shaw, who pointed out the happy combination made by the Associa-

tion of the social and educative branches of its work. He thanked them for the honour they had done him by electing him as their president, and was convinced that the future of the Association would prove as successful as its past. He urged them to do all they could to increase their membership, and so strengthen the Association. A capital musical programme concluded a very successful evening.

Mr. G. O. MILNES, electrical engineer to the Lancaster Corporation, in conjunction with Mr. W. McBretny, on April 10th gave a lecture and demonstration in "Wireless Telegraphy and Telephony" before a large audience of the Lancaster Astronomical and Scientific Association.

**ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.**—The annual conference of the Association will be held this year in Bradford on Whitsuntide. The Lord Mayor of Bradford will officially welcome the conference to Bradford on Whit Monday, and the President, Mr. P. Coleman, of the Northern Polytechnic Institute, will deliver an address. The meeting on Tuesday evening will be addressed by the Right Hon. J. A. Pease, President of the Board of Education, and in view of the introduction of the new Education Bill soon after Whitsuntide, this address will be looked forward to with exceptional interest. Papers will be read on "Corporate Life in a Technical Institution," by Mr. W. Hibbert, of the Polytechnic, Regent Street; "Vocational Education," by Mr. A. C. Coffin, Director of Education, Bradford; and "Co-ordination within a County Area," by Mr. F. N. Cook, Secretary for Higher Education in the West Riding of Yorkshire.

**INSTITUTION OF ELECTRICAL ENGINEERS.**—On Thursday last week, Dr. E. Rosenberg read his paper on "Self-Synchronising Machines," before the Institution in London, and a discussion followed.

(YORKSHIRE SECTION).—A lecture was given by Mr. F. Simpson on "Prices Charged for Electrical Power," at Leeds, on Wednesday last. A discussion followed, and was adjourned.

**ILLUMINATING ENGINEERING SOCIETY.**—On Tuesday a paper by Mr. A. P. Trotter on "Standard Clauses for Inclusion in a Specification of Street Lighting" was discussed. A report will appear in our next issue. The discussion was adjourned to April 29th.

**Electrical Trades Benevolent Institution.**—On Thursday evening the annual festival dinner was held; the President, Mr. George Sutton, occupied the chair, and made an excellent speech in recommendation of the objects of the Institution, which was supported by Mr. A. B. Anderson, vice-president. The President announced that during the evening the sum of £854 6s. had been subscribed—almost double the amount received at the festival dinner last year. Proposing the health of the chairman, Mr. E. Byng offered to give £100 to the funds, if nine other sums of £100 were obtained within three months; as Mr. H. Hirst and Mr. G. Sutton would contribute £100 each, only seven such donations were required to fulfil the conditions of the offer, which was cordially commended to the audience by the President. A full report will appear in our next issue.

**Inquiries.**—The makers of the "Dickinson" trolley harp are asked for.

**Appointments Vacant.**—Lecturer in mathematics (£400 and quarters or £100 allowance), and lecturer on strength of materials (£350 and quarters or £100 allowance), for the University of Hong Kong; junior assistant superintendent of telegraphs for the Telegraph Department of Ceylon (£500); manager and secretary for the Minehead Electric Supply Co., Ltd. (£180 and percentage of profits); assistant clerk and collector (30s.), and junior switchboard attendant (20s.), for the Borough Electricity Department, Torquay. See our advertisement pages in this issue.

**Electrical Trades Union.**—To-morrow night at the Fulham Town Hall there will be a smoking concert, at which the chairman will be Mr. James O'Grady, M.P., supported by Mr. J. Kinniburgh, organiser of the E.T.U.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—On Saturday last at All Saints' Church, Gosforth, Mr. H. S. ELLIS, borough electrical engineer, of South Shields, fourth son of Sir J. Baxter Ellis, of Newcastle-on-Tyne, was married to Ida Beatrice, elder daughter of Mr. and Mrs. Henry Mosely, of Gosforth. After the ceremony a reception was held at Tilley's Rooms, in Market Street. The gifts, which were very numerous, included a grandfather's clock presented by the staff and workpeople of the Corporation electricity works at South Shields.

Mr. G. S. MCLAREN, of the British Westinghouse Co.'s meter testing department, has been appointed meter engineer at Taunton electricity works.

The staff and employes of the Birkenhead Corporation electricity works have presented a gold watch to Mr. W. H. FENNET, shift engineer, on his departure for Canada.

**General.**—Mr. G. WILSON, who has had charge of the electrical department of the North Staffs. Railway in the Uttoxeter district, has secured an important appointment under the Egyptian Government Railway.

Mr. G. GILKES, of Messrs. Gilkes & Co., turbine makers of Kendal, has been elected chairman of the Westmorland County Education Committee.

A complimentary dinner was given by various engineering friends to Mr. P. V. BROWNHILL at the *Progreedor Restaurant* in Sao Paulo, on the 25th ult., on his leaving the South American staff of Messrs. J. Stone & Co., Ltd., of Deptford, London to take over the important position of electrical engineer to the Paulista Railway Co. The chair was taken by Mr. J. A. HAMP, M.I.E.E. of the Sao Paulo Railway Co., and amongst those present was Mr. M. B. CHATER, late of the Buenos Ayres and Pacific Railway Co., who is succeeding Mr. Brownhill as Messrs. J. Stone & Co.'s representative in Brazil. After a very pleasant dinner and loyal toasts usually indulged in by Britishers abroad, the company adjourned to the Sao José Theatre, and witnessed the performance of the well-known musical opera "A Viuva Alegre" ("Merry Widow").

The marriage took place at Holy Trinity Church, Chesterfield, on April 9th, of Mr. A. B. IMPEY, assistant manager of telephones for the Chesterfield district, and Miss Margaret Mary Saunders, eldest daughter of Mr. C. J. Saunders, of Brockwell House, Chesterfield.

Mr. G. C. MILNES, borough electrical engineer, Lancaster, has been elected treasurer to the Lancaster Municipal Officers Association.

Mr. L. N. MILLS, recently with the British Thomson-Houston Co., Ltd., Rugby, has now joined the staff of the Electric and Ordnance Accessories Co., Ltd., and is engaged in the sales department at their Birmingham works.

**Tramway Officials.**—At a meeting of the Aberdare U.D.C., held on Monday evening, Mr. H. KING, traffic superintendent of the Merthyr Electric Traction Co., Ltd., was selected out of 120 applicants for the post of traffic superintendent to the Aberdare Council.

**Obituary.**—Mr. E. B. BRIGHT.—Telegraph engineering has lost another of its few remaining pioneers by the death, at the age of 82, of Mr. Edward Brailsford Bright, at Tottenham, on Monday morning. Edward Bright, elder brother to the late Sir Charles Tilton Bright, of Atlantic Cable fame, was born in 1831, and was the second son of Brailsford Bright. Cooke and Wheatstone's electric telegraph had lately been instituted under the aegis of the Electric Telegraph Co., which the two brothers joined in 1847, when respectively 16 and 15 years old. This came about through answering a *Times* advertisement for gentlemen's sons with education. Within a year of entering upon their new field, both boys became inventors, working together in more or less double harness. In those days, patent fees of £150 had to be paid, so the brothers contented themselves, for the time being, with starting a joint invention book, into which they, from time to time, entered up drawings, descriptions and dates. These were afterwards, with several additions, embodied in the famous patent of October 21st, 1852. It suffices to say here, that many of the novelties included therein are now in common use after a lapse of half a century. Perhaps the most important of their early inventions was the system, devised in February, 1849, of testing insulated conductors to localise faults from a distant point, by means of a series of standard resistance coils of different values, brought into circuit successively by turning a connecting handle, which enables repairing vessels to at once go to the scene of damage, instead of having to pick up and cut the cable here, there and everywhere at haphazard. The year 1851 saw some important changes in the lives of both the brothers. Charles left the "Electric" Co., and shortly after became engineer to the lately formed British Telegraph Co., whilst Edward joined the Magnetic Telegraph Co. Thus, the two brothers became engaged in advancing the early stages of two competing concerns. On the success of the Magnetic Co. being demonstrated, capital was quickly forthcoming for the organisation of a powerful chartered company entitled the English and Irish Magnetic Telegraph Co. In 1852, when only 21 years old, Edward Bright became manager of the "Magneto" Co. It was in this year that the brothers took out their famous patent, to which allusion has already been made. It contained 24 distinct inventions connected with telegraphs, and it may be well here to enumerate some of the more important. First of all, there was the porcelain insulator for fixing aerial telegraph wires mounted on posts, and, in one form or another, it continues in use to the present day. There was also its adjunct, the shackle or terminal insulator. This is also made of porcelain, and is universally employed for terminations, and whenever the wire has to be taken at an angle—over houses, for instance, round a corner, or in any case where great strains are involved. Then followed the now universal system of aerial telegraph posts, with varying length of arms, to avoid the chance of one wire dropping on another. After this came the brass tape device for the protection of insulated conductors of subterranean, or submarine, cables. There was then a translator, or repeater, for retransmitting electric currents of either kind in both directions on a single wire, also a standard galvanometer (foreshadowing differential testing) and a new type-printing instrument, as well as what was then a novel method of laying underground wires in troughs. At the outset of the "Magnetic" Co.'s operations the brothers found it necessary to devise fresh apparatus to compensate for the inductive discharge resulting from the long underground circuits, by discharging to earth and thus neutralising the recoil currents. Some of the results of these researches were detailed and illustrated experimentally by Edward Bright, at a meeting of the British Association at Liverpool, in 1854, in an address on "The Retardation of Electricity through Long Subterranean Wires." During 1855, young Bright thought out another important invention with his brother. This consisted of a system of duplex telegraphy which was worked successfully between London

and Birmingham. Charles Bright remained engineer-in-chief to the "Magnetic" Co. until about 1860, from which time (owing to press of other work) he held a consulting position only. Thereupon Edward Bright assumed the engineership in addition to the general management. Subsequently Sir Charles Bright went into partnership with the late Mr. Latimer Clark, but the brothers were again associated with each other from the year 1869 up to the time of the former's death. On the transfer of the Inland Telegraphs to the State, Edward Bright in 1869 became an independent engineer. Like his brother, he was an important factor in many Government Bills and arbitrations, and one of his more important late inventions was the electric fire alarm, modifications of which may be seen on so large a scale in our streets, warehouses, &c. As in the case of Sir Charles, though a prolific inventor and able engineer, Edward Bright died a poor man, which, indeed, he had been since his retirement some years ago. He was a member of the Institution of Civil Engineers, and a Member of Council of the Institution of Electrical Engineers, and originally with the late Dr. Dionysius Lardner, he brought out a work entitled "The Electric Telegraph," which, in its revised form, had a considerable sale. It is with the quite early, even youthful, work of this distinguished engineer that we have chiefly dealt, because—as in the case of his eminent brother—this undoubtedly formed the most remarkable feature of a distinguished career. His nephew, Mr. Charles Bright, F.R.S.E., so well known to our readers, is now the only remaining representative of the family engaged in the development of telegraphy.

MR. E. M. UNDERDOWN.—We regret to record the death which occurred suddenly on the night of April 11th, while entering a lift at the Strand tube railway station, of Mr. Emanuel Maguire Underdown, K.C., chairman of the Direct United States Cables Co., Ltd., for many years. The deceased gentleman was called to the bar in 1861, had been on numerous missions to foreign countries, was a prominent Freemason, and was very much esteemed in submarine cable circles. His son, Mr. Harry C. B. Underdown, is a director of the Direct United States Cables Co. The funeral took place at Knightsbridge on Tuesday.

ALD. E. HASLAM.—The death occurred, on April 9th, of Ald. Edwin Haslam, who had for many years carried on an electrical engineering business at 233, St. Helen's Street, Derby. The deceased, who was 70 years of age, was a brother of Sir Alfred Haslam, and had served on the Derby Town Council for 24 years.

MR. W. LOXLEY.—The death is announced, at the age of 82 years, of Mr. Wm. Loxley, for many years manager for Messrs. E. Green & Son, Ltd., the well-known engineers of Wakefield. The deceased, who had spent over 50 years with the firm, superintended the erection of Messrs. Green's American works at Matteawan, New York.

## CITY NOTES.

### Nairobi Electric Power and Lighting Co., Ltd.

The directors report continued satisfactory progress during 1912. The figures are as follows:—

	1910.	1911.	1912.
Units generated .. .. .	416,621	681,418	604,894
Motors connected, v.a.p. . . .	147	173	248
Lights connected, v.a.p. equivalents	5,929	8,193	10,653
Street lighting .. .. .	2,450	2,000	2,000
Net profit .. .. .	4403	£2,027	£2,642

There have been some exceptionally heavy expenses during the year 1912, in connection with leave pay and travelling expenses of the company's chief engineer and others, whose time for leave happened to fall within the year, and it is hoped that for 1913 the accounts will show a considerably increased income with smaller expenditure. It was reported last year that further power stations were to be installed on the Ruera River, but in consequence of negotiations with the Government, these new installations are delayed. Mr. Charles Udall, the chief engineer, has visited England for some months on holiday, and has resumed his post at Nairobi. The company has now reached a dividend-paying stage, and out of the balance shown in revenue account the directors have declared an interim dividend of 6 per cent. on the preference shares for the years 1906 and 1907, which was duly paid in January last. Although the remaining balance is sufficient to pay the same for another year, they recommend that, for the present, it be carried forward.

**Lancashire Power Construction Co., Ltd.**—The report states (says the *Financier*) that the accounts for the year 1912, after deducting the credit balance of £1,101 brought forward, show a debit balance of profit and loss account of £2,613. The annual meeting was held in London yesterday.

**Monte Video Telephone Co., Ltd.**—The directors have declared an interim dividend for the half-year ended January 31st at the rate of 5 per cent. per annum on the preference shares and 6 per cent. per annum on the ordinary shares.

**Anglo-American Telegraph Co., Ltd.**—The directors have resolved to declare an interim dividend for the quarter ending March 31st, 1913, of 15s. per cent. on the ordinary stock and £1 10s. per cent. on the preferred stock, less income-tax, payable May 1st.

### Babcock & Wilcox, Ltd.

THE directors' report for the year ended December 31st, 1912, shows a net profit of £126,147, plus £69,467 brought forward, making £195,614; deducting the interim dividends of 3 per cent. on the preference shares, and of 7 per cent. on the ordinary shares, amounting to £119,200, there is a balance of £376,414, from which the directors recommend the following dividends for the half-year ended December, viz., 3 per cent. on the preference (less income-tax), £3,000, 9 per cent. on the ordinary shares (free of income-tax), £149,400; placing to the reserve fund £150,000, and to the staff pension fund £10,000, leaving to be carried forward £64,014. The volume of business done during last year, and that carried forward into 1913, shows an increase over any previous period. The scope of the business, both in land and marine boilers and in other manufactures, is continually being extended. In common with other manufacturing concerns, work during the year was much hampered by the coal strike, and the cost of production is enhanced by the higher rates of wages and materials now ruling, the increased cost of coal, and the expense resulting from the Insurance Act. To counteract this, further extensions, both to the company's selling and manufacturing organisations, have been, and are still, being carried out. Having regard to this, it is considered desirable to further increase the company's cash resources, and the directors recommend the issue of £200,000 in 5 per cent. cumulative second preference shares at par. It is proposed to offer these shares to the holders of the present preference shares. It is recommended to make the same provision for the staff pension fund as was made last year.

### Midland Electric Corporation for Power Distribution, Ltd.

—The directors' report for the year ended December 31st (as abstracted in the *Birmingham Daily Post*) states that the increase in both revenue and profit has been much greater than in any previous year, and this result has been obtained partly because of the additional consumers secured, and partly through the exceptionally good trade in the area covered by the company's orders. The balance to the credit of the net revenue account is £12,843, which the board recommend be applied as follows:—Provision for debenture guarantee premium, £1,250; written off expenses of issue of debentures and ordinary shares, £2,444; transferred to depreciation account, £2,899; carried forward as a provision for the payment of the premium due on the redemption of the debenture bonds now outstanding, £6,250. These debentures, amounting to £250,000, will become due for redemption on June 30th next, and arrangements are being made to provide for this, and also for the additional sum necessary for the capital requirements of the company. During the year further capital amounting to £27,653 has been expended. The 3,000-kw. turbo referred to in the last report was not delivered in 1912, the delay being due partly to the coal strike in March, 1912. It has now been delivered and erected.

**Indo-European Telegraph Co., Ltd.**—The directors, subject to final audit, recommend the payment of a dividend for the six months ending December 31st, 1912, of 17s. 6d. per share (making with the interim dividend already paid, 6 per cent. for the year) and a bonus of 20s. per share, both free from income-tax. They also recommend a special distribution of 15s. per share, free of income-tax, out of interest accrued during the year upon certain investments and advance accounts. The dividend, bonus and special distribution as above will be payable on and after May 1st next. The transfer books will be closed from April 16th to 29th inclusive.

**Guildford Electricity Supply Co., Ltd.**—MR. H. P. SMALLPIECE presided at the recent annual meeting, and in moving the adoption of the report, he said that the gross revenue had increased by £1,390 to £10,069. The costs had gone up by £738. This was an eminently satisfactory state of affairs. The directors had considered it advisable to write off on the depreciation fund account £1,250, as against £1,000 written off annually during the past few years, putting £500 to reserve as against £400 in the preceding year. They had acquired a very valuable site of freehold land adjoining the original works, which would afford ample scope for the development of the business for many years. The report was adopted, and a 5 per cent. dividend approved.

**Telephone Company of Egypt, Ltd.**—The directors have declared a dividend of 6 per cent. (6s. per share), free of income-tax, on the preferred and deferred shares for the half-year ended December 31st, making 10 per cent. for the year; £2,000 is placed to staff pension fund, and £112,698 is carried forward.

**British Columbia Electric Railway Co., Ltd.**—The directors have declared an interim dividend at the rate of 8 per cent. per annum on the deferred ordinary stock for the half-year to December 31st.

**La Plata Electric Tramways Co., Ltd.**—The directors have declared a dividend of 6 per cent. per annum on the preference shares.

**Indian Electric Supply and Traction Co., Ltd.**—The directors report that during the year to December 31st the paid-up share capital has been reduced from £130,035 to £78,021. The surplus on the year's working in Cawnpore, including interest accrued, was £8,458, and, after providing for debenture interest, a dividend of 4 per cent. is recommended for the year, carrying forward £1,834.

### Anglo-Argentine Tramways Co., Ltd.

The annual report for 1912, which is to be submitted to the annual meeting at Winchester House, E.C., on Monday next, states that the gross receipts amounted to £2,778,303, less working expenses (which include various items amounting in the aggregate to £135,000 carried to depreciation renewals funds, in addition to £301,181 expended on ordinary maintenance) £1,824,022, leaving £954,281 plus £10,917 brought forward, making £965,228, less interest and charges as per net revenue account £755,922, leaving £209,306, less interim dividend of 4 per cent. on ordinary shares for half-year ending June 30th, 1912, £100,000 = £109,306. Out of this balance, the directors recommend that a final dividend of 4½ per cent. be paid on the ordinary shares for the half-year ending December, 1912, making 8½ per cent. for the year, which, after deduction of income-tax £6,198 will absorb £100,052, leaving £9,254 to be carried forward. The construction and equipment of the first subway line from Plaza Mayo to Plaza Once, a distance of over two miles, is progressing satisfactorily, and it is expected that this section will be open for traffic in October next. In order to meet the disbursements in connection with the construction of the subways, the properties required in connection therewith, new extensions, additional rolling stock, and under the powers conferred by the resolution of the company of June 1st, 1910, a further issue of £1,500,000 5 per cent. debenture stock was made in October last at a price of 98½ per cent. The directors report the death of Mr. Hector Monnon, a director. Mr. Georges de Laveleye, president of the Bank of Brussels, has been elected to fill the vacancy. The board again place on record their appreciation of the services rendered during the year by the local committee, the general manager, and the staff of the tramway generally, both at home and abroad.

As usual, there is published, together with the directors' report, a report by the general manager, in which he states that while the Government during the year 1912 has continued its progressive policy, in the commercial world affairs have not been satisfactory on the whole. The depression which commenced in 1911 was further accentuated by the disappointing results of the wheat harvest (1911-12).

Building of big houses in the central districts has continued on a large scale, and great changes are noticeable in almost all streets, the old one-storeyed buildings being now practically a thing of the past in the centre. Building in the suburbs has, however, considerably diminished, and rents, which had risen enormously during the past years, are now stationary, and have even, in some instances, been reduced.

Immigration is greatly improved. The population of the city shows an increase of 5½ per cent.

Although not up to the standard of previous years, the increase in the number of passengers carried by the company as compared with 1911 is still quite satisfactory, in spite of the poor commercial results of the year. In passengers carried the increase was 5.72 per cent., and in car km.-run 3.79 per cent. The increased rolling stock has permitted of more thorough and frequent overhaul of cars. The number of breakdowns and interruptions caused through deficient working of cars has remarkably decreased. The daily average number of cars that entered for repairs has gradually decreased from 2.8 per cent. in December, 1911, to 0.6 per cent. At December, 1911, there were 1,539 motor-cars, two parlour cars and 666 trailers, and at end of 1912, 1,758 motor-cars, two parlour cars and 807 trailers.

The more important works carried out in 1912 were:—Revised and partially reconstructed, 268 motors; repainted, 630 motors, 404 trailers; partially repainted and revarnished, 1,251 motors; seven trailers: new cars erected in 1912, 219 motors, 200 trailers. Much work has been done on maintaining the overhead installation in good state of repair, and the number of cases of breakages has consequently not been important. These accidents will be still further considerably reduced when the company has fully complied with the new municipal ordinance that disposes that telephone protection wire shall be suppressed altogether in the centre of the city, and in the outskirts only one protection wire is to be placed. Over 80,000 metres of wire of 80 mm.² have been employed for the renewal of trolley wire.

The underground feeder system has worked satisfactorily. Very considerable permanent-way work has been done. Paving works all over the city have been continued on a fairly large scale, and this has necessarily affected permanent way installations to a good extent. The weather in 1912 was, from a tramway point of view, on the whole even worse than in 1911. The passengers per car km. increased from 4.04 to 4.11.

Expenditure increased by £88,644 (5.62 per cent.), wages amount accounting for £55,360, stores £17,737, and taxes £20,792; current diminished by £6,702. Wages have a continuous tendency to increase and hours of labour to diminish. The pay of guards and motemen of the first and second grades was increased from November, 1911, from \$4.20 and \$4.00 per day to \$4.50 and \$4.25 per day. The increased expenditure for 1912, due to the higher rate of pay, amounts to £12,440. The taxes paid during 1912, exclusive of concession taxes and advertising taxes, amount to \$2,657,493 paper, or £230,000, equal to 8.32 per cent. of the gross receipts. Advertising taxes amounted to £10,000. Notwithstanding the high coal freights and the increased cost of current per kw.-hour, the increased car km. run (2,811,600), and the consequences of the miners' strike in England, electric current has cost £6,702 less than in 1911.

Fortunately a considerable economy has to be recorded in the average consumption per car km. which in 1911 reached 767 watt-hours, whereas in 1912 the average was reduced to 688 watt-hours, a decrease of 10.30 per cent.

The percentage of expenditure on receipts has varied slightly, being for 1912 60.52 per cent. in comparison with 60.41 in 1911, notwithstanding the unavoidable increases in payments for 12 per cent. Municipality tax and for extra cost of current. Amongst the staff, there has been entire freedom from agitation, and the men seem, in general, to be perfectly contented. This is due to the company's method of treating them well. Providing for the families of the employes in the shape of the Mutual Aid Society has undoubtedly been one of the most important factors, together with the security they have of some provision in the case of death. The manager enters in detail into the work of this mutual aid society.

The construction of the subway between Plaza Mayo and Once has proceeded rapidly during the year, and the actual excavation for the tunnel was approaching completion by the end of December. Much work was done in the completed tunnel in the shape of electrical installations, painting, staircases, preparing platforms at stations, &c. It is anticipated that the first section can be inaugurated in October, 1913. Preliminary works and surveys were also carried out for the extension of the first section to Caballito, as also for the line from Retiro to Constitucion. There has been a satisfactory year as regards dealings with the Municipality. In July the Municipal Council granted the company a concession for various new extensions, amounting to some 45 km. of new track, comprising a new line between Once and Chacarita, extension of the line in Entre Rios and Calle Velez Sarafiel as far as the Riachuelo, a new line *ad Calle* Neuquen to Villa Santa Rita, and several other short extensions and connecting lines. These extensions come into the company's concession without any new onerous conditions.

COMPARATIVE TABLE.

Year.	Receipts.	Expenditure.	Passengers carried.	Miles run.	Receipts per mile run.	Ex. penses per mile run.	Cars in stock.
1910	\$2,419,186	\$1,564,093	576,496,624	42,861,596	18.54d.	9.14d.*	2,156
1911	2,631,836	1,723,928	299,154,835	46,019,328	13.73d.	8.93d.*	2,207
1912	2,778,302	1,824,021	316,290,077	47,766,067	18.96d.	8.49d.*	2,567

\* Does not include credits or debits to depreciation renewals funds.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Canadian General Electric Co., Ltd.—Further issue of 1,900,000 dol. common stock, in shares of 100 dol. each.

And to allow the following securities to be quoted in the Official List:—

Calgary Power Co., Ltd.—Further issue of £48,900 5 per cent. 30-year first mortgage bonds of £100 each (Nos. A, 4,112 to 4,600).

Compania Ferro Carril do Jardim Botânico (Jardim Botânico Tramway Co.)—Further issue of £200,000 5 per cent. 40-year first mortgage bonds of £100 each.

Empire District Electric Railway.—2,921,000 dol. first mortgage 5 per cent. sinking fund gold bonds of 1,000 dol. each.

London Electric Railway Co.—932,794 ordinary shares of £10 each, fully paid (Nos. 1 to 932,794) (special application).

The Committee have appointed a special settling day, as under:—

Wednesday, April 30th.—Shawinigan Water and Power Co.—Further issue of \$1,000,000 capital stock, in shares of \$100 each.

And ordered the undermentioned to be quoted in the Official List:—

Adelaide Electric Supply Co., Ltd.—£75,000 additional 5 per cent. debenture stock.

Hell's United Asbestos Co., Ltd.—60,000 6 per cent. cumulative preference shares of £1 each, fully paid (Nos. 140,001 to 20,000).

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of \$35,000 5 per cent. 50-year mortgage bonds of \$100 each (Nos. B29,631 to 30,160).

Shawinigan Water and Power Co.—Further issue of \$1,000,000 capital stock, in shares of \$100 each.

Vancouver Power Co., Ltd.—Further issue of \$50,000 4½ per cent. perpetual guaranteed debenture stock.

**Holsworthy Electricity and Gas Co., Ltd.**—Presiding at the third annual meeting Mr. W. Kivell said he regretted that the growth of the electrical undertaking was slow. The units sold during the year were £9,868. In consequence of the great rise in the price of fuel the directors had deemed it prudent to increase the price of electric current for power from 2d. to 3d. per unit, the increase to take effect from April 1st. The net credit balance, after providing for debenture interest, was £366, as against £467 for 1911, and it was resolved to allocate the balance as follows: Dividend of 4 per cent. to be paid; £25 carried to depreciation account, electric undertaking; £44 to be written off preliminary expenses account, and £38 to be carried forward. Thanks were accorded the chairman, the secretary (Mr. J. Rowland), and the manager (Mr. Illingsworth).

**Bude Electric Supply Co., Ltd.**—The *Financial News* states that the total receipts on revenue account for the year 1912 amount to £2,010, and the working expenses to £684, leaving a gross profit of £1,325. After deducting interest on debentures and temporary loans there remains a net profit of £1,200, which, with the balance brought forward of £111, makes a total of £1,311 available. The directors recommend a 7 per cent dividend, and commission to secretary, absorbing £727; £440 to depreciation account, which is now increased to £1,300; and £144 is to be carried forward.

**Bank Rate.**—The bank rate was yesterday reduced from 5 per cent. to 4½ per cent.

### Automatic Telephone Co., Ltd.

MR. JAMES TAYLOR, J.P., presided over the first annual meeting of this company, held in Liverpool last week. In moving the adoption of the report (see ELECTRICAL REVIEW, page 572), he said that the profit, £13,493, was satisfactory for the first year's working of the company, formed for the purpose of introducing a new commodity. Dividend on the 6 per cent. preference shares had been paid, absorbing £11,815, and £1,313 had been written off preliminary expenses, leaving a balance to be carried forward of £370. The company started business on January 1st, 1912, and in the early part of the year automatic exchanges at Epsom and the General Post Office, London, were completed and handed over to the Post Office, and to the public making use of them. As a result of their satisfactory working, the Post Office had placed with the company an order for an automatic exchange at Leeds, to start with an equipment of 6,800 lines. The company were now negotiating, with good prospects of success, for further orders for different towns in this country. An order had been received for an automatic exchange in Cordoba, Argentina, and two representatives of the company were touring the Far East giving demonstrations in the various countries where the company held rights, and there was every prospect of satisfactory business resulting. There was no doubt that the telephone system in this country required improved plant and extension on a large scale, and it was to be hoped that no false notions of financial economy or demands for expenditure in other directions would be allowed to interfere with the provision of the telephone facilities which the public expected, and to which they were entitled, more especially as experts in the telephone business were unanimously of opinion that a handsome return could be earned on a large amount of further capital judiciously expended. The company had received continual and effective assistance from the Automatic Electric Co., of Chicago, but as progress was made at the Liverpool works in the manufacture of automatic equipment, the proportion purchased from Chicago was gradually decreasing.

MR. D. SINCLAIR seconded, and the report and balance-sheet were unanimously adopted.

None of the directors were yet due to retire.

### Imperial Tramways Co., Ltd.

In the Chancery Division on Tuesday, April 8th, Mr. Justice Swinfen Eady sanctioned a scheme of arrangement on the petition of the company.

MR. CLAUSEN represented the company, and stated that the scheme was exceedingly simple. The shares of the company consisted of cumulative preference shares and ordinary shares. The preference dividend was three years in arrear. Certain funds were set aside some years ago, and earmarked for division among the ordinary shareholders. The ordinary shareholders claimed that that money belonged to them, and was not applicable to pay the preference dividends. Circumstances had arisen which made it very desirable to clear up all questions as to arrears of dividends. The scheme proposed, therefore, was that the preference shareholders should waive their rights to the three years' dividends for 1909-10-11, the preference dividend to be paid from January, 1912, onward. The ordinary shareholders would waive their claim to the special fund, and allow it to go to a general fund of profits, so as to pay the preference dividend at once. The rights of the preference shareholders were contained in the memorandum, and the effect of the scheme was that the preference shareholders waived the rights conferred upon them by the memorandum. The meeting in support of the scheme was very nearly unanimous; no one now opposed the petition.

His LORDSHIP sanctioned the scheme.

**Johnson & Phillips, Ltd.**—The directors' report for 1912 states that the profit on trading accounts, &c., after making provision for bad and doubtful debts, and after charging to revenue upwards of £6,000 for maintenance of buildings, plant, &c., amounts to £28,325, plus £1,033 brought forward, making £29,358. From this there are to be deducted:—Remuneration of directors, auditors and trustees' fees, £1,378; interest on debenture stock, £6,772; reserve re debenture sinking fund, £6,143; interest on second debentures, £2,250; depreciation on machinery and plant, &c., £5,640; interest on loan, £546; amount written off patents, licences, &c., £1,306; cost of issuing second debentures, £2,007, carrying forward £3,315. The directors have appointed Mr. G. E. Davis, Mr. H. J. Sheppard and Mr. E. M. Dence as additional members of the board. The meeting is called for April 24th.

## STOCKS AND SHARES.

Tuesday Evening.

MARKETS in most cases have assumed a stronger tone during the past few days. For this the reason is that the Balkans outlook is regarded as more settled, while the fact of money becoming cheaper is a powerful stimulant to an improvement in prices.

There is a little public buying going on in certain of the markets; and even in those which have not this lever to help them, the anticipation is that the demand will spread to them later, and so prices there, also, are disposed to harden.

The Home Railway market shows a good deal of strength. The eye which hitherto has been fixed, wide open, on possible labour troubles, is beginning to relax its strain, and the attractions of Home Railway stocks from the investment point of view are coming into stronger focus. To what extent this is a far-sighted view it is not for us, perhaps, to venture an opinion; but in matters of investment, as in other things, it is often as well to fix upon a line of policy and to stick to it. The capitalist, therefore, who has made up his mind to keep out of the Home Railway market for fear of labour disputes, may be well advised to resist the temptation to buy just because everybody else is doing the same thing.

This does not necessarily apply to electrical stocks, for they are governed by a set of conditions different from those which prevail elsewhere. Central London stocks are better this week, Districts and Metropolitan have both hardened, and Underground Electric Railway shares and income debentures are once more on the mend. London United Tramways Debenture rose 2, thus regaining half of its fall of last week. British Electric Traction issues remain weak. Three of the company's stocks have further receded.

It is a matter of incidental interest to observe that the Canadian Pacific has recently started to electrify short portions of its wonderful system, and an announcement this week speaks of a 5-mile tunnel in British Columbia which is to be thus treated. A further part of the same message adds that the first sea-going vessel electrically-propelled has been built for service in Canadian waters and will be used for the navigation of the Canadian canal system.

Electricity supply shares are amongst the few which have yet to benefit by the better tone prevailing in other departments. Possibly because the summer is coming on—as witness the snow-storm at the end of last week—the market for electric lighting shares is dull. City Preference were marked down  $\frac{1}{2}$  the other day, but it was a mistake, and the quotation was restored to 12 $\frac{1}{2}$ . County Ordinary, at 10 $\frac{1}{2}$ , are  $\frac{1}{2}$  lower. On the other hand, improvements of  $\frac{1}{2}$  have occurred in Charing Cross Ordinary, Edmundson's Preference and Westminster Preference, the last-named shares evidently attracting investment notice from the excellence of their security.

The Telegraph market is firm, with a steady inquiry for the principal issues. Anglo-American Preferred rose  $\frac{1}{2}$ . Commercial Cable Debenture is  $\frac{1}{2}$  higher. Indo-Europeans gained 30s. The Telephone section is equally steady. New York Telephone bonds continue to advance, and United River Plate Telephones are  $\frac{1}{16}$  higher, but Oriental Telephones, at 1 $\frac{1}{2}$ , show a fall of  $\frac{1}{16}$ . Monte Videos are unchanged at 1 $\frac{1}{2}$ , upon the declaration of the usual interim dividend at the rate of 6 per cent. on the Ordinary. Telephone Company of Egypt, in paying 6 per cent. final dividend, makes its distribution 10 per cent. for the year. Constantinople Telephone shares are a little better, at 4 $\frac{1}{2}$ , for the £5 fully-paid shares.

Interest in the Marconi case is possibly waning a little, on account of the protracted nature of the proceedings and the somewhat technical character of the more recent evidence. The latter, however, has given the public some little knowledge of the way in which it is occasionally possible to market shares in a new company or a fresh issue, and affords an insight into the different "floors" upon which various sets of buyers are let into the good thing when it comes along. It must be remembered, however, that when people make big profits in the Stock Exchange, they usually do so by the taking of big risks, a point which it is well to bear in mind when considering the Marconi inquiry. Marconi shares are a little lower on the week, although the Preference are unchanged.

Anglo-Argentine Tramway issues are good, upon the excellent character of the report, following the declaration of an increase in the dividend on the Ordinary shares from 7 $\frac{1}{2}$  to 8 $\frac{1}{2}$  per cent. This has had the effect of raising the Debenture stocks, while the Second Preference at 5 $\frac{1}{2}$  are  $\frac{1}{16}$  better. Brazil Traction recovered 1 $\frac{1}{2}$ . British Columbia Electric Deferred and Preferred are both higher, on the declaration of an interim dividend at the rate of 8 per cent. on the Deferred stock.

Mexico Trams, ex 1 $\frac{1}{2}$  dividend, are  $\frac{1}{2}$  up on balance. Mexican Light and Power Common shares at 7 $\frac{1}{2}$ , ex 1 dividend, remain unchanged. Most of the Latin-Canadian issues are steady, and there is a fair demand for best class bonds. Montreal shares are up 3 points, but lost them and 2 more in addition. Allowing for their dividend deduction, Shawinigan Water shares are practically unchanged. The La Plata Electric Tramways' directors recommend a dividend at the rate of 6 per cent. per annum on the Preference shares, covering the period from July 1st to October 31st, 1911. Men in the market studied the announcement with grim interest.

The Manufacturing group is very quiet. India-Rubbers are 5s. better and British Westinghouse Debenture has been picked up, the price rising 3 $\frac{1}{2}$  to 64. Babcocks eased off a little, and Armament shares are slightly on the dull side. Dick, Kerr fell  $\frac{1}{4}$ . Rubber shares, after a temporary spurt, gave way on a fresh decline in the price of the commodity. The market is depressed, and is likely to remain so until something comes to the aid of the raw product to make the price better.

The affairs of the Northern Light, Power and Coal Company were ventilated at a general meeting held last Monday, when it was stated that arrangements had been made whereby the Canadian Klondyke Company undertook to lease the property of the Northern Light concern, and to guarantee a substantial annual revenue. Meanwhile the Northern Light 5 per cent. bonds remain at the nominal quotation of 10—20.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

Table listing English Electricity Supply and Power Companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 15th, Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 15th, Rise or Fall, Present Yield p.c.

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Table listing Colonial and Foreign Electricity Supply and Power companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 15th, Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 15th, Rise or Fall, Present Yield p.c.

TELEGRAPH AND TELEPHONE COMPANIES.

Table listing Telegraph and Telephone Companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 15th, Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 15th, Rise or Fall, Present Yield p.c.

\*Unless otherwise stated, all shares are fully paid. † Paid in deferred interest warrants. ‡ Interim Dividend. § In Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railway and tramway companies in the Home section. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 15th., Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 15th., Rise + or Fall, Present Yield p.c.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railway and tramway companies in the Colonial and Foreign section. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 15th., Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 15th., Rise + or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 15th., Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 15th., Rise + or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

## PRESERVATION AND PROTECTION OF STANDING TELEGRAPH AND TELEPHONE POLES.

[COMMUNICATED.]

UNDER the above heading a lengthy extract from the Canadian *Electrical News* appeared in the columns of the *ELECTRICAL REVIEW*, on January 3rd, 1913 (page 33).

In the opening paragraph it was asserted that "practically all poles fall at the ground line because of decay, and on account of this weakening at the base, have to be replaced or cut off and reset while the top portion is still sound."

It will be obvious to those engineers who are responsible for the renewal of pole lines in this country that such a statement must represent Canadian experience and not English practice. Scepticism as to its general application on this side of the Atlantic is still further increased by the following observation: "The average pole (cedar) has a life of about 10 years." Dealing briefly with the extracts referred to, it is scarcely correct to say that poles fall at the ground line because of decay; at any rate such occurrences are the exception and not the rule. The fact is that deterioration commences near the top of a pole and not at the ground line. A reason for this is not far to seek. Poles have to be notched for the reception of oak arms; these latter are usually secured in position by G.I. bolts which



FIG. 1.—MODE OF DECAY OF CREOSOTED POLES.



FIG. 2.—CREOSOTED POLE, DATED 1900, CARRYING 68 WIRES: PROBABLE LIFE, 20 YEARS LONGER.

involve as many auger holes through a pole as there are arms to equip. Moisture slowly percolates into each tiny aperture and eventually destroys the heart core of the timber; hence disintegration takes place from the apex downward.

In these circumstances a preservative coating, such as is recommended in the Canadian *Electrical News*, would neither prevent decomposition nor render innocuous the decay which may have already started. An interesting photograph (fig. 1) shows more clearly than words can describe the destructive forces that are at work. The pole from which these two pieces were sawn two years ago was branded "1882." Thus nearly 30 years' uninterrupted service has been registered; and when it is remembered that the pole in question was exposed to the fury of hail, rain, frost and snow during the whole of the time named, the record is not a bad one.

How does it happen that a pole of cedar wood in Canada can only be depended upon for a period of 10 years, whereas one of Norwegian spruce or of Baltic pine in England may be safely relied upon for 25 years? The answer is to be found in the utilisation of creosote oil. Nearly every pole in

this country is creosoted, which renders it practically immune to climatic conditions. "Burnetting" and "bonchering" have been tried, but experience has shown that "creosoting" is far and away the best.

The process of creosoting consists of injecting creosote oil into the fibres under pressure. Trolley loads of poles, chained together, are wheeled into a long cylindrical tank, and after the cylinder end has been closed, oil is forced in by pumps to ensure the maintenance of the requisite pressure inside the tank. Owing to the brittleness imparted to the poles by this treatment and consequent liability to fracture when unloading them, it is not desirable that the timber should be completely charged with preservative oil. The quantity of creosote forced into poles is usually 8 lb. to the cubic foot of timber; and where the wood is perfectly seasoned and well dried this quantity will form a complete protective shell impervious to moisture.

Engineers agree that a pole should be pierced as little as possible; hence the practice of using climbing irons for gang purposes has fallen into disuse. For the same reason, pole testing axes have been recalled. A wise plan to discover whether a pole is subject to internal decay is to tap it with an ordinary hand hammer, when a peculiar hollow sound may be heard—difficult perhaps to explain, but never to be forgotten when once heard by those interested in the subject at issue. On odd occasions a gang joiner will report a defective pole, the condition of the latter having been discovered whilst using an anger for the erection of additional arms.

With a view to maintaining intact the protective shell of a creosoted telegraph pole, the Post Office Engineer-in-Chief stipulates that poles shall not on any account be notched near or below the ground line. This is all right as far as it goes, but it does not solve the real problem under consideration. Numerous efforts have been made to modernise the method of arming telegraph and telephone poles, but so far without success. In this connection the following incident is not devoid of interest. The late Mr. Langdon, of the Midland Railway Co., read an excellent paper before the Institution of Electrical Engineers, in April, 1896. During the discussion that followed, a representative of one of the leading railway companies in the British Isles is reported to have said: "I admit we have been in the habit of using this method of arming poles; but the writer has for some time been employed on a plan by means of which the timber of the pole shall remain intact both for ties and arms. The ties have been tried and found efficient, but the arms have not yet been finally arranged for."

The significance of the above quotation lies in the fact that the original system of arming poles is being pursued by that railway company to-day as merrily as ever.

If a creosoted pole could be yoked into service without having recourse to sawing and boring the upper parts, it is difficult, if not impossible, to say how long it would last; for, even with the present method of "rigging," its life may be relied upon to cover the period beyond which additions or alterations would justify its replacement.

**High-Pressure Underground Cables.**—In the electrification of the Italian railways, extended use is being made of underground cables working at high pressures. A three-phase cable having a cross-section of  $3 \times 40 \text{ mm.}^2$  and working at 25,000 volts, is being laid in connection with the Milan-Lecco line, over a distance of 70 km., and a similar cable, with a cross-section of  $3 \times 50 \text{ mm.}^2$ , 50 km. in length, is on order for the Giovi Ronco-Sanpièdarena Railway. The latter will be tested with 85,000 volts at the works of Messrs. Pirelli & Co., of Milan, who are the makers of both cables; and after laying, a test of 65,000 volts will be applied.

**Wages and Condition at Aberdeen.**—The *Soloman* states that a mass meeting of electrical engineers was held in Aberdeen Trades Hall buildings recently to discuss grievances with regard to rates of pay, hours of labour, the question of overtime payment, &c. Complaint was made that no answer had been received to a thrice-repeated request to the masters for a conference, the first request having been made last October. It was eventually agreed to ask the masters for an increase of 1d. per hour in wages, raising them to 9d. and 10d. per hour, the latter for chargemen. The employers were requested to forward an answer by Wednesday, the 9th inst., and in the event of the demand not being conceded, and other matters considered, it was unanimously agreed that the employes strike.

\* Our readers will, no doubt, recall the article in question from the fact that the heading was similar to the present one, and also because of a brief letter on the subject from Mr Wade adversely criticising it.

## THE FIRST INTERNATIONAL CINEMATOGRAPH EXHIBITION.

(Concluded from page 622.)

THE B.T.H. exhibits included a variety of semi-indirect "eye-rest" fixtures, which are so well known that it is unnecessary to recapitulate their arrangement and advantages. A new type of



FIG. 4.—B.T.H. CONCENTRATING TROUGH REFLECTOR.

cornice troughing was exhibited for the first time. Parabolic reflectors of ribbed glass are mounted in swivel holders, from two to ten reflectors being carried in each frame, according to requirements. Along the focal axis of each reflector is mounted a 17-watt or 20-watt metal lamp, the maximum candle-power of the complete unit being 240 c.p. The inclination of the reflectors in the holding frames (which are screwed to the wall), is varied till even ceiling illumination is secured. The lamps are 1 ft. between centres, and a 6-in. hollow cornice conceals the whole fitting.

Among the other exhibits shown by this firm may be noted their 18-amp. lens and flood lamps for stage lighting. These are exceptionally light and convenient; the necessary ballast resistance is mounted in a ventilated case at the foot of the lamp standard, and connection with a strong and neat wall or floor pocket is effected by a flexible cable. Carbon feed is obtained by the rotation of a right- and left-threaded spindle, the screws on which are of equal pitch for A.C. and of 6:4 pitch for D.C. working. Only one size of carbon need be used whether working on D.C. or A.C. supply.

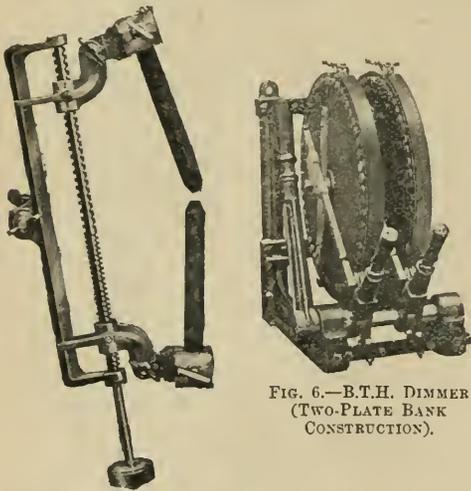


FIG. 6.—B.T.H. DIMMER  
(TWO-PLATE BANK  
CONSTRUCTION).

FIG. 5.—RACK FOR D.C. LENS LAMP.

For dimming purposes, an improved type of plate rheostat has been designed. This may be mounted flat on a wall, or any number of units may be built in a bank as shown in fig. 6. The plates illustrated have 50 steps (100-step plates are under construction), and the crank and rack control provided allows of very smooth regulation. A plunger in the handle of each plate lever enables the latter to be interlocked or disconnected from the horizontal shaft controlled by the master lever at the left of the bank. The rheostats will stand from 100° to 120° F. temperature rise indefinitely, and the plates are easily adaptable to two or three-wire circuits.

The "Indra" diffused lighting unit (exhibited by the E.E. and E. Co.), is now available in a variety of sizes and patterns. From the description of these fittings which has already appeared in these columns, readers will remember that the chief advantage secured is a single diffusion of all light emitted by the lamp, and hence higher efficiency than is possible in ordinary diffusing fittings where considerable multiple reflection and therefore absorption of light occurs.

Several firms exhibited electric programme number indicators, the chief recent improvements in which relate to the reduction of the number of wires required between the controller and the indicator. The crudest form of number indicator requires 42 interconnecting wires but, by suitable grouping of the lamps (as regards position and electrical connection), the Waltham Co. reduce the number of leads required to 25, while the Stage Equipment Co.'s indicator needs only 20 wires to show numbers 1 to 19 and "Extra" and "Deputy." In all modern indicators, a master switch is used for "1" in the double numerals. It is interesting to note that, on

the Stage Equipment Co.'s systems, numbers 0 to 999 can be shown in 6-ft. numerals on four sides of an indicator by the use of 42 lamps and 38 wires, the latter being accommodated in a 1½-in. conduit. The addition of one wire and two lamps enables 0-1,999 to be shown.

The S.E. Co.'s footlight float is exceptionally shallow, and, the reflector being a single piece of sheet metal, behind which is all the wiring, it is possible to wash the reflectors with a water squirt. A hinged lid affords easy access to the wiring and holder connections.

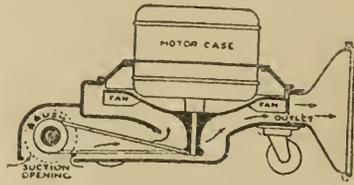


FIG. 7.—"HOOVER" SUCTION SWEEPER.

The float lamps (usually of 25-watt consumption) are mounted 6 in. apart, and, in order to insulate their holders from the reflector sheet, holes rather larger than the holder diameter are cut in the metal and fibre washers are fitted above and below the latter. The screw-rings on each holder are chamfered on their inner edges so that they are able to force together the projecting fibre washers and thus fill the annular clearance space between the holder and the sheet metal. The floats are carried on steel spring shock absorbers.

The same firm also exhibited a new type of batten carrying lamps on a Uralite strip and having a stout iron guard frame with a specially long "approach," the latter being designed to reduce the risk of abrupt collision in music-hall installations where drop scenery is crowded. The wiring of the battens is in a fire-proof chamber, instantly accessible through a removable metal cover.

The importance of electric chameleon and flashing signs to cinema halls was hardly adequately represented by the exhibits shown. Messrs. Whiteley showed good examples of Causton signs in the gallery, and the Waltham Co. exhibited their attractive "Autaray" sign consisting of an 18-in. diameter kaleidoscope group surrounded by "rays" of lamps, alternate ones of which are alternately extinguished so that the effect is produced of sinuous streams of light.

**Cinema Switchboards.**—A number of types of switchboards were exhibited suitable for use in cinema operating boxes. These boards varied considerably in the details of their arrangement, but generally comprised a main ammeter and voltmeter, a two-pole, double-throw switch (to change over from one projector to another while the first machine is being re-threaded), a voltmeter switch or tapper-key and fuse-boxes for the projector, pilot light and projector motor circuits. A switchboard shown by the Stage Equipment Co. offered the advantage that it practically formed its own wiring diagram, all the back connections being made by clearly traceable copper strip. Various types of regulating resistance frames were shown; for heavy current work and where the operator's comfort is studied, the unit type of rheostat mounted outside the operating chamber and controlled by knife switches offers obvious advantages.

**Vacuum Cleaners.**—The electrically-driven vacuum cleaner provides a most convenient and efficient means of cleaning all places of public assembly, and large numbers of these machines are already at work in cinema halls.

At the Cinematograph Exhibition, MESSRS. FYFE, WILSON & CO. demonstrated the working of their "Hoover" suction sweeper, which combines the beating and sweeping action of a rotating broom (having spiral lines of brushes), with the suction effect of a centrifugal fan. As shown in fig. 7, a ½-H.P. vertical spindle motor, running at 3,800 R.P.M., is direct-coupled to a centrifugal fan, and drives the sweeping brush through a quarter-turn rubber belt. The latter and the motor brushes are easily accessible by removing a few screws. The usual cleaning tools can be attached by rigid or flexible piping to an adapter connected to the suction opening of the cleaner.

The "Imperial" vacuum cleaner, shown by the ELECTRIC APPLIANCES CO., LTD., weighs only 10 lb., and probably enjoys the distinction of being the lightest motor-driven machine on the market. A ½-H.P. motor running at 7,000 R.P.M. drives a centrifugal fan, the discharge passage from the casing of which is carried in a continuous spiral to the filter bag connector. All the parts requiring inspection can be laid bare by the removal of six screws. A wick oil-cartridge attached beneath each motor-bearing carries six months' supply of lubricant, and the spindle-bearings are self-aligning (having ⅜-in. play in their seatings). We understand that many of these cleaners are in regular use by the L.G.O. Co. and various railway and steamship companies and theatres. For so small a machine the suction exerted is remarkable.

THE BRITISH VACUUM CLEANER CO.'S exhibits included several of their well-known motor-driven rotary pump equipments with Booth filters and fan-suction cleaners for lighter duties. The 2-H.P. rotary pump equipment mounted complete with starting gear on a small truck is specially suitable for theatre cleaning, the powerful suction available (25 in. vacuum against a closed nozzle) making possible thorough cleaning of thick seating, &c. It is hardly necessary to remind readers that this firm was the first to place vacuum cleaners on the market. Their products now include a

long series of hand and motor-driven machines ranging in capacity from 500 to 40,000 cu. ft. of air per hour (free inlet), and in price from 22s. upwards.

The recording cinematograph target exhibited by LIFE TARGETS, LTD., constituted one of the greatest novelties of the Exhibition. The exhibit should have been arranged so that visitors could see exactly what the proposition was without paying 6d. entrance fee; the latter certainly included the right to six shots, but it ought to have been more easily evident what the target was. This was described in our issue of April 4th.

## PROCEEDINGS OF INSTITUTIONS.

### Colliery Cables.

By W. T. ANDERSON, M.I.E.E., M.INST.M.E.

(Abstract of paper read before the INSTITUTION OF MINING ENGINEERS, at Manchester, February 11th, 1913.)

(Concluded from page 621).

On paper-lead-covered and armoured cables single suspenders of the clamp type have been successfully used, although the writer does not recommend them, unless very efficient protection is accorded to the lead. In the upcast shaft of the Pretoria Pit, Lancashire, such an arrangement withstood the explosion with practically no dislocation, although most of the boxing in was destroyed.

Fig. 8 is an illustration from a photograph taken by the writer, with the permission of the Hulton Colliery Co., Ltd.

Continuous vertical casing, since the issue of the new rules, need hardly be considered.

Methods of lowering shaft cables largely depend on the gear at hand and on shaft conditions. The safest way, from the cable point of view, is to fasten the cables by lashings or small specially-made clamps to a wire rope controlled by a haulage engine

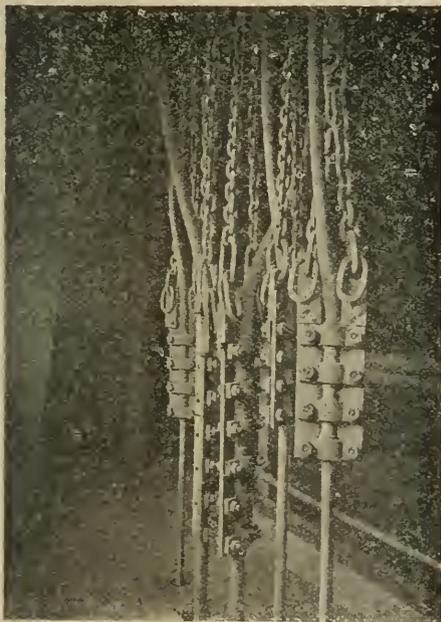


FIG. 8.—SINGLE SUSPENDERS OF THE CLAMP TYPE, SUPPORTING PAPER-LEAD-COVERED AND WIRE-ARMOURD CABLES, AT THE PRETORIA PIT

of sufficient strength and braking power to hold the necessary weight. Such engines are generally available, and the necessary guide pulleys for the wire rope are easily fixed up. The cable itself should be mounted close to the pit top and fed on to, and fastened to, the descending wire rope.

The best material for lashings is ordinary spun yarn  $\frac{3}{8}$  in. or  $\frac{1}{2}$  in. in diameter. The yarn should be used double, and each tie should carry about 1 cwt. of the weight of the cable.

An interval of 12 hours or so should elapse after lowering before cleating is commenced. This is especially advisable in deep pits, where the temperature at the top and the bottom of the shaft may vary to a considerable extent. Cases have been known of cleats being actually raised from their bearers by contraction of the cables.

Lowering direct from the cage with the drum slung either inside or underneath, can only be effected when there are no buntions in

the shaft, or when cleats are attached to their outer sides. Means must be provided to check the revolving drum, in case the weight of the loop of slack cable should overbalance that of the drum.

Raising from the pit-bottom is only possible when the clearance in the shaft is sufficiently great to allow of a loaded drum being taken down. The method is rapid but objectionable, in that it amounts, for a period at least, to single suspension, with consequent strains.

Lowering direct from a capstan or a haulage-engine requires, perhaps, more care than any of the preceding, and should only be undertaken in the case of heavily armoured cables. Lowering should be continuous and without interruption, in order to avoid undue bearing strain against the jockey-pulley. When winding from the cable-drum to the engine-drum, the cable bend should form a C and never an S bend; and when the cable is used for any but the uppermost length in a shaft, great care should be exercised in winding it over the steel hawser and the couplings underneath it.

Lowering with a locomotive should only be adopted as a last expedient.

If the total underground load is shared between two or more feeders cases should be rare indeed in which both break down simultaneously. An even greater precaution is to install mains in different shafts, making their electrical connection below ground.

For roadway cables intake airways should be selected, and the position chosen for the run should be such as to afford the greatest security from mechanical damage. In main roadways where there are good walls and sound roofs, the cables may be fixed in a permanent manner by cleats. Where there is a liability of damage from falls, the cables should be suspended in such a manner and with so much slack that they will readily tear away without fracture. With this in view, many methods of slinging are adopted, the least reliable being, perhaps, the pig skin suspender, in which the eyelet is very prone to draw out, as the material deteriorates. Better far is the simple expedient of tarred marline fixed at regular intervals, not exceeding, say, 10 ft.

The writer noted a case recently where a paper cable was run on slings 800 yards in-by with so little slack as to become as taut as a fiddle-string through the movement of the road. The joints were made without any boxes, and the mechanical strain, coupled with moisture at the unsealed end of the run, caused a very serious fire at that spot. Roadway cables more than any others are liable to come under Sec. c of Rule 12, and it may be mentioned that single-armoured cables (under certain normal conditions enumerated) will require to have their sheathings bonded together every 100 ft.; also that if two singles are so used, the conductivity of the sheathings of either shall be at least equal to 25 per cent. of the conductivity of the conductor enclosed thereby.

For installation purposes, it is advisable to take the new roadway cable down the pit intact on its drum, jacking it up on an improvised trolley running on tub-wheels, and paying out as the trolley moves along. If there is not room for the drum to be taken down the road, it must be jacked up and the cable drawn off and run in-by on tubs, rollers, or pit-props, care being taken to avoid dragging it along the ground and so causing needless abrasion to the outer servings of jute.

If it is found impossible to get the drum down the shaft, the cable can be taken off at bank and lowered—either lashed to a haulage-rope or fixed to a capel—and run in-by as it descends. In no circumstances should a twist or kink be allowed to occur.

The importance of the question of boxes cannot be over-estimated, not only as seals to prevent moisture from entering the dielectric, but as means for making-off the armour in an electrically and mechanically sound manner, and of thus effecting continuity of the sheathings.

None but trained jointers should be employed on this type of work, and only the very best materials should be put in. If for reasons of general safety the sweating of cores cannot be undertaken, mechanical connectors, having an electrical conductivity not less than that of a sweated joint, should be used, care being taken so to protect such fittings with tape that the hot compound cannot creep into their crevices, with the possibility of ultimate sparking.

The fundamental features to be looked for in joint-boxes are absolute water-tightness and mechanical strength; long bearing glands; adequate means of bonding through from sheathing to sheathing; and such design as will reduce to a minimum the risk of cavities or "blow-holes" forming in the compound.

All pedestals should rest on porcelain feet immersed in the compound.

It is most inadvisable to joint actually in the shafts, but when it is necessary a vertical box must be used. Such a box should never be installed unless all dropping water can be temporarily diverted. Much the best method of arranging shaft joints is to make a horizontal connection in a heading or inset, even at the inevitable expense involved in the construction of such an inset. The most suitable box for this work is, undoubtedly, that of the horizontal type, in which the incoming and outgoing cables enter at one end, as illustrated in figs. 9 and 10. When it is desired to feed various levels from the shaft cable, a similar type of horizontal box may be used with an additional gland at its inner, or roadway, end. Such a box should be provided with disconnecting links, in order to allow of ease in testing. Boxes on lead-covered paper cables should have their glands "wiped" on to the leaden sheathing—an impossible matter, of course, in places where a blow-lamp cannot be used.

Terminal boxes are usually of the bifurcating or trifurcating type, and the question of protection of leads is one of some difficulty. The leads must certainly be metal-cased; when they must

be under one cover, a wrought-iron case constructed on site is perhaps the most suitable method to adopt. Alternatively a box may be provided, specially designed for use in any position, fitted with stuffing glands, and screwed so that barrelling, large enough to enclose three vulcanised india-rubber singles, can be fixed to the box. At the terminal ends of the rubber leads, fibrous tapes should never be allowed to come into contact with the metal of

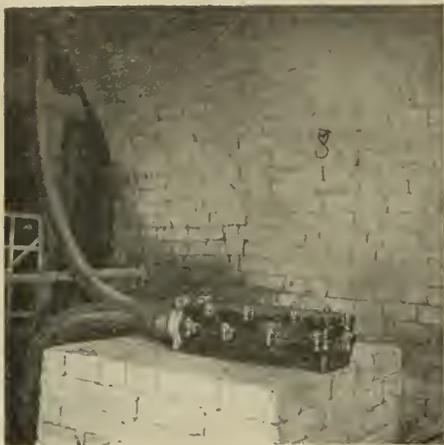


FIG. 9.—SINGLE-ENDED TYPE OF HORIZONTAL JOINT-BOX (FOR FIXING IN AN INSET) TO CONNECT UP SHAFT CABLES.

lugs or conductors. The obvious method is to seal with material which will form a homogeneous water-proof covering from the cable trim to the lug. Not only will this arrangement facilitate the periodical work of testing, but it will minimise the risk previously mentioned of vagabond currents getting on to the metallic sheaths of the cables.

When joints are completed, the box must be filled up with an insulating compound, in order to protect the conductors and insulation from moisture. It is essential that this compound should be of high insulation resistance, that its consistency at the temperature at which it is poured into the box allows it to run freely, and that it sets hard, with no tendency to drain away from the box at normal temperatures.

For mining work the writer has always made it a custom to use only compounds suitable for extra-high-tension work, preferably with a high melting point, having a pouring temperature

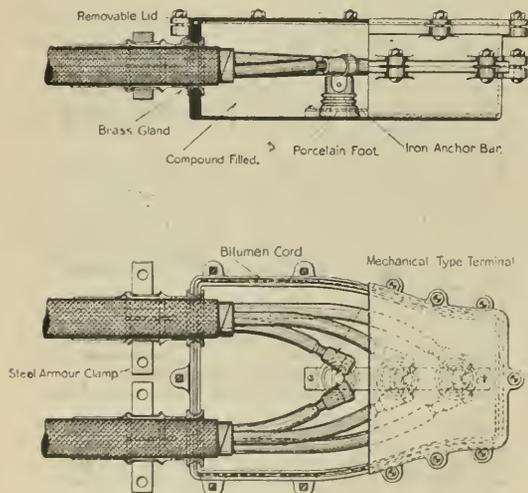


FIG. 10.—DETAILS OF SINGLE-ENDED HORIZONTAL BOX.

of, say, 300° to 330° F. While overheating is injurious to the compound, it should never be used too cold, as the efficacy of the seal is thereby endangered. Enough attention is usually not given to this most important point. Not only should the correct pouring temperatures of any compound be ascertained, but jointers should always be compelled to use thermometers in order to gain such temperatures. Where heating cannot be done locally, it is necessary to get the compound rapidly transmitted from bank to box in some non-conducting jacket arrangement; the writer has seldom found much difficulty in effecting this, generally by placing large buckets in tubs filled with sawdust or some similar material.

The compound should be poured rapidly and continuously into the box, preferably through a funnel, and every facility should be given for air and gases to escape. It is essential that the boxes should be so efficiently filled that no cavities are left. If, on inspection after cooling, the box is found to be not quite full, final toppings are absolutely necessary.

As regards bonding and earthing, the new rules really enforce what manufacturers have been making their standard practice and generally recommending for several years past.

Rule 8 (a) provides that all sheathings, &c., "shall be earthed by connection to an earthing system at the surface of the mine." In the memorandum, reference is made to the use of at least two earth plates, and the addition of a footnote, quoting the Board of Trade Tramway Regulations in this connection, suggests that compliance therewith would be in order. Those regulations provide for two plates not less than 20 yards apart, which "shall be constructed, laid, and maintained so as to secure electrical contact with the general mass of earth, so that, if possible, an electromotive force, not exceeding 4 volts, shall suffice to produce a current of at least 2 amperes from one earth-connection to the other."

This result is somewhat difficult to obtain with ordinary earth-plates; indeed, the writer has failed to accomplish it with copper plates, each of 2 sq. ft. area, laid in a bedding of coke, although the intermediate ground was well soaked with saline water. This, however, only demonstrates the wisdom and breadth of the rules, which, while indicating a high degree of efficiency, do not hamper its attainment by narrow or vexatious regulations that might easily be rendered abortive by local conditions.

Copper plates should be avoided on account of their rapid deterioration. Iron cylinders or pipes driven vertically into the ground and filled with breeze, into which engine cocks can drip, make perhaps the best job, provided that a sound and visible mechanical and electrical connection is made with them. As an alternative, a couple of old boiler plates thrown into a pond have often been known to give excellent results. It is always well, however, in addition to any earth-plates at the surface, to bond all metallic sheathings by means of three or four separate tinned-copper conductors made off with lugs to the flanges of pipes, known always to contain water, and forming a widely distributed contact with the main mass of earth.

In conclusion, the writer would put forward an earnest plea with respect to upkeep and maintenance. Nearly all the faults met with in his experience—barring those of a purely mechanical nature—have been due to carelessness, and could have been readily prevented. Rigid tests for insulation resistance, for continuity of sheathings, and for proving the efficiency of earth-connections, should be made in respect of all cables at least once a month, and their results recorded and compared. Deterioration, or even the result of unknown mechanical damage, may thus be traced before serious consequences ensue.

#### DISCUSSION

MR. H. V. HART-DAVIS pointed out that last year there were 12 fatal accidents in mines due to electricity, as against 21 in the previous year, and the Electrical Inspector said that proper connections to earth might have prevented six of them; this showed the importance of efficient earthing. Instead of a separate earthing cable where transformers were used, he suggested a copper sheath under the armouring of the high-tension cable. In his opinion sufficient attention had not been given to lighting circuits underground; armoured cables should be used right up to the lamps.

MR. E. LONG referred to the recent paper by Mr. E. K. Scott, and deprecated the use of aluminium cables and wood casing in shafts. He preferred cleating at intervals to single suspension.

MR. G. S. CORLETT advocated paper-insulated cables for pressures of 3,000-5,000 volts. For lighting he preferred twin armoured conductors with joint boxes. In the case of a step-down transformer system, he pointed out that the probability of a heavy rush of current on the armouring of the high-tension cable was too remote to call for any special precautions.

MR. W. B. SHAW said that the single-suspension clamps shown were of his design, and the method was particularly applicable to armoured lead-covered paper cables, but not very suitable for bitumen-insulated cables, except short ones.

MR. A. F. W. RICHARDS said that it was important that the actual requirements of the Home Office as regarded earthing in the case of a transformer installation should be ascertained.

MR. J. D. PATON spoke in favour of due consideration being given to the advantages of aluminium for conductors, pointing out that though armoured cables were now required by law, the economic features of the question must not be disregarded.

MR. S. H. LEE suggested that three locomotives and a number of wagons were not necessary to hold back a cable weighing 6 tons. He did not favour single suspension, as mines were now often 1,500 to 3,000 ft. deep. In sinking new shafts it would be advantageous to provide special space for the cables. For trailing cables, the cab-tire sheathed type had proved to be much superior to any other type. In the event of a dead short between the cores, the arc would not penetrate the sheathing. He referred to the advantages of putting the cables behind the timbers in a road, or burying them in iron pipes.

MR. G. G. L. PREECE said that bitumen-insulated cables could easily be made to withstand a pressure of 6,000 volts, but paper insulation underneath the bitumen was often used as an additional precaution. He did not recommend single suspension.

MR. R. NELSON (Electrical Inspector of Mines) said he was very gratified to note that regulations which were designed primarily to secure safety appeared to the author to be successful, also in

assisting the manufacturer by "the standardisation of conditions." With Mr. Anderson's views in general, he expressed close agreement. Mr. Anderson recommended rubber-covered cables as "undeniably the best, both from a physical and from electrical points of view." Later, however, he remarked that bitumen covered cables were "by far the most suitable for average colliery work." He could not mean that rubber-covered cables were the best "for average colliery work." If he had in mind what were usually called "tails," Mr. Nelson suggested that "making off or tailing cables" were obsolete below ground in mines. The best sphere for rubber-covered cables, if they had one at all below ground in mines, was in connections between controllers and resistance grids. Mr. Anderson mentioned the matter of the proper section of high-tension armouring where the current was transformed down at the shaft bottom, or elsewhere, for use in-by. It should be remembered that the difficulty did not occur when the neutral point in both systems was earthed. To meet an insulated neutral point there was an alternative to Mr. Anderson's suggestion—namely, to fix earth plates at the junction of the two systems, and connect them in parallel with the surface earth by means of the armouring of the high-pressure cable alone, or, if the circumstances were thought to require it, in parallel with some other effective conductor. He supported the recommendation to "share the total underground load between two or more feeders." He would not expect two old boiler plates "thrown into a pond" to form a good earth connection. Water had an appreciable resistance, and he would expect to find that two buried boiler plates would give a better result. Mr. Anderson's last paragraph was a complete guide to proper maintenance.

MR. W. T. ANDERSON, in reply to Mr. Hart-Davis, said that a reduction in the number of fatal accidents due to electrical causes of nearly 50 per cent. in the first year in which the electricity rules were in operation was their soundest justification. Mr. Hart-Davis's plea for a copper shield under the armour of high-tension shaft cables, in order to bring their lead-carrying capacity into line with the low-tension requirements below ground, was hardly feasible except in the case of lead-covered cables. In the event of pit water getting inside the armour, galvanic action would probably arise. The suggestion was otherwise distinctly sound, if only to avoid the danger set up by mechanical bonds between sheathing and an auxiliary earth wire, as it was most difficult to render these bonds efficacious. He agreed with Mr. Long's plea, that all colliery cables should be armoured (with the exception, of course, of trailers). This question of armouring had been disposed of by the new rules. Wooden casing had been mentioned by the writer, but dismissed by him as impracticable. His remarks applied equally to the split telegraph poles mentioned by Mr. Long. Rule 12 (D) happily put this suggested method entirely out of court. It was a method which was quite opposed to the spirit of the new rules. For normal conditions, in shafts, bitumen-covered cables without hygroscopic material of any kind in their internal construction were the best. He was inclined to agree with Mr. Corlett, that it was not electrically necessary to increase the high-tension armour as an earth connection to a low-tension system below ground; an earth on the low-tension might not affect the armouring of the high-tension system, but would probably be confined to the underground portion of the installation. Mr. W. Bolton Shaw, in referring to the single suspension at Hulton Colliery, had borne out the writer's remarks. The cables were light, and were of the one class which could be so treated without grave risk of injury. The writer could not, however, agree with Mr. Shaw that the clamp method of single suspension was good for paper-lead covered or for any other type of cable, and under no circumstances would he recommend its use. With regard to hydraulic pressure being set up at the bottom of paper-covered cables, this could not occur in cables the insulation of which was impregnated layer by layer and not in bulk. He had refrained purposely from any mention of aluminium for mining work, as he considered its use impracticable. The only form in which aluminium could be considered from motives of economy would be in the case of bare overhead lines. It was true that he had shown all his copper cores mechanically connected, for the reason that such connections catered for all eventualities. There could be no doubt, however, that sweated joints were to be preferred, and, broadly speaking, conditions allowed of their being so made in 50 per cent. of the mining boxes. For pit conditions of exposure to air and moisture the writer could not imagine a finer preservative for wood than creosote. Mr. S. H. Lee had suggested that three locomotives (two to lower and one as a stand-by) used to install a 6-ton cable were far from necessary. With this statement he could not agree. The stresses and safety factors to be provided for were impossible to gauge by ordinary calculation. Greasy rails, gradients, and local conditions might upset any ordinary precautions, and, as several recent accidents had shown (in one case where a couple of railway trucks accompanied the cable down the pit), it was much wiser to have a ton too much than an ounce too little, especially when the nose of the cable had to be followed down by men on the top of the cage. With regard to the capel, there was no question of lack of confidence in the more modern one made to the design of the cable makers. It was tested to 15 tons before being used for 6. Doubtless it was capable of taking something like 50 tons. The clamp was put on at the wish of the colliery authorities, and came in very handy as an anchor for the stand-by hawser. With regard to bare rubber-sheathed trailing cables, he was inclined to think that, although their initial cost was great, they had a great future before them. To thread considerable lengths of cable behind the timbering of roads was apt to do more harm in kinks and abrasions than would justify any increased protection, apart from the enhanced difficulty in slinging them satisfactorily in such a position. To bury roadway cables was undoubtedly bad practice, and one such successful

attempt could not justify its adoption. The writer particularly welcomed Mr. Nelson's contribution to the discussion. For all main feeders (both shaft and roadway) installed under average conditions, rubber-insulated metal-sheathed cables were unquestionably the best. Their cost, however, rendered them quite prohibitive for ordinary commercial purposes. Next in suitability and generally efficiency undoubtedly came bitumen, which possessed many of the properties which rendered the use of rubber so excellent. Regarding the unsuitability of rubber for "tailing" purposes, it was, of course, clear that the ultimate desire of the framers of the new rules was to persuade manufacturers of switch-gear to provide on their apparatus suitable sealing chambers for the cables, and so do away with tailing cables altogether, a consummation which would be most heartily welcomed by the cable manufacturer. Perhaps if Mr. Nelson were to substitute the word "obsolescent" for "obsolete," he would describe more accurately the present position. In present circumstances where terminal boxes were provided the cores of cables going through them should invariably be cut. To continue through such boxes with the unprotected paper or bitumen-insulated cores (bifurcated or trifurcated therein) would be impossible: there remained then only rubber-insulated leads or bare metal. Such rubber-insulated leads provided the necessary mechanical strength. Under the new rules they were themselves enclosed in a metal sheath or tube (to a point presumably as near their respective studs as the tubing could be brought). The safest method of making them off to the lug was to provide the non-fibrous seal mentioned in the paper. Mr. Nelson's remarks regarding earthing by plates in water were interesting. It should, of course, be borne in mind that plates thus treated were not exactly surrounded by water, but were probably more or less sunk in mud. The recent report on electrical accidents, where high resistance in the earth-circuit had led to trouble, abundantly justified Mr. Nelson in the stand taken to ensure efficient connections to earth; and the writer could only add that if colliery engineers would armour, bond, and earth soundly, fatal mishaps below ground due to electrical causes would practically become unknown.

### Electric Supply in London.

By FRANK BAILEY, M.Inst.E.C.

(Abstract of paper read before the SOCIETY OF ARTS, April 9th, 1913.)

THE use of electrical energy as the motive power of our tube and other railways, for the working of our factories, and for lighting, heating, cooking, &c., has become so general that few of those who now participate in its advantages realise the difficulties that were experienced in the early days of pioneering a new industry. In 1890 I placed before this Society a short account of the progress of electric lighting in London, and I will now endeavour to bring this information up to date.

The Electric Lighting Act of 1882 limited all provisional orders to a period of 21 years. This short period did not encourage enterprise, and strenuous efforts to secure a sounder basis for the building up of a great enterprise resulted in the passing of the Electric Lighting Act of 1888, which extended the period to 42 years. Useful pioneering work was, however, accomplished between 1882 and 1888.

Up to the year 1890 none of the London vestries—now merged into borough councils—had decided to embark on municipal trading, with the exception of the St. Pancras Vestry, and it was not until the commercial success of the various undertakings had been established that 13 of the remaining borough councils in London applied for and obtained provisional orders. We ought therefore to appreciate the enterprise of the 13 companies who had undertaken the responsibilities of carrying out the obligations imposed upon them by the terms of the provisional orders granted under the Act of 1888. These companies had to raise the capital they required without being able to quote actual experience of a profitable yield; and it is remarkable, considering the inexperience of the industry at that time, how few mistakes were made, and how well the capital was expended. Most of the early pioneering plants have now disappeared, the capital cost having been redeemed out of revenue.

The table on p. 662 gives, in a summarised form, the present position of the various supply authorities in London. It shows the output for the 14 local authorities who work their own provisional orders, as published for the municipal year ending March 31st, 1912, and as estimated for the year ending March 31st, 1913. The output given for the 13 companies is taken from the published accounts, supplemented in many cases by information kindly supplied.

The total output includes some supplies given for railway and tramway purposes, within the area of the County of London, which, according to the census returns of the year 1911, contains 74,816 acres and a population of 4,521,685 persons.

To complete the statement so as to include all electric supply, reference must be made to the various railways and tramways operated by electric traction.

The total amount of electrical energy utilised for all purposes may be estimated for the year 1912 as follows:—

	<i>Units.</i>
Railways ... ..	271,500,000
Tramways ... ..	130,000,000
General supply ... ..	277,500,000
<b>Total ... ..</b>	<b>679,000,000</b>

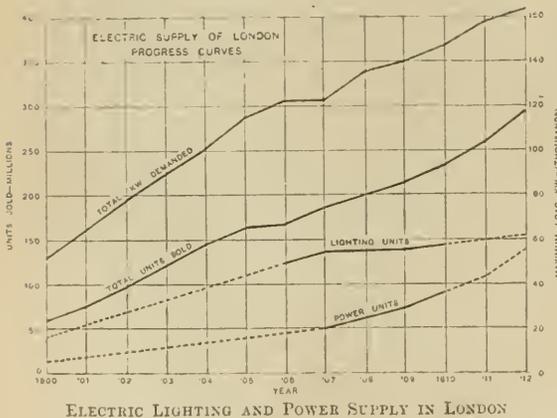
ELECTRIC SUPPLY IN LONDON.

Local authority.	Capital expended.	Units sold.		Max. load. Winter, 1912-13.
		1911.	1912.	
	£	Estimated.		k.w.
Battersea ...	298,038	4,288,000	6,200,000	3,050
Bermondsey ...	181,172	4,144,438	4,600,000	1,960
Fulham ...	281,008	3,331,497	3,900,000	2,170
Hackney ...	356,394	6,615,521	9,800,000	4,290
Hammersmith ...	344,153	9,335,892	9,600,000	5,900
Hampstead ...	437,000	4,794,417	5,240,000	3,290
Islington ...	513,462	6,416,953	8,000,000	4,930
Poplar ...	302,468	9,193,872	12,000,000	5,250
Shorditch ...	379,619	6,994,711	9,000,000	4,680
Southwark ...	108,673	1,790,963	3,000,000	1,760
Stepney ...	426,777	11,972,955	14,000,000	6,500
Stoke Newington ...	36,000	426,527	475,000	320
St. Marylebone ...	2,069,823	13,458,698	15,000,000	9,700
St. Pancras ...	557,468	9,452,067	11,376,000	3,740
Woolwich ...	310,000*	2,198,504	2,517,000	1,650
	£6,602,055	94,445,100	14,708,000	£9,130
<i>Company.</i>				
Drompton ...	276,042	2,868,817	3,029,888	1,890
Charing Cross ...	2,340,762	27,118,199	27,657,290	13,990
Chelsea ...	490,301	4,016,478	4,184,072	2,800
City ...	2,000,324	26,633,754	27,488,860	18,510
County ...	1,885,648	20,450,787	22,512,478	12,800
Kensington ...	388,709	5,821,514	5,727,890	3,640
London ...	1,345,883	20,476,982	28,409,755	13,500
Metropolitan ...	2,103,996	13,567,501	15,666,247	11,260
Notting Hill ...	249,608	2,336,849	2,482,414	1,630
South London ...	403,310	4,479,487	5,000,118	3,130
South Metropolitan ...	624,949	4,855,580	5,481,340	4,000
St. James' ...	426,398	10,708,689	11,044,768	5,950
Westminster ...	1,252,630	19,868,622	18,638,125	10,880
Central (St. James & Grand Westminster Joint) ...	600,296	—	—	—
Wood Lane (Kensington and Notting Hill Joint) ...	224,340	—	—	—
	£14,613,196	163,203,264	177,323,258	103,980
Grand totals ...	£21,215,251	257,648,364	292,031,258	163,110

\*Estimated.

NOTE.—Local authorities' accounts made up to March 31st each year. Companies' accounts made up to December 31st each year.

The progress of the supply authorities is shown graphically by the curves indicating the maximum demand and output in units. The influence of the advent of the metal-filament lamp is shown by the lighting output, any temporary depressing effect being more



than neutralised by the increase in the sale of units for power purposes. The future demand for increased illumination from existing wiring, and the necessity for providing all the buildings with the necessary means for utilising this most efficient and economical light shows signs of steadily increasing and exceeding all estimates based on the old carbon-filament lamp. Between the years 1889 and 1904 every unit sold at from 6d. to 8d. could be utilised to obtain light up to 2E0 C.P. for one hour by using carbon lamps, or, say, 30 C.P.-hours for 1d.; now by using the tungsten lamp at the present moderate charges for supply, 1 unit will provide 833 C.P. for one hour, or say, 208 C.P.-hours for 1d.; or, in other words,

the consumer obtains about six times the light for the same investment.

The Electric Lighting Act of 1888 did not contemplate the use of the electric motor, which was then made only in small sizes, and its great future was not realised by the public; but from 1890 to 1900 the utility of the electric motor was generally recognised, and pioneering efforts, involving much enterprise and patience, resulted in its gradual adoption and final universal use, with beneficial results to both supplier and consumer.

The electric supply authorities in 1906 combined to make an exhaustive canvass of all factory power users in London, and ascertained that the total amount of power required in all districts within the County of London was 208,806 H.P., or, say, 156,600 kW. The total connection for electrical power now amounts to about 135,000 kW., or 86 per cent. of all power required, and the increasing use of this power is shown on the curve.

From 1886 to 1900 the Willans engine was remarkable for the perfection of its design and the skill shown in its manufacture. The demand for generators of larger size placed the Willans engine at some disadvantage, and after the year 1900 the steam turbine took command of the field. The remarkable economy of the steam-turbine compelled many users to replace their Willans and other engines, securing not only more power for the same floor space, but also any amount of power from 500 kW. upwards.

The history of the steam turbine in this country is practically a biography of the life of the Hon. Sir Charles Parsons. In 1893 a Parsons turbo-alternator of 350 kW., then considered an enormous size, was constructed under exceptional circumstances, requiring quick manufacture and successful performance. A number of these machines were ordered to enable me to overcome complaints of vibration arising out of the working of reciprocating engines, and it became necessary to replace the latter by steam-turbines or to close the works. The result was successful; and while I must express the deepest gratitude to the inventor of the Parsons turbine, it is probable that the success of these machines encouraged the building of larger sizes and placed the turbine in the list of practical methods of electrical generation.

An interesting development is now being applied to the Parsons turbine in the form of speed-reducing gear, consisting of the employment of toothed gear wheels running in oil. It is better that the steam turbine should have a high speed and the generator a lower speed, and by means of this gearing the best conditions can be obtained without material loss or noise.

If we consider the wonderful progress of turbine design during the last 12 years, as proved by the fact that all reciprocating steam engines are now being superseded, we must recognise and appreciate



BIRD'S-EYE VIEW OF LONDON'S ELECTRICAL CENTRE OF GRAVITY.

the work of Sir Charles Parsons in startling the world with a revolution in mechanical science. There are many makers of turbines of various types, but, whether adopting the Parsons principle or some variation of it, their existence is due to the indefatigable pertinacity with which Sir Charles Parsons overcame all pioneering difficulties until he revealed the possibilities of a great commercial success.

Prior to 1883 the steam boilers used in this country were of the cylindrical type, and the water-tube boiler came to us from America, with the usual prejudice to overcome. In the capable hands of Messrs. Babcock & Wilcox, the water-tube boiler established itself as the safest and most economical means of obtaining a high steam pressure, with an integral superheater capable of raising the temperature of the steam to the highest limit permissible in the steam turbine.

The Babcock Co. have also done good service to the electrical industry of this country by perfecting an automatic stoker of the chain-grate type, which can be arranged to burn any kind of fuel—from Welsh small coal to the softest coal obtainable.

One effect of the great improvements in steam-generating plant is that the 257 million units sold in 1911, together with the units expended in distribution and for works purposes, were obtained by the consumption of about 570,000 tons of coal. If the present use of electrical energy were replaced by the old method of a separate

steam plant for each power user the amount of coal required would be at least 1,000,000 tons per annum more than at present, and the wasteful consumption of this increased quantity of coal would result in a repetition of the dense fogs which were so prevalent before the introduction of electrical supply. It must also be remembered that the distribution of power by means of underground mains has removed from the surface of the streets a

replacement. Each small gear wheel made about 120 million revolutions. On interurban and city railways the same wheel had to be changed after about 80 million revolutions, in other words, after about 24,000 or 36,000 car-miles, according to diameter of wheel, &c. The Prussian State railway management requires a guaranteed minimum of 24,000 miles for the small gear wheels and of 48,000 miles for the large gear wheels. As a matter of fact, distances of 120,000 miles have been accomplished without the large gear wheels needing replacement.

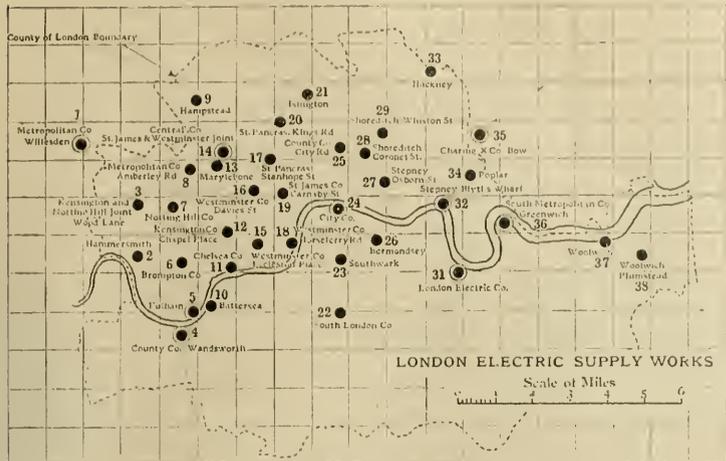
In like manner the wear of the bow of the current collectors varies considerably. Much depends on the material of the bow, on the amount of traffic, on the position of the rails, and on the construction of the overhead line. Aluminium bows, most commonly used, have, before needing to be changed, covered distances on interurban lines of from 2,000 to 3,000 miles, the overhead line being of simple construction. On main railway lines where trains are still hauled by steam locomotives, causing the wire to rust, the average life of the bows is about 1,000 to 5,000 miles, and on main lines with electric traction only it is about 9,000 to 12,000 miles.

Electrically or pneumatically-worked contactors have been very successful, the switch contacts having stood 6,000 short circuits before needing to be replaced.

In the case of the transformers on a city and suburban railway the internal insulation had to be changed after six years—i.e., after about 35,000 miles—because it began to crumble or break. The insulation of the coils themselves, however, was still good.

On the same railway the overhead wire was also changed after six years. The original copper cross-section of 90 sq. mm. had been worn about 40 per cent., so that there was still 60 per cent. of copper left. However, it was not deemed advisable to allow a greater wear in order to avoid increasing the drop. There was a daily traffic beneath the overhead line of about 220 trains, each with four bows, so that the wire was changed after about two million bows had passed along it.

The maintenance costs of the motor-cars (six-axle cars with two 200-H.P. motors) were, on the above-mentioned railway, about 2d. per car-mile, three-quarters of which is to the account of the electrical equipment. The average annual maintenance costs of four-axle motor-cars (four 70-H.P. motors) of an interurban railway are also given as about 2d. per car-mile. The working costs on other lines are still smaller, but then it must be borne in mind that electric traction has only been recently introduced there, so that the motors and equipment are still under guarantee and the makers bear a share of the working expenses.



ELECTRICITY WORKS SUPPLYING LONDON.

large number of coal-carts which formerly supplied the needs of power users, and also the necessary dust-carts to remove the ashes.

It has been suggested that large electric power works in the coal-fields or down the river would, by superseding all the existing generating works, secure some economy in the costs of generation. Such economies can easily be shown on paper, and it can with equal ease be demonstrated that the additional cost of mains and losses in transmission more than counterbalance any hypothetical economy in generation.

London is at present supplied from 38 generating works, the positions of which are shown on the plan. Many of the works are equipped with plant of the latest design and best economy, and, having facilities for extension at low capital cost, it would appear to be wiser to convey coal to them rather than to provide expensive copper mains from distant works. Some of the existing works have sites of the utmost value to the future supply of London, and, so long as the centre of gravity of the whole demand falls at a hypothetical point not far from the south side of Blackfriars Bridge, it is clear there is greater economy in developing works on all sides of this point rather than the concentration of the load in a distant region.

(To be concluded.)

COPPER.

MAINTENANCE COSTS OF ELECTRIC TRACTION.

OUR contemporary, the *Railway Gazette*, in a recent article by its Berlin Correspondent, gives the following interesting figures in connection with maintenance costs on German electric railways:—

The annual mileage figures depend essentially on the use that has been made of the traction equipment, and this, of course, differs on the several systems. Whilst on the City railways the average amounts to 56,000 motor car-miles, on the suburban lines, where, besides the ordinary local traffic, mixed trains are also hauled, the average amounts to 20,000 or 25,000 car-miles. The following are some fairly comparable results for the different railway systems regarding the wear of certain parts of the electrical equipment:—

The wear of the carbon brushes varies from 2 to 8 mm. per 1,000 car-miles, according to the type, number of revolutions of the motor, and amount of attention given. How far equalising connections in the commutator could diminish wear has not yet been definitely established.

The commutators must be ground or turned down on an average after about 20,000 to 30,000 miles; distances of 36,000 miles have been accomplished without undue wear of the collector. Too great a wear of the commutator would cause the insulating material to protrude between the commutator bars, and flat places to form themselves on the commutator, resulting in considerable wear of the carbon brushes. Commutators of the usual dimensions used in single-phase motors must be completely renewed after about six years. The armature bearings, if carefully attended to, are renewed after about 24,000 to 30,000 miles.

The data as to the wear of the gear wheels vary considerably. On one railway with infrequent stops the small gear wheels of the motor have lasted over 100,000 miles without requiring

THE importance of copper to modern industries is shown clearly by the figures tabulated in Messrs. Merton's schedule of principal copper supplies, which gives the world's output, and the outputs of the principal copper-producing countries, for the last 20 years, including 1912. We see from this that, whereas the world's output in 1893 was a little over 300,000 tons, it had increased to over half a million tons in 1901, and was doubled in the subsequent decade, the total output for 1912 being 1,004,485 tons. Allowance must, of course, be made for the fact that, of late years, statistics on the subject have been more carefully compiled, and countries whose output, while small, was not included, have only come on the list with a fairly high figure, which may be responsible for some of the sudden leaps taken by the totals. For instance, while the average annual increase over the ten years 1893-1902 was 27,000 tons, the difference between the output for 1899 and that for 1900 was only 7,270 tons, while that between 1898 and 1899 was 42,618. This, however, may be traced to high prices in 1899 stimulating production, which, in the ensuing year, reached its limit for the time being. Between 1903 and 1904 there is the remarkable difference of 69,225 tons. The American mines, principally those of Montana, increased their output considerably in 1904, besides which Mexico was estimated to have advanced 5,000 tons, Namagua was 1,700 tons up, Australasia 5,000, and Japan 3,500. The high prices of 1907 further stimulated production, the effects showing themselves in 1909, which advanced 85,245 tons over the preceding year; 66,980 tons of this increase was put out by United States concerns. The following year the United States showed a decrease, and the increase for 1911 was only 7,615 tons. After this comes the largest increase of all, 132,565 tons for last year. The United States figures show an increase of 70,970 tons. Japan has 10,000 tons, Chile nearly 8,000, Canada 10,000, Australasia 6,000. Of the total, the favoured Continent yielded '66, South America '07, Europe '11; Japan with 65,500 tons, and Australasia with 47,000, were the only other contributors of much consequence.

Looking over the columns, Australia and Canada show good, steady increases, Australia having doubled in 12 years, and Canada

in 10. Chile had its highest output last year, and Germany makes slow, but steady, increase. Japan has a most gratifying progress, very steady; Norway is now over 10,000 tons; there is a good show in Serbia's 7,240 tons, and Russia made a strong advance last year. Spain and Portugal also show a considerable increase after five years of much the same figures.

Messrs. Merton's table shows that the output of the following countries exceeds 10,000 tons:—Norway and the African mines; over 20,000, Germany and Peru; over 30,000 Canada, Chile and Russia; over 40,000 Australasia; over 50,000 Spain and Portugal (taken together); over 60,000 Japan; over 70,000 Mexico.

In connection with the above figures, the information to be found in the chairman's speech to the fourth ordinary general meeting of the Rio Tinto Co. is of considerable interest to consumers as well as producers. Mr. C. W. Fielding, who occupied this position, alluded to the high prices ruling in 1906 and 1907 as "unhealthy," as unduly stimulating production and bringing into the market excessive supplies, which kept the price down subsequently. In 1911, however, stocks began to come down, and in 1912 they were almost too low, and the price at one time rose temporarily to over £80. The price has been low this year owing to the unsettled state of European politics keeping the buyer from the market. Supplies would thus, after sound financial conditions in a country, appear to be, if not the determining factor in price, at any rate a good indicator of tendency.

Messrs. Merton's monthly circular is now to hand, and shows European supplies (excluding Rotterdam, Hamburg and Bremen) as 32,261 tons, a withdrawal of 3,885 tons during the month. Of this 1,410 tons are from English ports, the remainder of the reduction being on quantities afloat and at Havre. Including Dutch and German ports, the supplies are 45,074 tons, or an increase of 401 tons, and there are estimated to be 2,500 tons more at other European ports.

Arrivals from North America to Europe have been strong at 29,770 tons. Spain and Portugal contributed rather less than average to England and France, but more than usual to other countries. Chile shipments are just below average, and Australian lower than usual. Total deliveries, at 42,927 tons, are medium, the average for the past 12 months being 41,500.

American stocks at the end of February were 54,600 tons, or 400 less than at the end of January. Total visible supply for the end of February was 99,273 tons, 1,172 tons better than at the end of the preceding month.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 7,530. "Number impulse instrument for automatic telephone systems." SIEMENS & HALSKE Akt.-Ges. (Convention date, March 29th, 1912, Germany.) March 31st. (Complete.)
- 7,531. "Supervisory circuits for telephone systems." SIEMENS & HALSKE Akt.-Ges. (Addition to 7,130, 1912; Convention date, March 30th, 1912, Germany.) March 31st. (Complete.)
- 7,534. "Control for electrical systems." C. F. KETTERING. (Convention date, August 9th, 1912, United States.) March 31st. (Complete.)
- 7,545. "Selective electrical distribution systems." C. F. KETTERING and W. A. CHAVET. (Convention date, November 20th, 1912, United States.) March 31st. (Complete.)
- 7,546. "Control for electrical systems." C. F. KETTERING. (Convention date, November 11th, 1912, United States.) March 31st. (Complete.)
- 7,551. "Electrically controlled valves." W. C. S. CHAPMAN. (A. D. Chapman, Cape Colony.) March 31st. (Complete.)
- 7,570. "Electric warp stop motions for looms." J. HANCO. March 31st. (Complete.)
- 7,581. "Luminous switch handles or the like." H. WADE. (Voigt and Haefner Akt.-Ges., Germany.) March 31st. (Complete.)
- 7,585. "Signal systems for railways and apparatus for use therewith." E. C. R. MARKS. (W. H. Gillman, United States.) March 31st.
- 7,589. "Combined intercommunication and party line telephone systems and the like." STEERING TELEPHONE AND ELECTRIC CO., LTD. (Telephon Fabrik Akt. Ges. vorm. J. Berlin, Germany.) (Divided application on 6,580 of 1912, March 16th, 1912.) March 31st.
- 7,600. "Dynamo-electric machines." BRITISH THOMPSON-HOUSTON CO., LTD., F. H. CLOUGH and L. DUNKEA. March 31st.
- 7,610. "Transmitting apparatus for use in wireless telegraphy and telephony." G. MARCONI and C. S. FRANKLIN. March 31st.
- 7,638. "Electric bells or gongs." F. F. MACDONALD. April 1st.
- 7,640. "Galleries or carriers which support shades or globes for gas and electric incandescent lights." J. N. MOLLETT. April 1st.
- 7,656. "High-tension duct-insulator with safety fuse." A. BITTER and E. WEISSBERG. April 1st.
- 7,670. "Telephones." C. F. KILLAS. April 1st.
- 7,675. "Means of producing electrically effects corresponding to the form, density, or other physical qualities of bodies." F. A. HEHON. April 1st.
- 7,722. "Incandescent electric lamps." T. W. LOWDEN. (Addition to 1,150, 1912.) April 2nd.
- 7,750. "Electric apparatus for heating and cooking." E. W. LANCARTEA. April 2nd.
- 7,755. "Form of contact for electric bells, alarms, and the like." J. H. CERNINOTON. April 2nd. (Complete.)
- 7,756. "Electric switches." R. H. BARROT and E. ECHATNER. April 2nd. (Complete.)
- 7,776. "Electric alternating-current machines." ALLMANNA SVENSKA ELEKTRISKA AKTIEBOLAGET. (Convention date, April 6th, 1912, Sweden.) April 2nd. (Complete.)
- 7,784. "Dynamo-electric machines." ALLGEMEINE-ELEKTRICITÄTS-GES. (Convention date, April 2nd, 1912, Germany.) April 2nd. (Complete.)
- 7,795. "Dynamo-electric machines." E. MIDDLEBROOK and H. SMITH. April 2nd.
- 7,802. "Actuating gear for magnets and dynamos for electric ignition." E. H. MICKLEWOOD. April 3rd.

- 7,805. "Electrical conductors and supporting means for same." BRITISH INSULATED AND HELEBY CARLES, LTD., W. M. MORDEY, J. W. ASLEY and D. B. BAUNDERSON. April 3rd.
- 7,888. "Time switch." J. G. MEHNE. April 3rd. (Complete.)
- 7,840. "Construction of electrical dynamo with counter compounding." J. PEDGOKOT. April 3rd. (Complete.)
- 7,842. "Driving of looms by electric motors." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, April 3rd, 1912, Germany.) April 3rd. (Complete.)
- 7,846. "Means of housing the recording strip of electro-cardiographs or the like." SIEMENS & HALSKE Akt. Ges. (Convention date, April 6th, 1912, Germany.) April 3rd. (Complete.)
- 7,847. "Wireless-controlled vessels." R. CARTWRIGHT. April 3rd.
- 7,896. "Regulation of electric motors by means of boosting and lugging machines." ALLGEMEINE ELEKTRICITÄTS-GES. (Convention date, April 3rd, 1912, Germany.) April 3rd. (Complete.)
- 7,918. "Enclosed electric switches." V. HOPE. April 4th.
- 7,931. "Electric conduits and the like." F. S. RIFFINOILLE and F. L. BROUGHTON. April 4th. (Complete.)
- 7,932. "Electrical heating bodies composed of non-metallic resistance materials." GERBUDER SIEMENS & Co. (Convention date, April 11th, 1912, Germany.) April 4th. (Complete.)
- 7,933. "Automatic electric direction and danger indicator for mechanically-propelled vehicles." A. R. DAVY, A. W. P. FELLOWS and T. M. JONES. April 4th.
- 7,949. "Electric arc lamps." A. S. LONG. April 4th.
- 7,977. "Detectors for use in wireless telegraphy." GRATHAM & LATHAM, LTD., L. J. GRATHAM and B. F. SOBATKA. April 4th.
- 7,983. "Arrangements for starting and regulating direct-current electric motors." F. COMONT. (Addition to 6,108/12.) April 4th. (Complete.)
- 7,994. "Speed-indicating apparatus." CHAPERN'S (SHIP) TELEGRAPH CO., LTD., and J. HOWIE. April 5th.
- 7,996. "Sealing terminals and connections for electric cables." F. A. CORTEZ-LEIGH and G. BROGHALL. April 5th. (Complete.)
- 8,024. "Telegraphic transmitters." W. E. SHAW. April 5th. (Complete.)
- 8,027. "Arrangement of current transformers for high voltages." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt. Ges., Germany.) April 5th. (Complete.)
- 8,093. "Production of gases by electric arc." R. HADDAN. (International Ionizing Process Co., United States.) April 5th. (Complete.)
- 8,054. "Ship signalling or telegraph apparatus." J. STOREY. April 5th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

- TIMING DEVICES FOR MAKING AND BREAKING ELECTRIC CIRCUITS AND FOR OTHER PURPOSES. H. S. HASFIELD. 6,404. March 14th.
- VAPOUR ELECTRIC APPARATUS. M. A. E. Leblanc. 6,655. March 18th.
- DISTANCE-OPERATED MECHANISMS AND SIGNALS ON ELECTRIC SUPPLY SYSTEMS. H. W. HADDOCK, A. H. DYKES and W. DUDDELL. 6,716. March 19th.
- ELECTRIC TRANSMITTING MECHANISM FOR MARINE ENGINE GOVERNORS. S. RUMOHLO. 6,828. March 19th. (Addition to No. 29,764 of 1909.)
- AUTOMATIC ELECTRIC CIRCUIT-BREAKING ARRANGEMENTS. E. MÜLLER. 6,990. March 21st.
- SIGNALING BY MEANS OF ELECTRO-MAGNETIC WAVES. F. J. CHAMBERS. 7,242. March 25th.
- PROTECTIVE DEVICES FOR THE CONDUCTOR RAILS OF ELECTRIC RAILWAYS. C. H. MEZ and S. G. REDMAN. 7,591. March 28th. (Addition to No. 11,847 of 1908.)
- SHIP-RING COLLECTOR DEVICES FOR ELECTRICAL INSTRUMENTS AND MACHINES. A. DEBY and F. T. EDGEcombe. 8,640. April 12th.
- ELECTRIC COUPLING OR CONNECTION FIXTURES. S. TROOD and J. H. DALE. 8,609. April 26th.
- ELECTRIC PHOTOGRAPHIC PRINTING OR COPYING FRAMES. J. B. HALDEN. 10,183. April 30th.
- VACUUM ELECTRIC WATER-HEATER. J. MARR. 12,367. May 24th.
- ELECTRIC APPARATUS FOR MEDICAL AND OTHER PURPOSES. C. H. IVINSON and G. BRYANT. 12,757. May 30th.
- FRICITION CLUTCH GEAR FOR USE IN ELECTRIC BOAT-HOISTING APPARATUS. J. FIELDING. 12,892. June 1st.
- MEANS FOR SELECTIVELY OPERATING ONE OR SEVERAL OF A SERIES OF ELECTRICAL DEVICES. A. SCHMIDT. 14,121. June 17th.
- ELECTRIC INDUCTION HEATER OR FURNACE. A. HELLENSTEIN. 14,164. June 17th. (June 16th, 1911.)
- PROTECTIVE DEVICES FOR ELECTRIC CIRCUITS. BRITISH THOMPSON-HOUSTON CO. (General Electric Co.) 16,708. July 17th.
- ELECTRIC THERAPEUTIC APPLIANCES FOR THE SOLES OF BOOTS, SHOES AND THE LIKE. G. WILSON and C. J. WILSON. 16,768. July 18th.
- APPARATUS FOR REPRODUCING UNIDIRECTIONAL ELECTRIC CURRENTS. J. SCHIESSLER. 18,655. August 14th. (Convention date and Patent of Addition not granted. Divided application on No. 4,061 of 1912, February 17th.)
- CONTACT DEVICES FOR CONTROLLING POINTS OR SIGNALS ON ELECTRIC TRAMWAYS AND THE LIKE. J. J. H. V. WEENEN, H. W. G. J. STOFFELS and J. B. van der SPRENKEL. 19,150. August 21st.
- SPARK PLUGS. J. J. THOMPSON. 20,248. September 5th.
- AUTOMATIC ELECTRICALLY-OPERATED ELEVATORS. R. LILJEBLAD and AKTIEBOLAGET Elevator. 23,918. October 19th.
- PRODUCTION OF HIGH-FREQUENCY CURRENTS ADAPTED FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY. W. P. THOMPSON. (Compagnie Universelle de Telegraphie et de Telephonie Sans Fil.) 24,937. October 31st.
- MEANS FOR ELECTRICALLY TRANSMITTING AND INDICATING ORDERS, SIGNALS, INFORMATION OR THE LIKE. C. J. EVANS. 26,094. November 20th.

1913.

- MEANS FOR REGULATING THE OUTPUT OF DYNAMO-ELECTRIC MACHINES. T. W. TATTERSALL. 1,205. January 16th.
- ELECTRIC RESONANCE APPARATUS. H. W. HADDOCK, A. H. DYKES and W. DUDDELL. 5,807. March 3rd. (Divided application on No. 6,716 of 1912, March 19th.)
- DIFFERENTIALLY-WOUND COMPOUND DYNAMO-ELECTRIC GENERATORS. C. F. KETTERING. 6,615. March 5th. (May 22nd, 1911. Divided application on No. 3,794, February 16th.)

# THE ELECTRICAL REVIEW.

Vol. LXXII.

APRIL 25, 1913.

No. 1,848.

## ELECTRICAL REVIEW.

## EXHIBITIONS AND TRADE EXPANSION.

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WE have always maintained that large international exhibitions formed a most valuable medium for the extension of trade abroad by giving manufacturers an opportunity for introducing their goods to foreign buyers; but we have fully realised that the non-existence, until the last two or three years, of any organisation established specifically for the purpose of arranging British exhibits and for obtaining the best available spaces, often made it difficult for firms to take part in such exhibitions, and, in any case, detracted from their ultimate value.

It had previously been the custom, when any large exhibition was proposed abroad, for the Government to consider whether or not it would participate officially. If it were finally decided to participate, a Royal Commission was appointed to arrange the British section, but by the time the Commission had been actually appointed and had got to work, all the best spaces had usually been taken up by other countries. Moreover, the absence of any permanent policy with regard to exhibitions, and the lack of experience of previous exhibitions on the part of each new Commission, prevented the best possible results being secured to each individual exhibitor in the British section.

We consequently welcomed with considerable pleasure the appointment of a Royal Commission to inquire as to the nature and extent of the benefit accruing to British industries from the participation of this country in great international exhibitions. This Commission ultimately decided that it was essential that an efficient permanent organisation should be created to act on behalf of British exhibitors in all negotiations with foreign exhibition committees, Customs officials, &c., and to render them such assistance as would enable them to show their goods effectively at International Exhibitions without a prohibitive amount of trouble and expense. Such work could only be properly performed by a Government Department, and it is one more proof of the Board of Trade's recent practical interest in the extension of the trade of this country that it should so readily have formed a separate body, under the direction of Mr. U. F. Wintour, to carry out the recommendations of the Commission. That this Department has fully justified its formation, even in so short a time, is proved by a report we have now before us which deals with the work of the Exhibitions Branch in connection with the Exhibitions at Brussels, Rome and Turin.

As a result of previous experience at exhibitions, British manufacturers had become rather apathetic regarding new departures of this kind, but there is undoubted evidence that this apathy is being gradually overcome. In the report which is before us the Exhibitions Branch endeavours to trace the commercial results which have accrued to British exhibitors from participation in the Brussels and Turin Exhibitions (the exhibition at Rome was an Art Exhibition and therefore is not of commercial interest). With the object of ascertaining these results, the following questions

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### FOREIGN AGENTS:

<p>ADELAIDE: Messrs. Atkinson &amp; Co., Gresham Street.</p> <p>AUCKLAND, N.Z.: Gordon &amp; Gotch, Albert Street; The Mining and Engineering Review, 16, Palmerston Buildings, Queen Street.</p> <p>BERLIN: Asher &amp; Co., Unter den Linden; Speyer &amp; Peters, Unter den Linden 43, N.W. 7.</p> <p>BRISBANE: Gordon &amp; Gotch, Queen St.</p> <p>CHRISTCHURCH, N.Z.: Gordon &amp; Gotch, Manchester Street.</p> <p>DUNEDIN, N.Z.: Gordon &amp; Gotch, Princes Street.</p> <p>JOHANNESBURG, CAPE TOWN, BLOEM-FONTEIN, DURBAN, PORT ELIZABETH, &amp;c.: Central News Agency, Ltd.</p> <p>LA UNCESTON: Gordon &amp; Gotch, Cimitiere Street.</p>	<p>MELBOURNE: The Mining &amp; Engineering Review, 90, William Street</p> <p>Gordon &amp; Gotch, Queen Street.</p> <p>MILAN: Fratelli Treves.</p> <p>NEW YORK: D. Van Nostrand, 25, Park Place.</p> <p>PARIS: Boyveau &amp; Chevillet, 22, Rue de la Banque.</p> <p>PERTH, W.A.: Gordon &amp; Gotch, William Street.</p> <p>ROME: Loescher &amp; Co., Corso Umberto 1° 37.</p> <p>SYDNEY: The Mining &amp; Engineering Review, 2, Hunter Street; Gordon and Gotch, Pitt Street.</p> <p>TORONTO, ONT.: Wm. Dawson &amp; Sons, Ltd., Manning Chambers; Gordon and Gotch, 32, Bay Street.</p> <p>WELLINGTON, N.Z.: Gordon &amp; Gotch, Cuba Street.</p>
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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's.)

# 1913 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,**  
4, Ludgate Hill, London, E.C.

were submitted to all British exhibitors at Brussels and Turin:—

1. Have you had, up to the present time, any development in your business which you can directly or indirectly attribute to the Exhibition at Brussels (Turin)?

2. If so, can you give any information as to the extent or value of such development?

3. Have the sales effected, as a result of the exhibition of your goods at Brussels (Turin), repaid you for the cost of exhibiting?

4. Have you any observations to make with regard to any improvement which might be made in the organisation of British exhibits at future exhibitions?

The tracing of "results" of any scheme of advertising is by no means an easy matter, and participation in an International Exhibition, like other forms of advertising, may lead to results which it is very difficult, if not impossible, to trace. It should be borne in mind, however, that abstention from exhibiting when one's competitors are showing their goods may easily lead to a falling-off in sales, so that even if no new business accrues exhibiting will often have had results. Experience has shown that even in the cases of firms with an established reputation and world-wide connections attempts to discontinue advertising have usually been followed by a diminution in the sales effected, and it has been one of the chief causes of Government action as regards foreign exhibitions that the neglect of one of the important forms of national advertisement would be equally detrimental to our interests as a manufacturing country.

The individual answers received to the above questions were, for the most part, of a satisfactory character. In the case of the Brussels Exhibition, 32 per cent. of the exhibitors stated that their exhibits had produced good tangible results. A further 33 per cent. of the exhibitors indicate that they are satisfied with the result of their exhibits, making a total of 65 per cent. who feel that their expenditure in this form of advertising has not been misplaced. Of the remaining 35 per cent., the great majority simply answered the questions in the negative. Of all the answers received relating to the Brussels Exhibition only 11 expressed dissatisfaction, and four of these were from firms who had sustained heavy losses in the fire which destroyed the greater part of the British Section. As regards the Turin Exhibition, the results reported up to the present are not so good as in the case of Brussels, but the time which has elapsed since this Exhibition is hardly sufficient to allow of any accurate estimate of the commercial results which are likely to accrue. The Turin Exhibition, as a whole, also suffered from adverse circumstances, and it is consequently satisfactory to find that 24 per cent. of the exhibitors reported definite tangible results, while a further 30 per cent. reported themselves as satisfied, making 54 per cent. in all. Replies to Question 4 show a distinct desire on the part of exhibitors to co-operate with the Board of Trade in increasing the efficiency of our exhibition work, and the majority of the exhibitors from whom replies have been received have expressed appreciation of the manner in which the organisation of the British sections was carried out and of the services performed on their behalf.

Taking the statistical showing at its face value, results may therefore be taken to be eminently satisfactory, particularly so having in view the short time during which the Exhibitions Branch has been at work. Moreover, we are disposed to think that the Exhibitions Branch is too modest in the conclusions it draws from these statistics. Our experience goes to show that the British commercial community is not too prodigal of its praise, particularly where any Government institution is concerned, and is all too ready to complain on the slightest provocation. We therefore think that the work of the Board of Trade in connection with these Exhibitions is even more fruitful of results than the reports from exhibitors would lead one to believe. We trust that the wish is not father to the thought.

If we might offer criticism at such an early stage in the Board of Trade's active work in exhibitions, it would be that initiative might be displayed in organising independent exhibitions, as well as in participating in foreign exhibitions of the type of those at Turin and Brussels. Taking these two exhibitions as fairly representative, our criticism is that there are other countries than Italy and Belgium whose trade is much more important to us, and where an exhibition of

British goods would have much greater results in actual sales; there is a very urgent need for manufacturers to introduce their goods on these markets by ocular display, and permanent, or even temporary, exhibitions organised by the Board of Trade would, we think, meet with support that has not been forthcoming when such exhibitions have been privately arranged or mooted. In South and Central America, in Egypt, in Russia, in our own self-governing Dominions, to name only a few of the countries where our trade might be greatly increased, such exhibitions intelligently organised would, we are sure, have incalculable results. We offer the suggestion for what it is worth; if it has already been considered we commend it for further consideration, confident that if carried out its effect on our trade would be tremendous. Meantime we appreciate the work already being done, and urge manufacturers to co-operate. They may not find everything as they wish, we have heard that they have not, but obviously the Exhibitions Branch is prepared to consider their suggestions for improvement, and is certainly already supplying a want that has been badly felt for many years.

While dealing with this question of exhibitions and trade extension, we may refer to another scheme of exhibition work recently developed by the Board of Trade in collecting samples of foreign goods selling in markets abroad, and placing them before British manufacturers of similar lines of goods. This work, which has up to the present been done by the Commercial Intelligence Branch, is extremely valuable, and is capable of much greater development. Perhaps it is not too much to hope that before long we shall have under Government control a thoroughly organised and efficient scheme of sample bureaux, both abroad for the display of British goods, and at home for the display of the most successful foreign goods which compete with our own on markets abroad. One actual sample is worth reams of description, and it seems to us that along this line the Board of Trade may safely hope to give even more active support to British trade than is already forthcoming. We are, of course, aware that any comprehensive scheme of this kind must entail considerable cost, but we maintain that this increase in expenditure will be fully justified by a large increase of trade, and a consequent improvement in the general prosperity of the country as a whole.

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## THE IMPORTUNITY OF LABOUR.

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It has always been prophesied by those who have had experience of the methods of the Labour Party that they would never be satisfied with the recent Act passed to reverse the famous Osborne Judgment. They regard that as but a step in the great stairway of industrial reform which is to lead up to a kind of worker's paradise. The so-called representatives of the working man in the political world are now engaged in the task of "pressing for further legislation."

This is a policy which offers many attractions. It produces the maximum of advertisement with the minimum of result. The pressure exerted must, of course, be nicely adjusted. On the one hand, it must not be so great as to involve the leaders of labour in an open breach with the existing Administration, or the existing Administration in defeat. That would never do. It would be "killing the goose" in more senses than one. On the other hand, the pressure must be such, and must be so applied, as to secure as much notoriety as possible. The workers who read the halfpenny papers up and down the country must be told that their trusted representatives in politics are labouring in their interest. Resolutions must be passed at Congresses; these resolutions must be carried with all due pomp and circumstance (and expense) by influential deputations to Cabinet Ministers assembled at Whitehall. It is thus that the pro-

letariat are persuaded to believe that so much of the Trade Union funds as is subscribed for party purposes is being advantageously expended.

A favourable example of this up-to-date form of propaganda has recently been brought into prominence. It took the form of a deputation from the Parliamentary Committee of the Trade Union Congress to Mr. McKenna at the Home Office on April 8th. The object, apparently, was to draw the attention of the Home Secretary to certain resolutions passed at the recent Congress at Newport. The whole process rather reminds us of the archaic practice among European Monarchies, whereby, months after the demise of a Crowned Head, a state official is sent to "announce" the death. The deputation mentioned 25 resolutions, each one of which would require (according to the Home Secretary) to be dealt with by legislation. Let us mention a few of these at random:—Total provision for the blind; closing of factories and workshops over the week-end; prohibition of deductions from wages and the imposition of fines; provision of means whereby a magistrate can pay a cab-driver reasonable expenses incurred in discovering a delinquent fare; and amendment of the Workmen's Compensation Act so as to compel employers to insure.

According to the report in the *Times*, these are some of the topics dwelt upon by the deputation. The same journal reports the Home Secretary as having said:—

"He would only have been too glad to have introduced Bills on every one of the topics which had been raised, but there would not be the slightest chance of being able to get through more than a tithe of them."

We can well imagine Mr. McKenna, hand on heart, saying in a spirit of the utmost conciliation: "I and my colleagues have the inclination to confer these boons, but the exigencies of time prevent us." With similar candour did Mr. Spenlow declare, on his honour, that he would return willingly David Copperfield's premium, "but he had a partner—Mr. Jorkins."

We do not say for a moment that some of the suggestions put forward by this "deputation" did not fully deserve to be placed in the limbo of things for which there is no Parliamentary time. Take, for instance, the ridiculous proposal that factories and workshops should be closed over the week-end. How could the business of a great manufacturing community be conducted under such conditions?

In the brief abstract of the proceedings which we have been able to consult, it appears that Mr. McKenna was loud in his expression of sympathy, but very careful not to commit himself or the Cabinet to any active step. That, as it seems to us, is exactly what the Labour Party want—accept legislation whenever it pleases the Government of the day to pass it, but by no means use threats or become aggressive if you do not obtain it.

The reappearance in the House of Commons of the Old Dog in a new doublet—the Minimum Wage resolution—is another example of what we have ventured to call the importunity of labour. Notwithstanding the teachings of experience this same old ridiculous resolution makes its appearance year after year. It is rather surprising to find, too, that it is meeting with support in quarters where opinion ought to be better informed. Space does not admit of our dealing at length with this question; but there is one point we should like to make. It is that the minimum or living wage must necessarily be based on the cost of living for the time being. If that cost is increased, the so-called minimum must be increased. It follows that even if a minimum

wage of 30s. were guaranteed to every worker this year, a few years hence, when the price of the loaf had gone up, the cry would be heard for an amendment of the minimum wage.

#### Units and Abbns.

THE modern craze for abbreviation, and the insatiable passion for devising new units and systems of units, have lately given rise to a serious outbreak on the Continent, to say nothing of the isolated but equally sad case in the United States to which we recently drew attention. The disease appears to resemble influenza in that the germ or spore or whatever it be that disseminates the plague leaps over vast distances, leading to epidemics which appear to be quite independent, and that a single attack by no means safeguards the victim from a recurrence, but rather renders him more susceptible than ever to the complaint. From the boiled-down title of this essay on "New Units and Abbreviations" may be gathered some idea of the fearful prospect that would lie before us, should the virus attack the literature as well as the technical terminology of our time. What is the matter with the people who are constantly trying to foist upon a patient but sorely-tried world new and superfluous symbols and abbreviations? It cannot be want of time to use the longer but obvious and customary forms, for the time they expend on elaborating and learning the new hieroglyphs would far more than swallow up the time they might save by using these. One dare not suggest that it is nothing but laziness, whatever one may think; and therefore one is at a loss for a plausible explanation of this particular mental twist.

Our comments are prompted by a recent report of certain very eminent German Societies advocating the use of a set of abbreviations which we give on another page—not because we approve of them in the least, but for the information of readers who may come across them in German writings and will naturally be at a loss to translate them without this little glossary. We had thought of criticising the separate items, but, indeed, as Beatrice said of Benedick's bad parts, they maintain "so politic a state of evil, that they will not admit any good part to intermingle with them." We therefore will merely invite our readers to—"Look at them!"

#### The Benevolent Electrical Trades Benevolent Institution.

OUR hearty congratulations are due to the Electrical Trades Benevolent Institution on the excellent result of the festival dinner, no less a sum than £854 having been added to the funds. It is worthy of note that more than half this amount was largely due to the personal efforts of the chairman, Mr. George Sutton, who has thrown himself into the work with an amount of zeal and energy worthy of the beneficent objects of the Institution, and has set a splendid example to future chairmen, not only in this respect, but also in his admirably conceived address in commending the Institution to the favourable regard of his audience at the dinner. His obviously sincere and heartfelt appeal should bear good fruit—and, indeed, it has already done so, as evidenced by the generous offer of Mr. E. Byng to contribute £100 to the funds if nine others would do likewise. Two such donors have already been found, in the persons of Mr. Sutton himself (whose large donation, as well as that of his firm, bears witness to the earnestness of his convictions) and of Mr. Hugo Hirst; and we trust that the remaining seven will come forward well within the specified limit of three months. As we go to press, we learn with pleasure that Mr. E. Garcke will make a fourth donor of £100. We hope to add the other six names in our next issue.

We should like to direct particular attention to the chairman's remarks on the subject of donations from limited companies. As he pointed out, the welfare of employes undoubtedly falls within the legitimate range of a public company, and at a time like the present, when trade is flourishing, there ought not to be the slightest hesitation on the part of boards of directors in performing their duty in this respect.

## THE MECHANICAL DESIGN OF SWITCHES.

By A. R. C. JENKS, A.C.G.I.

ELECTRIC driving of mechanical engineering works—generally by direct current—is now almost universal, and even a moderate-sized works may have in its equipment several hundred motors, supplying power for the large machines independently, the smaller ones in groups, and the various auxiliaries, such as cranes, air compressions, pumps, &c. Each of these motors is controlled by its own starting and operating switches, which are at the mercy of the men working the machines, who do not understand them and cannot be expected to appreciate their niceties. It is, therefore, surprising that the design of the majority of switches is still mechanically so imperfect, when the treatment they are likely to receive is considered. Improvements constantly tend in the direction of making them electrically rather than mechanically fool-proof; but this tendency is bound to lead to increased complications and therefore increased possibilities of mechanical breakdown.

In the most common type of starting switches—viz., the flat-segment type—the contacts and contact arm are mounted on a slate, marble, or composition base, and owing to the hard and non-resilient nature of these substances, it is difficult to prevent the small nuts and screws fixing the moving parts from becoming loose under the continuous rough usage to which the switch is subject; moreover, if it is of the open type most of the wear and tear is taken entirely by the base. In this respect the ironclad or protected type has the advantage, as the casing relieves the base of the mechanical strains; but this type is less accessible for repairs and is very heavy to take down and replace.

The chief fault of this simple starting switch is that it is easy to operate it too rapidly. This difficulty has been overcome in one design by moving the contact arm indirectly through a worm reducing gear by means of a second shaft to which the handle is connected. This is, on paper, an excellent idea, but practically the worm and worm wheel are not made nearly robust enough and consequently both are soon stripped. Another disadvantage is that the arrangements for holding the handle or worm in gear when starting, and releasing them when the arm is full over, are not satisfactory. In order to stop the motor and return the arm to the starting position, a neat little button is provided to short-circuit the no-volt coil; often, however, the arm sticks and will not release itself, and as it cannot be “assisted” from outside the casing, banging and jolting are resorted to, until it goes back.

When overload releases are fitted they are also a source of weakness. Their parts are generally small; and, as they ought to go for months without operating, they are liable to get stuck, owing to gummy oil and grit in the joints of their mechanism. When a short does occur, and it is essential that they should act, they cannot be depended upon to operate within 50 per cent., or even 100 per cent., of the current set for; and since they usually cut out by short-circuiting the no-volt coil, they are open to the same objection as the push-button for stopping.

The strongest and most reliable controller is the drum type universally used for service motors on traction work and cranes. The drum is well supported and protected from mechanical damage by the very rigid casing. Unless, however, the “notching” gear and spring are amply strong and well designed, it is possible to stop the drum between notches, causing much damage to the fingers through continual arcing. The advantages of this type as regards durability are becoming more widely appreciated, and a modified form—the pillar-type controller—is being increasingly used for machine-tool motors.

Another point which, though not strictly concerned with mechanical design, might be noted, is that it is absolutely essential that proper “inching gear” should be provided for obtaining the very small movements often required when setting machines or taking out work. It should be possible to obtain just as small a movement with the machine light as when it is fully loaded.

Main switches with intricate toggle joints are liable to give trouble when the joint-pins begin to wear; this occurs

fairly quickly, as they are generally too small and do not receive much attention in the way of lubrication. It is, however, scarcely possible to avoid these joints when heavy currents have to be broken by trip-gear incorporated with the switch.

Although, therefore, the “fool-proof” ideal appears attractive, advances in this direction can usually be obtained only at a sacrifice of mechanical simplicity, and this sacrifice is often too great. When the time lost during the course of a year through continual small delays caused by defects in switches is considered, it pays the user to insist on ample strength and simple design, thus ensuring that, instead of being generally defective, they will always be in good order. Reliance will have to be placed for protection from damage on fuses only, but these cannot easily go wrong, and wilful tampering can be avoided by enforcing severe penalties and by placing them under lock and key. It must be constantly borne in mind that the machinist regards his switches more or less in the same light as he regards his spanners, and treats them with about the same amount of consideration. Any extra expense to the user on heavier switches is likely to be amply repaid by reduction of lost time and of repair costs.

## NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

THE Westminster B.C. Power Co. is preparing plans for a large hydro-electric plant on the Indian River. The idea is to utilise a number of small streams at high elevation, and run pipes down to the power house; the effective head of water will be about 1,800 ft.

The development of some 30,000 H.P. at the confluence of the Rivers Nicolum and Coquahalla, in British Columbia, is also contemplated by another concern.

The British Columbia Electric Railway Co. are building a large receiving station, which will contain four sets of transformers, each having a total capacity of 36,000 kW., stepping down from 60,000 volts to 11,000 volts.

Two towns in Western Canada, Vernon in British Columbia, and Canora in Saskatchewan, have recently put into operation Diesel engines driving generators, and as this type of plant appears to be particularly suited to the needs of many of the small, but growing, towns of the West, the performance of the plants already started will, no doubt, be watched with interest and, if successful, other similar installations are certain to follow.

Strathmore, Alberta, will probably have an electric light plant soon, as a company proposes to install two 65-H.P. producer-gas engines to drive two 35-kw. alternators, together with necessary transformers, lamps, meters, &c.

The Hydro-Electric Power Commission of Ontario intends to advertise almost immediately for tenders for the construction of a transmission line to Windsor from the main switching station at Dundas. The routes have not yet been decided upon, although four different ones are under consideration. The cost will amount to several million dollars, and all the towns along the route will be supplied with electricity. Tenders are also to be invited for material for the construction of transmission lines from Cannington to Beaverton, from Berlin to Elmira, from Clinton to Goderich, and from Brantford to Paris. The cost of material for these extensions will be about \$2,000,000.

The Manitoba Government is erecting an experimental station at Estevan with the object of demonstrating the commercial possibilities of lignite. It is said that the matter of installing a large power plant near Estevan is now being considered by New York financiers, who will furnish the necessary capital immediately the feasibility of the scheme has been proved by the tests.

**International Congress of Cold.**—Papers offered to be read at the Congress in the United States in September next should be sent as soon as possible to the Secretary, 431, South Dearborn Street, Chicago, U.S.A.



hard mica having risen above the commutator segments, causing a bad contact; and after cutting down the mica and cleaning up the commutator, the dynamo ran quite satisfactorily. I may here mention that when the dynamo was separately excited and fully loaded, it sparked slightly, this being due to the bad contact between brushes and commutator before mentioned, and would not give its correct voltage.

E. Wells.

Cambuslang, April 21st, 1913.

**Prospects in Electrical Engineering.**

I agree with Mr. Ebben's letter on the above subject. It is true that, generally speaking, one of the most interesting sections of the ELECTRICAL REVIEW is the "Situations Vacant" column, but it is, at the same time, the most lamentable.

In my opinion, central station engineers can be divided into three classes:—Those who eagerly look forward to the day when the ELECTRICAL REVIEW is obtainable, and who peruse it generally; those who can almost turn to the "Situations Vacant" columns blindfolded, and whose interest in the REVIEW begins and ends there; and those who never even look at it at all.

Almost invariably one can on taking up a copy of the ELECTRICAL REVIEW, which is undoubtedly the pioneer paper not only for reading matter, but for positions advertised, laugh at central station engineers.

Take, for instance, this week's issue (April 11th): An arc lamp trimmer is requested at a wage of 27s. per week, and the same firm requires a junior shift engineer at a salary of 28s. The fortunate engineer who gets the position will be presumably from 25 to 30 years of age, have served his apprenticeship, studied at a technical school, worked for years at a salary of a few shillings per week in order to gain experience. He will have to take on a position of responsibility, very probably work seven shifts, including night shift, which only tends to break up a man's constitution and shorten his days, also Sundays and Bank Holidays, &c., and will be subject to almost unbearable heat and din and risk of the engine room. And all this is for—what? A shilling more than the labourer who is required to trim arc lamps.

Concerning Mr. Ebben's suggestion that the heads of the various technical institutions should devote one hour per session to a lecture on "prospects on electrical engineering." This is a noble idea, and would certainly benefit members of the profession, but it would inevitably result in the "falling off" of students from the classes, if the plain truth were spoken. Obviously, it would not be in the principal's interest to give such a lecture. I remember some years ago, a distinguished engineer, Mr. Lloyd Barnes, giving a lecture on the matter at the opening of the session at the Liverpool Technical School, and stating that electrical engineering was the most difficult profession a young man could possibly follow. The effect of this and other remarks resulted in the decrease of over 50 per cent. in attendance at the next lecture, and at the finish of the session there remained only about a dozen students.

But leaving this point and in conclusion, to those of us who have already put "our hands to the plough," and spent some years in studying and acquiring experience, the only means of realising an improvement of our conditions, is, to use the words of Robert Burns: "When freedom, harmony and love unite us in the grand design."

A. C. Black.

Bootle, April 14th, 1913.

**Salaries and Wages.**

Referring to your interesting article on "Salaries and Wages" in the current issue (April 11th), the enclosed details of classification of employment and maximum wages for each grade, which has recently been agreed by the St. Marylebone Borough Council, may be of interest.

The first thing that stands out is the adoption of a minimum rate for men of whatever class. Although there is a maximum fixed for each of the grades, the intention is that a thoroughly competent man who has reached the maximum of his grade shall be transferred to the grade

immediately above, if there is any possible vacancy. In some cases it can be done even if there be no vacancy. It is not intended that each man in each grade shall automatically reach the maximum, and there are no automatic annual increments provided for. An annual recommendation is made to the Electric Supply Committee each year as to the advance in wages which should be given, and each advance directly depends on each man's individual merit. An advantage of this grading is that it gives an intermediate course between an incompetent man and discharge; he can be severely punished by being placed in a lower grade, which punishment will frequently meet the case, whereas if no system of grading were in force, the man would probably be discharged.

This classification, of course, excludes myself and the four heads of departments: Secretary and accountant, generating engineer, mains engineer, and sales manager.

A. Hugh Seabrook,

General Manager.

St. Marylebone Electricity Supply,

April 15th, 1913.

**ST. MARYLEBONE ELECTRIC SUPPLY.**

Approved by Council April 3rd, 1913.

**Salaries and Wages—Classification of Grades for Permanent Employment.**

Grade No.	Maximum wages for unclassified juniors:—	Present No.	Estab-lishment.
1	Up to 16 years of age ... .. 15s.	24	
	Maximum wages for unclassified lads and youths:—		
2	Above 16 and up to 24 ... .. 22s.	9	
	Minimum Wages for Men for whatever Class.		
	25 years of age ... .. 25s.		
	26 years of age ... .. 26s.		
3	27 years of age ... .. 27s.	6	
	28 years of age ... .. 28s.		
	29 years of age ... .. 29s.		
	30 years of age and upwards ... 30s.		
	Minimum Wages for General Employment.		
4	Chief assistants ... £6 0 0	Engineering	6
5	1st class assistants 5 0 0	or	8
6	2nd class assistants 4 0 0	otherwise.	12
7	1st class clerks ... 3 0 0	Applicable	14
8	2nd class clerks ... 2 0 0	to	33
9	3rd class clerks ... 1 0 0	men or women.	10
10	Representatives ... 2 10 0	Plus bonus	14
11	1st class foremen 4 0 0		7
12	2nd class foremen 3 0 0		—
13	Leading hands ... 0 1 0 hr. or prorata wky.		4
14	Draughtsmen ... 3 0 0		1
15	Assist. draughtsmen 1 15 0		1
16	Painters ... 0 0 9 hr.		—
17	Bricklayers ... 0 0 11 "		1
18	Carpenters & joiners 0 0 11½ "		2
19	Wiremen ... 0 0 11 "		12
20	Mates (all classes) 0 0 9 "		14
21	Storekeepers, head 2 10 0		3
22	Storekeepers, assist. 1 15 0		—
23	Handy labourers ... 0 0 8 hr.		16
24	General labourers... 0 0 7 "		22
25	Dynamo and Motor attendants ... 2 0 0		4
26	Switchmen ... 2 10 0		2
27	Battery attendants 1 15 0		2
28	Sub-sta. attendts. 2 10 0		4
29	Drivers ... 2 10 0		5
30	Stokers ... 2 15 0		8
31	Volt regulators ... 1 5 0		—
32	Filters ... 2 10 0		5
33	Meter testers and repairers ... 2 5 0		3
34	Meter readers ... 2 0 0		10
35	Meter collectors ... 2 5 0		1
36	Jointers ... 2 10 0		5
37	Box inspectors ... 1 15 0		3
38	Lamplighters ... 1 7 6 Part time only		25
39	Arc lamp trimmers 1 15 0		2
40	Inspectors... 2 10 0		—

With regard to Grade No. 2, this is designed to deal with employes who have not been specifically placed in one or other of Grades Nos. 4-40. Such cases will be few, and the grade is provided to give a small increase over Grade No. 1 until the employe is sufficiently skilled to pass into one of the other grades.

Grade No. 3 provides a minimum wage, and it provides for every man of 30 years of age in the department receiving a minimum weekly wage of 30s.

L.G.B. Arithmetic.

On page 640 of your last issue (April 18th) Mr. R. H. Hooper is reported to have made the following comments at Coventry :—

“There were just over 2,000 consumers of electrical energy out of a population of 115,000, so that practically one-fiftieth of the population were making a contribution to the relief of rates for the benefit of the others who did not happen to be users . . . .”

“Those gallant 2,000! No wives, children, or households consuming the flashing fluid in order that the remaining 113,000 may live in domestic comfort at the usual average rate of five per family.

The electricity consumers of Coventry are indeed an example to the rest of the country.

Benedict.

Grades Nos. 4-9 relate to sub-heads of departments and the clerical staff, and for these (and No. 10, the representatives) we have laid down a normal establishment, shown in the foregoing schedule, which corresponds with the existing employes who it is proposed should be allotted to these grades. This normal establishment should only be taken as the present figure, but no alteration therein will be made without the Council's knowledge.

For (Grades Nos. 11-40 we do not think it convenient to lay down any fixed establishment in view of the fluctuating nature of some of the work, but the present numbers of each grade are shown on the schedule.

It will be noted that there are some grades (Nos. 11, 16, 22, 31 and 40) to which at present no employes are allotted, but we have thought it well to make provision for employes of these descriptions for the future.

Generally as to increments of wages, we do not, in any case, suggest a fixed increment, as we think the staff should be dealt with every year in the light of the year's working, and given such increments, within the maxima laid down, as may from time to time be thought desirable.

19-20, York Place April 10th, 1913.

Institution of Electrical Engineers.—Election of Council.

Many members of the Institution will, I believe, be disappointed with the Council's nominations to fill the vacancies on the Council. This for two reasons : that the constitution of the Council seems tending to become official rather than commercial; that the Local Sections have insufficient representation.

The renewed interest in the affairs of the Institution which has shown itself since Dr. Ferranti's presidency has been due, I think, to the feeling that the programme of development which he outlined would be followed, and that the Institution would become of real practical assistance to the industry. To this end should we not have a greater proportion of business men on the Council ?

On the present Council the Local Sections have, in addition to their special representatives, Messrs. Dickinson, Faraday Proctor, Pearce and R. K. Morcom. All these gentlemen retire, and the Council's nominees, worthy of the highest honour though they may be, do not represent the provinces in the same direct manner.

The Local Sections want binding closer to headquarters; I believe this can be attained by fuller representation.

W. B. Woodhouse.

Dewsbury, April 15th, 1913.

The Preservation of Telegraph Poles.

We see in your issue of the 18th an article on “Preservation of Telegraph Poles,” and we note that the author now talks of the brittleness of poles which have been creosoted. We do not think that this is a fact, and believe that if anything poles and timber which have been creosoted are stronger than the same unpreserved. We think that any Post Office engineer would bear us out in this contention. Perhaps you have room in your valuable paper to insert this contradiction.

With regard to the decay caused by wet getting inside poles, we can only reiterate what we have previously said, and always recommend users of poles that it is much better for any cutting and boring to be done before the poles are creosoted.

For Richd. Wade, Sons & Co., Ltd.,  
CHRISTOPHER WADE, Managing Director.

Hull, April 21st, 1913.

Electric Laundry Irons.

With reference to the remarks by “Ironical” regarding the above, I think it only fair to manufacturers to mention that my firm have been using electric laundry irons for the past two years. These irons are in constant use, and up to the present have been in every way successful. The flexible wiring has not, even in one instance, been renewed. The writer will be pleased to furnish any further particulars to anyone interested.

J. Martin M. Carr,  
Manager, JOHN BARKER & CO., LTD., Electrical Dept.

Kensington, W., April 22nd, 1913.

[Other communications on this subject will be found in our “Business Notes.”—EDS. ELEC. REV.]

ELECTROSTATIC CAPACITY AND INSULATION RESISTANCE MEASURED BY DIRECT-READING METHODS.

By J. RYMER-JONES.

Capacity test (by charge or discharge).—Employing a scale of 1,000 equal divisions, adjust the slide reading (*s r*) of the universal shunt so that the testing battery gives a throw of exactly 1,000 divisions for 1 microfarad. *E.g.* :—

- If the shunt value *s r* gives 1,000 divisions for 1 mfd. then 754 divs. =  $754/1,000$ , or 0.754 mfd.
- If the shunt value *s r* be reduced to *s r*/10, then 754 divs. =  $754/1,000 \times 10$ , or 7.54 mfd.
- If the shunt value *s r* be reduced to *s r*/100, then 754 divs. =  $754/1,000 \times 100$ , or 75.4 mfd.

Using a Sullivan highly sensitive galvanometer (for use on shore), a shunt value *s r* of 2,928 gave exactly 1,000 divisions from a standard condenser of 1 mfd. (fig. 1).

Substituting a drum of core for the condenser, and retaining the same shunt value (*s r*), a discharge of 611

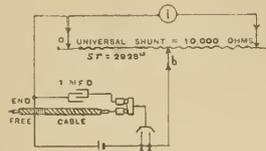


FIG. 1.

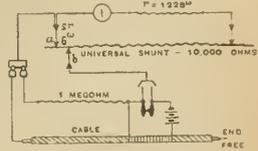


FIG. 2.

divisions given by the cable core therefore represents 611/1,000, or 0.611 mfd.

If it be preferred to get larger throws when the discharge reading is undesirably near to the zero end of the scale, it is simply effected by doubling *s r* or *s r*/10, as the case may be, and dividing the throw by two.

Insulation resistance (by direct deflection method).—The diagram (fig. 3) represents a scale of 1,000 equal divisions, and also the same scale calibrated for resistance. If the galvanometer coil be so shunted that the testing battery, in circuit with one megohm, produces a deflection of 1,000 divisions, then the resistance represented by any other deflection (*d*) will be 1,000/*d* megohms; *e.g.*, a deflection (*d*) of 500 =  $1,000/500 = 2$  megohms.

The resistances corresponding to certain other deflections are given in the diagram by way of a graphic illustration of how the resistance (*R*) is in inverse ratio to the deflection, or  $R = 1,000/d$  megohms. That is to say, *R* is the reciprocal of the deflection multiplied by 1,000. Consequently, the resistance represented by any deflection is obtainable without calculation from Barlow's or other Tables of Reciprocals.

Having, therefore, adjusted the universal shunt reading (*s r*) so that the testing battery gives exactly 1,000 divisions through one megohm, the reciprocal of the deflection from

the cable, when the latter is substituted for the megohm, gives the absolute dielectric resistance  $R$  at any moment after applying the testing battery.

As one division low down the scale represents a much greater difference in the resistance than one division near to the 1,000 end, it is not desirable to read below (say) 200 divisions, *i.e.*, equivalent to 5 megohms when using a shunt value  $s r$ .

The same scale serves for higher resistances by proportionately increasing the shunt values as given below:—

For resistances between megohms	Use shunt reading	Then $R =$
1—5	$s r$	Reciprocal of $d \times 1,000 \times 1$ .
2—10	$2 s r$	" $d \times 1,000 \times 2$ .
10—50	$10 s r$	" $d \times 1,000 \times 10$ .
20—100	$20 s r$	" $d \times 1,000 \times 20$ .
100—500	$100 s r$	" $d \times 1,000 \times 100$ .
200—1,000	$200 s r$	" $d \times 1,000 \times 200$ .
1,000—5,000	$1,000 s r$	" $d \times 1,000 \times 1,000$ .

÷ The equivalent for a deflection of 200 divisions.

It will be noticed that if the deflection  $d$  is near to the 200 divisions when using, say,  $10 s r$ , it will be much higher up the scale when using the next larger shunt value, *viz.*,  $20 s r$ , for testing the same insulation resistance.

Some years ago the writer employed such a scale as that shown in the diagram calibrated for resistance, from which to read directly the absolute  $D R$  values of condensers during manufacture, using different scales and shunts to suit particular limits of resistance.

The avoidance of figuring out results when many condensers had to be tested saved much time, and is easily practicable, because the galvanometer deflection in the factory is quite steady.

The modified *equally divided scale* method explained above is, however, more applicable to *core* and to *cable* testing, especially when a test is affected by *earth currents*, or by

*Adjusting the shunt ( $s r$ ) to give 1,000 divisions through 1 megohm.*—If the galvanometer be very sensitive, necessitating a very low  $s r$  value, a difference of 1 may be excessive; this is easily remedied by using the higher value for  $s r$ , and reducing the resulting deflection to exactly 1,000 by adding resistance ( $r$ ) to the galvanometer coil circuit; *e.g.*, employing a highly sensitive Sullivan galvanometer, a testing battery of 600 volts gave a deflection of about 1,020 divisions when using a universal shunt value ( $s r$ ) of 6; and putting 1,228 ohms in series with the galvanometer coil brought the deflection to exactly 1,000. (Fig. 2.)

Substituting 1.6 N.M. of cable core for the standard megohm, and increasing  $s r$  from 6 to 6,000, *i.e.*, increasing the shunt value 1,000 times, the same testing battery gave—

1st minute ( $d$ ) 854 divs., the reciprocal of which is 0.001171, and the  $D R \dots \dots = 1,171$  meg. abs.  
 Or  $\frac{1,000}{854} \times 1,000 \dots \dots = 1,171$  meg. abs.

When thoroughly discharged and tested by the ordinary method the calculated  $D R$  was as nearly as possible the same.

Long single scale for factory or laboratory.—  
 Distance from galvanometer mirror to scale ... 12 ft. 6 in.  
 Length of 1,000 divisions ... .. 4 ft. 6 1/2 in.

Short double scale for cables subject to earth current disturbances.—  
 Distance from galvanometer mirror to scale ... 3 ft. 6 in.  
 Length of 500 graduations (each representing two divisions)\* ... .. 1 ft. 3 in.

\* The graduation is the same on both sides of zero.

PARLIAMENTARY.

City and South London Railway.

A SELECT COMMITTEE of the House of Lords, of which Lord Sanderson is chairman, commenced the consideration on April 17th of this Bill. The Hon. J. D. Fitzgerald, K.C., appeared for the promoters, and there was a large number of opponents, including the Bank of England and several insurance offices, who were represented by counsel.

The Hon. J. D. FITZGERALD explained that the railway was the pioneer in tube railway construction in this country. At the time it was built, it was thought that a tunnel of a width of 10 ft. 2 in. would be sufficient, but when other tubes came to be constructed the tunnels were made larger in diameter. The chief object of the present Bill was to enable the company to increase the size of the tunnels to that of other tube railways, so as to secure quicker running, a more frequent service, and improved rolling stock. During the morning and evening rush hours the company found great difficulty in accommodating the passengers who wished to travel, and it was that difficulty which had prevented the line being extended beyond its present termini at Clapham Common. The largest number of trains which could be run at present was 24 per hour, which, with five carriages per train, enabled 4,820 passengers to be carried. When, however, the tunnels were enlarged they would be able to put on 40 trains during the hour, each composed of seven carriages, with a seating capacity which would enable nearly three times the present number of passengers to be carried. Counsel went on to explain that under another Bill which would come before the Committee the Charing Cross, Euston and Hampstead Railway Co. were asking for powers to construct a line from their present Camden Town Station to Euston, where it was proposed to connect up with the City and South London line. If that scheme was sanctioned it would be possible to run through trains from Clapham Common in the south, to Highgate, Hampstead and Golder's Green in the north, which would be a very great convenience to the travelling public. Mr. Fitzgerald said he was unable to account for the opposition of the Bank of England and the other City firms, because this was not a proposal to construct a new line. It was a line which had been working for years without doing damage to anyone, and all that was now desired was to slightly enlarge the diameter of the tube. It was proposed to work the line in the same way as other tube railways were worked—by a system of supplying the motive power to the wheels of each carriage, thus getting rid of vibration and dispensing with the use of a locomotive.

Evidence in support of the Bill was given by Mr. ALBERT H. STANLEY, the managing director of the company, and Mr. C. B. STUART-WORTLEY, M.P., the chairman. Mr. Stanley stated that the accommodation which the company was able to offer was very inferior to that which was given by the later tube railways, and the result was that the traffic had shown a falling off of late years. Up to a point the company was fairly successful, and the traffic steadily increased; but some years ago it ceased to expand, and it had since gone back. If they could bring the tunnels up to the

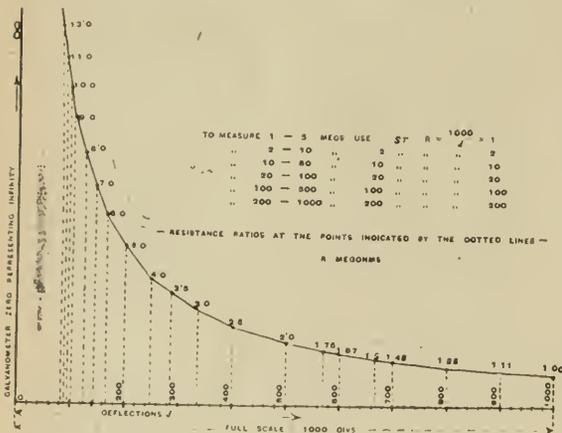


FIG. 3.

Shunt galvanometer by  $s r$  to make the testing current give through 1 megohm a deflection of 1,000 divisions, then resistances for any deflection are obtained direct from a table of reciprocals without calculation.  $R = 1,000/d$  meg.;  $d = 1,000/R$ .

*induced* and *undulating currents*, so disturbing to cable testing in the ship's tanks at sea, and which necessitate *meaning* several excursions.

Moreover, when testing a cable for  $D R$  by the usual *direct-deflection* method, one very important criterion as to its electrical soundness is the regularly decreasing *differences* between *minute* readings, and also the strict comparison between the (say) "negative," "earth," and the subsequently observed "reversed current" readings, according to the usual routine.

It will therefore be obvious that a scale calibrated for resistances is not so suitable for cable testing as an equally divided scale; and as the reciprocal of the observed deflection is obtained from Barlow's Tables, and therefore the  $D R$  value obtained by inspection, the method is practically *direct reading*, in so far as it obviates calculation.

same diameter as the other tube railways, and run similar coaches, he believed the traffic would again increase.

After hearing further evidence in favour of the Bill, the Committee found the preamble proved, but held over the consideration of clauses until they had disposed of the next Bill on their list.

### Metropolitan Railway Bill.

(Concluded from page 636.)

MR. WILLIAM WILLOX, the engineer of the Metropolitan Railway Co., explained the engineering details of the two extensions. The first extension from Moorgate Street to Lothbury was, he said, about 502 yards long, and the two tunnels would be about 54 ft. 6 in. below the surface of the pavement. He had put in a proviso to the effect that they would not deviate upwards to such an extent as to bring the rails within 45 ft. of the surface of the road. It was proposed to construct the tunnels by means of shields with compressed air. They would be 16 ft. in diameter, which was rather larger than the ordinary electric railway tunnels. They did not encroach upon any private property. The length of the extension to link up the line with the Waterloo and City Railway was about 250 yards, and in that case the tunnel would be 12 ft. in diameter.

SIR DOUGLAS FOX also gave evidence in favour of the Bill. He said that he was engineer for the Bill of the Great Northern and City Co., in 1902, and on that occasion he satisfied Parliament that the extension to Lothbury could be safely carried out. Since that time, both engineers and contractors had had a good deal of experience as to the construction of tube railways, and by the use of compressed air he thought they had greatly minimised the possibility of injury along Moorgate Street. He regarded it of very great importance that the compressed-air method of construction should be employed in order to prevent the possibility of damage. In the estimates they had allowed £16,000 for compensation in respect to the Waterloo and City extension and £4,000 for the extension to Lothbury.

MR. C. L. MORGAN, chief engineer of the London, Brighton and South Coast Railway Co., giving evidence in support of the Bill, said that the extensions did not present any engineering difficulties.

Similar evidence was given by Mr. H. Dalrymple-Hay, C.E., Sir A. Stenning, and Mr. J. F. Middleton, a contractor.

MR. G. J. TALBOT, K.C., addressed the Committee on behalf of the petitioners against the Bill, and laid stress upon the fact that at one point the crown of the Central London tube would be only 1 ft. 6 in. below the new line. A very slight subsidence might cause serious consequences to wells, hydraulic lifts and the strong rooms of banks.

After hearing further evidence from a number of property owners who opposed the extensions on the ground that their property would be endangered, the Committee decided that the Bill might proceed so far as the proposal to extend the Great Northern and City line from Moorgate to Lothbury, subject to the conditions laid down in the Act of 1902. They rejected the proposal to give a connection with the City and Waterloo line.

### London Electric Railway Bill.

ON Monday the Committee proceeded to consider the Bill promoted by the London Electric Railway Co., which is opposed by the London County Council and the Hammersmith Corporation.

MR. BALFOUR BROWNE, K.C., in opening the case, said that the Bill sought powers to extend the Great Northern, Brompton and Piccadilly Railway at Hammersmith to a junction near Ravenscourt Park with the Kensington and Richmond branch of the London and South-Western Railway. It further proposed a junction between the Hampstead, Euston and Charing Cross Railway and the City and South London Railway on the widened tunnel. The London County Council wished the Committee to reject Clause 40 of the Bill, which gave the company power to carry out work beneath the public streets without compensation for the removal of the subsoil, the rights of which are vested in the Council. Mr. Balfour Browne said that the promoters were simply giving effect to the ordinary law in the clause which had laid it down that where a company used sub-soil which was at such a depth below the surface of a public street that it was of no practical value to the public, they should not be obliged to pay compensation.

MR. FREEMAN, K.C., said that the position of the London County Council was that the railway would run down Northumberland Avenue and Southampton Row—throughfares which had been improved very largely at the public expense. In such a case, the Council thought it only right that a company wishing to go underneath such throughfares should be compelled to pay the Council something towards the cost of the improvement.

The Committee decided that they would allow the clause to stand, and the preamble of the Bill was declared proved.

**Central London Railway Bill.**—All opposition to the Central London Railway Bill has been withdrawn, and consequently it has been taken from the group down for consideration by Lord Sanderson's Select Committee.

**Richmond (Surrey) Electricity Supply Bill.**—The Standing Orders Committee of the House of Commons has decided that the Standing Orders in the case of the above Bill may be dispensed with, and that the Bill shall be allowed to proceed.

**Leeds Corporation Bill.**—The Standing Orders Committee have decided that the Leeds Corporation may proceed with their Bill, on condition that Tramway No. 6 is struck out.

**Herne Bay Gas and Electricity Bill.**—The Unopposed Bill Committee of the House of Commons has passed the preamble of the above Bill, which, amongst other things, gives power to the Herne Bay Gas and Coke Co. to supply electricity within the Urban District of Herne Bay.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Plexsim Sealing-Wax Heaters.

MESSRS. SIMPLEX CONDUITS, LTD., of 116, Charing Cross Road, W.C., have recently given attention to the development of electrical sealing-wax heaters, which, in view of the outbreaks of fire that have occurred with non-electric types, ought to be very favourably received in factories where much packing in sealed parcels is carried on. Two patterns have been designed, of which we give illustrations herewith.

In the case of the "Plexsim Industrial Pattern," shown in fig. 1, the sealing-wax is placed in the inner receptacle, and is allowed to run over the two slopes at either end, which are also heated to prevent the wax from cooling down: it can be picked up by the

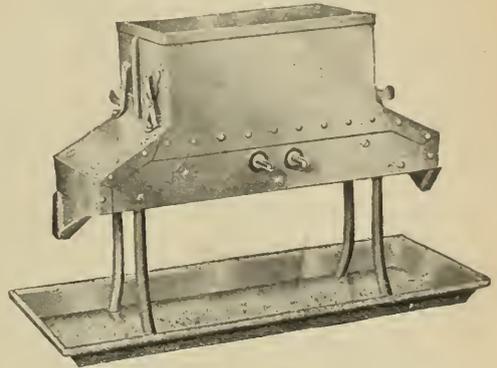


FIG. 1.—PLEXSIM SEALING-WAX HEATER, INDUSTRIAL TYPE.

flaps of the parcels to be sealed. Where it is required to make use of an ordinary seal impress, the wax can be allowed to run down the slopes, which are specially shaped at the bottom to allow it to drop off. The amount flowing out of the central chamber can be accurately regulated by opening or closing the apertures with the small shutters provided. Any excess wax is caught in the



FIG. 2.—PLEXSIM WALL-PATTERN SEALING-WAX HEATER.

tray upon which the heater stands and used again, thereby guarding against waste. The appliance is substantially constructed in black enamelled iron, and being double-ended, allows two persons to work with it at the same time.

The wall pattern, shown in fig. 2, is intended for the use of chemists, and in other trades where a large quantity of small packages require sealing. It is specially suitable for use where the ordinary hand seal impress is used, or where the packages are small and require sealing in a number of different positions. The heater is made suitable for fixing to the wall, and for use with the ordinary sealing-wax supplied in sticks. The latter is pressed on to the heated cast-iron point, which is so shaped as to allow the melted wax to fall off the point in the form of small drops suitable for receiving the impress.

The appliance is solidly constructed, and the heated portions are insulated and ventilated from the base upon which it is mounted, which always remains cool. The heater is ready for use in three or four minutes from switching on. The energy consumption is so low, however, that it may be kept continually in circuit without undue expense, and may be connected to any convenient lampholder.

#### Gate-end Box for Docks and Mines.

The gate-end box which is shown in the accompanying view, fig. 3, and for which the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., are responsible, consists of a standard ironclad switch and fuses, with the usual device for preventing the switch cover being opened with the switch at the "on" position. This switch is interlocked with the plug, to which is connected the flexible cable running to the motor. This interlock refuses admission to the plug with the switch closed, and prevents the plug from being withdrawn with the switch closed. The earthing conductor is brought back from the motor to the plug, and here it is connected to special terminals, which make contact with others in the plug socket. These contacts are so arranged that the first thing done on the insertion of the plug is the completion of the

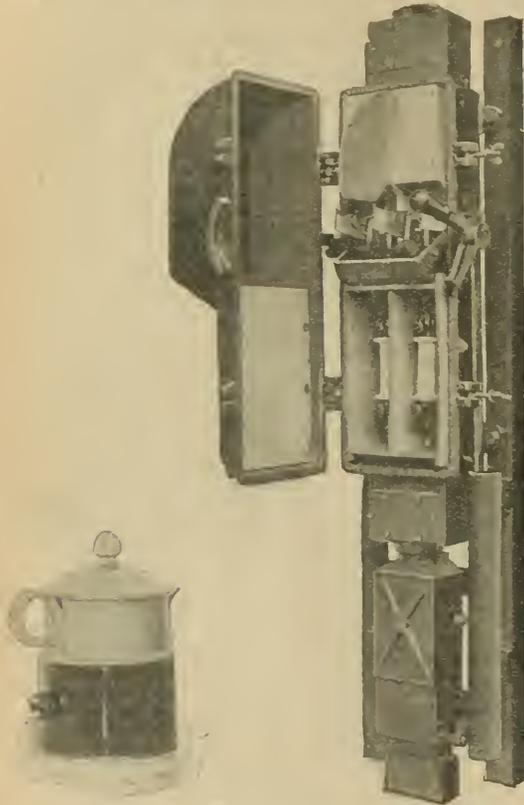


FIG. 4.—STONEWARE BOILING JUG.

FIG. 3.—G.E.C. GATE-END BOX FOR DOCKS AND MINES.

earth circuit, and the last thing on its withdrawal is the breaking of the earth circuit. The result is that the motor can never be under pressure with the earth connection unmade. It will be observed from the illustration that the lower part of the interlocking bar is protected from any blows that might do damage by an iron tube. The interiors of the switch and fuse cases are well protected against arcs, and adequate clearances are given between the fuses and case and between the switch blades and case. It will be remembered that the Home Office has recently called attention to the fact that many switches are defective in this respect.

#### Stoneware Electric Utensils.

A neat novelty has been introduced by MESSRS. BAXTER AND CAUNTER, LTD., of 219, Tottenham Court Road, W., under Hosgood's patents, in the form of a series of stoneware utensils provided with electric heaters, as illustrated in fig. 4, which shows a one-pint boiling jug. The heating element is placed round the lower part of the vessel, and is protected with an insulated metal cover; being in actual contact with the stoneware, it communicates heat to the latter very quickly, and on trial with a two-pint jug we find that less than 10 min. suffices to boil a pint of cold water. The jugs can be used for heating water, milk, beef-tea, &c., or cooking eggs, and a shaving pot is made on similar lines. The socket is adapted for direct connection to an ordinary lampholder. Other patterns are in course of preparation. These utensils are much cheaper than metal ones.

## LEGAL.

SCHLOSS & Co. v. DODD.

IN the City of London Court, on April 17th, before his Honour Judge Rentoul, K.C., an action was brought by Messrs. Louis Schloss & Co., electric lamp manufacturers, 3, Rangoon Street, Crutched Friars, E.C., against Mr. Edward H. Dodd, electric lamp dealer, 11, Old Bond Street, Bath, to recover the sum of £2 4s. for electric lamps supplied. There was no dispute about the order or delivery of the lamps, but the defendant said that they were defective. Judge Rentoul observed that the burden of proving that was on the defendant. When a man received electric lamps and he raised as a defence that they were not fit for the purpose for which they were supplied, he had to prove it.

Defendant said that he tested the lamps when they arrived, and then he wrote to the plaintiffs and told them that they were defective. He first tested three lamps. The filaments went, and the plaintiffs sent him three more which were no better than the others. Then he went through all the lamps and returned the lot to the plaintiffs.

JUDGE RENTOUL pointed out that substituting three others might be an admission that the original ones were wrong, or it might be an endeavour to avoid litigation.

MR. MORLEY, plaintiffs' solicitor, said that the lamps were supplied in November and defendant gave a post-dated cheque to February 10th, which was returned twice marked "Not provided for." No lamps had been exchanged as alleged; others were sent as ordered.

DEFENDANT said he told plaintiffs that he would not meet the cheque as the lamps were defective.

MR. MORLEY said that the lamps had not been returned to the plaintiffs. They were sent back, probably, but were delivered to someone else on the premises. There was no complaint about the lamps being defective until the cheque was stopped.

JUDGE RENTOUL said it would not do for the defendant to keep electric lamps for several months, and then say they were defective. If he had written at once and said that the lamps were wrong, it would be another question. It was not fair to keep lamps, send a cheque, and then say that they were bad.

Defendant said he gave the cheque in February, not in November, as the plaintiffs said.

JUDGE RENTOUL said that the defendant had put himself in the wrong by keeping the lamps as long as he did. There was no complaint for several months.

JUDGE RENTOUL gave judgment for the plaintiffs for the amount claimed, with costs.

#### QUINN v. SUNDERLAND CORPORATION.

AT Sunderland County Court on April 17th, before Judge Bensey, Mrs. Margaret Quinn brought an action against the Sunderland Corporation to recover damages in respect of injuries received while a passenger on one of its tramcars.

MR. MUNDAHL, for the plaintiff, said Mrs. Quinn was 70 years of age. She and her son proceeded to get on to a car, and as she was making an attempt to reach a vacant seat, the vehicle started with a jerk. As a result, Mrs. Quinn was thrown. Her nose and her wrist were broken. The plaintiff claimed £5 for the doctor's bill, £2 9s. for special nourishment and £3 for loss of employment. She also claimed that she was entitled to additional damages for pain and suffering.

JUDGE BONSEY: Your view is that a conductor should not start a car until all the passengers are seated. That is not the general practice.

MR. MUNDAHL: That is so, but a conductor starts a car at his own risk, and he should take special care in the case of elderly and infirm persons.

JUDGE BONSEY said he could not find that the conductor of a tramcar was bound to delay starting his car until all the passengers had seated themselves at their own pleasure. The only obligation on him was to give reasonable time for them to be seated and if they were not seated then it was at their own risk. He was convinced that in this case the conductor had led the lady to a seat, and had given her reasonable time to sit down, but she did not take advantage of the time given her. He, therefore, gave judgment for the defendants.

A formal order for costs was made, but it was understood that it would not be enforced.

#### ACTION AGAINST DUNDEE CORPORATION.

THE record has been closed in the Sheriff Court in an action at the instance of a motor lorry company against the Corporation. It is alleged by pursuers that a lorry belonging to them fell through an improvised roadway, which had been opened up by the Town Council, for the purpose of laying an electric cable. They claim £50 as damages.

#### SENTENCE FOR STEALING.

AN extraordinary series of thefts from the Glasgow Corporation's tramcar building and repairing works at Coplawhill, extending over a period of six years, was disclosed in the Sheriff Court on Thursday, last week, when a foreman electrician, James Pollock, was charged. Accused pleaded guilty to having, between January 1st, 1907, and February 25th, 1913, stolen 2 tons of armature coil

copper wire, 6 cwt. of copper commutator bars, 9 cwt. of block tin, and 25 miles of insulated copper wire, valued at about £800. Pollock had been in the service of the Corporation for 15 years, and had a wage of £3 per week. Unfortunately he had fallen into bad company, and, to increase his means, had sold those articles belonging to the department.

SHERIFF BOYD, in passing sentence of six months' imprisonment with hard labour, said that while this might be the first charge brought against the accused, it was a very serious one.

#### NATIONAL TELEPHONE ARBITRATION: QUESTION OF COSTS.

BEFORE the Railway and Canal Commission (Mr. Justice A. T. Lawrence, the Hon. A. E. Gathorne-Hardy and Sir James Woodhouse) was mentioned on Monday last the case of the National Telephone Co., Ltd., *v.* His Majesty's Postmaster-General.

SIR ALFRED CRIPPS, K.C., on behalf of the company, asked that the taxation of costs might be on the higher scale. His Lordship, he said, had not expressly mentioned that it should be, but it was usual to allow higher scale costs in exceptional cases, and he thought he might say this was an exceptional case. He did not know what attitude the Attorney-General would take, but all parties were desirous that the taxation should go on.

The ATTORNEY-GENERAL (Sir Rufus Isaacs, K.C.) said he did not desire to question the costs being given on the higher scale. It was a question entirely for his Lordship and he, therefore, did not desire to put forward any argument. His Lordship knew all about the case, and anything that was reasonable and right they were prepared to do. They did not want to pay more, and at the same time they did not want to pay less than his Lordship should think was reasonable and right.

His LORDSHIP, after consultation with the other commissioner, said that they thought the taxation ought to be on the higher scale.

SIR ALFRED said he was obliged to his Lordship, and under these circumstances the matter could go forward.

#### SOLOMON *v.* WELLS, RAYNER & CO., LTD.

ON Saturday last, in the King's Bench Division, before Mr. Justice Rowlatt, an action was brought against defendants, electrical engineers, of Paddington Street, W., by Mr. David Carvalho Solomon, who was formerly in their employ.

MR. R. P. G. JOHNSON, on behalf of plaintiff, stated that his client sought to recover £126 8s. 6d., for commission due and payable under an agreement dated March 25th, 1912, by which defendants agreed to pay Mr. Solomon a commission of 2½ per cent. on defendants' turnover in their electrical business above £4,000, for a period from January 1st, 1912, to December 31st, 1912, including net cost of work in hand at December 31st, 1912, such commission to be payable before January 31st, 1913. Defendants had paid into Court and admitted liability of £99 1s. 10d. out of the £126 8s. 6d. The position was, explained counsel, that the defendant company, which he understood was a private company, carried on business as dealers in electrical supplies. In May, 1911, plaintiff entered their employment when something was said about giving plaintiff an interest in the business, and it was agreed that he should receive besides his salary, a commission on the turnover above £4,000. It was explained to Mr. Solomon that the business was carried on in such a way that until they had a turnover of £4,000, there would be no profit accruing. Mr. McClelland, the chief shareholder and managing director of the business, told plaintiff what the amount of business was for the current year up to that time, but explained that they expected to double it during 1912, and said that the £4,000 had already been reached during the first three months of that year. There was also some mention of a large country job in particular, the order for which had been given in 1911, and upon those representations, Mr. Solomon himself drew up a form of agreement, but although Mr. McClelland objected, he signed it substantially in the form in which plaintiff had drawn it up, by which plaintiff was to receive £2 a week and 2½ per cent. on the turnover over £4,000, including net cost of work in hand at December 31st, 1912. Nothing further came of the matter until a day or two before the agreement ran out, when Mr. McClelland asked plaintiff whether he felt he was entitled to commission on 1911 orders.

His LORDSHIP: The whole question is the application of the word "turnover."

MR. JOHNSON agreed, and said the trouble was as to the work remaining unfinished at the end of 1911.

MR. CUMBER, on behalf of the defendant company, said that the plaintiff knew when he entered into the agreement, exactly what was intended by the word "turnover," and he was now trying to introduce into the agreement something which it was never agreed between the parties should be in it. The balance-sheet was produced to plaintiff at the time, and the method that was adopted for arriving at the turnover on which the commission should be based was quite usual.

After hearing evidence on both sides and considerable legal argument, his LORDSHIP said he saw so many reasons for deciding in favour of both sides, that he would consider his judgment.

On Monday MR. JUSTICE ROWLATT delivered judgment. He said that the point in dispute merely involved the construction of a document, but the evidence and arguments made it necessary that he should carefully consider the decision to which he had come. The plaintiff made an agreement with the defendants, a firm of electrical engineers, to serve them for a year, and they agreed to pay him a commission of 2½ per cent.

The defendants had put forward accounts for the purpose of calculating the commission showing the full amount of the invoices rendered during the year, and added to that was the net cost of the work in hand. There was no dispute as to those figures, but they had deducted the net cost of work in hand at the beginning of the year, which it was said they had no right to do. The plaintiff contended that the turnover of the company meant the amount of the invoices rendered during the year. He said that if the turnover was to be taken as involving the exclusion of work unfinished at the beginning of the year then the clause which said "including work in hand in December, 1912" was of no effect at all. He said that in order to give meaning to those words, they must adopt his construction that the word "including" meant in addition to. Of course the more accurate turnover was the actual work done in the year, which involved the exclusion of the beginning part. On the other hand, the defendants said that the plaintiff was paid by salary up to December 31st, 1911, and was not paid by commission at all, and that he, therefore, had no interest in work being done up to that time. When they came to the following year the contract was that he was to be paid by commission on the business of the company for the period during which he engaged himself to serve under the agreement. He (the judge) had come to the conclusion that the defendants were right. He thought that the governing consideration actually was that the plaintiff was going to serve for a year, and that he was to be paid by commission on the volume of business done during that period only, and not something more. He had had his salary up to the end of the preceding year. The best construction his Lordship could put upon the agreement was that it was to be assumed that he was not to be paid commission during the period he was being paid by salary. He, therefore, gave judgment for the defendants, with costs. Judgment was entered accordingly.

#### IMPORTANT APPEAL CASE *re* FACTORY ACTS.

AT the Middlesex Sessions, held at Caxton House, Westminster, on Monday, before Mr. Montagu Sharp and a bench of magistrates, the appeal of the North Metropolitan Electric Power Co., Ltd., was heard against two convictions on June 26th, 1912, by the Highgate Magistrates for committing breaches of Rules 18 (d) and 28 of the Home Office Regulations regarding the generation, transformation and use of electricity in factories and workshops.

Mr. Bodkin appeared for the appellants, and Mr. J. Hunter Gray and Mr. Boyd for the respondents.

MR. GRAY said the appeal was with respect to two convictions, but it would be convenient to take them together. The convictions were for failing to comply with certain regulations which were issued under the Factory Acts of 1901 and 1907 to govern the proper protection of electric supply companies' works. The drawing he had put before the Court was the Finchley sub-station, which was supplied with electrical energy from the main station at a very high voltage. Energy was supplied by this sub-station to the Metropolitan Tramways Co. for the purpose of driving their tramways and lighting them, and for some other subsidiary work. In the room of which he produced the drawing the voltage was 10,000 volts. It was not necessary that each conductor should be of 10,000 volts, and they were agreed that the voltage which was exposed in the case they were considering was something like 6,000, and strict precautions had to be taken to prevent anyone coming in contact with a conductor carrying such high voltage, especially as, unlike other sources of danger, one could not see that the danger was there. The result of the alleged failure on the part of the appellants was that a man was killed. Counsel proceeded to direct the attention of the Bench to the drawing of the room, and pointed out the cable coming in from the main station bringing in electrical energy at 10,000 volts. There was also an X on the drawing, which showed a porcelain tube. It was at this point that a part of the conductor was bare, and it was at this point that the young man who was killed came in contact with the conductor. The workman who was killed, whose name was Arthur Shapcot, had the duty of cleaning certain parts of the machinery, and on March 25th, 1912, during the night he was cleaning the part just above the bus-bars. There were three inverted troughs, and above that were the pressure limit resistances. A great deal of dust got on to these, and therefore it was necessary for them to be kept constantly clean. The young man was told to clean these pressure limit resistances, and in order to do that he had to get up from the floor, because the height of the pressure limit was about 10 ft. from the ground. He appeared to have got on to the right-hand oil switch cell, and from that position to have dusted part of these resistances. Then by some means or other, he appeared to have gone over to the left-hand oil switch cell, so as to finish the cleaning of the resistances from that side. Unfortunately, while he was there his left wrist appeared to have come into contact with the bare conductor at the part marked X on the drawing, and he received the whole 6,000 volts and was killed. He submitted that the purpose of the rules of the Home Office was clearly to provide against accidents of this kind, and what the legislature had done, and what had been found in practice to be the necessary thing, was that persons who had to do with such apparatus, should make the whole of the room dead. In this case the particular part of the room where the young man was working was dead, but unless the adjoining parts of the apparatus were also dead there was still danger and liability to accident. Therefore there was an alternative provision made in the regulations as if they only cut off sections of the room they had to properly screen off the adjoining parts so that accidents might be avoided. The contention of the prosecution was that the part marked X should

have been properly screened off so that the young man in going on to the left-hand oil switch for the purpose of cleaning could not, under any circumstances, have come into contact with the bare metal. Substantially that was the whole case. Rule 28 read: "(28) No person except an authorised person or a competent person acting under his immediate supervision, shall undertake any work where technical knowledge or experience is required in order adequately to avoid danger; and no person shall work alone in any case in which the Secretary of State directs that he shall not. No person except an authorised person or a competent person over 21 years of age acting under his immediate supervision, shall undertake any repair, alteration, extension, cleaning or such work where technical knowledge or experience is required, in order to avoid danger, and no one shall do such work unaccompanied." On the night in question, the young man was accompanied by his superior, Thomas Styles, and the contention of the prosecution was that he was neither an authorised person nor a competent person over 21 years of age. To see what an authorised person was they had to look at the definition, and it was there laid down:—"Authorised person" means (a) the occupier, or (b) a contractor for the time being under contract with the employer, or (c) a person employed, appointed, or selected by the occupier, or by a contractor as aforesaid, to carry out certain duties incidental to the generation, transformation, distribution, or use of electrical energy, such occupier, contractor or person being a person who is competent for the purposes of the regulation in which the term is used." Whether this young man was competent as defined by the regulations was of course a matter of opinion, but, *prima facie*, he would say that the very fact of his being killed was to some extent evidence that he was not competent.

THOMAS GEO. STYLES said he was 26 years of age, and was at the Finchley sub-station. He remembered the accident to Shapcot, who was his assistant. Witness was in charge of the room in which the accident took place. Shapcot was on duty on the night in question, and was instructed to clean the pressure limits. Witness was standing on the platform higher up than the deceased. At the time of the accident the bus-bars on the left-hand were completely dead. He saw a great flare where Shapcot was standing, and went to him, and found that something was wrong and called assistance, and it was found he was dead. The only mark he saw was on the deceased's wrist. The deceased had a piece of white rag in his hand, and was dusting the resistances. He did not know how the deceased got where he was. The union just inside the insulator was bare.

In cross-examination, witness said he gave evidence at the inquest on Shapcot, and the jury exonerated him from all blame. He had been over six years in the employ of the company. He started at the Finchley sub-station, and was under Mr. Hunt, the sub-station engineer in charge. He was promoted to be charge attendant. Before being promoted, Mr. Hunt observed his work, and questioned him from time to time. The cleaning was carried out once a week by different shifts. The work was done at night, and it came to the return of each shift once in the week. Shapcot had worked five or six times with him, and had done the very work they were doing when the accident happened. Shapcot was an active man, and was very keen on his work. He understood deceased had had three terms technical instruction at the Tottenham Institute. He found the deceased very competent. He knew under the regulations that he would not be allowed to work if incompetent, and there had been nothing to make him regard Shapcot as anything but a perfectly efficient assistant. On the night in question he told the deceased to do his work. Deceased used the same ladder as he did to get to do the right-hand oil cells, and when he got there he was in his accustomed place for doing the work where he had been on previous occasions. The oil or brick cells were about 6 ft. high. From the position in which the deceased usually stood he could by stretching have done all the work required. He would of course have either to straddle over or crawl under certain cables.

Counsel, by means of the model, took the witness over the position occupied by the deceased on the night in question, and witness pointed out the cables which were dead. There were various positions in which the deceased could have done the work, and witness would have had no hesitation in climbing anywhere about on the right-hand side. The bus-bars on the No. 1 side that night were disconnected. From the time he saw the deceased doing his work to the time he saw the arc, and knew there was trouble, was hardly any time. He dropped his screwdriver, and, after stooping to pick it up, he saw the deceased on the other side of the passage, and saw the arc. Counsel took witness through a list of a number of other duties carried out by deceased, with the object of proving that he was possessed of very considerable technical knowledge and skill. Had he questioned the deceased on whether the different apparatus in the room were live or dead he could have told him. From his knowledge of the place, the deceased ought not to have been on the left-hand side at all, and there was no necessity for him to be there for the purpose of doing the work he had to do. His belief was that the deceased did not touch the bare spot at all, but a part of the insulation just as it emerged from the porcelain cover.

THE CHAIRMAN: Which means that the insulation was defective?—Witness said he thought the deceased caught hold of it to steady himself, and the insulation was not strong enough.

In re-examination, Witness said the deceased would not often go into the high-tension room. He would go into it every shift, and if anything were wrong would call witness. The room where the accident took place was the most dangerous in the station. It was not possible, standing on the oil switch on the right, to clean the whole of the bus-bars. Witness would not have stood on the left-hand oil switch. He believed that deceased fully understood the danger

of 10,000 volts. He saw the deceased get on to the left side in the previous week, but on that occasion that side was dead.

MR. G. SCOTT RAM, H.M. Inspector for the Home Office, said he had to visit electrical stations to see that the regulations were complied with, and he went to the Finchley sub-station after the accident.

MR. GRAY was proceeding to put it to witness to say what provision might have been made in the station to prevent the action, when MR. BODKIN objected, and pointed out that the question was whether the particular regulations had been contravened or not. These regulations had the force of an Act of Parliament, and it was no part of the duty of a gentleman, however expert, to put his interpretation upon any section.

MR. GRAY: If the isolating switch had been open could this accident have occurred at the place where it did occur?—It could not.

If the isolation switch had been closed and a screen had been placed round the current transformer, could that accident have happened?—No.

Speaking as a practical man, is there any practical difficulty in any of these methods of avoiding accidents?—None whatever.

MR. GRAY: Supposing the isolating switch were on, and there were no screens, is there any other way of rendering the whole of that room dead?—The cable might have been made dead from the far end.

THE CHAIRMAN: Then that is a third alternative?—Yes. It would be some miles away at the next sub-station.

THE CHAIRMAN: But that would be impracticable?—It is very often done by telephoning to the other station.

MR. GRAY: That would not have stopped the working?—No; if the other feeder could have gone on.

Answering further questions put by MR. GRAY, witness said that, in his opinion, the easiest way to have cleaned the pressure-limit resistance would be first to clean one side, standing on top of the right-hand cell, as Shapcot did, and then it would be the easiest thing to clean from the other side. He did not consider there was any difficulty of a person getting across from one side of the passage to the other. If a person went to the top of the bus-bars to clean, there was nothing to prevent him from coming down on the other side on to the left-hand cell.

Cross-examined by MR. BODKIN, witness said it was easy to get across from the right-hand series of cells to the left-hand. He admitted it was a distance of at least 2 ft. 6 in., and that a man would have to bend down to make himself 3 ft. 2 in.

MR. BODKIN: Active official as you are, could you reduce your height to 3 ft. 2 in. and then step across 2 ft. 6 in.?—Witness said that the same questions were put to him at the Police Court, and he gave the opinion that a man could get across. He had been to the station since then, and saw an engineer do it.

Replying to the CHAIRMAN, witness said he had not been to this particular station before the accident, but he had been to other stations of the same company. The station was visited by other inspectors. The station had been going on for many years, and he believed it had been inspected.

If this is so, how is it that the Home Office has not pointed out this defect?—It is not the duty of the Home Office to point out all defects. The duty of complying with the regulations is upon the occupier.

How can they say whether the regulations are complied with if they are not aware of the defect?—It is their duty to be aware.

Then why is not this pointed out? I want to be perfectly fair. Here is a Government department supposed to overlook buildings. This has gone on for some years, and then there is an accident, and the Home Office say: "Why is not this done?" If the Home Office officials did their work properly they would have detected this dangerous spot?—It is a regulation dealing with special work and repairs, and extensions. The Home Office official might go to that building once a week and never catch them at this particular cleaning work. This regulation requires that certain things are to be done when you do certain work, but you might go a hundred times and not see that work done.

But the inspector would know when it was cleaned; certain men would have to be in certain positions?—He would know certain things ought to be done when it was cleaned, but it is no matter to the inspector what they do if they make it safe in accordance with the regulations. If the switch had been off everything would have been safe and the regulations would have been complied with, but they did not do that. They chose to have another method, and in choosing that they did not make the proper provision.

How is it that the Home Office, with all this inspection, did not foresee these things, and point out to the officials the chance of a possible accident? You are the expert?—We told them in the regulations that when anything has to be done on the switchboard they shall do either of two things, and they have done neither. It is impossible for the Home Office to send inspectors out to see to these, as they do not know when the work is to be done.

This closed the case for the respondents.

(To be continued.)

We shall complete our report of the hearing in our next issue, but the result may now be given.

THE CHAIRMAN said the Bench were unanimous in their decision. As regarded the conviction under Regulation 18, they were of opinion that the appellants should have opened the switch, which would reduce that point of danger. Therefore, in that case, they thought the appeal must be dismissed, but that the penalty should be reduced to £10 10s. With regard to the conviction under Regulation 28, they were of opinion that within the technical meaning of the regulation Shapcot was an authorised person, and in that case the appeal was allowed. They made no order as to costs.

**BUSINESS NOTES.**

**Electric Clocks at the Ghent Exhibition.**—We are informed that among the many interesting things shown at I.L.M. Post Office exhibit at Ghent Exhibition, which is to be opened this week, is an installation of electric clocks made by the SILENT ELECTRIC CLOCK CO., LTD., of London. In the centre of the Stand is a hanging clock with four faces, while other smaller clocks are placed elsewhere—the whole installation being controlled from one master clock. These clocks are of the standard pattern as supplied to I.L.M. Post Office, for which department the Silent Co. have carried out, and are now carrying out, many important electric clock installations. The main feature of this company's system lies in the "rotary armature" dial mechanism invented by Mr. G. B. Bowell.

**Electric Laundry Irons.**—Referring to the letter of "Ironical," in our issue of the 11th inst., Mr. G. Maurice, manager of the fixture and heating departments of the G.E.C., agrees that the writer's remarks would have been fully justified up to quite recently. The GENERAL ELECTRIC CO., however, has recently placed upon the market a "Magnet" electric laundry iron, which will do away with most of the objections raised by our correspondent to this class of electric-heating apparatus, and to demonstrate the progress made in this class of goods, the company would have much pleasure in submitting to "Ironical" a sample of these "Magnet" laundry irons to test.

Referring to the same correspondence, MESSRS. SIMPLEX CONDUIITS, LTD., inform us that they have supplied a large number of their "Service" type iron. This iron was described in our issue of April 5th, 1912, and is provided with special means of protecting the connector and with a revolving connection box, which takes up any twisting of the connecting wires when the iron is in use, preventing the frequent failures attributable to this cause. They send us an interesting report from the chief engineer of Dundee regarding a number of these irons in use at the laundry attached to the King's Cross Hospital at Dundee, which is worth reproduction, as showing the economy of electric irons:—

Weight of irons in use: Two 8½-lb., one 12-lb.

Date.	Material Ironed.	No. of workers.
Monday, Feb. 17th, 1913...	21 pieces of flannel; 27 unstarched dresses.	1
Tuesday ... ..	40 pieces body linen ...	
Wednesday ... ..	150 aprons ... ..	2
Thursday ... ..	Collars, cuffs, belts, ties, caps, small pieces of finery and 130 bibs of aprons.	2
Friday ... ..	16 starched dresses and petticoats	

Units used for week, 42; at 1d. = 3s. 6d.

Coal previously used, 3s. 6d. Net saving for week, 2s.

Date.	Material Ironed.	No. of workers.
Monday, Feb. 24th, 1913...	24 unstarched dresses ...	1
Tuesday ... ..	27 pairs of flannel 38 underclothing	1
Wednesday... ..	147 aprons ... ..	
Thursday ... ..	432 articles ... ..	2
Friday ... ..	14 starched dresses and small finery	1

Units used for week, 58; at 1d. = 4s. 10d.

Coal previously used, value 6s. 6d. Net saving per week, 1s. 8d.

The workers state that the irons are eminently satisfactory, as, owing to the fact that the irons are always ready, the time taken to do the work in hand is very much lessened; also the comfort, compared with the awful heat experienced before, is unique. The management have since gone in for a glossing iron for the collars and cuffs, which now does away with the old coal stove entirely.

**Siemens on Parade.**—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, obtained both a first and second prize at the London Van Horse Parade in Regent's Park. As many of our readers are aware, the firm's delivery vans are used for displaying their well-known posters.

**New Zealand's Electrical Manufactures.**—From the report of the industrial census of New Zealand taken in 1911, which has lately been issued, it appears that the value of the productions of the electrical engineering concerns in the Dominion in that year amounted to £69,673.

**Book Notices.**—*Chronique Illustrée du Concours International de Télégraphie Pratique.* Turin, 1911. Milan: from the Author. Price 20 fr.—This really magnificent souvenir of the 1911 competitions at Turin, prepared by Sig. F. Geronimi, constitutes a complete record of the organisation, execution, and consummation of the noteworthy event, which took place during the run of the Exhibition at Turin. Most ample information is given regarding the arrangements that were made, and the volume is replete with photographic illustrations, many of which are very beautiful. A full account is also given of the proceedings at Como in honour of Volta, and of the celebrations at Milan, followed by a chronicle of the closing visit to Rome, and much other matter. Unfortunately, there was only one British competitor on this occasion, so that the results of the trials are of little interest to this country; but the

work as a whole will be invaluable when the organization of a similar international competition is under consideration, and we must express our admiration of the manner in which this volume has been written, illustrated, printed and bound.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXII, No. 1. April, 1913. New York: The Institute. Price \$1.00.

"Transactions of the Institution of Engineers and Shipbuilders in Scotland." Part VI, 1912-13. Glasgow: The Institution.

"Descrizione una Macchinetta Electro-Magnetica." By Dr. Antonia Pacinotti. Milan: Associazione Elettrotecnica Italiana.

"Transactions of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXIX Part 5. April, 1913. Newcastle-on-Tyne: The Institution. Price 6s.

"Journal of the Franklin Institute." Vol. CLXXV, No. 4. April, 1913. Philadelphia, Pa.: The Institute. Price 50 cents.

"Journal of the Roatgen Society." Vol. IX, No. 45. April 1913. London: Smith & Ebbis, Ltd. Price 4s. net.

**French Electrical Imports.**—The value of the dynamo-electric machinery imported into France last year amounted to only £371,920, as compared with £378,640 in 1911. On the other hand, the imports of electrical and electrotechnical apparatus increased in value from £571,200 to £671,600.

**Bankruptcy Proceedings.**—SAMUEL SMITH (trading as Smith & Sons), 22A, 24 and 26, Victoria Square, Widnes, Lancaster, electrical engineer, &c.—The adjourned public examination of the above-named debtor was held at the Court House, Government Buildings, Victoria Street, Liverpool, last Monday. It was reported that there had been disputes between the debtor and his sons as to the conduct of the business, and a deed of assignment was executed, but later, finding himself in difficulties, debtor filed his petition. There had, in the meantime, been a proposal to convert the business into a company, but the matter had fallen through. The Official Receiver stated that the deed of assignment was executed about seven months before the date of the petition, and that the deed became operative. He (debtor) filed a statement showing an estimated surplus of £750. In regard to the assets the debtor stated that £750 was the surplus if the estate had been realised promptly and properly, but he did not think there would be that amount of surplus now. Under those circumstances, the accounts would have to be amended. Subject to the accounts being amended, the examination was closed.

**Liquidations.**—THE GILBERT ARC LAMP CO., LTD.—Creditors must send particulars of their debts, &c., to Mr. W. A. Henderson, 3, Fenchurch Street, E.C., the liquidator, by May 15th.

BERRY CONSTRUCTION CO., LTD.—A meeting is called for May 22nd at 29A, Charing Cross Road, W.C., to hear an account of the winding-up from the liquidator, Mr. J. C. Wrist.

ACOUSTIC PATENTS, LTD., 353, Oxford Street, London, W.—Date of release of liquidator, April 10th.

**Patent Application.**—Application has been made for the restoration of Patent No. 22,819 of 1908, granted to Thomas John Murday for "Improvements in Primary Electric Clocks."

**Safety Lamp Approved.**—The *London Gazette* contains notice of approval by the Home Office, of the Gray-Sussmann electric safety lamps, Nos. 3 and 4, for use in all mines covered by the Coal Mines Act, 1911.

**For Sale.**—MESSRS. P. HUSTLETON & Co. will, on May 1st, sell by auction, at Dalling Road, Hammersmith, a large quantity of electrical apparatus. See our advertisement pages in this issue.

**Trade Announcements.**—Arrangements have been completed for the continuance of the old-established business of John Musgrave & Sons, Ltd., by a new company with a cash capital of £80,000, which was duly registered on March 12th. Such new company, in addition to acquiring the assets of the old company, has purchased the goodwill and patterns of the business of Messrs. J. & E. Wood, engineers, of Bolton, and Mr. Henry Wood will act as a director. The name of the new firm is JOHN MUSGRAVE & SONS (1913), LTD., and its address Globe Ironworks, Bolton. It is stated that the new capital introduced into the concern is ample for its requirements.

MESSRS. J. PRICE & SON, electricians, &c., have opened new premises at 113, Bedford Road, Rock Ferry, near Birkenhead.

MESSRS. MARSH, SON & Co., dealers in electrical fittings, are relinquishing their depot at 11, Upper Priory, Birmingham.

MESSRS. H. W. BUTLER & Co., of Craven House, Kingsway, W.C., have been appointed agents for London and district for Messrs. James MacIntyre & Co., Ltd., of Burslem, makers of electrical porcelain.

**Catalogues and Lists.**—MESSRS. C. E. LUGARD & Co., Chester.—Illustrated pamphlet of 28 pages, fully detailing and showing by means of half-tunes and line diagrams, the Vulkan drive applied to several makes of planing machines—the Vulkan reversing electro-magnetic clutch and the automatic reversing switch.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., Tyssen Street Dalston, N.E.—Eight-page booklet, giving full particulars of their series system of h.c.p. illumination, as at present applied to street lighting by the Brighton Corporation. It is claimed for the Brighton system that low-voltage h.c.p. "Wotan" lamps can be used for replacing series arc lamps, with a considerable reduction in working and maintenance costs. The existing wiring can be employed and the same substitutional resistances.

THE ELECTRICAL CO., LTD., Charing Cross Road, W.C.—April stock list of A.C. and C.C. motors, kinematograph sets, &c.

**Messrs. Petters, Ltd.**, 63, Queen Victoria Street, London, E.C.—New 16-page catalogue, with excellent art coloured pictures, giving description, specification, results of tests, &c., of the Petter patent semi-Diesel crude oil engines.

**The General Electric Co., Ltd.**, 67, Queen Victoria Street, London, E.C.—Publication No. 1,862 (eight pages), containing fully-illustrated particulars and prices of the "Magio" suction cleaner, the "Little Briton," "Rapid," "Express," and "Turbine" vacuum cleaners, and attachments for use with them.

**Messrs. Verity, Ltd.**, King Street, Covent Garden, London, W.C.—New publication No. 751, contains some illustrated information concerning the "Aston" totally-enclosed and ventilated type motors, ranging from  $\frac{1}{2}$  to 80 H.P. Tabular particulars are given for such motors for voltages ranging from 110 to 500 volts.

**Messrs. Scholey & Co., Ltd.**, 151, Queen Victoria Street, London, E.C.—Small pocket pamphlet, entitled "The 'Leakage' at your Lift—have you Noticed It?" in which the waste occurring in hydraulic installations is alluded to and the merits of the Graham electric lift are summarised.

## LIGHTING and POWER NOTES.

**Acton.**—The U.D.C. has requested the Metropolitan Electric Supply Co., Ltd., to submit an estimate for the lighting of the public baths, library, and Council offices, and also for supplying electricity for power for the artesian well and other purposes at the public baths.

**Argentina.**—The Compania Alemana Transatlantica de Electricidad is making active propaganda in connection with the use of articles of domestic use, such as kettles, irons, toasters, heaters, &c., which have not yet to any great extent been adopted in Buenos Ayres.

So as to meet the increased service in Concepcion del Uruguay, the Anglo-Argentine Electricity Co. will shortly commence the construction of a new power house, plans of which have already been approved.—*Review of the River Plate.*

**Ayrshire.**—Two new pits which have been put down near Dreghorn by Messrs. Wm. Baird & Co., are to be equipped with modern electric plant, including electric motors for winding.

**Bingley (near Keighley).**—The U.D.C. proposes to erect an electricity sub-station upon a portion of the market site.

**Birkenhead.**—At a meeting of the T.C., Alderman T. S. Deakin, in presenting the estimates for the year, said the Electricity Committee had come forward with a contribution of £2,000, which was £500 above that included in the estimates for the year 1912-13. In addition to this, the Committee believed that it would be able to increase the renewals fund by over £2,000, which would raise that fund to somewhere about 8 per cent. of the total capital outlay. The Tramways Committee's traffic receipts showed a considerable increase, the figures for 1912-13 being practically £2,000 above those for 1911-12, and some £1,700 in excess of the estimated income. It expected to do even better in this respect during the present year, and to be able at its close to swell the renewals fund by £2,100. This was essential owing to the necessity of providing funds for the renewal of the tracks, which work would probably have to be faced in the near future. At March 31st the fund amounted to not more than £14,000, which was rather less than 4 per cent. of the amount expended on capital account—none too big a reserve when bearing in mind that the undertaking would not be freed from debt for a further 16 years. In the discussion which followed, Mr. D. J. Clarke said that the total capital expenditure of the Electricity Committee was £176,797, and the outstanding debt £131,017; therefore, the Committee had paid back £45,000, and it had a reserve fund of £10,063.

**Blackburn.**—At a meeting of the Corporation Electricity Committee, on Monday evening, Mr. P. P. Wheelwright, electrical engineer, submitted his scheme for erecting and equipping a new electrical station at Greenbank, at a cost of £75,800. This was adopted after discussion. The new premises are not intended to supersede the present establishment in Jubilee Street, where new machinery has just been installed, but rather to act as an adjunct to it. The demand for power is gradually increasing, owing to its more general adoption for houses and for mills and factories. Mr. Wheelwright says that what is required is an increase in productive power to enable the department to keep ahead of the demands, and not to have to refuse customers in the future. It is true that the present plant is not yet fully loaded up, but it must be borne in mind that a long period after the adoption of a scheme must elapse before the new station can be erected and completed ready to give a supply of energy. The new station is proposed to accommodate about 10,000 kw. of plant.

**Bridlington.**—A L.G.B. inquiry has been held into the application of the Council to borrow £5,000 for the purposes of the electrical undertaking. The electrical engineer (Mr. A. J. Beckett) stated that the demand for current was greater at the present time than it had ever been in the past, and it was likely that further application would have to be made for another loan for mains and services, amounting to £3,500. The profit made at the works since they were opened was about £2,784, and there was a small reserve

fund. The £5,000 included £2,905 for generator; £420 for pipes, &c.; £220 for switchboard; £100 for contingencies; £500 for new pipes and extensions; and £200 for air filter and foundations. The total amount borrowed for the electrical undertaking was £47,125, of which £46,746 had been expended up to March 31st.

**Bristol.**—To the annual report of the Bristol Chamber of Commerce about to be issued for consideration at the meeting of this organisation on May 22nd, an interesting report is contributed with regard to the Corporation electrical supply. An optimistic tone characterises the statement, in which the following occurs:—

"Progress by the Bristol Electricity Department has been most marked during the year. The net number of new consumers added to the books was 357, being the highest number recorded since the inception of the undertaking, and comparing most favourably with the increase of 62 new consumers in 1911, which year itself was a very good one. The additions to the system in the equivalent of lamps of 30 watts, equalled 51,576, as compared with 22,562 in 1911.

"The most recent and interesting development in connection with the department has been the introduction of electric cooking stoves. The Electricity Department has kept in touch with the modern demands, and is supplying electric stoves as rapidly as they can be obtained from the makers for cash, or on hire-purchase terms. A considerable number has been disposed of in this way, and by advertising, systematic interviewing and public exhibitions the uses of electricity for cooking, and for other domestic purposes, is being kept well before the Bristol consumers and prospective consumers, and the use of electricity for all purposes is steadily advancing in public favour. A special low rate is charged for cooking.

"Power matters have progressed most satisfactorily, and a great confidence in electricity as a source of power has been firmly established in Bristol. The total H.P. connected to the mains at the end of the year exceeded 13,000 H.P. The following are some of the trades using electricity for power:—Tobacco, cocoa, printing, leather, confectionery, cloth, joinery, galvanised iron, brewing, paper-making, engineering and cold storage, and during the year there has been added a very large flour mill.

"The results of the introduction of the hire-purchase of installations department have again been most gratifying, a considerable percentage of the increase of consumers being due to the facilities afforded for acquiring installations on deferred payment terms."

**Colwyn Bay.**—The abstract of accounts of the U.D.C., for the year ended March 31st, 1913, shows that the gross profit on the electricity undertaking was £3,482.

**Delabole.**—This village is to be lighted by electricity, the old Delabole Slate Co. having promised to supply energy at a cost of about £1 per lamp per annum. In order to carry out the scheme the ratepayers have adopted the Lighting Act.

**Doncaster.**—In connection with the R.D.C.'s scheme of sewerage works at Askern, the L.G.B. has sanctioned the borrowing of £3,165 and £500, the latter amount being for electric motors and pumps.

The B. of T. has granted the T.C. an order to enable electricity to be supplied by the Corporation within the areas of the Bentley-with-Arksey and Babby-with-Hexthorpe Urban Councils.

**Dublin.**—An examination of the details of the Public Lighting Committee's estimates discloses the fact that the income estimated for the current year at £95,075 is now expected to reach £95,233, while the Committee has set down as the probable income for the ensuing 12 months the sum of £108,096, which it is confident will be realised. The working expenses have, however, shown an increase from £37,857 to £41,413, practically all of which is accounted for by the increase in the cost of coal of £2,650, and of wages and materials of £840. After providing for interest and repayment of loans, the Committee estimated to have a surplus for the current year of £16,724, which is now expected to realise only £13,326. The surplus, of course, would have approximated more closely to that anticipated when presenting last year's estimate were it not for the increase above referred to. A sum of £3,331 is proposed to be allocated in relief of next year's rates out of this surplus, and, taking this with an amount which the Council resolved last year to transfer, the total sum brought to relief of rates for the current, and the coming, year amounts to £8,831. An alternator has been renewed at an expenditure of £1,500 out of the profits of the current year.

**Ealing.**—Having further considered the proposals of the Fixed Price Light Co. for the adoption of a scheme for the lighting of small houses, the Electricity Committee of the B.C. has ordered a reply to be sent to the company that, at the present time, it is not prepared to accept the offer.

**Edinburgh.**—It was reported to the Electric Lighting Committee that the estimate of expenditure in connection with the department for the year 1913-14 is £80,265, as against an estimated expenditure for 1912-13 of £73,470, and an actual expenditure in 1911-12 of £69,640. The estimated revenue is £142,660, as compared with an estimate of £135,410 in 1912-13, and an actual revenue of £131,678 in 1911-12. The sum estimated for cost of coal is £30,000, as against £24,000 last year.

The Electric Lighting Committee has agreed to extend the mains to Cramond, provided the consent of the B. of T., the County Council and the Lothians Power Co. is obtained. The extension will cost about £900. The Corporation mains at present extend to Craigcrook Castle, and it is expected that a number of residents

and proprietors in the Cramond district will take advantage of the further extension.

The Electric Lighting Committee has also approved of the proposal to supply electricity to Redford Barracks direct from the city mains. The cost of the supply will be 1d. per unit more than the rate within the city.

**Grimsby.**—A L.G.B. inquiry was held on April 16th, into the application of the T.C. for loans of £9,300 for new plant for the electric light works, and £8,000 for mains and services. The inspector, Mr. T. C. Ekin, suggested that a sum of £6,000 in the sinking fund, which accumulated during the first three years of the undertaking before a regular loan was taken up, should be utilised in respect of the present application. In consequence, the Council revised the application to £9,300, made up as under:—Turbine and condensing plant, £7,500; switchboard and cables, £300; pipework, £600; foundations, £250; additional feeder panel, £100; extension of cooling towers, £200; oil separator, £150; contingencies, £200.

**Harwich.**—Efforts are being made to form a local electric light and power company, for the purpose of supplying "cheap electricity" to the district.

**Hazel Grove.**—The B. of T. has issued a prov. order to the Hazel Grove and Bramhall U.D.C., authorising it to supply electrical energy for public and private purposes in the urban district.

**Higham Ferrers.**—Electrical mains are about to be laid in the town, the company holding the Order having informed the T.C. that it will forthwith commence the laying of mains in the High Street.

**Hoyle.**—The U.D.C. has had under consideration a report by the electrical engineer, recommending the following extensions as capital expenditure:—400-kw. set and condensing plant; engine, £1,750; alternator and exciter, £800; panel and rheostat, £110; piping and valves, £200; condenser, £1,830, and other items, totalling £5,500. The Council approved of the scheme, and decided, subject to the approval of the L.G.B., that the extensions be proceeded with. It was also decided to advertise for tenders for a triple-expansion Belliss engine coupled to a 400-kw. alternator, and a committee was appointed to consider the tenders and report thereon.

**Hyde.**—The Corporation had decided to ask the Joint Electricity Board to submit to the Street Lighting Committee a scheme for lighting Newton Street, Old Road and Bennett Street by electricity, together with an estimate of the cost.

**India.**—According to the *Indian Textile Journal*, arrangements are being made with a view of largely increasing the power available at the Cauvery Falls during the dry months of the year and rendering it secure from interruptions on account of shortage of water. The scheme also embraces extensive irrigation works.

**Japan.**—A correspondent says that the development of hydro-electric stations for supplying Tokio and district with power, has been making great headway. There are plants with a total capacity of about 225,000 kw. starting up, under construction, and projected for this purpose. The transmission pressure is generally 66,000 volts, the transmission lines being equipped with steel towers for distances of 60 or 70 miles. The Sagami Water Power Co. is just placing orders for 12,000 kw. of plant for two power houses, for the supply of power in Yokohama. The transmission will cover 45 miles, and be at 66,000 volts pressure.

At the annual meeting of the Yokohama Foreign Board of Trade just held in Yokohama, the chairman referred to the great development in hydro-electric companies in Japan, stating that the total subscribed capital of such companies exceeded £25,000,000. A large number of the concerns have not yet reached the dividend-paying stage, but there can be no doubt that the cheap power they will be able to offer to industrial concerns will in due course prove a great asset to the country and a stimulus to many industries struggling against the handicap of dear fuel. He added that although Japan may not have much coal there is an ample rainfall, and, fortunately, also suitable physical configuration, which will make it possible for consumers to be supplied with all the water and electrical power they require at a moderate cost.

Another correspondent says a period of severe competition for the electric lighting business in Tokio is about to be inaugurated, for as a result of the announcement that the Katsuragawa Electric Co. will be ready to supply current about the middle of May, the Nippon (Dento Karata) Electric Light Co. is making every effort to have its plant ready by the end of the present month. The last-named concern proposes to only supply the two districts of Shitaya and Asakusa at first, and with the view of securing clients has decided to install 30,000 10-c.p. lights free of charge for several months.

**Kilmarnock.**—The T.C. has approved of a scheme for providing electrical installations in dwelling houses up to a rent of 20s. free of cost, the charge for energy to be 5d. per unit, with a minimum of 1s. 5s. per annum. The approval of the scheme, however, has been given on the understanding that the scheme may be dropped, if, after experiment, it is found not to pay.

**Leatherhead.**—The Leatherhead and District Electricity Co., Ltd., has recently extended its sphere of operations in certain parishes under the parochial control of the Epsom Rural District

Council. We understand from Mr. Leslie Dixon, the manager, that the company has obtained powers to supply in the parishes of Bookham, Eillingham, Cobham and Stoke D'Abernon, and has laid seven miles of three-phase high-tension mains for supplying light and power in these parishes. A supply to the first two parishes mentioned will be given almost immediately as the new plant is practically ready. Cables are now being laid to Cobham, where a supply will be available, when the mains are completed, in the course of a few months.

**Lincoln.**—An inquiry has been held by the L.G.B. relative to the Council's application for sanction to borrow money for local purposes. It was stated that £12,500 was required for extensions at the electricity works, information as to the proposals being supplied by Mr. S. Clegg, the Corporation electrical engineer.

**London.**—LEWISHAM.—The chairman of the B. of G., discussing the question of electric lighting in the Infirmary, said, with regard to their engineer, he did not think anybody knew he was acting against any rules of any association. It was thought at one time that the prices for installing the electric light might be prohibitive, but now they found that the cost was not likely to be so great as they estimated. He added that he had received a letter from a churchwarden of a Lewisham church, in which it was stated that the cost of lighting the church with gas for the quarter ending Christmas, 1911, was £9 10s. 1d., and Lady Day, 1912, £9 19s. 1d. The cost of lighting the church by electricity for the Christmas quarter, 1912, was £4 12s. 9d., and for the Lady Day quarter, 1913, £2 14s. They were paying 4½d. per unit, whilst the Guardians would only pay 2d. per unit for lighting and 1½d. for power.

MARYLEBONE.—As from the June meter meetings, the non-contract tariff for heating is to be reduced to 1d. per unit flat-rate, and for cooking to 1d. per unit for the winter six months, and 1d. for the summer six months. The general manager is of opinion that this reduction will do away with the 2d. and 1d. maximum demand system. Mr. A. C. Roberts, district auditor, in his report upon the audit of the accounts of the Council for the year ended March 31st last, stated that exception had been taken to two classes of expenditure in connection with advertising the undertaking, viz., £81 for labour and materials upon private fitting work, where no charge was made to the customer, and which arose in cases where the work had been done on approval and the customer had elected not to purchase the fitting installed; and £101, the purchase of exhibition tickets for free distribution to persons who might possibly become purchasers of fittings or consumers of current; and the contribution to the expenses of one exhibition. Neither of these expenditures, the auditor concludes, appears to come within any powers which the Council possess, but both items on this occasion had been covered by special sanctions under the Local Authorities (Expenses) Act, 1887. An agreement has been entered into with Marshall & Snelgrove for a stand-by supply. This agreement provides for 60 kw. at £2 per annum per kw., and a further charge of 1d. per unit, except during peak hours (during peak hours 6d. per unit); the minimum amount to be received from 1d. units consumed per annum to be not less than £62 10s. (equivalent to 15,000 units); the firm to undertake not to renew any of its existing plant; and the emergency supply to be used only during peak hours in case of breakdown to its existing plant and while it is under repair.

WESTMINSTER.—The Westminster E.S. Corporation has agreed to a six months' extension of the period of negotiation with the City Council in regard to public lighting in St. George, Hanover Square.

BATTERSEA.—The B.C. is appealing against the decision of Judge Joyce not to grant the Council an interim injunction against the County of London Co., in respect of the laying of trunk mains through the borough.

The Special Committee on London Electricity Supply, appointed in February, 1912, by the L.C.C., states that it has concluded the preliminary steps of its investigation, which included numerous conferences with the various electricity suppliers in London, and has collected a large amount of information. It now proposes to hear expert evidence on the matter, and will be glad to have the views of authorities on either the technical or business side of the matter placed before it.

**Long Eaton.**—The U.D.C. has authorised the engineer to proceed with the extension of the electricity plant at an estimated cost of £10,000.

**Manchester.**—The Electricity Committee reports that, notwithstanding the increased cost of coal and materials during the past year, an even rate of progress was more than maintained. During the past 12 months 104,000,000 units were sold, as compared with 93,000,000 units for the previous year. In considering the estimates, the Committee allocated £28,500 to the relief of the rates.

**Mansfield.**—For the ensuing year the Electricity Committee will make a contribution of £400 from profits towards the general district rate.

The T.C. has accepted the tender of Messrs. J. Maude & Co. for the provision of electric standards for public lighting in the Mansfield Woodhouse district. The Mansfield Woodhouse U.D.C. has accepted the Mansfield T.C.'s terms for the lighting of the streets, and the L.G.B. has sanctioned the T.C.'s application for the borrowing of £230 for that purpose.

**Mexborough.**—The U.D.C. has resolved that application be made to the L.G.B. for sanction to borrow a further £1,000 in addition to the sum of £10,500 for extensions at the electricity works.

**Moffat.**—The T.C. has agreed to accept the offer of Mr. W. E. Townsend, of Edinburgh, to submit the necessary detailed plans and specifications, and give a complete estimate of the cost, free of charge, for a scheme of electric lighting, on the understanding that if the scheme goes on he is appointed engineer to carry it out. It is believed that in the Well Burn there will be ample water power to provide a sufficient supply of electricity for the burgh.

**Oldham.**—A statement has just been compiled by the engineer showing that the Corporation obtained Parliamentary powers in 1892 to supply electrical energy within the borough. The Greenhill station was opened in June, 1903, with plant of 6,000 H.P., which together with that transferred from the old station made the total capacity 6,720 H.P. In 1911-12, a further extension was found to be necessary, and a steam turbine of 2,000 H.P. was installed. During the last two years the demand had increased greatly for power purposes, and rose from 583,553 units in 1910-11 to 888,840 units in the year ended March 25th, 1912. The number of consumers now connected to the mains is upwards of 1,700. In 1911-12 the number of units sold was £5,992,476. The capital expended up to March, 1912, was £306,746, of which £100,000 had been repaid or was in hand.

**Philippines.**—A Manila paper says the favourable report of the expert who has just completed his investigations of a site for a hydro-electric plant near Pagsanjan is at hand, and as a result the Manila Electric Railroad and Light Co. will invest the sum of P. 3,000,000 approximately, for the purpose of securing cheaper electricity for Manila and the suburban lines. The proposed site on the Caliraya River is distant about 60 miles from Manila. The construction will consist of a dam and runway with an outlet turning the water back into the river again. The initial unit installed will provide at least 33 per cent. more power than is now necessary to supply light and power for Manila, or 10,000 H.P., with an efficiency in Manila of about 80 per cent.

**Rishton.**—In regard to the objection of the District Council to the application of the Accrington Corporation for permission to supply electricity to the paper mills of Messrs. A. M. Peebles & Son, Ltd., the Rishton Council appointed a deputation to confer with the town clerk of Accrington.

At a meeting of the Rishton Council on April 17th, it was decided to consent to the application by the Corporation to the B. of T. for an order authorising the Corporation to supply electricity to Messrs. Peebles' mills, subject to certain reservations and conditions.

**Rochdale.**—The profit on the electricity works for the year is £2,883. With the exception of 1911-12 this is the lowest since the department began to pay, and is attributed to increased cost of coal, and to additional interest and sinking fund charges on extensions, the full benefit of which cannot yet be felt. The gross profit on the year was £11,740, as against £10,664 a year ago. Of the net profit of £2,883, £2,000 is being allocated to the relief of the rates and the balance carried to reserve.

The Electricity Committee has agreed to supply current in bulk to Whitworth for five years on terms mutually arranged.

**Romford.**—The U.D.C. has sealed an agreement with the County of London Electric Supply Co., and given consent to the prov. order being granted to the company, subject to the insertion of a purchase clause.

**St. Thomas.**—The Westindische Compagnie, of Copenhagen, having bought the "French Wharf" in the Danish Island of St. Thomas, have decided to undertake works for the modernisation of the harbour, including the building of quays, the installation of electric cranes, the construction of a power house, &c. For particulars of the machinery requirements, application should be made to the company.

**Salford.**—The General Electric Co. have offered to supply the Electricity Committee with flame arc lamps on loan free of charge for experimental purposes. The offer has been accepted, and the lamps are to be tested in Chapel Street.

**Skelton and Brotton.**—The B. of T. has granted the application of the U.D.C. for a prov. order for electric lighting.

**South Africa.**—The ratepayers have approved of a scheme for the supply of electric power for lighting Umtata, estimated to cost £7,000. The Municipal Council will borrow the necessary funds from the money in hand for the water scheme. Power will be generated at Umtata Falls, one mile from the town.

**Stockport.**—On April 16th, Mr. R. H. Hooper, L.G.B. inspector, conducted an inquiry into the application of the Corporation for sanction to borrow £24,500, for the purposes of the electricity undertaking. There was no opposition.

**Swansea.**—The Housing Committee has asked the Tramways and Electricity Committee to submit an estimate of the cost per week to be charged upon the houses which are to be erected at Town Hill, for electric lighting, such costs to be added to, and included in, the rent of the houses. Application is to be made to the L.G.B. for sanction to borrow £40,000 to cover the cost of extending the generating plant and the construction of sub-stations, mains, cables, &c.

**Swinton (Lancs.).**—The Tramways and Electricity Committee has instructed the Clerk to point out to the L.G.B., that the expenditure on the supply of electricity to Broad Oak Park

would be greater than the amount sanctioned to be borrowed (£600), and to ask if the Board would allow the work to be proceeded with—application for sanction to borrow a further sum being made later.

At the D.C. meeting last week, Mr. Heywood, referring to the electricity undertaking said there were now 167 consumers, and the units sold were 206,339 and the receipts £1,728, as against 159,182 units and £1,433 for the previous year. The total loans borrowed for the undertaking were £13,910, the repayments up to the present being £1,134. The capital expenditure had been £12,892, and the loans unspent £1,018. The Broad Oak Park extension was now taking practical shape, after several years of hesitation on the part of the Council. The deficit for the past year was £238, but the expenditure was coming down, and there were prospects of having a balance in hand before long.

**Yeovil.**—The T.C. is having a report prepared with regard to the relative cost of electricity and gas for driving the machinery of the sewage works.

**York.**—At the last meeting of the City Council, it was reported that the L.G.B. had given sanction to the borrowing of £500 for the wiring of premises for electric lighting as desired by the Council, the period of repayment being fixed at 10 years. The following tenders were recommended for acceptance:—Two water-tube boilers, with superheaters, chain-grate stokers, pipe work, &c., Messrs. Babcock & Wilcox, Ltd., London, £4,213; supply and erection of a turbo-alternator of a capacity of 3,500 kw., 3,000 H.P.M., condensing plant, &c., the Oerlikon Co., of Zurich, Switzerland, £9,967; storage battery and reversible booster, &c., and the maintenance thereof for a term of 15 years, the Tudor Accumulator Co., Ltd., £3,899, with a maintenance charge of £188 per annum. In answer to a question addressed to him, Alderman Meyer stated that the approximate cost of laying cables in the streets of the city generally for street lighting, domestic lighting and other domestic purposes would be £16,500 for 30 miles of streets. The cost of the feeders, distributors, &c., would be £119,000 if carried out on the underground system, but if powers could be obtained to carry it out in another manner the cost would be reduced to £71,108. So far as regarded street lighting, he would recommend the Council to consider some scheme for undertaking this. Alderman Wragge expressed the opinion that if it was only going to cost the city £16,500 to light the whole of the streets, it was time the work was undertaken. If that sum was spread over a period of 40 years at 3½ per cent., the interest and sinking fund would be £825. The supply of electricity from the Council's own works would cost £2,250, the two sums together totalling £3,075, whereas the gas company was now receiving £1,500 for lighting the streets by gas. Besides that, they would be able to make a substantial profit, and the saving which would be made would amount to a 1½d. rate. The recommendations of the Committee were adopted, including the proposal to light the streets by electricity, as outlined by Alderman Meyer and Alderman Wragge.

## TRAMWAY and RAILWAY NOTES.

**Birmingham.**—A special meeting of the City Tramways Committee was held on the 15th inst. for the purpose of hearing the views of a deputation from the Diocesan Conference, which had passed a resolution recommending that no cars should be run on Sundays, in order that all employes might have an opportunity of attending Divine worship. The Committee, after hearing the deputation, expressed sympathy with the object in view, but explained that the public convenience had to be considered, and many difficulties were likely to present themselves. It was agreed, however, to refer the whole matter to Mr. A. Baker, the general manager, who was instructed to consider the points raised and report to the next meeting whether anything could be done to meet the views expressed by the deputation.

**Blackburn.**—The general manager of the tramways (Mr. J. H. Cowell) states that the gross receipts for the past year were £66,683, against £63,129 in the previous year; working expenses £42,516, against £41,235; gross balance £21,166, against £21,894. The net profit was £3,870, comparing with £1,290 in the previous year. The traffic details show an increase of 17,150 miles, 556,452 passengers, and £3,171 in receipts. From parcel carrying the revenue was £2,191, against £1,995; 276,715 parcels were handled during the year.

**Bury.**—The profit on the tramway sections for the past year was £9,572, of which £5,000 is to go to rate relief purposes, £1,000 to insurance fund account, and the balance to reserve and depreciation fund account.

The experimental service *via* Heywood Street is to be continued for another month.

**Doncaster.**—At a meeting of the Finance Committee, the estimate of the Electricity and Tramways Committee for six new tramcars, with covered tops, at an estimated cost of £800 each, was approved of. The purchase of additional cars is necessitated by the growth of the tramway traffic generally.

**Hlland.**—The U.D.C. has decided to suggest to the Huddersfield Corporation the dropping of the proposed extension of

the tramways from Elland Town Hall to West Vale, owing to the decision of the Greatland D.C. not to consider the question further until the Huddersfield Parliamentary Bill has become law.

**Heywood.**—At a meeting of the Electricity and Tramways Committee on April 16th, it was reported that there was a loss of £110 on the tramways undertaking during the past year's work, and a loss of £4,118 on the electricity undertaking. These losses are equal to a rate of 10d. in the £. For the previous year the losses were £712 on the tramways, and £2,532 on the electricity undertaking.

**Huddersfield.**—The borough treasurer's financial statement respecting the tramways for the 12 months ended March 31st, 1913, showed a capital outlay to date of £117,408. The miles run were 2,383,858, compared with 2,245,427. The income amounted to £109,709, or 11'04d. per car-mile, against £101,602, or 11'18d. last year. The income was made up as follows:—Passengers, £106,286; postmen, £300; parcels, £1,238; advertising, £1,200; coal haulage, £676; and sundries, £9. The total working expenditure was £65,528, or 6'59d. per car-mile, compared with £57,239, or 6'12d. last year, leaving a gross surplus of £44,181, against £47,363. Interest on capital absorbed £13,318, and redemption of debt £10,904, and after provision had been made for depreciation at 3 per cent., there was a net surplus of £7,437, or 7'5d. per car-mile, against £11,766, or 1'52d. last year. The balance brought forward on the reserve or renewals account amounted to £13,253, the interest on investment was £350, and the transfer for the 12 months £12,522. The payments amounted to £7,841, leaving a fund of £18,284. The Committee has decided that £6,590 be transferred to the borough fund in relief of the borough rate, and that the balance of £847 be placed to the reserve or renewals fund, making the total amount in that fund £19,131.

The urban districts of Holmfirth, Kirkburton, Lepton and Mirfield are to be linked up with the Huddersfield tramways by means of motor-omnibus services.

**Japan.**—In connection with the electric railway between Yokohama and Tokio, the electrical track is now being laid alongside of the existing steam road; the 10,000-H.P. gas-engine station for supplying this line is also being equipped—the engines were illustrated recently in our pages.

**Leeds.**—The balance-sheet of the tramway undertaking issued on Monday shows that after providing for every form of expenditure there remains a sum of £61,374 to be used for the relief of the rates—an increase of £211 over the corresponding figure of last year. This is nearly equal to the produce of a 7d. rate. The total revenue of the undertaking amounted to £411,531 (or 11'23d. per car-mile), an increase of £16,210. The increased number of passengers carried was 3,646,242. Traffic receipts amounted to £405,551 (11'120d. per car-mile) against £391,142 (11'008d.). Advertisements on cars realised £3,661. Traffic expenses amounted to £109,413, wages of drivers and conductors being £77,442—an increase of £3,881. General expenses were £36,005, an increase of over £1,000. Regarding £19,809 set aside for rates and taxes, £5,300 of this is being held over pending the decision of the House of Lords on the tramway rating case. If the appeal is dismissed the profits will benefit to the extent of the sum now held over. The total working expenses were £213,817, leaving a balance of £197,713 to be carried to the net revenue account, which, with bank interest, &c., amounts to £205,224. Out of this has been paid £42,196 for interest on capital; £5,020 income-tax, and £3,216 as rent for the Morley lines, leaving £154,790 to go to the appropriation account. £19,922 had to go to the sinking fund, and £41,752 for renewing the permanent way—a record figure—£1,439 increase on the previous year. Other items brought the total expenditure of the account to £93,415, which, deducted from the available surplus of £154,790, left a net surplus of £61,374 odd. The estimate of the department in this respect was £60,000.

**London.**—The L.C.C. has circularised all the Metropolitan B.C.'s requiring them forthwith to send to the Assessment Committee a provisional valuation list containing the assessment of the County Council's tramways, on the ground that the hereditament has been reduced in value, in consequence of the falling off of the receipts from the tramway undertaking due (among other things) to competition from motor-omnibuses.

**Merthyr Tydfil.**—The T.C. has entered into an agreement with the Merthyr Electric Traction and Lighting Co., whereby the time of purchasing the undertaking by the Corporation is extended until 1934.

**Plymouth.**—A return submitted by the general manager of the tramways for the financial year ended March 31st shows that the cars travelled 820,406 miles, and carried 8,834,786 passengers. Including £1,985 received from the Plymouth, Stonehouse and Devonport Tramway Co., the total receipts amounted to £40,208, an increase of £263 compared with the previous year. All the sections showed an increase in receipts, the highest, however, being on the Peverell route. The total expenditure amounted to £37,370, an increase of £820. For the previous year the figures were:—Miles travelled, 809,036; passengers carried, 8,666,269; receipts, £39,079; and expenditure, £36,550.

**Preston.**—The Tramways Committee has decided that a new crossing be constructed between Derby Street and Pole Street; it is also proposed to purchase three additional top-deck covers, at an estimated cost of £360.

**Radcliffe.**—At a meeting of the U.D.C., it was reported that there was a net profit of £1,411 on the working of the tramways for the past year, which was double that of the previous year.

**Rochdale.**—The net profit on the tramway undertaking is £7423 as compared with £6480 last year. For the first time the undertaking contributes to rate relief. The Committee proposes to offer £2327 for this purpose, and asks to be allowed to carry £5,096 to the renewals fund, which the members feel requires strengthening in view of the coming necessity for renewal of track.

**St. Melton's.**—The U.D.C. on April 16th decided to oppose the Western Valleys Railless Electric Traction Bill.

**U.S.A.**—After three years of complex negotiations and heated controversy, the contracts for the operation of the dual rapid-transit system for New York city were signed on March 19th. These contracts relate to the operation of a system the total cost of which will be about \$100,000,000. Of this, one-fourth covers the existing systems and \$300,000,000 the construction now under way or authorised for the new subway, elevated and surface lines. When the new system is placed in operation, which will probably be in 1917, there will be over 600 miles of single track in service, as compared with 271 at present. —*Electrical World.*

**York.**—The City Council has agreed to the suggestion of the Electricity and Tramways Committee that blind persons should be permitted to ride on the tramcars free of charge.

## TELEGRAPH and TELEPHONE NOTES.

**Brazil.**—Particulars have been published regarding the organisation of wireless telegraphy throughout Brazil. The scheme will embrace an international service of wireless telegraphy both terrestrial and trans-oceanic, a river service, a frontier service and an inter-State service. The international stations will include one at Belem, having a range of 4,000 miles, one at Cape Santa Martha having a similar range, and another at Rio de Janeiro have a range of 2,000 miles. The text of the decree may be seen at the Commercial Intelligence Branch of the Board of Trade.—*B. of T. Journal.*

**Chile.**—Official sanction has been accorded to the scheme for organising a wireless service in Chile, consisting of a long-distance chain from Africa to Punta Arenas and a low-power chain between Arenas and Talcahuano.

**Constantinople.**—The *Journal of the British Chamber of Commerce* of Turkey states that the progress of the telephone construction has been delayed by the impossibility of getting the necessary cables and ducts from Great Britain, these being contraband of war. Nevertheless over 26 km. of cable has been laid, and practically all the underground piping is in place. The work of erecting poles in the outlying districts is now in progress, and the three principal exchange buildings are well advanced. Over 3,000 subscribers have been enrolled.

**Imperial Wireless System.**—On Wednesday last week the Select Committee on the Marconi contract resumed the examination of Mr. Godfrey Isaacs regarding the transactions in shares of the American Marconi Co. The witness stated that the price paid by the English Co. for the shares of the United Wireless Co. was \$750,000; they were sold, with other property, to the American Marconi Co. for \$1,400,000. A letter was read from Sir Henry Norman stating that he had never in any way been connected with the Poulsen people.

On Thursday the examination of Mr. Godfrey Isaacs was concluded. He stated that he had personally made no profit in connection with the purchase and sale of American shares, and that the American Co. had no interest at all in the British Co. He believed the foreign Governments with which he had been in negotiation when the Committee was appointed were now awaiting the report of the Technical Committee. The delay had not affected the American Co. Mr. Harry Isaacs was then called, and explained the transactions with his brothers, Sir Rufus Isaacs and Mr. Godfrey Isaacs. Afterwards Mr. Ernest Hawkins was examined regarding the letter which he had written to Mr. Godfrey Isaacs, and the information he had received from Mr. Charles Kerr, who also gave evidence. Mr. Kerr stated that on May 9th, 1910, he formed the Poulsen Wireless Telegraphy Syndicate, Ltd., and held an option on the Poulsen patents, which expired in February, 1911. The option was not exercised, and the syndicate went into voluntary liquidation on June 28th, 1911. Mr. A. A. Campbell Swinton reported to him on the Poulsen system. Since the expiration of the option he had had no interest whatever in the Poulsen system, but he still thought it the better system.

On Monday Sir A. H. Brown gave evidence, and the examination of Mr. Kerr was concluded. Mr. Harcourt Rose, a member of the firm of solicitors that acted for the Poulsen Co., referred to the evidence of Mr. Godfrey Isaacs regarding the origin of the rumours, which he contradicted in detail, stating that the promoters of the Poulsen system were in no way associated with the allegations against Ministers. Evidence was given by stockbrokers regarding the market in American Marconi shares on

April 17th, 1912, the latter stating that the price on April 19th was artificial and absurd, and that the public rushed in recklessly. The Committee adjourned till Wednesday.

**Telephone Electrical Staff.**—In reply to a question regarding the case of the electrical staff transferred from the National Telephone Co., the Postmaster-General said he found that owing to the arrested development of the telephone system during the latter part of the company's existence, the average length of service of the electrical staff was very high. Under the arrangements sanctioned by the Treasury, it was only possible to place a certain proportion of this staff on the establishment: a number of men with long service had consequently to be assigned to an unestablished class, and complaints were made to him on their behalf. He had now secured the assent of the Treasury to the creation of a considerable number of additional established posts for the benefit of this staff, as a temporary measure; and also to the grant to those members of the electrical staff (other than faultmen) who did not secure establishment, of a special allowance of 1s. per week, to cease on establishment, by way of compensation for certain privileges which were granted by the company on a higher scale than that which prevailed in the Post Office.

**Wireless and the Aurora.**—It is stated that during the occurrence of strong aurora borealis it is almost impossible for the wireless station on Spitzbergen to communicate with the station at Ingo, near Hammerfest. This fact seems to confirm the theory that the aurora is an electrical phenomenon.—*E.T.Z.*

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" April 11th.

**VICTORIA.**—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

April 29th.—20,000 yd. of 3-in. fibre conduit, for the Melbourne City Council. See "Official Notices" April 11th.

June 11th.—Switchgear and instruments, for the Melbourne City Council. See "Official Notices" to-day.

June 10th. Deputy-Postmaster-General, Melbourne. Incandescent electric lamps.—July 8th. Common-battery switchboard at Windsor.—*Australian Mining Standard.*

**NEW SOUTH WALES.**—May 12th. Fibre conduit for the Sydney City Council. May 26th.—Meters and glazed stoneware bridges. July 7th.—Arc lamp carbons. Specifications 10s. 6d. for each section, from City Electrical Engineer's Department.—*Australian Mining Standard.*

**TASMANIA.**—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

**QUEENSLAND.**—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" April 11th.

August 27th.—Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

**W. AUSTRALIA (P.M.G.'s Department).**—July 9th and 16th. Wire.—July 30th. Switchboard cable.—July 30th. Steel towers, battery material, &c.—August 6th. Insulators telegraph and telephone material and poles.—*Australian Mining Standard.*

**Barnes.**—May 19th. Feeder and distributor cables, for the U.D.C. See "Official Notices" to-day.

**Barrow-in-Furness.**—May 7th. Electric light installation at the workhouse, for the B.G. See "Official Notices" to-day.

**Belfast.**—May 19th. Circulating-water pump, for the Corporation Tramways and Electricity Committee. See "Official Notices" to-day.

**Bolton.**—April 28th. Reservoir construction in connection with the new Back-o'-th'-Bank generating station. Mr. A. A. Day, Borough Electrical Engineer.

**Bootle.**—May 13th. Boiler and pipe coverings for Marsh Lane electricity works. Borough Electrical Engineer's Office, Pine Grove.

**Canada.**—WINNIPEG.—May 15th. City Light and Power Department. Two three-phase generators of 5,000 kW. for direct connection to 6,800-H.P. water turbines; also spare parts Chairman, Board of Control. Deposit, £205. Particulars, Board of Trade Com. Intel. Department in London.

**Chesterfield.**—The T.C. is to obtain tenders for an overhead electric light cable for Chatsworth Road, and for an installation of batteries and extension of the sub-station at Whittington Moor.

**Dublin.**—May 1st. E.H.P. sub-station switchboard and accessories and alteration to existing E.H.P. switchboard, for the Corporation. See "Official Notices" to-day.

**Felixstowe and Walton.**—May 5th. One 150-KW. Diesel-driven D.C. generating set for the U.D.C. See "Official Notices" April 18th.

**Glasgow.**—May 9th. Cables, meters and arc lamp carbons for a year, for the Corporation. See "Official Notices" to-day.

May 26th.—Two steam turbo-alternators, with condensing plant (5,000 kW. and 2,000 kW. respectively), for the Corporation Tramways Department. See "Official Notices" to-day.

**Hoylake and West Kirby.**—May 5th. One 400-KW. alternator and triple-expansion Belliss engine, and evaporative condensing plant, for the U.D.C. See "Official Notices" April 18th.

**Italy.**—MESAGNE.—Tenders are about to be invited for the establishment of an electric light installation. Particulars of the Giunta Provinciale Amministrativa.

**King's Lynn.**—May 5th. One 400-KW. steam dynamo with condensing plant and pipework, for the Corporation. See "Official Notices" April 18th.

**London.**—ROYAL MINT.—April 25th. 120 tons of ingot copper. See "Official Notices" to-day.

L.C.C.—May 6th. 3,200 tons B.S.S. steel girder tramway track rails and fastenings; (2) 1,100 tons of special section ditto; and (3) 1,400 tons slot rails and conductor tees. Specifications and forms of tender, £2 each section, returnable, from Mr. G. W. Humphreys, Chief Engineer, County Hall, Spring Gardens, S.W.

May 7th and 9th.—Electrical installations at (a) Elthorne Road Special School, Holloway, and (b) Wilton Road Central Elementary School, Hackney. See "Official Notices" to-day.

May 13th.—One 20-ton overhead band crane, for the Shorditch sub-station. See "Official Notices" to-day.

The Highways Committee is to invite tenders from selected firms for two hydraulic accumulators and a pump for the third section of the central car repair depot.

**Mexborough.**—May 30th. Lancashire boiler, for the U.D.C. electricity department. See "Official Notices" to-day.

**Newport.**—April 26th. One 2,000-2,500-KW. steam turbo-alternator, surface condensing plant, one 600-KW. D.C. generator, and E.H.T. and L.T. switchgear, for the Corporation. See "Official Notices" April 11th.

**Norway.**—April 29th. Christiania Electric Works. Condensing plant for two 6,000-KW. steam turbines. Also two electrically-driven centrifugal pumps, to be tendered for by Messrs. H. & S. A copy of the conditions has now been received from H.M. Consul at Christiania, and can be seen at the Board of Trade Commercial Intelligence Department, in London. "Elektricitetsverket's Expeditionskontor, Raadhusgaten 19," Christiania. Local representation by a resident agent is essential.

May 1st.—Narvik Electrical Works. 200 metres of 600-mm. turbine pipes with intake machinery, 260-H.P. turbo-generator, two transformers, H.T. cables, &c. Specification, &c., from Dipl. Ingeniør Per Larssen, Hamar, Norway.

**Panama.**—The National Assembly has passed a law authorising the carrying-out of public works in various parts of the country. The works include the construction of electric lighting installations, telegraph and telephone lines, &c. A list of the works to be carried out may be seen at the Commercial Intelligence Branch of the Board of Trade.—*Board of Trade Journal.*

**Peterborough.**—May 6th. One 500-KW. D.C. steam turbine generating set and two steam boilers, for the Corporation. See "Official Notices" to-day.

**Rochdale.**—May 14th. Electrically-driven induction draught plant, for the Corporation electricity department. See "Official Notices" to-day.

**Salford.**—May 19th. Tenders invited for 10 car bodies and 10 Brill trucks. General Manager, 32, Blackfriars Street, Salford.

**Sheffield.**—May 5th. Excavations, retaining walls and extension to water service reservoir at Neepsend Power Station, including valves, pipework, &c., for the Corporation. See "Official Notices" April 18th.

**South Africa.**—DURBAN.—May 28th. Electric meter-testing equipment, for the Council. Copy of specification, &c., may be seen at Board of Trade Com. Intel. Dept. in London.

**South Shields.**—May 1st. Tramway stores for one or three years, for the T.C. Mr. W. T. Robson, manager, Dean Road.

**Spain.**—June 16th. "Direccion General de Obras Pùblicas, Ministerio de Fomento," Madrid. Concession for the construction and working of an electric tramway from L. to Tarragona. Deposit of 10,427 pesetas (about £385) to qualify. Local representation necessary. Particulars at the Commercial Intelligence Branch of the Board of Trade, London, E.C.

**Warrington.**—May 13th. Traction battery and reversible booster, for the Corporation. See "Official Notices" to-day. Advertising on Corporation tramcars. Tramways manager, Car sheds, Warrington.

**CLOSED.**

**Admiralty.**—Messrs. Carls Frères (Associates of Consolidated Diesel Engine Manufacturers, Ltd.) have received an order from the British Admiralty for two reversible Diesel marine engines of 1,500 h.p., each. These engines will be of the two-stroke open marine type, fitted with crossheads, and of Messrs. Carls's latest design.

**Australia.**—MELBOURNE.—According to *Tenders (Mining and Engineering Review)*, a contract has been placed by the City Council with Messrs. Willans & Robinson for two turbo-generator sets, each of 1,000 kw. The turbines are of the Willans standard disk-and-drum type. The alternators are by Siemens, and are for 6,000 volts, 50 cycles, three-phase. The condensing plant is of the Willans standard augmentor type. The plant is to be erected at the Spencer Street power house.

The same exchange states that the Australian Metal Co., Ltd., have secured an order for the following plant, to be installed at the Bellbird Colliery, Hutton (N.S.W.):—

Two Brown-Tindley engines, direct-coupled to two A.E.G. 26-kw. alternators, 2,200-volt, three-phase, 50 cycles, 375 r.p.m.; one eight-panel switchboard, with one Tirrell regulator panel; one 250-kw. A.E.G. motor-generator, operating at a distance of 1½ miles from the station, the motor being supplied with current at 2,000 volts; one endless-rope haulage gear, driven by two A.E.G. 150-h.p. 2,000-volt motors; one main and tail rope haulage gear, driven by one A.E.G. 100-h.p. 2,000-volt motor; one 300-h.p. A.E.G. variable-speed 2,000-volt motor, driving "Sirocco" fan of 400,000 cu. ft. per minute; three A.E.G. 30-h.p. 2,000-volt motors, driving screens; one A.E.G. 50-h.p. 500-volt motor, driving 6 × 10 Worthington pump; six A.E.G. 5-h.p. motors, driving 4-to pumps. All cables, motor-pumps, switchgear, are to be of A.E.G. latest design, specially suited for underground mining work. There will also be installed two 100-h.p. A.E.G. motors, and five A.E.G. static transformers, to transform from 2,000 to 100 volts. The consulting engineer for the colliery is Mr. J. H. Newby, and the mine engineer is Mr. Mathlesco.

**SYDNEY.**—The contract for a 5,000 kw. turbo-alternator has been placed with the Australian Metal Co., Ltd. (Electrical Department), Sydney, at £21,233. The list of tenders was given last week.

**NEW SOUTH WALES.**—The *Australian Mining Standard* states that the Public Works Department has ordered a "Carrick" three-motor electric overhead travelling crane for Uhr's Point workshops, £566, from J. E. O'Toole & Co., Sydney; also an electric installation at Uhr's Point power station, £1,000, from the Aust. General Electric Co.

**Croydon and Dundee.**—A contract for traction trolley lamps for the Dundee tramways for the ensuing 12 months has been received by Messrs. Siemens Bros. Dynamo Works, Ltd., who have also obtained a renewal of the contract for the supply of similar traction lamps to the County Borough of Croydon for the ensuing 12 months, together with the supply of "Wotan" drawn tungsten wire lamps for depot lighting, &c.

**East Ham.**—The T.C. has accepted the tender of Callender's Cable & Construction Co., Ltd., for main feeder cable.

**Edinburgh.**—The tender of the Bastian Meter Co., Ltd., has again been accepted by the Corporation for the supply of 2½-ampere meters.

**Greenock.**—The Corporation has accepted an offer of Halley's Industrial Motors, Ltd., for a motor wagon for the electricity department, for £700; also a tender of the British Westinghouse Co. for two A.C. motors for 750 kw. each, to be coupled to existing low-tension dynamos, for £2,288.

**Huddersfield.**—The Electricity Committee has accepted the tender of Messrs. E. Green & Son, at £866, for an economiser. The Committee has also accepted the tender of Messrs. Greenwood and Batley for a turbo-dynamo, to take the place of plant to be scrapped.

**Hungary.**—Messrs. Ganz & Co., of Budapest, have secured a contract for the construction of an electric tramway in the town of Kolozsvár.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government Departments named:—

**ADMIRALTY.**

Miscellaneous articles.—Chalcide Electrical Storage Co., Craigpark Electric Cable Co.  
Distributing boxes.—B.I. & Helsby Cables, Ltd., Chadburn's (Ship) Telegraph Co., Clarke, Chapman & Co., Hawkers, Ltd., McGeoch & Co., E. F. Moy, Ltd., Player & Mitchell, Spagnoletti, Ltd.

**INDIA OFFICE.**

Accumulators.—Pritchetts & Gold.  
Boxes.—Siemens Bros. & Co.  
Cable.—Bolton & Sons and Hooper's Telegraph, &c., Works.  
Cells.—Tudor Accumulator Co.  
Motors.—Lancashire Dynamo, &c., Co.  
Switches.—Edgar Allen & Co.

**WAR OFFICE.**

Dynamos.—J. H. Holmes & Co.

**POST OFFICE.**

Telephonic apparatus.—Automatic Telephone Manufacturing Co., B.I. and Helsby Cables, Ltd., and Peel-Comer Telephone Works, Ltd.  
Wood arms.—Miller's Timber & Trading Co.  
Silence cabinets.—King & Scarborough.  
Telephonic cable.—Siemens Bros. & Co.  
Telephonic cable.—B.I. & Helsby Cables, Ltd., and W. T. Henley's Telegraph Works Co.  
Dry cells.—Siemens Bros. & Co.  
Stoneware ducts.—Albion Clay Co.  
Telegraphic ironwork.—Guest, Keen & Nettlefolds, Ltd., Portland Bolt and Nut Co., and C. Richards & Sons.

Morse paper.—Waterlow & Sons.  
Power plant and wiring.—Niton Wireless Station.—Westminster Engineering Co.  
Telephonic exchange equipment.—East Exchange, London, Western Electric Co., new Victoria Exchange, London, and Kilmarnock Exchange, Peel-Comer Telephone Works, Ltd.; City Exchange, London, (open version to keyless working) Western Electric Co.  
CROWN APPOINTMENTS FOR THE COLONIES.  
Underground telephone cable.—B.I. & Helsby Cables, Ltd.  
Poles, &c.—Siemens Bros. & Co.

**Leds.**—The Mircless-Watson Co., Ltd., of Glasgow, have recently secured a repeat order for a large surface condensing plant for the Corporation electricity works, capable of dealing with 130,000 lb. of steam per hour. The plant will be connected to a turbo-alternator, for which Messrs. Willans & Robinson have just received the order. The condenser of this installation is of a very special design, to suit the conditions of dirty water obtained for condensing purposes from the river Aire. This water contains a large amount of woollen material, which, along with mud, soon clogs up the ordinary type of condenser. The condenser is designed so that all the tubes can be cleaned out whilst the plant is in operation. The flow of the cooling water can be reversed without interfering with the running of the plant. The condenser is of the vertical type design, having 24,600 sq. ft. cooling surface. The total height of the condenser is 28 ft., and it weighs 85 tons.

**London.**—L.C.C.—The Highways Committee has accepted tenders for the supply of tramway parts, equipment, &c. for the year ending April 30th, 1914, from the following firms:—

Motor and generator spares.—British Westinghouse Co., Dick, Kerr & Co., and Manchester Armature Repair Co.  
Cont. roller, circuit-breaker and other switch, &c., details, and magnetic brake spares.—British Westinghouse Co. and Dick, Kerr & Co.  
Contact fingers and parts, segments, &c.—British Westinghouse Co., Dyer and Young, Estler Bros., Edwin Showell & Sons, and Tramway Supplies, Ltd.  
Pressed brass and steel articles.—Hadfield's Steel Foundry Co., Conveyor and Elevator Co., Peter Heiler, and M. Mole & Son.  
Electric cable, insulators (other than rubber).—Ebonestos Manufacturing Co., Crystalite Manufacturing Co., and British Westinghouse Co.  
Wire Co., Liverpool Electric Cable Co., W. T. Glover & Co., Hooper's Telegraph & India Rubber Works, and Saxonia Electrical Wire Co.  
Copper bonds.—B.I. & Helsby Cables, Ltd.  
Rubber details.—J. G. Ingram & Son, North British Rubber Co., and I.R., G.P. & Telegraph Works Co.  
Moulded insulators (other than rubber).—Ebonestos Manufacturing Co., Crystalite Manufacturing Co., and British Westinghouse Co.  
Fibre articles.—J. Burns, F. A. Fild & Co., and Mosses & Mitchell.  
Mica and micaite articles.—D. Jaroslaw and George Schulz & Co.  
Insulators and porcelain for electric trackwork.—Bullers, Ltd., Doulton and Co., and Taylor, Tunnicliff & Co.  
Baking and air-drying insulating varnish.—Pinchin, Johnson & Co. (three years).  
Car furniture.—Edwin Showell & Sons, Player & Mitchell, Brush Electrical Engineering Co., G. D. Peters & Co., and Gabriel & Co.  
Machined bronze bearings.—Anti-Artition Metal Co.  
Machine-finished articles (brass, gun metal, &c.).—Edwin Showell & Sons, Estler Bros., Anti-Artition Metal Co., Player & Mitchell, and Davs and Timmins.  
Machine-finished articles (iron, steel, &c.).—Wilkes, Ltd., British Westinghouse Co., Bayliss, Jones & Bayliss, E. H. Buntall & Co., Davis and Timmins, F. W. Cotterill, Louis Hervé, John Holroyd & Co., H. boten Bros. & Co., and F. W. Rowlands & Co.  
Gear and pinions, wheels, ratchets, worms, &c.—British Hele-Shaw Patent Clutch Co., John Holroyd & Co., and F. W. Rowlands & Co.  
Dropped stampings.—Charles Bunn, Woodall & Co., Armstrong, Stevens and Son, and Wilkes, Ltd.  
Iron and steel forgings.—Nale & Jordan, Hurst, Nelson & Co., Woodall and Co., W. J. Ritchie & Co., Bayliss, Jones & Bayliss, Chas. Bunn, Wilkes, Ltd., and Perry Read Engineering Works Co.  
Springs.—Lion Spring Co., Geo. Baller & Co., Smith Bros. & Hill, Joseph Steel & Sons, Tempered Spring Co., and West Bromwich Spring Co.  
Machined iron castings.—Carron Co., John Crowley & Co., H. Newton Knights & Co., and Thomas Summerson & Sons.  
Iron castings.—Brightside Foundry & Engineering Co. and Joseph Williamson & Co.  
Machined malleable iron castings.—Bullers, Ltd., Leys Malleable Castings Co., and Brecknell, Munro & Rogers.  
Malleable iron castings.—John Crowley & Co. and Byden & Co.  
Steel castings (machined and unmachined).—Thomas Firth & Sons, National Steel Foundry, Ltd., Samuel Pease & Sons, Edgar Allen & Co., F. W. Rowlands & Co., Hadfield's Steel Foundry Co., and H. R. Marsden, Ltd.

In their observations on the tenders, the Highways Committee say that, with a few exceptions, they have accepted the lowest tender in each case. For certain items, two or more firms, some of them the present contractors, submitted the same price, and the Committee have, in most of these cases, accepted the tender of the present contractors. "The prices received for certain of the items are unfavourable, and we submit a recommendation that the tenders therefor should not be accepted." They recommend that none of the tenders for the following be accepted:—

	Schedule.	No. of items.
T. 8	(contact fingers and parts, &c.)	23
T. 10	(moulded insulators, other than rubber)	4
T. 14	(baking and air-drying varnishes)	2 and 4
T. 18	(machine-finished articles—brass, gun metal, &c.)	15
T. 19	(machine-finished articles—iron, steel, &c.)	13
T. 22	(iron and steel forgings)	15
T. 29	(steel castings, machined and unmachined)	4

The Fire Brigade Committee recommends for acceptance the tender of "Cedes" Electric Traction, Ltd., for two electrically-driven motor escape vans, for £1,658, the company to be allowed to sub-let the supply of the batteries to the Tudor Accumulator Co., Ltd.

The Highways Committee received the following tenders for (1) the reconstruction, for electric traction, of the existing horse tramways from Highbury Station to City Road, *via* St. Paul's Road, Canonbury Road, New North Road and East Road; and (2) the reconstruction of the tramways from Chapel Street to Nile Street, Woolwich, and the construction of the authorised tramways from Catford to Southend, *via* Bremley Road. The tenders also contain provision for certain paving and other works outside the tramway tracks in connection with street widenings along the routes of the

tramways from Highbury Station to City Road, and from Chapel Street to Nile Street. The improvement works to be done by the contractors along the latter route, however, form only a small portion of the total, the remainder of which will be executed by the Woolwich Metropolitan Borough Council on the Council's behalf—

## (1) Highbury Station to City Road tramways.

	Tramway works.	Improvement works.	Total.
A. N. Coles	£45,772	£4,835	£50,107
John Mowlem & Co., Ltd.	48,589	4,799	53,387
Dick, Kerr & Co., Ltd.	50,736	4,785	55,521
G. Percy Trentham, Ltd.	57,084	4,672	61,607

## (2) Chapel Street to Nile Street, Woolwich, and Catford to Southend tramways.

	Tramway works.	Improvement works.	Total.
A. N. Coles	£99,425	£1,069	£100,515
John Mowlem & Co., Ltd.	40,611	1,479	42,120
George Wimpey & Co.	41,581	1,301	42,883
Dick, Kerr & Co., Ltd.	48,228	1,464	49,692
G. Percy Trentham, Ltd.	52,249	1,400	53,649

The lowest tender in each case is that submitted by Mr. A. N. Coles. The Committee say:—"We have given very careful consideration to the question of the steps to be taken to provide for the electrification of these three tramways in the shortest time possible, and with due regard to the work being executed to the satisfaction of the Council. It is probable that the work on the three routes will be in progress at the same time, and as the work from Highbury Station to City Road will have to be carried out in two portions, and is situated at a considerable distance from that to be undertaken south of the Thames, we feel that the Council's interests would best be served by entrusting the works to two contractors, instead of the whole of the works being done by one contractor. We accordingly propose that the reconstruction of the tramways from Highbury Station to City Road should be undertaken by Mr. A. N. Coles, and that the construction and reconstruction of the Catford to Southend and the Chapel Street to Nile Street tramways should be undertaken by John Mowlem & Co., Ltd. the firm submitting the second lowest tender."

The tenders received for the rewinding, &c., of 17 300-KW. and three 500-KW. motor-generators at tramway sub-stations were:—

Newton Bros.	.. .. .	(recommended)	£7,957
Manchester Armature Repair Co.	.. .. .		8,830
Dick, Kerr & Co., Ltd.	.. .. .		14,100
British Westinghouse Electric Co.	.. .. .		21,321

ISLINGTON.—The Guardians have accepted the tender of the General Electric Co., Ltd., for a supply of electrical fittings and sundries.

LEWISHAM.—The B. of G. on Monday were informed by the Works Committee that Messrs. W. R. Reynolds, whose tender had been accepted for the electrical installation at the workhouse and infirmary, had withdrawn as they had omitted to include the prices for lamps and fittings. Their tender was for the infirmary £479, and for the workhouse £449. In pursuance of the Board's instructions, they had accepted the tender of Mr. A. J. Hewens for the infirmary, his price being £749, and he had signed the contract. With regard to the workhouse installation, Messrs. Weston & Sons, whose price was £640, had written that they did not feel justified in taking the work on at the price quoted, £640, and made another offer. The Committee recommended that the tender of Messrs. Haycroft, Ltd., be accepted, for £759 10s.

Mr. J. Clewom inquired whether any communication had been received from Messrs. Tredegar & Co., whose tender was £668.

The Clerk said the firm had not been communicated with.

Mr. Clewom proposed that the report be referred back, with a view to Messrs. Tredegar being asked if they stood by their tender.

Mr. J. Weeks, in seconding, said there was a difference of close on £100 between the two tenders, and, in fairness to Messrs. Tredegar, they should have an opportunity of declining the work.

Mr. W. Wood said the desire of the Committee was to avoid "any more fooling about." The specifications were absolutely perfect.

Mr. Weeks replied that the specifications were sent out at 10 o'clock at night, and decided upon the next day. He was not surprised that the experts could not understand them.

The Board referred the matter back to the Committee for further consideration.

LYMINGTON (HANTS).—The T.C. has accepted the tender of the Lymington Electric Light & Power Co. for installing the electric light at the offices, at £65. The only other tender was from Messrs. F. W. Cook & Son, of Southampton, at £60.

MANSFIELD.—The Mansfield Engineering Co. has been appointed to supply wiring sundries to the T.C. for the current year.

OBAN.—The T.C. Lighting Committee received tenders from Callender's Cable Co., Ltd., and the British Insulated & Helsby Cables, Ltd., for renewal of certain portions of defective cable. The offer of Callender's Cable Co. was accepted.

PAISLEY.—Messrs. Siemens Bros. have received a contract for a 500-KW. rotary converter for the electricity works, at £1,477. Five firms tendered.

SALFORD.—The Education Committee has accepted the tender of Messrs. Willoughby & Wilcox for wiring in the new laboratories and workshops, for the sum of £40. The Juvenile Employment Sub-committee has accepted the tender of Messrs. Davenport, Sparrow & Co. for electric lighting at the Employment Bureau. The Electricity Committee has accepted the offer of Messrs. J. Jewel & Sons, Birmingham, for the purchase and removal of the No. 1 engine and generator at the electricity station, for £800. The tenders of the following for the purchase of quantities

of waste turbine and crank chamber oil have been accepted:—Mr. E. W. Wollaston, 12 barrels, at 13s. per barrel; Mr. E. Spencer, 39 barrels, at 9s. per barrel.

SOUTH AFRICA.—Messrs. Siemens have obtained a contract for the yearly supply of "Wotan" drawn tungsten wire lamps to the Government of the Union of South Africa.

SWINDON.—The T.C. has accepted for the ensuing year the tender of the Reason Manufacturing Co., Ltd., for miniature and single-tube type electrolytic meters.

SWINTON AND PENDLEBURY.—The U.D.C. has accepted the following tenders in connection with the erection and equipment of the Broad Oak Park sub-station:—

W. Farnworth & Son.—Building,	£45.
General Electric Co.—Switchgear,	£119.
General Cable Manufacturing Co.—Supply main,	£205.

WEST HAM.—The T.C. has accepted the offer of Messrs. Cory & Son to supply the following coal to the electricity works during a period of 13 months—5,917 tons of peas, 10s. 2d. per ton; 6,000 tons ditto, 15s.; 41,000 tons ditto, 16s. 3d.; 6,881 tons of rough, 10s. 2d. per ton.

## FORTHCOMING EVENTS.

Physical Society.—Friday, April 25th. At 5 p.m. At the Imperial College of Science, South Kensington, 8 W. Paper on "Some Experiments to Detect  $\beta$ -rays from Radium-A," by Messrs. W. Makower and S. Russ; and other papers.

Junior Institution of Engineers.—Friday, April 25th. At 8 p.m. At 89, Victoria Street. Paper on "Condensing Machinery," by Mr. J. Elliott.

"Northampton" Past Day-Students' Association.—Saturday, April 26th. At 8 p.m. At the Northampton Institute, E.C. Annual general meeting.

Institution of Civil Engineers.—Monday, April 28th. Students' meeting. At 8 p.m. Lecture on "Law in Relation to Engineering," by Mr. T. Frame Thomson.

Tuesday, April 29th. At 8 p.m. At the Institution of Mechanical Engineers. Annual general meeting.

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, April 28th. Paper on "Cascade Connections," by Mr. H. V. Henniker.

(London).—Thursday, May 1st. At 8 p.m. Paper on "The Use of the Electrostatic System for the Measurement of Power," by Messrs. C. C. Paterson, E. H. Rayner and A. Kinnes.

Illuminating Engineering Society.—Tuesday, April 29th. At 7.30 p.m. At the Royal Society of Arts. Discussion on paper on "Standard Clauses for Inclusion in a Specification for Street Lighting," to be resumed.

Royal Society of Arts.—Wednesday, April 30th. At 8 p.m. Paper on "The Science Museum," by Mr. F. G. Oaklie.

Society of Engineers.—Saturday, May 3rd. At 8 p.m. At the Holborn Restaurant. Bohemian concert.

Salford Technical and Engineering Association.—Saturday, May 3rd. Visit to the Economist Works of Messrs. E. Green & Son, Ltd., Wakefield.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, April 22nd.—"A" Company. Recruit training, 7 to 8 p.m.; company training, 7 to 10 p.m.

Tuesday, April 23rd.—"B" Company. Recruit training, 7 to 8 p.m.; company training, 7 to 10 p.m.

Thursday, May 1st.—"C" Company. Recruit training, 7 to 8 p.m.; company training, 7 to 10 p.m.

Friday, May 2nd.—"D" Company. Recruit training, 7 to 8 p.m.; company training, 7 to 10 p.m.

Saturday, May 3rd.—All Companies. Annual Musketry at Purfleet Rifle Ranges. Trains leave Fenchurch Street Station, Midland Railway, Tilbury Branch, at 1.15, 1.35 and 2.15 p.m. Men arriving by later trains will be unable to fire. Rifles, &c., are provided for at the Ranges.

Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt. For Officer commanding L.E.E.

FRENCH ELECTRICAL STEEL.—The production of steel in France by means of the electric furnace amounted in 1908 to 2,289 tons crude, and 1,235 tons finished. In the three years to 1911 the output rose to 13,850 tons and 8,898 tons respectively. As France is the birthplace of the electric furnace, this result may be regarded as only natural.—*La Revue Electrique*.

SCARCITY OF ENGINEERING APPRENTICES.—A correspondent writes:—"Attracted by the short hours now being worked, and the good wages being earned by colliery lads, many strong-built boys in central and south-east Lancashire are preferring the coal mine to the foundry or the cotton mill. It is stated that there is a growing scarcity of apprentices in the engineering industry in the Bolton district, one large firm of textile machinists offering increased wages in order to attract youths."

# THE ELECTRICITY WORKS OF TROLLHÄTTAN.

(Continued from page 641.)

The large turbines were supplied by Messrs. Nylqvist and Holm at Trollhättan and Messrs. Boving & Co.'s branch works at Kristinhamn.

Each alternator is provided with an automatic circuit-breaker in the power station, from which armoured cables lead through the tunnel to the switch-house, where a duplicate set of bus-bars is provided. The power distributed locally at 10,000 volts is taken off these bus-bars, while a single set of 50,000-volt bus-bars can be connected to them through step-up transformers, with automatic circuit-breakers and oil-switches on both primary and secondary. Three extra-high-pressure lines are in use at present, including a double one to Gothenburg. Elaborate protection against lightning discharges is provided, including choking coils, horn arresters shunted by oil-resistances, series-connected

and the neutral point. The connections of the 10,000-volt generator are of bare copper bar carried on insulators; on the 50,000-volt switchgear, copper tubes are employed. Intermediate wiring is done with lead-sheathed and steel-armoured

multi-core cable, laid on shelves; the wiring for a group of apparatus belonging to a single unit, such as current transformers, relays, &c., is all embodied in one cable. Fire-proof divisions are provided between conductors of different phases, with a metal screen in front of them, and all oil-immersed apparatus are lodged in fireproof cells.

Views of the different types of bus-bars and switchgear are given in figs. 13 to 15.

The transformer primaries are delta coupled and the secondaries in star; the guaranteed efficiency of each at 3,000 K.V.A. ( $\cos \phi = 1$ ) and 10,000 volts is 98.5 per cent.

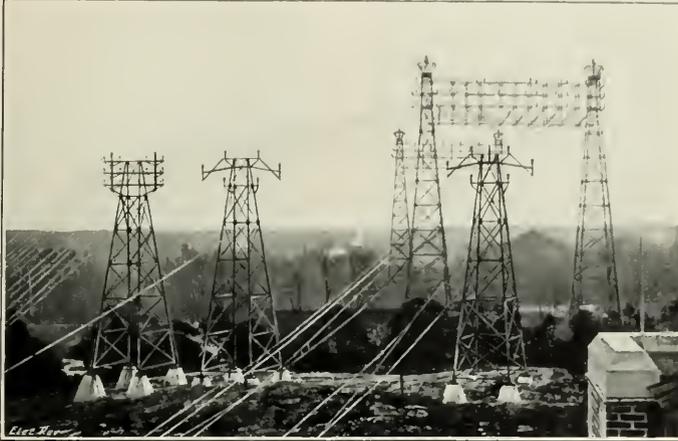


FIG. 7.—FEEDERS LEAVING POWER STATION.

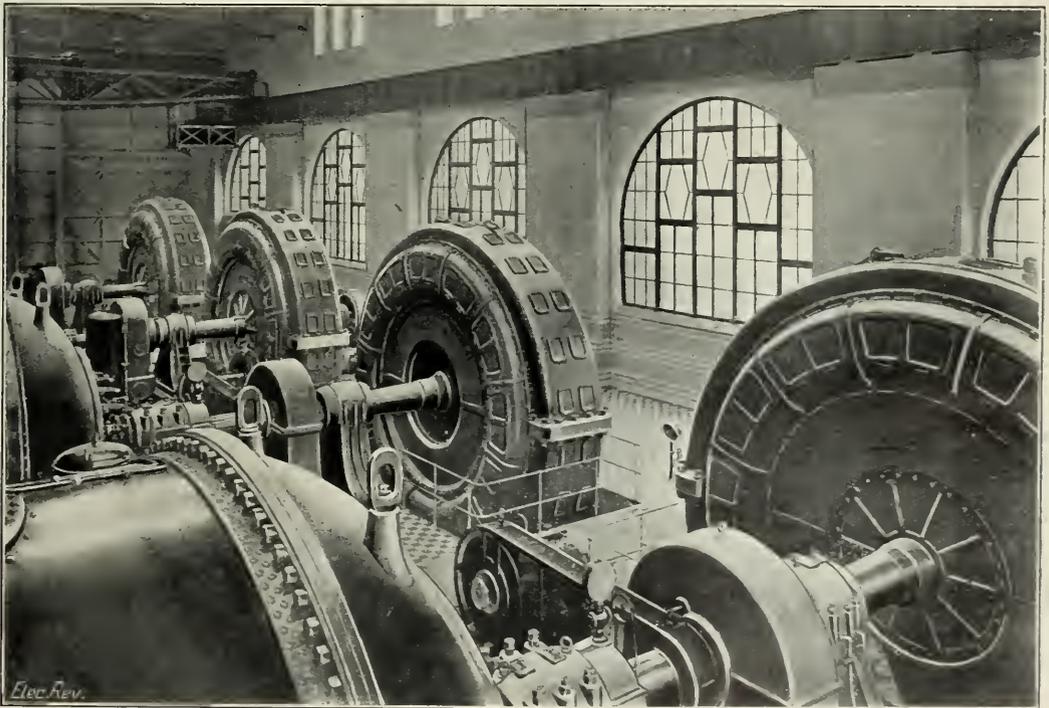


FIG. 8.—INTERIOR OF TURBINE ROOM.

liquid resistances, roller lightning arresters, and water-jet dischargers. The transformer secondaries are also protected with inductance coils, and spark gaps between the phases

They were required to withstand a short circuit on the network with the whole station in parallel. The windings were tested with double the working voltage for a quarter of an

hour, and will carry continuously a load of 3,670 k.v.a. with a rise of temperature not exceeding 60° C. The oil tanks are made of boiler plate with welded joints, and are absolutely air and oil-tight. The cooling water is circulated through coils of copper pipe, 60 litres per minute being required for this purpose. The active part of each transformer weighs 16 tons, the tank and oil weighing 12 tons. Alarm devices are provided, which give warning of high or low level of oil, due to excessive temperature on the one hand, or leakage on the other. Direct-reading and distance thermometers are also employed, the latter communicating with the switch-room, where an elaborate system of signals worked by relays, with alarm bells and lamps, is installed.

A 60-ton travelling crane was provided in the power

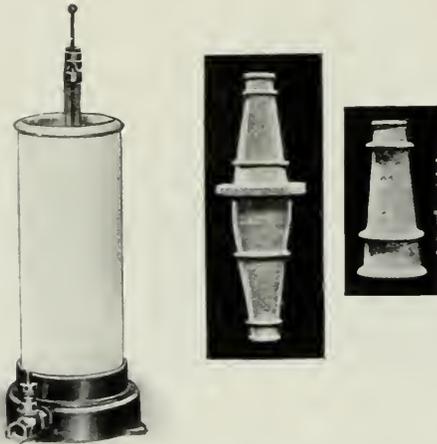


FIG. 9.—WATER-COLUMN LINE DISCHARGER, AND PORCELAIN INSULATORS.

station, and a 42-ton gantry crane to lower the machinery from the railway track on the cantilever to a lower track on a level with the site of the power station—a height of about 30 m. (fig. 11). A special friction brake was provided on the latter, cooled by circulating oil forced between the friction disks; an electromagnetic brake was also fitted.



FIG. 10.—STATOR OF 11,000-K.V.A. THREE-PHASE ALTERNATOR.

The travelling crane is provided with a 10-ton crab in addition to the big one, as the latter will seldom be used, and the former works at a much higher speed.

Special porcelain insulators have been designed by the Almänna Svenska Electric Co. for use on the Trollhättan

undertaking. The ruling feature of these is the plain conical shape, with only one or two drip flanges near the ends; leading-through insulators are made of two such cones fixed together at their bases. The great advantage of the smooth exterior is that the insulator is unaffected by arcing-over, where ribbed types would be split by the heat of the arc. Examples are shown in fig. 9.

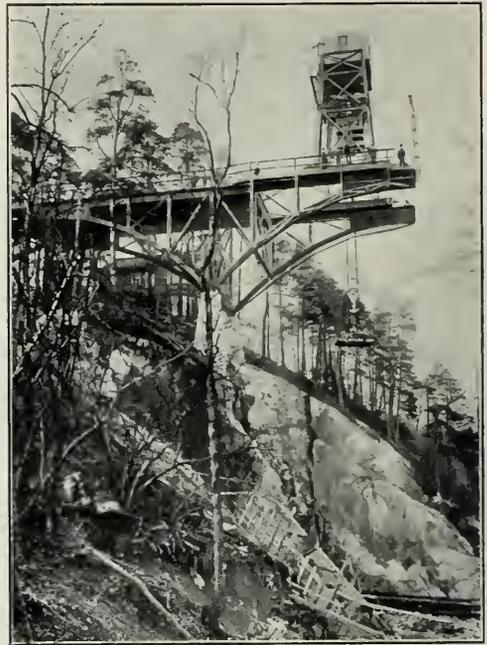


FIG. 11.—CANTILEVER GANTRY CRANE, 42 TONS.

The company state that the disadvantages of corrugations outweigh their advantages. The smooth insulators, when exposed to a moist atmosphere, are quickly dried by the slight leakage currents, and are less liable to become covered with a film of dirt and moisture than corrugated insulators.

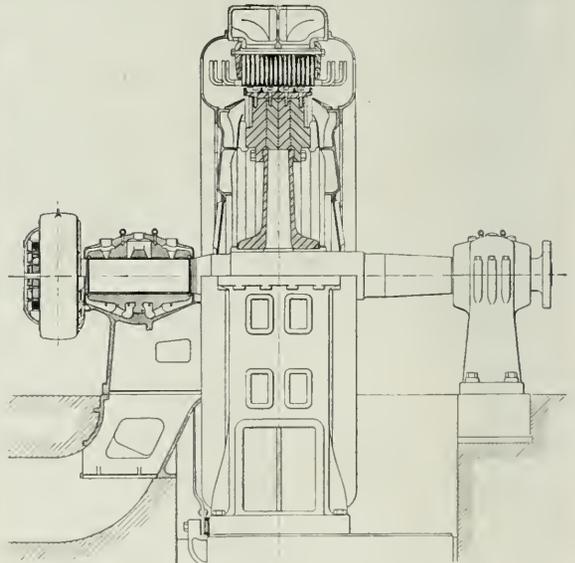


FIG. 12.—PART SECTIONAL ELEVATION OF GENERATOR.

The potential gradient and electrostatic surface density are also uniform all over, and the mechanical strength of the plain conical shape is exceptionally great, the insulators being superior not only when subjected to heavy stresses, but also when undergoing shock and vibration during transport.

Cast-iron plugs are cemented into the top and bottom of the conical insulators, affording a convenient means of fixing the insulators and any apparatus that may be attached to them. One of the chief advantages of the smooth surface is the ease with which it can be kept clean; the economy of material and light weight, and the possibility of making large sizes in one piece, as the porcelain stands the oven well, are further points in their favour, tending to cheapness and ease of standardisation. In the case of leading-in insulators, the possibility of puncture has to be considered; this is guarded against by increasing the diameter of the base of the insulator. The arcing-over voltage for these smooth insulators is practically the same as for air; the presence of flanges, which produce non-uniform electrostatic density with resulting ionisation of the air, is found to reduce the arcing-over value in the older types of insulator. The arcing voltage being thus definitely known, the factor of safety can be closely determined, and in the case of the Trollhättan installation the makers have supplied insulators having a factor of safety of 10 for 10,000 volts, and 4.5 for 50,000 volts. Immersing the insulators in a cloud of steam reduced the factor of safety by 40 per cent., rather more than the reduction on flanged insulators, but, on the other hand, the smooth insulators dry themselves more readily and keep cleaner.

The main circuit-breakers are of the oil-immersed type, mechanically or electrically operated. Those which are

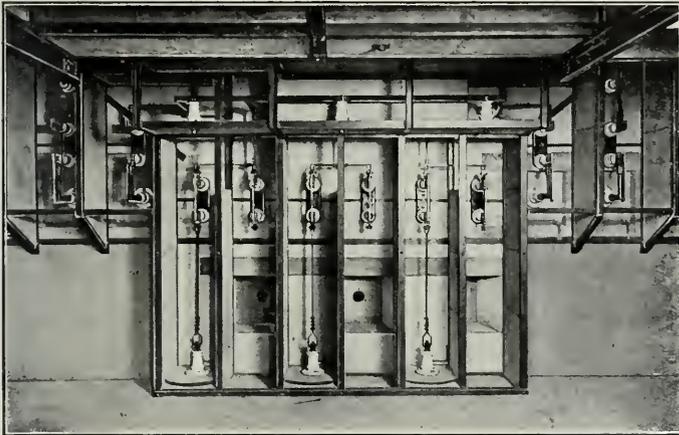


FIG. 13.—GROUND FLOOR OF SWITCH-HOUSE; 10,000-VOLT BUS-BARS AND DISCONNECTORS.

automatic are controlled by low-voltage relays, which are all of the same pattern and size. The oil-tanks are all arranged so that they can easily be lowered to expose the contacts for inspection; for the larger sizes special trucks are provided to facilitate this operation, as shown in fig. 17, with motor-driven lifting-frames. The electric operation of the switches is effected with direct-current solenoids, and the controlling switches are provided with special signalling and interlocking devices; normally each of the controlling handles stands at a middle or zero position, whether the circuit-breaker is closed or open, and no signal lamps are alight, but the operation of a circuit-breaker is at once signalled on the control board. If a breaker is closed on a short circuit, it automatically opens instantly, and cannot again be closed until the control handle has first been moved to the "off" position. Some of the oil circuit-breakers are provided with charging resistances on each pole, in series with the line, so that when switching on, the pressure is applied in



FIG. 14.—FIRST FLOOR OF SWITCH-HOUSE; 10,000-VOLT BUS-BARS.

two approximately equal stages. By this means the current rushes often experienced when switching-on a transformer are avoided, a precaution of special importance when low frequencies are employed. The resistances are also of advantage when charging long lines or underground cables. These resistances are put inside the apparatus.

Before adopting the design of the circuit-breakers, the first one was subjected to a mechanical test by switching it on and off 10,000 times. The circuit-breakers were also tested on loads of 20,000 K.V.A. In the 50,000-volt circuit-breakers, seen in the middle of fig. 17, the distance between phases is 90 cm.

All the oil circuit-breakers on the distributing system which are arranged for automatic overload release have time-limit relays; those in the power station and main sub-stations are of the Siemens-Schuckert induction motor type,

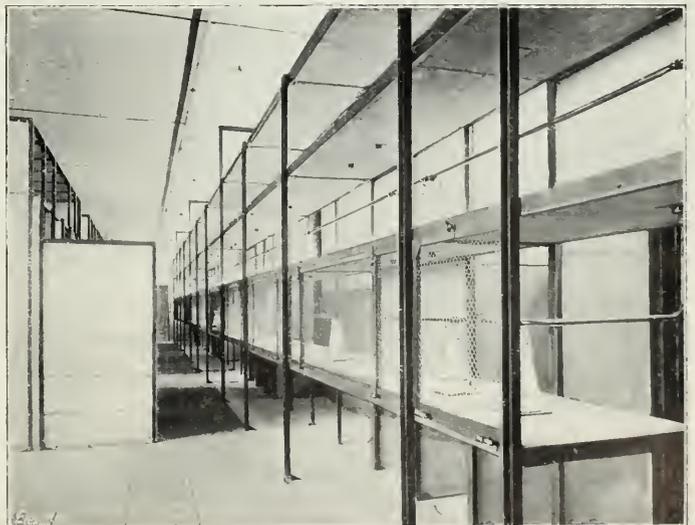


FIG. 15.—SECOND FLOOR OF SWITCH-HOUSE; 50,000-VOLT BUS-BARS.

which can only be worked with current from a separate source. For smaller switches the Almäna Svenska Electric Co. has developed a cheaper relay, which is released with current derived from the current transformer; this is of the solenoid type, and of specially strong construction, with separate graduated scales for regulating the tripping current and the time-lag respectively.

Choking coils are provided in all outgoing lines between the switchgear and the lightning arresters, as well as on the 50,000-volt side of the transformers; the latter also have reinforced insulation between the turns near the terminals. The lightning arresters are of the roller air-gap type, in series with carborundum rod resistances, and of the horn type, also in series with resistances. A continuous path to earth, to take off static charges, is provided by water-jet arresters, of which a set is shown in fig. 16; these are installed on the 50,000-volt mains. On the longest 10,000-volt lines the same purpose is served by the water-column in a glass tube shown in fig. 9. The neutral-point of the generators is earthed through a grid resistance designed to carry 15 times the normal current with one phase earthed, for a period of 30 seconds. The neutral point of the high-pressure side of the transformers is similarly earthed.

At present ten 10,000-volt lines leave the Trollhättan switch-house, of which six are overhead and the rest underground; all these supply power to consumers in Trollhättan and the vicinity. A single 50,000-volt line runs to Hakantorp, Skara and Sköfde, and a double one to Lilla

primaries, one transformer being spare. By means of a star-delta switch the secondaries can be connected either in star on the 10,000-volt bus-bars, or in delta on the 6,000-volt bars. Ultimately there will be 15 single-phase transformers in this sub-station, with five incoming 50,000-

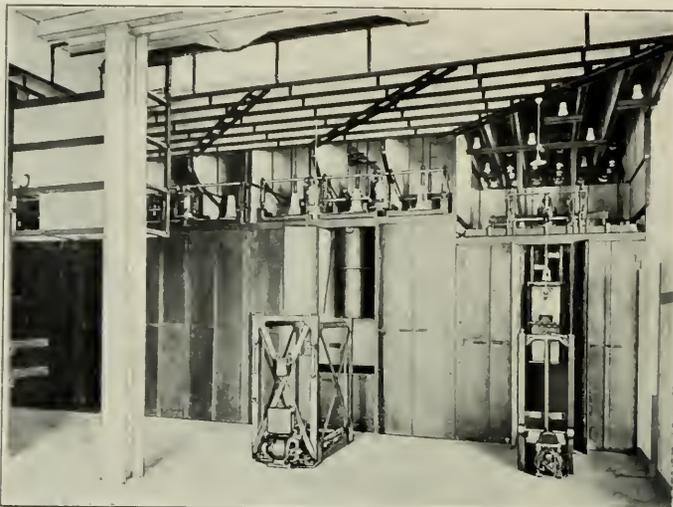


FIG. 17.—OIL-SWITCHES FOR 10,000 AND 50,000 VOLTS IN SUB-STATION AT GOTHENBURG.

volt lines, and 24 outgoing 10,000-volt feeders. The automatic signalling system mentioned in connection with the generating station is fully utilised here also, there being 180 indicators, with lamps and alarm bells, connected with the transformer cooling devices, automatic circuit-breakers, &c. The Corporation of Gothenburg takes energy from the sub-station at 6,000 volts, and distributes it to power consumers in the town, in addition to that derived from its steam generating station.

The distance from Trollhättan to Gothenburg is about 80 km., and to Sköfde 100 km. Primary sub-stations are situated at all the points mentioned above, and there are several secondary sub-stations on the 10,000-volt mains.



FIG. 16.—WATER-JET DISCHARGERS FOR 50,000-VOLT LINES.

Edet, Nol, and Gothenburg, with a branch from Lilla Edet to Alingsås. At Gothenburg the pressure is lowered to 10,000 and 6,000 volts for distribution to consumers by overhead and underground mains. The main sub-station contains seven 3,000-k.v.a. single-phase transformers, forming two three-phase sets with star-connected

**Explosion of a Turbo-Dynamo.**—A serious mishap, of a nature fortunately rare in these days of powerful generators, occurred on March 8th last in the Essen power station of the Rheinisch Westfälischen Co. Shortly after 11 p.m., the No. 4 turbine—a Zoelly machine running at 1,000 R.P.M. and coupled to a 5,000-kw., 0.8 power-factor, 5,250-volt alternator with salient rotor poles—began to emit peculiar rising and falling sounds; meanwhile the output of the machine fluctuated widely. The set was at once unloaded, the main switch being opened when the output was reduced to 900 kw. The alternator then showed normal voltage, but, while the main stop valve was being closed, the whole machine "burst." Wreckage flew in all directions and wrought considerable havoc. One piece of the stator, weighing several tons, was thrown through the wall of the power house, and, having damaged the tramway track, ricocheted against and damaged a building on the opposite side of the street. Five of the poles, weighing about 2,000 lb., were hurled through the roof, while the remaining seven were found in various parts of the power house. One pole soared over the houses on the other side of the street and buried itself deeply in the ground, while two others were found well over 100 yards away near the coke ovens of the Victoria Mathias pit. The engine room was strewn with splinters of iron and wood after the disaster, but with the exception of an adjacent 5,000-kw. set which was set on fire, no serious damage was done to the remaining valuable plant in the building. The power house building and some of the adjacent property belonging to the company were, however, badly damaged, but fortunately no loss of life or injury to person was involved.

The cause of the disaster has not been determined, and it is not believed that any definite conclusion can be reached in this respect. The town fire brigade and the station staff, aided by employes from the neighbouring colliery, soon restored comparative order to the works, and it is worth recording that current supply was only interrupted for about five minutes.

## NOTES.

**New Units, Abbreviations and Symbols.**—The Elektrotechnischer Verein, the V.D.I., and other associated bodies, have recently published amended recommendations for the nomenclature and notation of mensuration, time, mechanical, heat, light and electrical units and magnitudes. Most of the abbreviations recommended are of obvious significance, a large number being already in general use, but among the arbitrary, or less easily intelligible ones, may be noted:— $\mu = 0.001$  mm.;  $\lambda = 0.001$  ml.  $= 0.001$  cc.; dt. (= decatonne) = 100 kg.;  $\gamma = 0.001$  mg. Time intervals are represented by h., m., s., written on the line, and instants of time are denoted by the same abbreviations set above the line (thus, 4<sup>h</sup> 50<sup>m</sup>). The dyne is too small a unit for use in practical work, hence a new unit of force, the *vis*, is introduced. The *vis* is that force which imparts 1 metre per sec. per sec. acceleration to a mass of 1 tonne: 1 *vis* (= 1 v.) =  $10^7$  dynes, and is approximately equal to the weight of 100 kg. The corresponding work unit is the *vismetre* (vm.); and the power unit, 1 vm. per sec., is familiar under the name kilowatt. Again, 1 *bar* = weight of 1 grm. at 45° latitude; 1 kb. = weight of 1 kg.; 1 mb. = 1 megabar = weight of 1 tonne. It is clear that 1 v. = 102 kb. approximately; 1 kw.-hour = 3,600 vm.; 1 vm. = 1 kilo-joule = 1 kj. (= 102 kbm. approx.); 1 barmetre = 1 bm. = 1 grm.-metre; 1 vm. per sec. = 1 kw. (= 1 G.P. = 1 Grosspferd). The Hefner-C.P. is denoted by HK.; the Hefner-lumen by Lm.; the Hefner-lux by Lx. 1 microfarad is denoted by  $\mu$  F.; and the ohm by  $\Omega$ , and the megohm by  $M\Omega$ .

**Copper.**—Messrs. Merton's mid-monthly circular gives particulars of the stocks in England and France and afloat thereto from Chile and Australia on April 15th, 1913. These amount to 32,901 tons, an increase of 640 tons on the quantity registered on March 31st. While English stocks have increased 526 tons, and French 264, and the quantity afloat from Chile is 350 tons better than on March 31st, Australian shipments are 500 tons less, an amount nearly corresponding to the English gain. For the first fortnight of April the arrivals from North America are one-third above average. Spain and Portugal send a small quantity (668 tons) to England and France; but full average to other European countries. Chile shipments are average, and Australian very slightly below. Total deliveries, at 27,221 tons, are high, and denote an encouraging demand. During March American stocks were reduced by a considerable amount, 8,050 tons. The combined visible supply (excluding Holland and Germany), consequently lowered by a larger figure than has been recorded since April, 1912, viz., 11,935 tons. The world's supply (including Holland and Germany, and estimated in other ports) shows a decrease of 7,649 tons for March.

**Annual Concert.**—LONDON.—The staff of the Electrical Engineer's Department of the Great Eastern Railway Co. held their annual smoking concert at Cannon Street Hotel on Saturday, April 19th, and, with their friends, assembled in great force. Mr. H. W. Firth, M.Inst.C.E., presided, and was supported not only by several of the officers of the Great Eastern and other companies, but by several eminent gentlemen engaged in the electrical engineering world, amongst whom may be mentioned: Mr. Wm. Duddell, President of the Institution of Electrical Engineers; Mr. A. H. Walton, of the British Thomson-Houston Co.; Messrs. T. Stevens, John Wilson, J. Robertson, E. P. Grove, C. Busk, E. Barton, S. A. Parnwell, G. Keary, A. O. Shave, A. P. Parker, A. W. Polley, G. P. Parker, and C. S. Egerton. An enjoyable musical programme was interspersed with various toasts. Mr. E. P. Grove, of the London Underground Electric Railways, proposed the "Success of the Chairman, Directors and Officers of the Great Eastern Railway," remarking that, although his association with that company had been but of short duration, only dating from the extension of the Central London Railway to Liverpool Street, it had, nevertheless, been of a very cordial nature, and he could therefore honestly wish them every success. Mr. C. Busk, Continental traffic manager, suitably responded in a humorous speech. The next toast, that of "The Visitors," was submitted by Mr. F. W. Leake, who extended a very hearty welcome to all visitors present. Mr. Wm. Duddell, in reply, expressed the pleasure it gave them to be present, and dealt with electrical topics past and present. The toast of "The Chairman," which was received with great enthusiasm and musical honours, was very ably proposed by Mr. Robertson, of the Tilbury Railway, in response to which Mr. Firth thanked all for their kindness, expressed his gratitude for the loyal support he had received from the staff connected with his department, and stated that any success which had been achieved was due to one and all. He further remarked that he felt that the work of the department was being based on sound principles, and impressed upon the younger men the necessity of being interested in their work and endeavouring to make themselves thoroughly proficient in their various spheres. Mr. D. James proposed a hearty vote of thanks to the Committee. This was seconded by Mr. F. A. Kaffrell and responded to by Mr. J. W. Ball, hon. sec.

**Fatalities.**—HEBBURN.—A mysterious explosion occurred at Hebburn-on-Tyne on March 30th, by which a man named Collinson, and a woman named Gray, were killed, being blown through the ceiling of a house. The explosion was generally attributed to gas, but the evidence given at the resumed inquiry on April 17th suggested that the electric light service might be, in part at least,

responsible. The Northern Counties Electric Supply Co. was represented by Mr. Burton, Newcastle-on-Tyne, and amongst the experts present were Prof. W. M. Thornton, Professor of Electricity at Armstrong College; Mr. F. O. Hunt, Assistant Lecturer in Electricity at Armstrong College; Prof. J. A. Smythe, Lecturer in Chemistry at Armstrong College, and representatives of the local gas companies. Before resuming the taking of evidence, the jury inspected the electrical cable that had been taken from the site of the explosion.

Annie Collinson, daughter of the deceased man, said that about noon on the morning of the explosion she noticed a blue coloured smoke coming through the skirting board of the front room. She thought the smoke smelt like rubber burning. She told her father, who pulled the skirting board up and sent witness for water. The deceased woman, Mrs. Gray, her grandmother, then entered the room. Her father sprinkled water on the place, and just as she left the room to get more water she heard an explosion. In answer to questions, witness said she did not see any flame. There was a fire in the kitchen, but not in the front room.

John Hatley, manager of the Ellison House Hotel, on the opposite side of Lyon Street to that in which Collinson's house was situated, said he was in the hotel cellar about the time the explosion took place, when the electric lights gradually went out, and he afterwards found that all the electric lights in the house were out. Shortly after the lights went out the explosion occurred. The electric supply was drawn from the main which ran along the front of Collinson's house.

Constable Robson and John George Bennett, who were first on the scene after the explosion, said that immediately inside the doorstep of Collinson's house they saw a flame, which was more noticeable near the window.

Inspector Riddell also spoke to the flame; it was a "gassy" flame. He was of opinion the explosion was caused by a fused cable. When the electric cable was opened he detected a smell similar to that which he found in the house after the explosion. The cable was covered with tiles, but he thought there was a small breach.

At this point the inquiry was adjourned for a week, in order that an expert examination might be made of the electric cable and gas mains.

**COATBRIDGE.**—The *Glasgow Daily Herald* reports that Robert Hall, 51, a bellman or engine-keeper, was killed while employed in Lochrin Ironworks. "He was engaged trimming an electric lamp in the smithy, and had got on to some iron bars instead of a wooden board which he was in the habit of standing upon. He fell among the iron bars in an unconscious state." Artificial respiration was resorted to, but without effect.

**ROCHDALE.**—An inquest was held at Radcliffe, near Manchester, on Monday, into the cause of the death of a joiner named Geo. Hampson, who was killed at Mount Zion Bleach Works, near Rochdale. Evidence showed that the works were burnt out a month ago, and were being rebuilt. A fencing was necessary to protect the workmen using the scaffold from the dangers of a 10,000-volt live wire. The clerk of works informed the Coroner that he had specially warned the deceased of the danger of the wire, telling him that it meant instant death. The evidence showed that the deceased must have got over the fencing, and beneath the wire, and in a moment of forgetfulness had allowed his head to come in contact with it. The jury returned a verdict of "Accidental death."

**Association of Electrical Station Engineers.**—A meeting was held at Manchester on April 17th, 35 gentlemen being present. The proceedings were opened by the chairman (Mr. J. W. Lanham), who in a brief statement gave an outline of the work already done by the branch, and for the benefit of the new members present, explained the general aims of the A.E.S.E. The main business of the evening was to elect the permanent committee. It was resolved that it should consist of 12 members, at least one being appointed from each district represented, three from Manchester, and one from a private plant. The last-named representative will not be appointed until a few more engineers from private plants have become members of the Association. Mr. F. Clarke was appointed assistant secretary. It was resolved that the next general meeting should take the form of a social evening, the first portion being allotted to a paper and discussion on the general status of the profession and the usefulness of an Association. The hon. secretary, Mr. J. W. Thomas, B.Sc. Tech., will read the paper. The date of next meeting will be duly announced, and further details can be obtained from the hon. secretary (Manchester Branch) A.E.S.E., 15, Lotherton Street, Harpurhey, Manchester.

A meeting of the Bradford Section of the Association was held on 16th inst., for the purpose of completing the organisation of the Section which was commenced in March. The chair was occupied by Mr. W. C. Ekin, senior charge engineer at the Bradford electricity works (chairman of the Section), and there was a good attendance. It was reported by Mr. Chas. H. Broadbent (the hon. secretary) that 30 applications for membership had been received, these being from engineers in Bradford, Dewsbury, Colne, Shipley, Rotherham, Barnsley and Keighley, and that other applications were pending. It is proposed, as soon as the Section has been got into full working order, to arrange for social events in the summer months and lectures for next winter. After the replies from London with regard to some of the resolutions passed at the previous meeting had been discussed, the question of a delegate to the Conference arose, and it was unanimously agreed that Mr. C. H. Broadbent should represent the Bradford Branch. A discussion then ensued on the subject of increasing the membership of the

branch, and it was pointed out that a large number of men in the Bradford district were a little perturbed with regard to the effect of joining the Association on their future prospects; but it was easily shown that the main object of association was to improve their prospects and better the general conditions. Mr. C. H. Broadbent, 129, Hartington Terrace, Lidget Green, Bradford, is the hon. secretary for Bradford and district.

**British Engineers' Association.**—A meeting of this Association was to be held at the Cutler's Hall, Sheffield, yesterday afternoon at which Mr. Douglas Vickers, the president, was to preside. He was to introduce the Association's Commissioner in China, Captain T. C. Fitzlugh, M.V.O.

**Re Foster Engineering Co., Ltd.**—In the Companies Winding-Up Court on Tuesday, Mr. R. H. Burman petitioned for the compulsory winding up of this company. Counsel said that Mr. Justice Swinfen Eady had allowed the matter to stand over, with a view to the parties coming to an arrangement, and counsel now asked leave to withdraw the petition or to have it dismissed, the company to pay the costs. The petition was dismissed, the company paying the costs.

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION).—The annual report of the Committee states that the attendance at the general meetings remains unsatisfactory, the average attendance being barely 14 per cent. of the membership. Only two papers have been contributed from the Section. The past session was made memorable in the annals of the Section by the visit of the Institution to Glasgow during June last year. The membership of all grades now amounts to 390, an increase of 28. Commencing with January, 1914, the *Journal* will be published fortnightly during the session. The Council has in view a scheme for the better co-ordination of arrangements for selection and reading of papers in London and at the Local Sections. The office-bearers for the session 1913-14 will be as follows:—Chairman, Mr. J. A. Robertson; vice-chairmen, Mr. J. Lowson and Mr. T. Blackwood Murray; past chairmen (*ex-officio* members of Committee), Mr. Sam Mavor, Mr. F. A. Newington and Mr. W. M'Whirter; chairman of Students' Section, Mr. A. Page; ordinary members of Committee, Messrs. D. A. Starr, J. K. Stobert, J. F. Nielsen, W. L. Spence, M. B. Field, J. H. Bunting, J. S. Nicholson, E. T. Goslin and G. Stevenson; hon. secretary and treasurer, Mr. J. E. Sayers; assistant hon. secretary, Mr. W. F. Mitchell. Hon. sec. of Students' Section, Mr. J. W. Mowat.

(LONDON).—It is announced that the Institution does not hold a qualifying examination for admission as Student; but on and after June 1st, 1913, all candidates for election to the class of Students will be required to have one of the following qualifications:—

1. The Matriculation Examination of any University in the British Empire; or the Responsions Examination of the University of Oxford; or the Previous Examination of the University of Cambridge.
2. The Studentship Examination of the Institution of Civil Engineers.
3. The School-leaving Examination for the Scottish Education Department.
4. The Naval Cadet Passing-out Examination.
5. The Entrance Examinations for Woolwich and Sandhurst.
6. The School Examination (for School-leaving Certificate) or the Senior School Examination of the University of London.
7. The Oxford or Cambridge Local Examination. (A Senior Certificate, provided it covers English and Elementary Mathematics.)
8. The Oxford and Cambridge Higher Certificate (provided it covers English and Elementary Mathematics).
9. The Abiturient Examination of any German or Austrian Secondary School, or the corresponding examination of similar schools in other countries.
10. The Certificate of any other Educational Authority which may be recognised by the Council of the Institution, as equivalent for the purpose of admission to the class of Students.

(LONDON STUDENTS' SECTION).—The annual general meeting of this Section has been postponed from April 30th until May 7th. There are five extra-collegiate vacancies occurring on the Students' Committee, and nominations should be sent to the hon. secretary, Mr. E. T. Driver, 24, Bradgate Road, Catford, S.E., at the earliest opportunity. The next meeting will be held on Wednesday, May 7th, at 7.45 p.m., when Messrs. E. A. Richards and D. Dunham will read a paper on "Single-Phase Commutator Motors."

(BIRMINGHAM SECTION).—On Wednesday Dr. Giesbert Kapp read a paper entitled "On Phase Advancing," and gave a demonstration of his machine. The same paper was to be read in London yesterday.

(YORKSHIRE SECTION).—A paper was read by Mr. Sidney Simpson on "Prices Charged for Electric Power" at Sheffield on Wednesday, and a discussion followed.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—At the monthly meeting of the West of Scotland Branch, held on Friday last at Glasgow, discussion was resumed on the paper read by Mr. James McCann, Carronhall Collieries, on "Coal-Cutting Machines: their Installation and Manipulation." Mr. Sydney F. Walker suggested that a motor-generator should be fixed in any convenient part of the pit to furnish current at 100 volts on the constant-current system. The 100-volt service would eliminate all chances of fatal shock, and the constant-current system obviated the necessity of a switch on the motor and any starting or regulating resistance. Everything was done by rocking the brushes, and this could be accomplished by gearing worked by a lever or wheel from

outside the motor case, the shaft of the wheel or the gearing passing through a gas-tight gland.

THE SOCIETY OF ENGINEERS.—On Monday, May 5th, at the Institution of Electrical Engineers, a paper on "Tidal Waters as a Source of Power" will be read by Mr. C. A. Battiscombe.

CONCRETE INSTITUTE.—Reports of the Reinforced Concrete Practice Standing Committee on "Cracks in Concrete," and "The Surface Treatment of Concrete," were read at the meeting on April 10th. The next meeting will take place on April 21th, when a report of the Science Standing Committee, entitled "A Standard Notation for Structural Engineering Calculations," will be presented.

**For Sale.**—The Paisley Corporation has for disposal one 300-kw. Ferranti steam alternator, five Ferranti rectifiers, and about 200 Wright's M.D. indicators. See our advertisement pages in this issue.

**Inquiry.**—Makers of the "Snap" patent lamp lock are asked for.

**Appointments Vacant.**—Shift engineer, for the Stretford U.D.C. Electricity Department (£2). Working electrical engineer and fitter, for the Axbridge Union (35s. +). Chief assistant electrical engineer, for the Watford U.D.C. (£150). Switchboard attendant, for the Borough Electricity Works, Lancaster (25s.). See our advertisement pages in this issue.

"The Generators."—The next dinner of the Generators will be held at the Trocadero, to-night (Friday).

**Thirty Years' Celebration.**—The Austrian Electro-technischer Verein, of Vienna, recently held a special meeting to celebrate the completion of the thirtieth year of its existence.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—A pleasant little function took place at the Whitehall Club last Tuesday, when a number of personal friends entertained Mr. H. H. COUZENS to dinner. The occasion was to mark the impending departure of Mr. Couzens to Canada, where, we understand, he will take up a very important position. Mr. John F. C. Soell acted as chairman. Mr. Blain, the tramways manager at West Ham, in proposing the health of the guest, referred in eloquent terms to Mr. Couzens's ability as an engineer and to his great capacity for friendship.

MR. L. C. GILMORE, of the Maidstone Corporation electricity staff, has resigned, and joined the electrical department of Messrs. Drake & Fletcher, engineers, of Maidstone, who are extending this branch of their business.

MR. R. SHORT, for several years second engineer in the employ of the Falmouth Electric Supply Co., has been presented by the staff with a pipe and case and tobacco pouch on the occasion of his departure to take up the position of chief engineer to North Berwick Electric Supply Corporation.

MR. L. H. KING, electrical engineer to the Whitby U.D.C., has resigned, having accepted the position of station erection superintendent with the Marconi Wireless Telegraph Co. He commences his new duties in three months' time.

MR. T. A. G. MARGARY, mains superintendent of the Islington municipal electricity undertaking, has resigned his position.

The Leeds Tramway and Electricity Committee has decided to recommend the appointment of Mr. CHARLES N. HEFFORD as manager of the electricity department. Mr. Hefford was formerly assistant engineer in the department, and has been temporarily filling the position of manager since Mr. Harold Dickinson went to Liverpool. The Committee recommends that his commencing salary be £600 a year.

MR. B. W. GOTHARD, engineer of the Minchhead Electric Supply Co., Ltd., has been appointed electrical engineer to the Aldershot Gas, Water and District Lighting Co.

In order to show their appreciation of the manner in which their electrical engineer has carried out his duties, the directors of the Stratford-on-Avon Electricity Supply Co. have increased the salary of Mr. JULIAN G. THAIN by £30, together with an allowance at the new rate on the salary he has received since he was appointed. It will be remembered that Mr. Thain was appointed in September last in succession to Mr. Falcke, who is carrying on private business at Mansion House Chambers, E.C.

The Taunton T.C. has appointed Mr. G. S. MCCLAREN as mains and meter superintendent.

On leaving Ilfracombe for Grantham (Urban Electric Supply Co.), Mr. W. J. COPSEY, who has been connected with the Ilfracombe E.L. Co. for several years, was presented by the engineer and manager, Mr. H. Stewart, on behalf of the staff, with a marble timepiece. He was also the recipient of marks of esteem from the members of the Ilfracombe branch of the C.E.M.S. and the Junior Imperial League. From the former he received a writing bureau, a badge of the society being affixed, and from the latter a silver hot-water jug.

Mr. WILLIAM WYLD, M.I.Mech.E., M.I.E.E., borough electrical engineer and general manager of the Corporation Tramways, Birkenhead, has been appointed chief electrical engineer and manager for the borough of Hamstead. A native of Bishop Auckland, Mr. Wyld was educated at University College, Sheffield, where he studied mechanical and electrical engineering. He served his time to electrical engineering at Darlington, and his first appointment was as assistant in the Blackpool electricity works. From there he went as chief electrical assistant to Salford. Later, he moved to Wednesbury, and worked for the Patent Shaft and Axletree Co. He designed the electrical station there, and also fitted up the machinery for providing power and light. He was afterwards appointed electrical engineer at Doncaster, where he superintended the construction of the tramways. In 1904 Mr. Wyld went to Birkenhead, succeeding Mr. Fearnley, who went to Sheffield. On Mr. Bate leaving Birkenhead in 1907, Mr. Wyld was appointed to the dual position of electrical engineer and tramway manager, and he has been responsible for many important improvements in the Birkenhead undertakings. He is a member of the Liverpool Engineering Society, and was last year on the Council of the Tramways and Light Railways Association. In his new post, Mr. Wyld may rest assured that he will have the best wishes of everybody.

**General.**—At a *café chantant*, held last Monday at the Chiawick Town Hall, Mr. A. H. Stanley occupying the chair, the staff of the London United Tramways, Ltd., presented Mr. Z. E. KNAPP, who recently retired from the post of general manager to take up the position of chief engineer of the Underground Electric Railways of London, with an illuminated address and a gold watch, and Mrs. Knapp with a gold chain purse. In making the presentation, Mr. J. B. MacKinnon, traffic superintendent of the L.U.T., said the whole staff were eager to testify to the happy relationship that had existed since Mr. Knapp took office in 1910, and of the sense of justice, and the sympathy and generosity he had always displayed in matters affecting their well-being, and particularly with respect to the improvement in their conditions of employment. Mr. Knapp, in response, said the one change during his short period of office that gave him the greatest satisfaction was the introduction of the so-called "educational" system. The old method of disciplining men by suspension did not work well. Under the new method of merit and demerit marks a man was disciplined without the consequences reacting upon those who were dependent upon him. He had to thank the directors and the staff for all the consideration extended to him, and neither he nor his wife would ever forget their kindness, which had found a lasting expression in the handsome presentations that evening.

Congratulations to the Manchester Association of Students (in connection with the Institution of Civil Engineers) on the choice of its new president—MR. S. L. PEARCE, city electrical engineer of that city.

The *British Australasian* says that MR. G. T. MILNE, who takes the place of Mr. Hamilton Wickes as H.M. Trade Commissioner in Australia, has arrived in Fremantle.

**Obituary.**—MR. DACRE HELME.—We deeply regret to record the death, which occurred last Friday, following upon pneumonia, of Mr. Dacre Helme, borough tramways manager and electrical engineer at Nelson. Mr. Helme went to Nelson in 1904, having previously been associated with Messrs. Vickers, Maxim and Co., Barrow, and entered the service of the Corporation as a mechanical fitter and electrical engineer. When Mr. Henry was promoted, Mr. Helme was made chief assistant engineer, and on the tragic death of Mr. Henry in 1906, he was chosen chief electrical engineer and tramways manager. When Mr. Helme took over the concern, it was in a poor way financially, but, as a result of close study of the needs of the town and zealous efforts to cater for them, he had the satisfaction 12 months ago of announcing that the two departments had actually made a profit. Mr. Helme, who is described as a painstaking official, was a native of Hereford, and only 39. He leaves a widow and one son. The funeral took place at Little Marsden on Tuesday, and was attended by a large gathering, including the Mayor, Corporation officials and members of the Town Council.

MR. JOHN SAXBY.—We regret to learn from yesterday's newspapers that Mr. John Saxby, whose name has for many years been well known by reason of his inventions in connection with the interlocking of railway points and signals, passed away on Wednesday, at Hassocks, near Hayward's Heath. His firm, Messrs. Saxby and Farmer, Ltd., of Westminster, which has all along specialised chiefly in railway signalling inventions and work, is one of the oldest associated with British electrical industry. He was in his 92nd year.

MR. R. COATES.—The *Western Mail* reports a fatal accident having occurred on Saturday at Ystradgynlais, to Mr. R. Coates, manager of the electric light works of the Glangawe Electric Supply Co., Ltd. "No one witnessed the accident, but his body was discovered in the engine-house about 8.15 p.m. terribly mutilated, after having been whirled round by a fly-wheel. The unfortunate man's head was jammed in the machinery. Mr. Coates was 38 years of age, and he leaves a widow and four children."

An inquest was held on Tuesday. It was stated that deceased was at the works when he asked a man named George Harris to attend to the boilers. Harris proceeded to do so, and on returning found the manager's dead body near the fly-wheel badly mutilated and lying across the column. It was supposed that the deceased's clothing caught in the machinery, and that he was whirled to death. Dr. Walsh said that the body was badly injured, and before it could be extricated from the machinery it was found necessary to sever one of the hands. A verdict of "Accidental Death" was

returned, and the Coroner said he had written to the company suggesting that there should be more protection of the machinery.

MR. T. A. TISSEMAN.—The death occurred at Warminster (Wilts.), on April 14th, of Mr. Thos. Alfonso Tisseman, who, after serving his articles with Messrs. Crompton & Co., of Chelmsford, received the appointment of electrical engineer to Messrs. C. A. Vandervell & Co., of Acton Vale. Deceased, who had been ill for some time, was only 25 years of age.

J. R. HAZELDEAN.—The death has occurred of Mr. John Robert Hazelden, Tor Terrace, Newquay, electrical engineer, at the age of 57. Mr. Hazelden expired shortly after retiring to rest.

## NEW COMPANIES REGISTERED.

**G. St. John Day (Patents), Ltd.** (128,154).—This company was registered on April 4th, with a capital of £10,000 in £1 shares to take over from G. St. John Day, of Mumps Electrical Works, Oldham, the benefit of two patents relating (1) to electrical coupling devices, and (2) to improvements in the junction of cords or wires with electrical apparatus, and of two other inventions known as the "One-part Lampholder" and the "Mumps Lamp-holder." The subscribers (with one share each) are—G. St. John Day, 303, Park Road, Oldham, electrical engineer and contractor; J. Orme, 91, Queen's Road, Oldham, engineer; W. Chadwick, Haslemere, 89, Queen's Road, Oldham, solicitor. Private company. The number of directors is not to be less than two or more than four; the first are G. St. John Day, J. Orme and W. Chadwick, each of whom may retain office while holding 600 shares. Registered office, Mumps Electrical Works, Albert Street, Oldham.

**Premier Electric and Hardware Co., Ltd.** (128,630).—This company was registered on March 29th, with a capital of £2,000 in £1 share to carry on the business of electricians, electrical engineers, generalists and stores of electricity for motive power, light and heat, hardware merchants, &c., and to acquire the business carried on at 9 1/2, Cheapside, Golden's Green, &c., as the Premier Electric and Hardware Co. The subscribers (with one share each) are—G. Cohen, 9-10, Cheapside, Golden's Green, N.W., electrician; J. MacConnell, Old Serjeants' Inn Chambers, W.C., auditor. Private company. The first directors are not named. G. Cohen is first secretary. Registered by J. MacConnell, Old Serjeants' Inn Chambers, Chancery Lane, W.C.

**Electric Cookers, Ltd.** (128,070).—This company was registered on April 1st, with a capital of £5,000 in £1 shares (5,000 preference) to take over certain inventions relating to electric cookers, &c., and to adopt an agreement with H. T. Harrison. The subscribers (with one share each) are—C. A. Battiscombe, 120, Victoria Street, S.W., civil engineer; H. T. Harrison, 11, Victoria Street, S.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are C. A. Battiscombe (managing director) and H. T. Harrison. Registered by Jones, Son & Andrews, 64, New Broad Street, E.C.

**Reversible Turbines, Ltd.** (128,167).—This company was registered on April 4th, with a capital of £1,912 10s. in 1,750 "A" shares of £1 each, and 3,500 "B" shares of 1s. each, to acquire from W. G. Walker his invention for a reversible turbine engine, and benefit of patents or other protection in respect thereof. The subscribers (with one share each) are—H. W. McBean, 172, Wilbury Road, Letchworth, Herts., secretary; W. A. Stephenson, Loch Inch, Strathnam Park, S.W., secretary; A. E. Whitlock, 10, Horder Road, Fulham, S.W., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first. Registered by M. L. Knight, Bromley, Kent.

**Castlecomer Tramway Co., Ltd.** (3,963).—This company was registered in Dublin on April 3rd, with a capital of £40,000 in £1 shares, to promote, construct, equip and work, by steam, electric or other power, a tramway or light railway in Castlecomer, Co. Kilkenny. The subscribers (with one share each) are—R. H. Prior-Wandesforde, D.L., Castlecomer House, Castlecomer; J. B. Marr, "Cobban," Castlecomer, mining engineer. Private company. The first directors, to number not less than two or more than five, are R. H. Prior-Wandesforde, R. B. Gahan and J. B. Marr; qualification, £10; remuneration as fixed by the company. Registered office, Castlecomer, Co. Kilkenny.

**W. Leonard & Co., Ltd.** (128,187).—This company was registered on April 6th, with a capital of £500 in £1 shares, to take over the business of an electrical engineer carried on by W. Leonard Prangnell, at 4, Soho Street, W., as "W. Leonard & Co." The subscribers (with one share each) are—W. L. Prangnell, 4, Soho Street, W., electrical engineer; A. E. Rule, 4, Soho Street, Oxford Street, W., accountant. Private company. The number of directors is not to be less than two or more than five; the first are W. L. Prangnell and A. E. Rule, secretary. Registered office, 4, Soho Street, Oxford Street, W.

**National Engineering Co., Ltd.** (128,180).—This company was registered on April 5th, with a capital of £25,000 in 19,000 preference shares of £1 each, and 25,000 ordinary shares of 10s. each, to acquire from Otto Viola the business known as the National Engineering Co., for £19,000 (£6,500 in preference shares and £12,500 in ordinary shares), and to carry on the business of general and electrical engineers, &c. The subscribers (with one share each) are—A. Woder, 43, Addison Way, Hendon, N.W., engineer; E. Brown, 13, Alington Street, Ealing, W., engineer; W. Jebbit, 80, Manor Street, Clapham, S.W., engineer; J. White, 46, Wharton Street, King's Cross Road, W.C., engineer; S. Gozzett, 3, Harrington Road, Grove Park, Chiswick, W., engineer; D. Murphy, 139, Stanhope Street, N.W., engineer; W. Nichols, 512, High Road, Chiswick, W., engineer. Registered without articles of association. Registered office, 30-32, Seaton Street, Euston Road, N.W.

**Zephyr Ventilating Co., Ltd.** (128,319).—This company was registered on April 12th, with a capital of £7,500 in £1 shares to take over the business of a ventilating and general engineer, carried on by H. C. H. Tarr at Zion Road, Lawrence Hill, Bristol, as the "Zephyr Ventilating Co." to acquire from J. S. Armstrong and H. C. H. Tarr a certain patent, to carry on business of manufacturers of wires, cables and electrical appliances, electric and general engineers, &c. The subscribers (with one share each) are—J. Liddell, 46, Queen's Square, Bristol, manufacturers' agent; J. A. Murray, 9, Elm Grove Road, Bristol, sugar merchant. Private company. The number of directors is not to be less than two or more than six, the first are H. C. H. Tarr and J. Liddell; solicitor, J. McTurk, 31A, Corn Street, Bristol. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

**"Ceag" Electric Safety Lamp Co., Ltd.** (128,191).—This company was registered on April 7th, with a capital of £10,000 in £1 shares (2,500 7/8 per cent. cum. preference), to carry on the business of manufacturers, importers, and exporters of and dealers in electric lamps and all kinds of electric or mechanical accessories, tools, implements and articles, &c. The subscribers (with one share each) are—C. E. von Bernard, 63, Queensborough Terrace, W., gentleman; W. Strecker, 23, St. John's Wood Park, N.W., music publisher; M. J. Stoock, 19, St. Dunstan's Hill, E.C., merchant; T. H. Engelmann, 19, St. Dunstan's Hill, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are C. E. von Bernard, W. Strecker (chairman), M. J. Stoock and T. H. Engelmann; remuneration of chairman £50 per annum. Registered by Cresselmann & Rouse, 85, Gracechurch Street, E.C.

## CITY NOTES.

## Lancashire Power Construction Co., Ltd.

THE directors' report for the year ending December 31st, 1912, states that the contract for a 3,500-kw. generating set for the Lancashire Electric Power Co. has recently been completed, and the set is now doing regular work. The lead of the Parliamentary Co. is, however, continuing to increase at such a rapid rate that still further plant is required; an order has, therefore, been placed with this company for a generating set with a normal full-load capacity of 4,375 kw., and this set is due for delivery in September next. In order to provide the necessary capital for this plant, and also for various extensions of the mains, it is proposed to make an issue of £100,000 of 5 per cent. prior lien bonds, making with the £50,000 issued in June, 1911, a total issue of £150,000.

The trading profit of the Lancashire Electric Power Co. for the year 1912 has amounted to £14,617. This figure would have been considerably larger but for loss of revenue and increased expenditure as a result of the coal strike. The company's supply was kept intact throughout the period of the strike, but the loss in output was very considerable, and it is estimated that the profits were adversely affected to the extent of £1,380. There was also a strike in a branch of the textile trade in the early part of the year, which also made itself felt on the output of the company. To the trading profit has to be added £757, being interest on the hire-purchase instalments, &c., making a total of £15,374; out of this debenture interest requires £1,500, debit balance written off £7,737, and there is to be carried forward £3,137. The debit balance which appeared in the 1909 balance-sheet of the company as £17,194 has now been eliminated. Notwithstanding the troubles referred to above, the company's business has continued to develop in a most satisfactory manner, as the following figures indicate:—

	1908.	1909.	1910.	1911.	1912.
Units generated . . . . .	7,181,793	9,251,831	13,646,307	17,771,936	23,110,507
Max. load in kw. . . . .	2,800	3,330	4,610	5,530	6,730
H.P. connected . . . . .	5,960	7,710	10,600	13,600	16,400
Receipts . . . . .	£10,056	£16,294	£24,352	£32,726	£42,778
Expenditure . . . . .	£14,421	£15,164	£18,467	£22,031	£28,156
Trading result . . . . .	£4,365	£1,130	£5,885	£10,695	£14,617
	Loss.	Profit.	Profit.	Profit.	Profit.

The receipts from the low-tension general supply, which the company is operating in certain districts, continue to grow rapidly, and two more districts will be developed during the present year. The new contracts arranged for and which will come into operation this year are some of them of a most important description. Amongst others may be mentioned, as being of a public character, the agreements to supply electricity in bulk to the Corporation of Salford and to the urban district of Hindley, and the contract for the Lancashire and Yorkshire Railway electrification between Bury and Holcombe Brook. In the weaving trade the system of driving each loom by a separate motor (a system in which the company were pioneers) continues to make rapid progress, and two new mills at present in course of erection in the company's area, and which are to be supplied with electrical energy from the company's mains, are both being equipped in this manner.

The prospects for the current year are excellent, provided that no labour troubles occur to dislocate trade. The amount of work in hand at the commencement of the year, exclusive of the Salford contract, which had not then been entered into, and which is not likely to become effective before the autumn, was considerably in excess of the amount of work in hand at the commencement of 1912. It is true that the price of coal has risen some 20 per cent., but, owing to the provision of a coal clause in the company's agreements, this will not affect the company's profits to any serious extent. A marked improvement in the company's position as a result of the year's trading is, therefore, confidently anticipated.

DR. H. F. PARSHALL, chairman, presided on April 17th at Salisbury House, E.C., over the annual meeting, and in moving the adoption of the above report, he said that the balance-sheet, whilst satisfactory, might not show the progress of the business during the year, because that company was a holding company, and it was the progress of the Parliamentary Co., viz., the Lancashire Electric Power Co., which was of most interest. The connections of the Parliamentary Co. during 1912 totalled 2,102 kw., as against 2,107 kw. connected during 1911, and the work in hand, but not connected at the end of the year totalled 2,401 kw., as compared with 1,922 kw. at the end of 1911. Since the commencement of the year, the Salford contract had been arranged, and it was anticipated that the effect on this year's load would be to add 1,000 kw. or 1,500 kw. to the normal growth. The price had been very carefully worked out, and would bring a very substantial profit to the Lancashire Co., whilst it appeared to be an eminently satisfactory contract to the Salford Corporation. The units sold increased from 14,081,000 in 1911, to 18,815,000 in 1912, which was the greatest increase for one year that the company had ever experienced. The percentage increase was 33.6. During the same period the revenue increased from £32,150 to £42,776, while the trading profit increased from £10,695 to £14,617. The latter figure would have been considerably higher but for the coal strike, which lasted for six weeks, and which it was estimated affected the profits of the company to the extent of £1,380. All their contracts contained a clause to protect them against a general increase in the price of coal, but of course during the transition period they did not get the advantage of the clause. A further unsatisfactory feature was the breakdown of one of the generating machines, but the cost of repairing this had been borne out of the revenue account. There was also a strike in the weaving trade, which, also, to a small

extent, adversely affected the returns. The units sold from the low-tension system increased from 202,731 to 318,839, or rather over 50 per cent. The capital expenditure had been considerable owing to the power station extension, the total expenditure for the year being £63,844, of which approximately £45,500 was spent on buildings and plant at the power station; £3,795 on sub-station equipment; £8,985 on high-tension mains; and £5,500 on provisional orders. He did not see why the result during the present year should not be as good, as the amount of work in hand was greater than they had a year ago, whilst last year also they had no such important business as the Salford contract to look forward to.

MR. F. E. GRIPPER seconded the motion.

MR. CROSSWAY asked whether it was possible to have a profit and loss account of the Parliamentary Co.

The CHAIRMAN explained that they were the holding company, and found the money for the construction work of the Parliamentary Co., and the latter company issued securities to the holding company for the work done by them. This was the turning point of the company, because the Parliamentary Co. now being solvent, they would be free to pay dividends.

The report was adopted.

The CHAIRMAN said the Parliamentary Co. had several important supply contracts with people like the Lancashire and Yorkshire Railway Co., which might increase very rapidly, and so in order to be prepared they proposed to issue the balance of the prior lien bonds. £50,000 had already been issued, and there were £100,000 unissued. He had received an offer to take up the bonds, and most of the present holders of prior lien bonds whose consent was necessary to the new issue and to the terms, thought the proposed arrangement would be a fair one, because the additional money would enable the company to earn a very substantial profit. He mentioned the matter, but it would have to be brought before a special meeting to be called.

ANSWERING MR. CROSSWAY, the CHAIRMAN said that any shareholder could have the bonds on the same terms as the group who were prepared to take them up.

The retiring directors and auditors were re-elected.

## Re Durham Collieries Electric Power Co., Ltd.

SITTING for the disposal of company's business, Mr. Justice Neville, on Tuesday, April 22nd, heard a petition by the Durham Collieries Electric Power Co., Ltd., a summons in the debenture-holders' action of Poole v. The Company, by which the Court was asked to sanction a conditional agreement for sale of the company's assets to the Newcastle Electric Supply Co., Ltd., and the distribution of the purchase price amongst the debenture-holders of the Durham Co. Mr. H. E. Wright, who appeared in support of the application, said that the sale the Court was asked to sanction, was of the whole of the Durham Co.'s property and undertaking for 10,000 fully-paid shares of £5 each, and the scheme was for the distribution of those shares upon a certain basis amongst the holders of the debentures in the Durham Co. The Durham Co. had issued both debentures and prior lien bonds, and the Newcastle Co. held a large proportion of both, but, with regard to the prior lien bonds, the Court would not be troubled, as in so far as they were not held by the Newcastle Co., it was part of the agreement that that company should pay them off. Some £8,500 were held as collateral security for a debt of £3,500, but the whole of that was to be satisfied as part of the arrangement. The trustee for the debenture-holders made some claim for remuneration, and although that was not provided for by the agreement, he had a letter from the Newcastle Co. that they would pay what was demanded. The total debenture issue was £193,280, a large part of which were held by the Newcastle Co. and surrendered as part of the purchase consideration. In 1912, the Durham Co. went into voluntary liquidation, a receiver was appointed in the debenture-holders' action judgment pronounced, and a certificate obtained. The agreement for sale was conditional on the sanction of the Court being obtained, and, on its being completed, the Court was asked to sanction a distribution of the 10,000 ordinary shares amongst the existing debenture-holders in the Durham Co. *pari passu*. To avoid having fractional certificates where the amount of debentures held would not permit of an even allotment, the trustees were to have power to sell and distribute in cash. The proposal was approved at the meeting by a large majority of debenture-holders the amount of £141,510 voting in favour and only one (the holder) for £200 voting against, Mr. Spens on behalf of the holder of debentures to the amount of £1,370 now opposed the application. He was not prepared then, he said, with evidence, but asked for an adjournment, so that he might ask that the Durham Co. might be wound up compulsorily. The ground was that for years this company had been worked by the Newcastle Co. for their own benefit.

HIS LORDSHIP said that the opposition on that ground came too late, and sanctioned the sale and distribution at purchase price, as proposed, subject to the debts to be discharged by the Newcastle Co. being specified in the order.

**West India and Panama Telegraph Co., Ltd.**—A dividend of 1s. per share on the ordinary shares is announced.

**Cuba Submarine Telegraph Co., Ltd.**—Dividend on ordinary shares for the half-year ended December, 1912, at the rate of 6 per cent. per annum.

### North Metropolitan Electric Power Supply Co.

THE directors' report states that, for the year ended December 31st, 1912, the revenue amounted to £142,962, an increase of £10,087 over 1911, and the expenditure was £71,628, being £10,918 in excess of the previous year, of which £7,483 is due to the increased output, referred to below, and the balance to the higher price of coal. The balance at the credit of the account is £71,334. This, together with interest and dividends receivable and the amount brought forward, makes a total of £80,773. After providing for mortgage, loan and debenture interest, transferring £2,000 to the reserve fund, and placing £25,000 to depreciation account, the directors propose to pay the dividend on the 6 per cent. cumulative preference stock and a dividend at the rate of 6 per cent. per annum, together with a bonus at the rate of 8s. per fully paid share, on the ordinary shares, leaving £1,820 to be carried forward. The capital expenditure during the year amounted to £50,670, making the total £666,018. In June, 1912, a further issue of 6 per cent. cumulative preference stock was offered to the ordinary share and preference stockholders and taken up. The third instalment of 25 per cent. was called up in February, 1913, and the final instalment is payable this month. The directors propose at an early date to make a further issue of 5 per cent. mortgage debentures. The total number of units sold was 29,231,099, an increase of 2,776,607 units, or 10.5 per cent. The supply of electricity was maintained without cessation throughout the period of the coal miners' strike, although some weeks after the commencement of the strike, the company thought it desirable to urge economy in the use of the supply for traction purposes, and by authorised distributors and the larger power users. The output and revenue were, in consequence, adversely affected, and the costs for the year show an increase owing to the higher price of coal. The building and plant extensions in connection with the Brimsdown power station are nearly completed, whilst the Willesden power station extensions are still proceeding. Considerable extensions of the Hertford power station will be made at an early date in order to meet the demand for electricity for power purposes in that district. A supply of electricity has been commenced in the district of Hadley, and during the present year arrangements will be made to extend the supply to East Barnet. The total connections to the mains of the North Metropolitan Electrical Power Distribution Co., Ltd., the capital of which is held by this company, have increased by 13.9 per cent., and a dividend at the rate of 6 per cent. has been paid by that company in respect of the past year.

### Indian Electric Supply and Traction Co., Ltd.

THE annual meeting of this company was held on Monday at the offices, Orient House, New Broad Street, E.C., Mr. John B. Stone presiding.

THE CHAIRMAN, in proposing the adoption of the report, said that as they were aware, the £48,296 of 3-year debentures fell due for repayment on December 31st last. The majority of the debenture-holders who subscribed to assist the company at a critical period were not prepared to renew. It became necessary, therefore, to arrange for an issue of long-dated debentures to repay these and to provide further funds for development. He was glad to say that the board were successful in placing an issue of £60,000 20-year debentures, and the company was, therefore, free from anxiety in this respect. Referring to the progress of the undertaking, he was glad to say that the sales of current had risen from 813,204 units to 1,189,892, and the gross receipts were £13,572, as against £10,974 last year. The connections to the mains expressed in the equivalent of 33-watt lamps were 45,507, as against 28,739 in 1911. The demand for current for power purposes increased at a greater rate than that for lighting, and must continue to do so in a city such as Cawnpore, and considerable expansion in this direction might be looked for in the current year. They might also expect some extension of the municipal lighting. The cost of generating had risen from 1'03d. to 1'07d. per unit, owing to the increased cost of coal. Contracts for a large proportion of their requirements for 1914 had been arranged. The profit was about £500 less than was anticipated, due to the higher cost of coal, and certain expenses connected with the debenture issue, which the board had decided should be charged against revenue. The sales department showed a profit of £906, as against £600 in 1911. The expansion of the business had justified their proceeding with the installation of condensing plant, and this was in course of erection, and with the economiser which was being shipped, a substantial saving in coal consumption should be effected. They were also erecting a plant for cooling the water for condensing, and a brick chimney, which had been found advisable for the increased boiler power. These additions and improvements would cheapen the cost of production, and their effect should be felt in the latter part of this year. The new plant included a fifth boiler, which was being erected, and a 600-kw. generating set. The latter was purchased from the Government, after it had run efficiently for a few weeks at Delhi during the Durbar. They estimated that there was a saving of over 30 per cent. on this purchase as against the same plant being bought at home, shipped to India, and thence taken by rail to Cawnpore. The tramway earnings of 5d. per car-mile compared with 4'62d. last year, but costs were 4'90d. against 4'02d. Of the increase 1'5d. was due to track rent. The board had hoped that in view of the unremunerative nature of the tramway enterprise, the municipality might have remitted the track rent, and the latter had partly met the company by reducing the amount from Rs. 5,568 per annum to Rs. 2,451, which sum was included in the accounts.

The chairman expressed the board's appreciation of the work of the staff in Cawnpore and the improved results that had followed.

MR. SCOTT MOSCHIEFF, in seconding the motion, said that when he first met the shareholders of the company in 1909, the board had to report a loss of £9 on the year's working. The revenue in that year from the sale of current and from the working of the tramways was £6,750. They now came before the shareholders with a revenue of £17,435, and the £9 loss had been converted into a profit of £8,432. Those figures showed that there was a great deal of life in the company, and that was what he told them four years ago. In 1909 their output amounted to 131,060 units sold to the public. It was now nearly ten times that amount, but the revenue per unit had fallen from 4'65d. to 2'33d. That fall in the price really was a good sign, because it indicated a large increase in the company's business as suppliers of power. He had told them in the past that they looked to a great increase in the business in Cawnpore from the supply of power, not only for large mills, but for medium sized industries in the city. The figures received from Cawnpore for last year's increase showed a total of 451 h.p. in motors connected to the mains, and only half of that was accounted for by one large mill; the balance was divided among flour mills and engineering works, oil mills, &c. It was important to notice that they kept spreading out amongst those various industries, and that was a strong feature about the business. Another matter which had occupied the attention of the board last year had been the improvement of their plant in Cawnpore. Up till recently they had been crippled in this respect, owing to insufficiency of funds, and they had been forced to adopt a very conservative policy. Last year they had the benefit of a visit to England of their chief engineer, and, although he was home on holiday, he devoted a good deal of his time to getting out the scheme for introducing the condensing plant, to which the chairman had referred. They looked forward to considerable benefit from the use of that plant, although it would not be in active use until the latter part of this year.

The report was adopted.

### United River Plate Telephone Co., Ltd.—The

directors' report that the gross receipts in sterling for the nine months to December 31st in the River Plate were £400,068. Deducting expenses in Argentine and London, debenture interest and dividend on preference shares, and adding interest on investments, transfer fees, &c., and the sum of £5,492 brought forward from the previous year, there remains an available balance of £110,574. The estimated revenue charge required to provide systematically for future renewals of plant has, as before, been added to the item maintenance in the profit and loss account, and credited to reserve for renewal of plant, and all special replacements carried out during the period covered by the accounts have been debited to this reserve. The directors recommend that a dividend be paid for the nine months at the rate of 8 per cent. per annum, free of income-tax, that £2,000 be placed to the staff's preference fund, £30,000 to the reserve fund account, and that £5,804 be carried forward. To provide for the steady and gratifying growth of the business a new issue of 54,000 ordinary shares will be made forthwith to the ordinary shareholders at the price of £5 10s. per share.

### I.W. Electric Light and Power Co., Ltd.—The

annual meeting was held recently at Ryde. Mr. F. E. Gripper presided, and it was reported that the equivalent of nearly 10,000 additional lamps had been connected during the year, the largest increase being at Newport and Cowes. The profit from sale of current had increased by £500. After paying interest on debenture stock and the dividend on the preference shares there was a balance of £9,300, £1,685 more than last year. The directors recommended that £3,500 be placed to reserve for the renewal of plant and £1,000 to the ordinary reserve account. They also recommended that a 2 per cent. dividend be paid on the ordinary shares, requiring £2,000, and that £2,779 be carried forward.

**Montreal Light, Heat and Power Co.**—The directors have declared a dividend of 2½ per cent. (at the rate of 9 per cent. per annum) for the quarter ending April 30th.

**Stock Exchange Notices.**—The Committee have ordered the undermentioned securities to be quoted in the Official List—

Calgary Power Co., Ltd.—Further issue of £48,900 5 per cent. 30-year first mortgage bonds of £100 each (Nos. A 4112 to 4600).  
Empire District Electric Co.—£3,921,000 first mortgage 5 per cent. sinking fund gold bonds of \$1,000 each (Nos. 1 to 2,921).

**Electrolytic Alkali Co., Ltd.**—At the meeting held at Liverpool last week, there were some opposition to the resolution for voluntary liquidation, but after lengthy discussion it was carried on a poll.

**Brazilian Traction, Light and Power Co.**—A dividend of 1½ per cent. is announced.

**Kaministiquia Power Co.**—The directors have declared a dividend of 8½ per share (at the rate of 5 per cent. per annum) for the quarter ending April 30th.

**Held Over.**—Owing to heavy demands upon our space this week, we are compelled to hold over several reports of companies until next week.

### Direct United States Cable Co., Ltd.

THE directors' report for the year ended March 31st, 1913, states that the reserve fund account shows a balance of £487,474, as compared with £509,128 at March 31st, 1912, a decrease of £21,656, which is accounted for by expenditure in connection with the repair of the main cable in mid-Atlantic in June, 1912. The directors regret that the main cable has been again interrupted in deep water in mid-Atlantic. The cable ship *Dacia* has recently left London for the position, and will at once proceed with the repair. Three quarterly interim dividends of 2s. each per share (less income-tax), amounting to £34,301, have been declared and paid during the year, and a final dividend of 2s. per share (less tax) is now proposed, making a total distribution of 4 per cent. for the year. After providing a further £10,000 as provision for depreciation of investments, the balance of revenue, £20,104, is transferred to the reserve fund account.

The annual meeting takes place on April 29th.

### Anglo-Argentine Tramways Co., Ltd.

THE annual meeting was held on Monday at Winchester House, E.C., Mr. J. B. Concannon presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 653), after referring with regret to the death of Mr. Hector Monnon, one of the directors, said he was pleased to say that the business of the company continued to progress. They operated 330 miles of single track, as against 333 in the previous year. The number of passengers carried was 316,260,077, being 17,105,242 in excess of those carried in 1911. The gross receipts for 1912 were £2,778,802, an increase of £146,466. On the expenditure side, wages were £55,360 more, due mainly to their cars having run an additional 1,757,000 miles, and partly to higher wages and shorter hours. Cost of materials increased by £17,737, owing to heavier work on maintenance, and taxes, consequent upon increased receipts, were £20,792 more. On the other hand, they had the pleasing fact that, whilst the cost of current per unit was very high, owing to dearer coal and freight, and although their cars ran 1,757,000 more miles, they had been able, thanks to improved methods, to effect a considerable reduction in the number of units consumed, resulting in the charge under this head showing a decrease of £6,702. With normal prices for coal and its freight to Buenos Ayres, the saving would have been about £39,400. The net increase in expenditure worked out at £85,093 and the increase in gross profit at £61,373. The large total of £455,471 was expended upon maintenance and renewals during the year under review, necessitated by the board's policy of keeping up the property in a high state of efficiency. The amounts at credit of net revenue, including £10,946 carried in from 1911, after placing £135,000 to credit of depreciation funds, was £954,261. The annuity payable to the City company, debenture charges, dividends on preference shares, and the various sinking funds, absorbed £755,922, leaving a balance at credit of net revenue account of £209,306. An interim dividend of 4 per cent. had been paid upon the ordinary shares, and they now recommended a further dividend of 4½ per cent., making 8½ per cent. for the year, as against 7½ per cent. for 1911, leaving a balance of £9,254 to be carried forward. It was gratifying that they were in a position to propose an increased dividend on the ordinary shares, more particularly as the prior charges in 1912 showed an increase of £28,365 over those for 1911. The investments stood at £316,279, which was the cost price. On the other side they had an investment depreciation reserve fund of £9,131. Since the latter account was created, he regretted to say that there was a further depreciation amounting on December 31st last to about £12,000. They had not had to realise any of those investments, all of which were of the class that used to be described as "gilt-edged." Should they have occasion to sell, their ordinary reserve fund, which amounted to £66,013, would, of course, be available to meet the further depreciation, if any. A shareholder had written commenting upon the item £814,173, "discount and commission on issues of debenture stocks," figuring on the asset side of the balance-sheet, and suggested that it should be written off out of the profits. This, as he explained at the meeting two years ago, was being done by operation of a sinking fund. £515,292 of the amount represented the difference between the sale price and par of the 4 per cent. debenture stock, and £146,630 the bonus given to the old 6 per cent. debenture stock on their converting into 4½ per cent. debenture stock. Already £98,832 of these two stocks had been purchased in the market and extinguished. The balance of this item amounting to £253,330 refers to the 5 per cent. debenture stock, the sinking fund for the redemption of which would commence in 1916. The whole of the 4 per cent. debentures which involved an annual charge against revenue of £178,626 would be extinguished 22 years before the expiration of the concession, and the 4½ per cent. and 5 per cent. stock would be paid off a few years before that event. For the current year the receipts up to the 15th inst. showed an increase of £60,267, whilst the net profits to March 31st had also increased by £25,169. On the other hand, the debenture service for this year would absorb an addition of about £70,000. On the whole although many of the services continued to be adversely affected by the construction of the subways, they anticipated satisfactory results for the complete year, and they looked forward with interest and confidence to the opening of the first subway section towards the end of this year. In view of the general manager's statement, which was embodied in the report, he need not detain them much longer, but he must refer to the possibility of competition from motor-omnibuses. He should not have thought it necessary

to do so but for the fact that reference had been made to the subject in some of the newspapers, prompted, no doubt, by the success attained by motor-omnibuses in London. Now the conditions in London were quite different from those prevailing in Buenos Ayres. In London, as they all knew, the tramways did not penetrate the most important business centres either in the city or in the West End, whereas the omnibuses did, and very good use they made of the advantage both from their own and the public point of view. In Buenos Ayres, however, practically every street leading from the suburbs to the business and shopping centres of the city was traversed by tramways, and everyone acquainted with Buenos Ayres was aware that those streets were so narrow and congested that there was not sufficient space for their cars to pass each other, so that the cars inward and outward bound had to run over parallel streets. The problem of relieving this congestion was always occupying the attention of the municipal authorities, and it seemed very unlikely that they would permit the introduction of omnibuses, but assuming that they did, he was pretty confident that they would not compete successfully with their surface cars, and they certainly could not with their combined surface and subway systems. In conclusion, he might add that he was not aware of an omnibus company in this or any other country which was profitably worked in competition with a tramway company whose services tapped all the available sources of traffic.

MR. T. FRAME THOMSON, in seconding the motion, said it was interesting to notice how the extraordinary development of the city transportation of Buenos Ayres had followed the development of the tramway system. There had not been a retrograde step in the development of tramways in the city since their first introduction. As regards the question of motor-omnibus competition, there was no parallel between Buenos Ayres and London. London was one of very few cities in the world where up to a point omnibus travel was universal, and it was only within recent years that tramways had been used to any appreciable extent in London. In other big cities of the world it was exactly the reverse. For instance, in New York, the people had acquired the tramway habit and they held to it, and there was only one avenue where motor-omnibuses ran. In Buenos Ayres, the tramways were the first system of transport, having commenced running in 1868, and there never had been any other system, and as the chairman had said, the roads were too narrow to allow of it.

MR. HAMILTON, K.C., remarked that he was in Buenos Ayres last September and went over the whole of the company's system, and he agreed with the chairman and the vice-chairman that motor-bus competition was entirely out of the question. No sane body of people would provide the necessary money for such a service, as the streets were entirely occupied by their tramways—in fact, the streets were so narrow that he doubted whether motor-buses would be able to get down them. He would like to know whether it was proposed to enable a further issue of capital, and if so, what form it was likely to take.

The CHAIRMAN, in reply, said that at present they had one and a half million of unexpended capital, but with the heavy work they were doing on the subways that would not last very long. They had not settled anything definite yet, but they were considering with the Continental directors the advisability of postponing a further issue of debenture for a year or two, and placing instead the balance—one and a half million of the ordinary share capital. The report was adopted.

**Official Announcements re Companies.**—The following companies will, unless cause is shown to the contrary, be struck off the register within three months, and will accordingly be dissolved:—

British India Mica Co., Ltd.  
Chameteon Signs, Ltd.  
Dynelectron Syndicate, Ltd.  
Electrical and Mechanical Exhibition, Ltd.  
Electric Coin-Freed Meter Dimming Syndicate, Ltd.  
Electric Tramways Trust, Ltd.  
"Guaranteed" Oil Filters, Ltd.  
Hirst Magneto Co., Ltd.  
Illuminating Engineering Co., Ltd.  
Laboratories, Ltd.  
"Le Radiant," Ltd.  
Morris-Hawkins, Ltd.  
Motor-Hiring Syndicate, Ltd.  
S. P. (Schoenauer Patents) Syndicate, Ltd.  
Schreiber Electric Battery Co., Ltd.  
Scientific and Technical Publications, Ltd.  
Sonic Water-Power Syndicate, Ltd.  
Simplex Industrial Producer Gas Plants, Ltd.  
Smoke Destroyer Co., Ltd.  
Technical Inventors, Ltd.  
Vulcan Dynamo and Motor Co., Ltd.

**City Electric Light Co., Ltd. (Brisbane).**—The directors' report for the half-year ended January 31st, 1913, states that after making additions to the reserve fund, dividend equalisation fund, franchise and purchase sinking fund, accident insurance fund and renewal replacement and contingencies account, there remains a credit balance of £7,148, which, with the balance brought forward, makes £9,092 to be disposed of. The directors recommend that a dividend be paid of 3 per cent. on the preference shares and of 6½ per cent. on the fully-paid ordinary shares, and of 6½ per cent. on the contributing shares. These dividends, together with the dividend duty, will absorb £7,639, leaving £1,453 to be carried forward. The directors have decided to issue on or before April 30th next 40,000 contributing shares paid up to 10s. per share. These will be issued to the shareholders in proportion to their present holding, and will represent about 28 shares to each 100 shares now held.

### Indo-European Telegraph Co., Ltd.

THE directors in their report for 1912 state that the company's negotiations with the Postmaster-General, and with the Imperial German Telegraph Administration previously referred to, are now far advanced. The agreements with those administrations, when concluded, will place at the disposal of the company the much-desired additional cross-Channel cable wire, and will, at the same time, embody an extension of the company's working agreement with the Postmaster-General. The company's new cable wire will be connected with a new land wire throughout the whole length of the company's system, which will shortly be completed. The Imperial Russian Government have informed the company that, in view of the fact that the company's present concession from that Government does not expire until 1925, negotiations for an extension of the same should be deferred for the present. Having regard to the ever-increasing importance of radio-telegraphy, the directors have acquired a controlling interest in the Galletti wireless system, a new and independent system of much promise. Important experiments to establish its value are now in progress, and the necessary funds for this, and for the acquisition of the controlling interest above referred to, have been provided by the company. The sum thus provided is represented by the holding of £32,200 of the capital of Galletti's Wireless Telegraph and Telephone Co., Ltd. (a company formed and controlled by this company), which stands in the balance-sheet at its par value of £32,200. In view, however, of the risks which must attend the development of an entirely new system, the directors propose to make provision out of the year's profits for the whole sum of £32,200 represented by this investment. As a result of the recent extension of the concessions from the Russian and Turkish Governments for the working of the Black Sea Cable (Odessa-Constantinople) the half interest held in that cable by this company (which stood in the balance-sheet at the value of £25,000 under the heading "investments in other telegraph companies") is now directly vested in this company, which assumes responsibility for half the working and maintenance expenses. The designation of the investment has accordingly been altered to "half interest in the Black Sea (Odessa-Constantinople) Cable." The company having taken over in respect of its half ownership of the cable its share of the already existing reserve fund for maintenance, the directors are enabled to constitute in the balance-sheet a "Black Sea Cable maintenance fund" to the amount of £15,000, which is represented by investments on the other side detailed under Schedule D. The company's revenue from message account and other sources, as shown in the revenue account, amounts to £183,411, as compared with £172,427 for 1911, showing an increase of £10,984. The expenses are, on commercial and general account, £58,820, and on maintenance account £32,155, making a total of £90,974, as against £86,087 for 1911, showing an increase of £4,887. The revenue account, therefore, shows a balance of £92,437, which sum is carried to profit and loss account, 1912, and after deduction of income-tax paid is reduced to £87,024. To this is added the balance brought forward of £12,144, making a total of £99,168. Deducting £10,813 provided for depreciation of the company's securities to date and the interim dividend of £10,625 already paid, there remains a balance available for distribution of £77,730. The directors now propose to declare a dividend for the six months ending December 31st, 1912, of 17s. 6d. per share (making with the interim dividend already paid 6 per cent. for the year) and a bonus of 20s. per share, both free of income-tax. They propose further to make the provision of £32,200 in connection with the Galletti purchase and experiments above referred to, carrying forward £13,655. They also propose to make a special distribution to the shareholders of £12,750, equivalent to 15s. per share, out of interest upon certain investments and advance accounts. This distribution also will be free of income-tax. The directors have sustained a severe loss in the death of their esteemed friend and colleague, Mr. Ludwig Delbrück, so long associated with them as a director. The position will shortly be filled by another gentleman, preferably representing Berlin interests. To their great regret also they have lost the services, through retirement for reasons of health, of Mr. Geo. Plate, who represented Bremen interests on the board.

### Calcutta Tramways Co., Ltd.

THE directors' report, as given in the *Financier*, states that the gross receipts and the working expenses for 1912 were as follows:—Receipts.—Calcutta, £208,427; Howrah, £8,606; total, £217,033. Working expenses.—Calcutta, £115,380; Howrah, £6,786; total, £122,166. Revenue balance.—Calcutta, £93,046; Howrah, £1,819; total, £94,865. The balance forward from 1911 accounts £3,918, and bank interest £18, bring the total to £98,903. Deduct interest on debenture stock and dividend on preference and ordinary shares paid, £44,775, leaving an available balance of £54,028, which the directors propose to deal with by the payment of a final dividend of 5s. per share, making 7½ per cent. for the year, £34,402, adding to the depreciation fund £15,000, and carrying forward £4,626. The depreciation fund at the commencement of the year stood at £64,136. After adding thereto £1,704, interest on investments, and £15,000 proposed to be allocated, as above, and deducting £9,158 written off for renewals and additional expenditure on power house plant during the year, the fund will stand at £71,682. The steady and continued growth of the business, aided to some extent by the abnormal traffic during the period of the Royal visit at the beginning of the year, has produced a further record in traffic receipts, which amount to £215,271, against £200,384 for

1911, or an increase of £14,887. The expenditure shows an increase of £7,780, principally due to increased mileage run, and to the complete overhaul of the power station. Part of the cost of the latter, represented by certain additions to the plant to increase the efficiency of the station, rendered necessary by the growth of the traffic, has been charged to the depreciation reserve fund. The Howrah lines have also shown considerable improvement, as, with practically the same mileage, they show an increase in traffic receipts of £1,205, the increase in expenditure being £385, principally due to permanent way repairs.

### Oriental Telephone and Electric Co., Ltd.

THE directors' report for the year ended December 31st last states that, including £23,715 brought forward from December 31st, 1911, and after deducting the interim dividends of 3 per cent., paid November 1st last, on both the preference and ordinary shares, and making the necessary provision for redemption of the debenture stock and other charges, as shown in the net revenue account, the amount to be dealt with is £57,054. The directors recommend that this sum be appropriated as follows, viz.:—A final dividend of 3 per cent. (less income-tax) for the year on the preference shares, £1,500; a final dividend of 7 per cent. (free of income-tax) on the ordinary shares, making 10 per cent. for the year, £12,552; transfer to reserve account, £5,000; staff pension fund, £2,000; carrying forward £36,002. All the company's exchanges, together with those of the affiliated companies, continue to show improved revenues. The Bombay Telephone Co., Ltd., has further increased its dividend from 9 to 10 per cent., whilst the Telephone Co. of Egypt, Ltd., the Bengal Telephone Co., Ltd., and the China and Japan Telephone and Electric Co., Ltd., have paid their previous rates of 10, 6 and 5 per cent. respectively. In addition to the extensions at Madras, referred to in the last report, considerable extensions and improvements have been made during the past year at Rangoon and in Mauritius, and are now in full working, promising good results. In order to provide better and permanent quarters for the increasing business in the island of Mauritius, the company recently purchased a freehold plot of land in the town of Port Louis, upon which a substantial building is in course of erection, which is expected to be completed by the end of the current year.

The annual meeting is called for April 30th.

### Anglo-American Telegraph Co., Ltd.

THE directors' report for the year ended March 31st, 1913, states that three quarterly interim dividends of 15s. per cent. on the ordinary stock, and £1 10s. per cent. on the preferred stock, were paid on May 1st, August 1st and November 1st, 1912, absorbing £157,500, and the directors on February 1st last paid the final dividend for the year ending December 31st, 1912, amounting to £1 10s. per cent. on the ordinary stock, £1 10s. per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock. These payments absorbed altogether £262,500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3½ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1½ per cent. on the deferred stock. The balance at credit of revenue account includes £1,621 bank interest, &c., received during the year, and now amounts to £67,246. The present articles of association are quite obsolete and new ones have been prepared. These accord with present-day law and requirements, and contain provisions which are desirable now that the company has leased its cables to the Western Union Telegraph Co. The rights of the stockholders with regard to dividends and voting and in a winding-up have not been interfered with. The new articles will be submitted at the extraordinary general meeting immediately at the close of the annual meeting on April 29th.

### STOCKS AND SHARES.

Tuesday Evening.

STOCK Exchange markets for the time being seem to have got into smoother waters. The long-deferred fall in the Bank Rate took place last Thursday, and it is expected to be followed by a further reduction this week, provided that is, that the political outlook abroad does not cloud over again. It is recognised however, that the Bank of England directors, in not putting down the rate a full point, intended to give the financial world a hint that they did not regard the prospect as entirely pacific; but if the step is taken this Thursday, most people will regard it as a weighty opinion that the war in the Near East is over for all practical purposes.

The latest untoward development abroad is the straining of relations between Japan and the United States. Trouble has been brewing for some time between the two peoples, according to private information, and for the moment it looks as though there might be a rupture of peaceful feeling, unless the Americans care to placate their Western neighbours.

Home Railway Stocks failed to derive immediate benefit from cheaper money, but the market looks stronger now. The Under-

ground list is quiet. Districts dipped to 39½, but recovered to 40. Metropolitan are ½ down. Central London Ordinary and Preferred each put on a point, and the Deferred stock maintained its improvement of last week. Underground Electric shares are ½ easier, though the "A" remain at 11s. 6d. The immediate result of the reduction of the Bank Rate was an upward march in some score or so of Home Railway prior charge stocks, in which movement there participated, to the extent of a point or so. Metropolitan 3½ per cent. Preference; both the District Debenture stocks, and the four City and South London Preference issues. There is a general impression that this improvement will go still further. Underground Electric 6 per cent. Income bonds eased off to 93, and London Electric 4 per cent. Preference stock at 76 is a point down.

It is worth noticing, as having a possible bearing upon railway stocks as a whole, that the Scottish railway issues have shown extreme strength this week upon the assumption that the companies in the North will be shortly revising their fares in the upward direction. It is understood that the English companies will follow their example before long; indeed, they may be said to have started this already in a mild way, but if there should be a concerted movement, as authorised by the recently-passed Railways Act, there may be better days in store for the Home Railway market, until labour stirs up fresh strife. The British Electric Traction issues continue to fall. Yorkshire 4½ per cent. Debenture stock at 83½ is a point higher.

The Electricity Supply market has little change to disturb its customary placidity. Metropolitan was back to 3½, but this fall of ½ is more than counterbalanced by a rise of 5s. in Smithfields, which carried up the price to 1½. County First Debenture stock lost a point upon the offering of a small parcel in the market the other day.

The Manufacturing group is quiet, a rise of 30s. in Telegraph Constructions being the principal feature. Since the recent increase in the dividend to 20 per cent., there has been a persistent demand for the shares, while the Debenture stock at 97½ is also slightly higher. Babcock & Wilcox eased off to 3½ upon the appearance of the report, which, however, should have had an opposite effect upon the price of the shares, for it makes excellent reading, and the dividend is increased to 16 per cent.—equivalent to 32 per cent. upon the capital before this was doubled by the distribution of bonus shares last year. Some people appear to dislike the creation of the proposed Second Preference shares, but as the Company will have no difficulty in placing these, it will be getting the money at 5 per cent., and should be able to earn a great deal more than this upon the new capital. These new Preference shares, by the way, constitute an excellent investment, the security for them being admirable.

In the Telegraph department. Indo-Europeans, after their substantial advance, reacted 10s., but remain a good market. Investors on the look-out for Telegraph descriptions which pay well, and offer a reasonable chance of enhanced value. Commercial Cable Debenture stock again rose 1½. Anglo-American Telegraph Preferred continues to harden. Eastern Extension shares put on ½, and Globe Preference are a similar fraction to the good. The Telephone list is also firm. Monte Videos are 1½ higher, Oriental Preference rose ½, and Telephone of Egypt Debenture stock is ½ up. Reuter's eased off to the extent of ½, and American Telephone stock went back a point, which was picked up by the Company's Collateral Trust bonds.

The Canadian-Latin group is remarkable chiefly for a recovery of 8 points in Montreal Light, Heat and Power shares, which restored the quotation to 233½. The price is run up and down by comparatively small demand and supply; sometimes it moves without any stock changing hands at all. Another quarterly dividend of 2½ per cent. is just announced. Kaministiquia shares went back to 132½ on the declaration of the quarterly dividend of 1½ per cent.—certain holders had been expecting the distribution to be raised to the rate of 6 per cent. per annum this time.

The Mexican division is what the newspapers call "marking time." Mexico Trams at 110 are the turn higher, but the 5 per cent. bonds are ½ down, while in the Light and Power issues there have occurred no changes worth mentioning. Electrical Development of Ontario bonds at 95 show a rise of 1½, and there is a better tone in the market for Rio bonds of both classes. British Columbia stocks are harder, as it was expected would be the case so soon as the time expired for selling the rights to the new issues. Brazil Tractions dropped to 101 in consequence of a severe fall in Brazil Railway shares.

Part of the improvement in the Anglo-Argentine Tramways group has oozed out of the Debentures. The new scrip, by the way, is now quoted as fully-paid, and can be bought at 99, at which the yield is 5½ s. on the money. According to the accounts published last week, there is a surplus, after meeting all the Debenture interest, of about £350,000, so it is somewhat surprising that the Debenture stocks should be dull. Calcutta Preference regained their small fall of last week, and Lisbons hardened upon the declaration of the dividend, to which reference was made here in our previous notes.

The Rubber market has fallen into stagnation again, and prices are, on the whole, dullish, though the commodity is somewhat firmer. Armament shares are disposed to droop, in consequence of the new issues which are being made by Armstrongs and Vickers. Lively dealings are taking place in the latter on the basis of 5s. to 5s. 6d. premium for the renunciation letters. Amongst the few Stock Exchange markets to show pronounced animation, that for Copper shares stands out prominently. Copper, the metal, is expected to go much higher; but, inasmuch as the statistics are of so variable a quality, it is difficult for outsiders to gauge a position which is so largely capable of manipulation by speculators in some of the American centres.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, April 23rd.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
■ Acid, Hydrochloric .. .. per owt.	5/-	..
■ " Nitric .. .. per lb.	22/-	..
■ " Oxalic .. .. per lb.	23d.	..
■ " Sulphuric .. .. per cwt.	5/6	..
■ Ammoniac Sal .. ..	42/-	..
■ Ammonia, Mariate (large crystal) per ton	£29 10	..
■ Bleaching powder .. .. "	£6 5	..
■ Bisulphide of Carbon .. .. "	£18	..
■ Borax .. .. "	£17 10	..
■ Copper Sulphate .. .. "	£23 5	10/- dec.
■ Lead, Nitrate .. .. "	£27	£2 10s. dec.
■ " White Sugar .. .. "	£26 5	£2 5s. dec.
■ Peroxide .. .. "	£32	..
■ Methylated Spirit .. .. per gal.	7/6	..
■ Potassium, Bichromate, in casks .. ..	8/4d.	..
■ Potash, Caustic (88/90 %) .. .. per ton	£22 10	..
■ " Chlorate .. .. per lb.	8/4d.	..
■ " Perchlorate .. .. "	4/4d.	..
■ Potassium, Cyanide (98/100 %) .. ..	7/4d.	..
(for mining purposes only)		
■ Shellac .. .. per cwt.	80/-	..
■ Sulphate of Magnesia .. .. per ton	£4 10	..
■ Sulphur, Sublimed Flowers .. .. "	£6 10	..
■ " Recovered .. .. "	£5 10	..
■ " Lamp .. .. "	£5 10	..
■ Soda, Caustic (white 70/72 %) .. .. "	£10 5	..
■ " Chlorate .. .. per lb.	8/4d.	..
■ " Crystals .. .. per ton	£8 5	..
■ Sodium Bichromate, casks .. .. per lb.	8d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. .. per ton	£95	..
b " Wire, in ton lots .. .. "	£112	..
(1 to 14 S.W.G.)		
b Sheet, in ton lots .. .. "	£120	..
d Babbit's metal ingots .. .. "	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) .. .. per lb.	8½d.	3d. inc.
c " Tube (brazed) .. .. "	10½d.	..
c " " (solid drawn) .. .. "	9d.	..
c " Wire, basis .. .. "	£14	4d. inc.
c Copper Tubes (brazed) .. .. "	10½d.	1½d. dec.
c " " (solid drawn) .. .. "	9½d.	1½d. dec.
c " Bars (best selected) .. .. per ton	£85	41 inc.
c " Sheet .. .. "	£85	41 inc.
c " Rod .. .. "	£85	41 inc.
d (Electrolytic) Bars .. .. "	£12 10	£2 15s. inc.
d " Sheets .. .. "	£28 10	£2 15s. inc.
d " Rods .. .. "	£77 10	£2 10s. inc.
d " H.C. Wire .. .. per lb.	9½d.	4d. inc.
f Ebonite Rod .. .. "	4/6	..
f " Sheet .. .. "	4/-	..
g German Silver Wire .. .. "	1/10	..
h Gutta-percha, fine .. .. "	7/- to 8/-	..
h India-rubber, Para fine .. .. "	3/6½	4d. inc.
i Iron Pig (Cleveland warrants) .. .. per ton	68/4d.	1/10s. inc.
l " Wire, galv. No. 8, P.O. qual. .. ..	£14	..
g Lead, English Pig .. .. "	£18 12 to £18 17 6	£1. inc.
m Manganese Wire No. 2B .. .. per lb.	8/6	..
g Mercury .. .. per bot.	£7 10	..
e Mica (in original cases) small .. .. per lb.	6d. to 8s.	..
e " " medium .. .. "	8/6 to 6/-	..
e " " large .. .. "	7/6 to 11/-	..
n Nickel, sheet, wire, &c. .. .. "	3/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings .. .. "	1/10 to 1/5d.	..
p " " rolled bars & rods .. .. "	1/0½ to 1/2	..
p " " rolled strip & sheets .. .. "	1/2½ to 1/5d.	..
o Platinum .. .. per oz.	185/-	..
r Silicon Bronze Wire .. .. per lb.	11d.	..
r Steel, Magnet, in bars .. .. per ton	£26	..
g Tin, Block (English) .. .. "	£281	£2 293
n " Wire, No. 1 to 16 .. .. per lb.	2/7	£1 dec.
p White Anti-friction Metals .. .. per ton	£46 to £228	..
& Zinc, 8h's (Vielles Montagne bod.) .. .. "	£29	10/- inc.

Quotations supplied by—

- a G. Boor & Co.
- b The British Aluminium Co., Ltd.
- c The Bolton & Son, Ltd.
- d Frederick Smith & Co.
- e F. Wiggins & Sons.
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- h Edward Dill & Co.
- i Bolling & Lowe.
- k Morris Ashby, Ltd.
- l Richard Johnson & Nephew, Ltd.
- m W. T. Glover & Co., Ltd.
- n P. Ormiston & Sons.
- o Johnson, Matthey & Co., Ltd.
- p W. F. Dennis & Co.

Oldham, Ashton and Hyde Electric Tramway, Ltd.

The directors' report for 1912 states that the total revenue was £34,579, and the expenditure (including £1,600 for debenture interest and £1,000 placed to provision for renewals account) was £27,791, leaving a net profit of £6,788, plus £180 brought forward. There is to be placed to reserve fund £1,250; dividend, 5 per cent. per annum on the cumulative preference shares, absorbs £2,500; dividend on the ordinary shares at the rate of 7 per cent. per annum for the six months ended December 31st, 1912, making, with the interim dividend 6 per cent. for the year, £3,000; leaving to carry forward £218. During the past year £975 has been expended on capital account. The increase in the traffic receipts of £1,905, following on an increase of £1,202 for 1911, is principally due to better trade. £4,000 has been charged through the revenue account to renewals account, as compared with £2,000 for 1911.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

Table with columns: NAME, Stock or Share, Dividend for, Closing Quotations April 22nd, Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividend for, Closing Quotations April 22nd, Rise or Fall, Present Yield p.c.

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Table with columns: NAME, Stock or Share, Dividend for, Closing Quotations April 22nd, Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividend for, Closing Quotations April 22nd, Rise or Fall, Present Yield p.c.

TELEGRAPH AND TELEPHONE COMPANIES.

Table with columns: NAME, Stock or Share, Dividend for, Closing Quotations April 22nd, Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividend for, Closing Quotations April 22nd, Rise or Fall, Present Yield p.c.

\*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railways and tramways in the home market. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 22nd, Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 22nd, Rise + or Fall, Present Yield p.c.

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railways and tramways in colonial and foreign markets. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 22nd, Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 22nd, Rise + or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 22nd, Rise + or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 22nd, Rise + or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING MARCH, 1913.

THE March returns of electrical business which we publish here-with, exhibit as regards the exports record-breaking figures, and as regards the imports, a small increase over those of the previous month.

Thus, the exports during March reached the highest total so far recorded by us, viz., £991,303, this being due, however, to the inclusion of a huge telegraphic export to Ceylon valued at over £450,000, and bringing the telegraphic export for the month up to over half a million pounds in value.

It is interesting to note that the highest export value previously recorded by us was approximately £874,000 in March, 1910, while in March last year a total of some £821,000 was recorded. In the case of this month's figures, it is satisfactory to note that even excluding the large telegraphic total, the balance representing the

usual run of business amounted to over £480,000 in value—a very high total, which included over £168,000 worth of machinery, £96,000 worth of telephonic material, and £91,000 worth of cables—the latter section, however, comparing with some £106,000 worth in the previous month, and showing the only marked decrease as compared with the February figures.

The imports reached £253,112 in value, as compared with £236,079 in the previous month, increases in value being fairly general in all sections except those representing glow and arc lamps. The re-exports at £23,723 were fractionally higher than in February. Ceylon naturally heads the list of purchasers this month, but probably of more general interest are the high figures recorded for Argentina, New South Wales, Canada, India, Japan, &c., due to normal trade.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electroglow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	823	...	10	207	40	265	5,725	1,281	...	72	321	354	9,106
Germany ...	1,714	1,561	25	37	623	12	3,004	709	139	49	6	3,528	11,407
Netherlands, Java & Dutch Indies ...	1,038	1,804	228	13	36	...	1,360	200	...	...	50	1,177	8,906
Belgium ...	1,954	354	183	75	185	26	2,088	507	11	20	1,309	9	6,721
France ...	888	...	3,589	...	15	18	10,844	154	...	...	87	381	19,169
Portugal ...	59	935	33	46	...	...	91	...	...	...	...	355	1,071
Spain, Canary Isles and Spanish N. Africa...	2,002	3,985	53	14	...	992	4,367	...	...	...	635	401	12,419
Switzerland, Italy and Austria-Hungary ...	678	466	125	...	63	...	6,019	680	...	342	...	620	8,993
Greece, Roumania and Turkey ...	208	68	129	11	...	...	600	...	53	52	...	6,110	7,231
Channel Isles, Gibraltar, Malta and Cyprus...	197	127	32	117	...	71	272	120	901	...	...	249	2,086
U.S.A., Philippines and Cuba ...	418	226	364	175	...	37	583	...	2	...	...	147	1,952
Canada and Newfoundland ...	756	1,555	1,279	511	13	2,546	13,507	52	1,784	16	20,335	386	12,740
British West Indies, British Honduras and British Guiana ...	337	...	22	221	27	58	293	...	...	...	111	16	1,085
Mexico and Central America ...	10	23	39	38	24	...	63	...	2	...	...	...	199
Peru and Uruguay ...	143	226	...	112	...	...	590	10	11	...	...	32	1,121
Chile ...	372	1,810	1,670	505	480	208	5,367	268	936	126	118	5,524	17,381
Brazil ...	547	811	1,643	227	151	102	5,089	780	708	...	6,428	6,258	22,740
Argentina ...	3,750	20,507	1,673	619	272	471	11,111	3,934	4,234	1,564	14,606	8,238	70,977
Colombia, Venezuela and Bolivia ...	357	72	23	33	...	...	999	...	125	...	36	18	1,663
Egypt, Tunis, Morocco and Persia ...	899	45	96	...	23	15	1,589	388	197	...	632	569	3,953
British West Africa and Congo Free State	188	227	552	11	16	55	148	...	5	...	12	108	1,322
Rhodesia, O.R.C. and Transvaal ...	2,798	786	205	1,137	...	605	4,919	583	1,029	8	484	302	12,786
Cape of Good Hope ...	2,353	3,787	719	1,072	95	463	6,865	680	2,590	5	5,432	4,284	28,345
Natal ...	1,064	9,999	285	378	60	5	6,387	...	1,643	...	117	867	20,805
Zanzibar, Brit. E. Africa, Mauritius & Aden	148	76	34	163	...	580	537	70	102	...	38	189	1,937
Azores, Madeira and Portuguese Africa ...	106	701	222	99	...	733	4,230	...	...	...	25	142	6,258
China and Siam ...	1,374	628	1,925	1,180	...	40	2,759	...	378	...	202	325	8,811
Japan and Korea ...	637	8,102	110	39	35	487	14,117	1,701	2,490	55	71	4,848	32,692
India ...	4,125	10,915	2,863	2,139	63	1,601	10,396	3,851	2,553	466	2,743	840	42,555
Ceylon ...	73	765	82	41	...	464	1,715	381	163	...	106	454,156	457,946
Straits Settlements, Fed. Malay States, British Borneo and Sarawak ...	667	2,134	124	81	28	51	1,014	575	56	...	610	1,062	6,402
Hong Kong ...	390	810	200	128	17	10	110	...	37	235	187	69	2,193
West Australia ...	512	1,640	53	219	...	25	620	241	25	...	49	683	4,067
South Australia ...	796	1,223	228	199	44	844	378	...	497	53	90	200	4,552
Victoria ...	2,214	4,518	829	1,823	18	1,777	7,718	633	1,747	...	2,969	709	24,955
New South Wales ...	3,095	2,101	490	1,272	97	853	17,696	760	1,593	28	36,968	2,379	67,332
Queensland ...	114	1,400	91	159	...	81	929	...	135	...	...	...	2,909
Tasmania ...	20	...	...	...	15	385	180	...	48	...	309	...	957
New Zealand and Fiji Islands ...	1,185	6,791	797	361	...	475	5,271	830	1,002	18	396	1,842	18,968
<b>Total, £</b>	<b>38,439</b>	<b>91,178</b>	<b>21,025</b>	<b>13,462</b>	<b>2,440</b>	<b>14,355</b>	<b>159,550</b>	<b>19,390</b>	<b>25,196</b>	<b>3,196</b>	<b>96,134</b>	<b>509,938</b>	<b>994,303</b>

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	...	160	...	58	8	...	4,473	760	516	24	6,825	12,824	
Germany ...	10,216	21,195	1,763	10,539	6,951	3,144	73,028	7,638	2,239	6,662	7,864	151,239	
Holland ...	30	...	...	458	944	...	227	...	...	7	92	1,758	
Belgium ...	1,633	4,718	104	120	385	8	2,683	43	61	40	5,262	15,057	
France ...	371	1,000	1,118	776	600	1,212	1,032	...	297	4,133	3,849	14,388	
Switzerland ...	187	1,406	52	3	26	301	459	...	62	94	...	2,590	
Italy ...	...	4,085	...	...	14	...	668	...	...	...	...	85	4,852
Austria-Hungary ...	...	947	...	302	102	...	795	...	34	860	...	...	3,040
United States ...	4,762	549	656	14	119	83	14,092	25,520	330	27	727	16,879	
Canada ...	93	...	...	...	...	...	60	...	...	...	10	...	163
<b>Total, £</b>	<b>17,292</b>	<b>84,060</b>	<b>3,693</b>	<b>12,270</b>	<b>9,149</b>	<b>4,748</b>	<b>97,517</b>	<b>33,961</b>	<b>3,539</b>	<b>11,847</b>	<b>21,714</b>	<b>252,790</b>	

Additional imports: Spain, carbon, £622.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	11,857	1,364	1,511	610	...	6,605	...	159	414	1,203	23,723
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TOTAL EXPORTS: £994,303.

TOTAL RE-EXPORTS: £23,723.

TOTAL IMPORTS: £253,412.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

### IMPORT TRADE STATISTICS OF SWITZERLAND.

THE following figures of the imports of electrical and similar goods into Switzerland in the year 1911 are taken from the recently issued official trade statistics; the figures for 1910 are added for purposes of comparison, and notes of increases or decreases are given. Attention should be called particularly to the predominant position of German trade as contrasted with the practically insignificant British share in most lines:—

	1910.	1911.	Inc. or dec.
	Francs.	Francs.	Francs.
<i>Electric cable not insulated.—</i>			
From Germany ...	28,000	28,000	—
" France ...	14,000	19,000	+ 5,000
" Other countries ...	1,000	—	— 1,000
<b>Total ...</b>	<b>43,000</b>	<b>47,000</b>	<b>+ 4,000</b>
<i>Electric cable insulated with rubber or paper.—</i>			
From Germany ...	109,000	90,000	— 19,000
" Great Britain ...	4,000	5,000	+ 1,000
" Other countries ...	13,000	14,000	+ 1,000
<b>Total ...</b>	<b>126,000</b>	<b>109,000</b>	<b>— 17,000</b>
<i>Cable ditto covered with lead.—</i>			
From Austria ...	—	43,000	+ 43,000
" Germany ...	17,000	2,000	— 15,000
<b>Total ...</b>	<b>17,000</b>	<b>45,000</b>	<b>+ 28,000</b>
<i>Cable insulated with rubber or paper and covered with textiles.—</i>			
From Germany ...	174,000	192,000	+ 18,000
" Other countries ...	12,000	18,000	+ 6,000
<b>Total ...</b>	<b>186,000</b>	<b>210,000</b>	<b>+ 24,000</b>
<i>Cable ditto covered with lead.—</i>			
From Germany ...	67,000	95,000	+ 28,000
" Other countries ...	—	5,000	+ 5,000
<b>Total ...</b>	<b>67,000</b>	<b>100,000</b>	<b>+ 33,000</b>
<i>Steam boilers of iron or steel.—</i>			
From Germany ...	1,563,000	1,995,000	+ 432,000
" France ...	191,000	177,000	— 14,000
" Belgium ...	15,000	24,000	+ 9,000
" Great Britain ...	62,000	31,000	— 31,000
" Other countries ...	23,000	22,000	— 1,000
<b>Total ...</b>	<b>1,854,000</b>	<b>2,249,000</b>	<b>+ 395,000</b>
<i>Dynamo-electric machines and electric transformers.—</i>			
From Germany ...	1,106,000	921,000	— 185,000
" France ...	24,000	38,000	+ 14,000
" Italy ...	57,000	23,000	— 34,000
" Great Britain ...	2,000	3,000	+ 1,000
" Other countries ...	27,000	32,000	+ 5,000
<b>Total ...</b>	<b>1,216,000</b>	<b>1,017,000</b>	<b>— 199,000</b>
<i>Steam engines, locomobiles, steam turbines, &amp;c.—</i>			
From Germany ...	447,000	228,000	— 219,000
" France ...	26,000	10,000	— 16,000
" Great Britain ...	41,000	85,000	+ 44,000
" Other countries ...	7,000	7,000	—
<b>Total ...</b>	<b>521,000</b>	<b>300,000</b>	<b>— 221,000</b>
<i>Gas, petrol, benzine, &amp;c., motors.—</i>			
From Germany ...	188,000	192,000	+ 4,000
" France ...	199,000	180,000	— 19,000
" Italy ...	22,000	13,000	— 9,000
" Great Britain ...	28,000	17,000	— 11,000
" United States ...	33,000	50,000	+ 17,000
" Other countries ...	6,000	15,000	+ 9,000
<b>Total ...</b>	<b>476,000</b>	<b>467,000</b>	<b>— 9,000</b>
<i>Accumulators, batteries, electrodes.—</i>			
From Germany ...	186,000	196,000	+ 10,000
" Austria ...	53,000	48,000	— 5,000
" France ...	35,000	37,000	+ 2,000
" Other countries ...	25,000	16,000	— 9,000
<b>Total ...</b>	<b>299,000</b>	<b>297,000</b>	<b>— 2,000</b>
<i>Insulators, mounted.—</i>			
From Germany ...	59,000	60,000	+ 1,000
" France ...	3,000	3,000	—
" Other countries ...	4,000	2,000	— 2,000
<b>Total ...</b>	<b>66,000</b>	<b>65,000</b>	<b>— 1,000</b>

	1910.	1911.	Inc. or dec.
	Francs.	Francs.	Francs.
<i>Electric meters.—</i>			
From Germany ...	920,000	1,108,000	+ 188,000
" France ...	65,000	67,000	+ 2,000
" Italy ...	15,000	21,000	+ 6,000
" Great Britain ...	16,000	10,000	— 6,000
" United States ...	28,000	14,000	— 14,000
" Other countries ...	6,000	20,000	+ 14,000
<b>Total ...</b>	<b>1,050,000</b>	<b>1,240,000</b>	<b>+ 190,000</b>

	1910.	1911.	Inc. or dec.
	Francs.	Francs.	Francs.
<i>Telegraph and telephone apparatus.—</i>			
From Germany ...	368,000	300,000	— 68,000
" Belgium ...	163,000	165,000	+ 2,000
" Great Britain ...	—	68,000	+ 68,000
" Sweden ...	58,000	20,000	— 38,000
" Other countries ...	10,000	36,000	+ 26,000
<b>Total ...</b>	<b>599,000</b>	<b>589,000</b>	<b>— 10,000</b>

NOTE.—25 francs = £1.

### MUNICIPAL ELECTRICITY IN SHANGHAI.

WE have received from Mr. T. H. U. Aldridge, the electrical engineer to the Shanghai Municipal Council, an interesting report on the work of the electricity department for the year 1912.

From this it appears that the revenue for the year was 761,490 taels (tael = 2s. 6d. approximately); the balance to net balance 238,425 taels; and the net profit 62,318 taels, after allowing a sum of 50,000 taels for special depreciation on the Fearon Road generating plant. A sum of 24,476 taels was also included under revenue payments, being expenditure on interest and salaries in respect of capital works in connection with the new Riverside station, which will not be in regular use for some months. The cost of the Fearon Road generating station is to be written off during the next seven years, and this will, of course, reduce the net surplus for some years to come; the department has, moreover, during the past five or six years reinvested profits to the extent of 500,000 taels in the purchase of new plant and is in a strong position financially.

To turn to engineering details, the plant capacity at Fearon Road was 6,400 kw., of which 1,200 kw. was direct-current plant for traction supply. The maximum load was 6,000 kw., a 48 per cent. increase on the previous year, and was largely due to the great number of new lighting consumers, mostly Chinese, connected during the year, although, of course, also due to power and heating supplies increasing.

The units sold and accounted for were 12,130,537, including nearly 5½ million for private lighting, 940,000 for public lighting, 118,585 for heating and cooking, 2,300,000 for power, and 2,860,000 for traction. The total for the previous year was 8,300,000 units, and the estimated total for the present year is 20 million, an enormous jump which shows plainly the astonishing development in electrical matters in Shanghai.

The load factor was 23½ per cent., or practically unchanged from the previous year, and the coal per unit sold was 5 lb.

The new Riverside generating station will be brought into use during the year, adding some 4,000 kw. of plant capacity to help the estimated maximum load of 8,300 kw. next winter.

For the winter of 1914 a load of 11,300 kw. is anticipated, and it is, therefore, proposed to add, this year, four more boilers, two additional 5,000-kw. turbo-alternators, and additional trunk feeders between the new and old stations.

During the year 102 miles of overhead cable were erected, and 13½ miles of three-phase cable laid; nine new sub-stations were built, three of them designed to accommodate 1,000 kw. each, and the aggregate transformer capacity installed is now 7,500 kw.

The public lighting now includes 292 arc and 833 metal-filament lamps, the latter varying from 60 to 400 c.p. The total service connections at the end of the year were 6,870, 2,200 being added during 1912, and the report points out that the fact that lamp connections show an increase of only 26 per cent., is an indication that electric lighting is cheap enough in Shanghai now to attract the poorer class of Chinese consumer. The small consumer is relatively profitable in Shanghai owing to the comparatively cheap overhead distribution and service costs.

Bearing on this point the report says:—"It is noteworthy that a large class of consumer which is now being secured is found amongst those who, until using electricity, have been lighting their premises with oil lamps." "The transition from oil to electricity . . . is found in what might be called the poorer classes of Chinese shops as well as the better ones." "Electricity as an advertising medium is at last being fully recognised by the Chinese. . . . Then, again, a great number of houses in native alleys are being connected, from which source an enormous demand for electricity is anticipated in the near future."

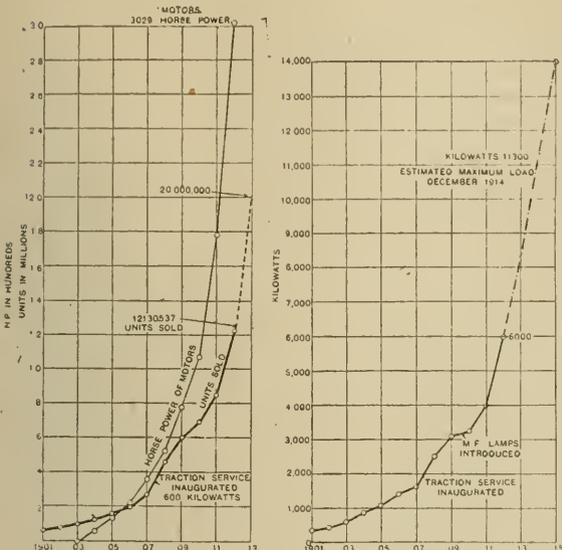
Electric heating and cooking apparatus are hired out by the department at a small monthly rental, and in this direction great progress is being made, the year's connections amounting to 293 kw., bringing the total connections to 674 kw.

Naturally, it is in the direction of power supply that the greatest progress has been made, and the report adds, "It is nothing to what we may expect within the next few years."

"Already in Shanghai there is a very large field for the electrification of mills and factories . . . and there is every likelihood of large mills being erected, . . ."

During the year, 1,254 h.p. of motors were added, making a total of 305 motors of over 3,000 h.p. now connected. Many of the older rice mills have substituted electric driving, while new ones commence by installing the electric drive. One sub-station already supplies over 500 h.p. for this purpose. In July last a cotton mill containing 10,000 spindles was connected to the mains and is electrically driven throughout. Contracts have been signed for other cotton mills for 1,200 h.p., and negotiations are pending for over 2,500 h.p. for other mills. Indeed, one has only to note that the power units increased from 760,000 in 1911 to 2,300,000 in 1912 to judge of the developments in this direction.

The report also refers to the opportunity for introducing the electric vehicle in Shanghai, to which Mr. Aldridge is now giving his attention.



Units sold and motor h.p. connected. Maximum load curve. SHANGHAI ELECTRICAL & SHANGHAI SUPPLY.

In conclusion, we reproduce one or two curves which speak volumes for the great progress being made in electricity supply in Shanghai; it is not too much to say that this state of affairs is due more than anything to the enterprise of Mr. Aldridge, the Council's electrical engineer, who, despite the difficulty of location, has succeeded in placing this Chinese city on an equal footing in electrical matters with the best municipal electrical undertakings at home.

PROCEEDINGS OF INSTITUTIONS.

Electric Supply in London.

By FRANK BAILEY, M.Inst.C.E.

(Abstract of paper read before the SOCIETY OF ARTS, April 9th, 1913.)

(Concluded from page 663.)

We have now dealt with the electrical supply works, and may turn, for purposes of comparison, to the other supplies of public utility—gas and water.

The position of the various gasworks and distributing centres is shown by the diagram. The position of the gas companies, according to Field's analysis of accounts for the year 1911, is given below.

	Nominal capital.	Sale of gas, 1,000 cb. ft.
Commercial Co. . . . .	£2,606,065	£3,295,000
Gas Light and Coke Co. . . . .	29,154,146	25,485,000
South Metropolitan Co. . . . .	8,325,340	12,604,000
South Suburban Co. . . . .	831,363	1,455,000
Wandsworth and Putney Co. . . . .	548,262	1,161,000
	£41,465,176	44,000,000

All these companies are not subject to any powers of purchase, and have unlimited tenure, holding a practical monopoly in their respective districts, but under terms of statutory supervision and limitation of dividends by the operation of a sliding scale, which form the most ideal protection for the public and the best encouragement for business enterprise.

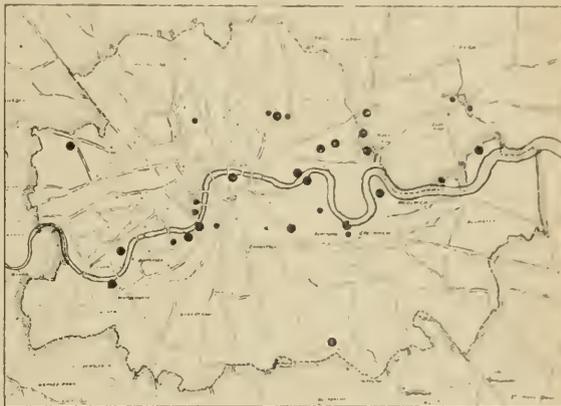
The supply of water is similarly obtained from a number of sources, and distributed from many reservoirs. In 1904, the Metropolitan Water Board acquired by purchase the undertakings of the

original eight water companies for the sum of 47½ million pounds, and now supply about 82,000,000 thousand gallons per annum.

It will thus be seen that the capital expended at the present time on electrical undertakings is approximately one-half of that spent on gas and water respectively.

The system of mains adopted throughout London is one of the most perfect examples to be found in any city, although it is not the cheapest. Lead-covered cables, insulated with oil-impregnated paper, are generally employed, and these cables—of which there is now more than 20 years' experience—actually improve with age; so long as the lead covering remains undamaged, there appears to be no limit to the useful life of the cable. Dr. Ferranti was the first advocate and maker of this type of cable in the form of concentric conductors, and thus earned the title of the pioneer of electrical transmission.

The brilliance of the tungsten lamp, accompanied by the low cost of obtaining increased candle-power, has raised the standard of domestic illumination and created a demand for more light. An electric supply is now essential to secure the greatest convenience in carrying out the ordinary domestic work of the home. Electric



GAS WORKS IN THE LONDON AREA.

radiators, chiefly of the luminous type, have brought comfort to many offices in the City of London. Electric ozonisers have proved their utility in purifying bad air and water. The electric vehicle may also become more generally used in this country. The increasing use of the electric motor for all purposes is a convincing proof of its advantages.

The following details taken from individual typical examples may be interesting:—

	Kilowatts connected.	Cost of supply per annum.
Printing (Newspaper) . . . . .	1,036	£1,812 2 6
" (General) . . . . .	56	119 7 11
Box makers . . . . .	9	80 0 10
Chemists . . . . .	92	221 11 4
Brewers . . . . .	39	153 10 6
Paint factory . . . . .	108	253 2 11
Soap makers . . . . .	110	68 15 9
Glass . . . . .	18	118 16 0
Blouse . . . . .	13	89 6 4
Wood wool makers . . . . .	166	623 8 6
Packing case . . . . .	52	214 17 10
Tailors . . . . .	63	159 15 5
Biscuit factory . . . . .	265	419 2 6
Confectioners . . . . .	174	569 11 9
Rubber factory . . . . .	222	219 16 5
Sawmill . . . . .	79	302 8 2
Spice factory . . . . .	69	371 4 4
Cabinet maker . . . . .	87	302 15 2
Ironfounders . . . . .	150	877 14 2
Vinegar brewery . . . . .	15	201 14 10
Marble masons . . . . .	101	294 2 0
Tobacco manufacturers . . . . .	22	133 3 5
Cold store . . . . .	164	922 2 9
Flour mills . . . . .	51	158 15 11
Ink . . . . .	48	235 2 10

The average cost for each kilowatt connected in the representative cases given in this table works out at £2 15s. 8d. per annum, or per horse-power, say, £2 1s. 6d. per annum. Had this horse-power been obtained from the old-fashioned engine, with the losses in shafting, belting, and steam pipes, starting up the plant and keeping the boilers warm all night, and the additional labour required, the cost would have been from £6 to £8 per annum, with further costs for continual repairs and all the annoyance of running steam plant taking up more room than it was worth.

We now come to the important question of street lighting. The development and perfection of the motor vehicle has resulted in an increased speed of street traffic, with many advantages though with some danger. Quicker transit has added to the prosperity of those who formerly suffered loss of time by blocks in the traffic; the delivery of goods is facilitated; and the expensive widening of

many streets is no longer necessary, as by doubling the speed it follows that twice the amount of traffic can be accommodated. To maintain safely this increased speed during hours of darkness a higher standard of artificial illumination has become necessary. A motor vehicle approaching at a speed of 20 miles an hour covers nearly 10 yards in one second, and, travelling without noise, leaves only the power of vision to protect the pedestrian. The adequate illumination of all thoroughfares will reduce the necessity of each vehicle carrying a searchlight and sidelights, or practically forming a travelling lighthouse.

The electric lighting of Cheapside is, like that of many of the main thoroughfares in the City of London, carried out by flame arc lamps, centrally suspended from steel ropes stretched across the street and placed at a considerable elevation in order to secure freedom from shadow and glare.

Improved street lighting is receiving consideration by the various borough councils in London, and their engineers and surveyors have recognised the value of better illumination, not only to ensure the safety of night street traffic, but also to improve adjoining property and to assist the police.

The London County Council now possess powers of purchase of the company undertakings in 1931, and after that date at recurring periods of 10 years—with the exception of the City of London where the Corporation have a prior right which expires in 1914. The terms of purchase are "the then value of all lands, buildings, works, materials and plant, suitable to and used for the purposes of the undertaking, provided that the value of such lands, buildings, works, materials and plant shall be deemed to be their fair market value at the time of the purchase, due regard being had to the nature and then condition of such buildings, works, materials and plant, and to the state of repair thereof, and to the circumstance that they are in such a position as to be ready for immediate working, and the suitability of the same to the purposes of the undertaking . . . but without any addition in respect of compulsory purchase or of goodwill."

These terms were practically based on Sec. 43 of the Tramways Act, 1870, and evidently provide for a fair market price for an undertaking in working order. The recent award in the arbitration proceedings to ascertain the sum to be paid by the Post Office for the acquisition of the National Telephone Co., may therefore be referred to with some interest, particularly as the terms of purchase were on the same lines, though with variations much in favour of the electrical supply undertakings. The Telephone Co. claimed £18,325,435, were awarded £12,515,264 (subject to certain adjustments which are at the moment *sub judice*), and had provided reserve funds which reduced their capital expenditure to £12,473,627.

The total capital expended by all the companies up to the end of 1912 will be found in the table given below, under the various items which appear in the standard form of accounts.

It should be noted that the Willesden works of the Metropolitan Electric Supply Co., being outside the boundary of the County of London, are not subject to purchase by the London County Council

#### SUMMARY OF TOTAL CAPITAL EXPENDITURE OF ALL ELECTRIC SUPPLY COMPANIES IN LONDON, 1912.

	Amount expended, Dec. 31st, 1912.
Land and buildings ... ..	£3,162,555
Plant and machinery ... ..	3,935,310
Tools and appliances... ..	40,124
Accumulators... ..	123,908
Transformers ... ..	539,531
Mains ... ..	5,349,304
Meters, instruments, &c. ... ..	625,427
Motors, &c., on hire ... ..	93,274
Public lighting ... ..	65,827
Station fittings, &c. ... ..	28,195
Offices and furniture, &c. ... ..	42,423
Distributing stations ... ..	113,607
Wells (artesian) ... ..	6,530
Preliminary expenses ... ..	487,181
	£14,613,196

under the terms as quoted above, but may be purchased by agreement. The Bow works of the Charing Cross and City Co. are also subject to purchase under special conditions.

If we consider that money has to be found by the companies to provide for the necessary capital outlay required to develop further such an important industry, and that the Act of 1908 authorises the London Council to advance money only for three years prior to 1931, it will be seen that for the next 15 years the interests of shareholders will require close attention, and that works of development will require strict economy, coupled with immediate return of some profit, to avoid a loss of capital to those who have encouraged and practically founded a new industry.

As regards conditions of supply and rates of charge, we sometimes hear suggestions that other cities either show more progress or obtain their light or power at a lower cost.

The average price in London for the year 1910, given in the statistics issued by the London County Council, was 8'42d. per unit for lighting and 1'16d. for power, or a general average of 2'54d. per unit, including meter rents.

I have ascertained from Chicago (population 2,250,000) that in the year 1912 they sold 141,752,000 units for lighting at an average selling price of 5'85 cents, say, 3d.; and 86,875,000 units for power at an average price of 3'88 cents, say, 2d. The total sale of 228,627,000 units gives an average of, say, 2'62d. per unit.

In the case of Berlin (population 2,072,000) the municipality granted a monopoly, under strict control, to private enterprise on terms of paying 10 per cent. of the net receipts, to be increased to 25 per cent. when the dividend exceeds 6 per cent. At the end of 30 years from the date of the concession the municipality may purchase the undertaking at its full then value, but without goodwill; and terms are also provided for earlier determination on payment of substantial premiums on the then value. The four original works—Markgrafenstrasse (1885), Mauerstrasse (1886), Spandauerstrasse (1889), and Schiffbauerdam (1890)—were limited by an agreement to an output of about 21,000 kw., and rapid development compelled the erection of the first transmission works at Moabit, followed in 1899 by the Oberspreer power house, which supply many of the suburbs; and in 1910 the Rummelsburg works were erected.

The rates of charge in Berlin are:—For lighting, 40 pfennige per kw.-hour, with a minimum charge of 100 kw.-hours per annum, say, 4'7d. per unit. For power, 16 pfennige, with a minimum charge of 400 kw.-hours per annum, say, 1'88d. per unit. In addition, there are charges for fixing and hire of meter and for the cost of the house connection, with a further charge for the compulsory inspection of wiring at the rate of 4 per cent. on the actual cost of the installation. The total sale for the year 1911-12 was as follows:—

	Units.	
Lighting ... ..	54,260,000	} Maximum demand, 94,570 kw.
Power ... ..	75,650,000	
Railways ... ..	69,850,000	
Bulk ... ..	23,610,000	
Total ... ..	223,370,000	

Paris (population 2,847,000) commences a new and sole concession on January 1st, 1913, to the Compagnie Parisienne de Distribution d'Electricité, under interesting conditions, and in the meantime the six old companies are preparing to be absorbed, and two new power works—one of 50,000 kw. at St. Ouen, near St. Denis, and the other of 25,000 kw. at the Moulineux—are now in operation. The conditions include payment of 10 per cent. per annum of gross receipts, nominally as a rental for the portion of the distributing system which now belongs to the municipality, with a sliding scale increasing this rent, the minimum annual payment being £120,000. The lease terminates in 1940, when all property will be taken over by the municipality without payment, and power is reserved to acquire the undertaking in 1924 on payment of the balance not then provided by the statutory sinking fund. The authorised rates of charge are 4'8d. per unit for lighting, and 2'9d. for power.

The experience of Buenos Ayres is interesting, as this important town of 1,500,000 inhabitants was formerly supplied by a number of companies, who allowed the prosperity following their pioneering work to fall into other hands. The Allgemeine Co., of Berlin, assisted by the Deutsche Bank and the Berliner Handelsgesellschaft, formed the German Overseas Electrical Co., which started the Compania Alemana Transatlantica de Electricidad in 1898, and obtained certain rights from the municipality for an indefinite time to lay electric cables throughout an important district. New works in the Calle Paraguay of about 5,000 kw. were started in 1899; and the next year the Cia. Generale d'Electricité were absorbed, to be followed by the River Plate Co.; the Boca works of the Anglo-Argentine Tramways Co., Ltd.; the Edison works of the Primitiva Gas Co.; and, finally, in 1905, the works of the Cia. de Traccion y Electricidad "La Capital" were taken over. The Boca works were enlarged by the addition of steam turbines to a total capacity of 30,000 kw.; and in 1910 a large power house at Deck Sud was completed, and now contributes a total capacity of 40,000 kw., with further extensions in hand. It is probable that the value of the shares in the old undertakings was not realised until control had passed into the hands of the exploiting company, and by adopting steam turbines the undertaking was soon prosperous. The terms of the concession provide for repayment of capital by the municipality less an allowance for depreciation, and this accounts for the fact that much of the old plant is still viable, and it may also lead to a renewal of the lease rather than to acquisition by the municipality on such onerous terms.

We can now see that no large city in other countries entrusts its electrical supply to municipal enterprise, and debates on the subject in various languages always repeat the arguments with which we are familiar. The final question of municipal trading *versus* controlled monopoly has been settled with advantage to the various municipalities, by allowing them some return on the profits; by limitation of dividends on a sliding scale, in which the consumer benefits; and by conditions of tenure.

The present and future prospects of the company undertakings in London provide some possibility of undesirable speculation; the uncertainty of a purchase clause may encourage pessimist rumours to depress the property, to be followed by equally good reasons for a convincing boom to the delight of the speculator. We have seen the interpretation of a similar, though weaker, purchase clause, and shareholders may be well advised to remember Buenos Ayres, and to place some confidence in the justice of the ultimate arbitrator.

The local authority undertakings in London have overcome many of the difficulties thrust upon them. Losses are met by special levies included in the rates, and profits provide some controversy as to their disposal. Contracting work, such as wiring buildings, &c., is objected to by the trade, and the expenses of advertising are not always allowed by the authorities. The technical and other officers work under the disadvantage of continual change in

administration; but, in spite of difficulties of all kinds, the electrical engineers of the Borough Councils have generally not only made their plant work, but have obtained the thanks of their customers, credit for themselves, and appreciation from their Councils, although the latter is not always expressed in a convincing manner.

In conclusion, may I be allowed to express a hope that the next paper on the subject—to be read, say, 20 years hence—will prove that the substantial progress made up to the present time was a sure indication of further great developments and the more extensive use of electrical supply. The difficulties of the past few years have created an army of skilled engineers, who have developed powers of resource, and the ability to look ahead; and, as they are mostly still young, they will, I hope, live to realise that they assisted to create an industry which, while increasing the luxury of the rich, reduces the poverty of the poor, and brings prosperity to the nation.

The CHAIRMAN (Mr. A. A. Campbell Swinton) opened the discussion by commenting upon the interesting and exhaustive character of the paper. There could be no doubt that the author was, of all men, best equipped for writing such a paper. The speaker recalled that in 1887, when he first came to London, he met the author for the first time; the author was at that time putting up an underground generating station just outside Whitehall Court, which was now, he believed, used as a sub-station. Since that date Mr. Bailey had been continuously in the electric supply industry of London, and was the first station engineer to apply steam turbines, showing admirable courage in so doing. The speaker had had considerable experience of steam turbines—an experience which, in fact, antedated the time referred to. He believed that the first steam turbines used in London, which still existed, although no longer in use, were two very small turbines employed in connection with the lighting of Lincoln's Inn Hall. In May, 1890, there had been installed under the speaker's supervision, some steam turbines for supplying electricity to New Scotland Yard, and these turbines were still at work, and the entire lighting and power—a considerable amount of printing and other work was carried on there—were supplied by these radial flow turbines, which had been running for 23 years. One of these turbines had been opened up last year, and despite the fact that its interior had not been inspected for 10 years, nothing was amiss, and it was put together again. Turning to the future of so great an industry, the aspect of affairs, was not without seriousness. What would happen, he would ask, for some years before the London County Council made the contemplated purchase? There would probably be great difficulty in finding capital, towards the close of the present companies' period of holding, for extensions; that was one of the evils of eventual municipal purchase upon the terms arranged for in the Electric Lighting Act. People would cease to find money for investment in a concern liable to be bought up at a very low price within a few years, and, in the speaker's opinion, the last Electric Lighting Act had not adequately provided for the difficulty which would arise in a few years' time.

Mr. W. M. MORDEY congratulated the author upon having given a second paper after a lapse of some 23 years, and hoped that, at the end of a similar period, he would give the survivors of the present audience the third paper to which he had referred.

Mr. JAMES H. ROSENTHAL said it was stated in the paper that the Babcock Co. had done much service in perfecting the chain-grate stoker, to which he would add that Mr. Bailey had himself contributed quite as largely to the development of that detail. He had had experience in foreign stations, municipal and other, nearly all over the world, and he did not consider that municipal stations were in any way better than those managed by companies. Probably municipalities would find it no less difficult than companies to raise money, for which reason he doubted whether the County Council would take advantage of their purchasing powers.

Mr. W. C. P. TAPPER said that the author of the paper had been chairman of a Committee of Engineers representing both companies and local authorities, appointed to consider the question of the future supply of London and to report on the matter. Of this Committee the speaker had been a member. He approved of the principle of central control, which must take place sooner or later. Whether, however, that central control would be effected by the London County Council or by some large company, he could not say. One difficulty would arise from the fact that the London County Council, although able to take over the complete systems of the companies, could not take over those of the local authorities; neither could any single large company do this. Assuming, moreover, that legal difficulties were removed, it would seem that the first matter to be settled would be the requisite standardisation of the system of generation. He thought it likely that a three-phase 50-period system at 6,000 volts pressure would be adopted by reason of its convenience for generating direct current, while should higher voltages be required for long distances, step-up transformers could be resorted to. He did not agree with the view that the whole of the 38 stations should be further developed. A good many of the existing stations had water facilities, in the way of canal or river, and might be developed up to their economical limits. When these were fully occupied, six or seven of the better-placed stations should be selected for further development. Extension should then be confined to such stations, the remainder gradually becoming distributing stations. The steam plant of existing stations could be run at peak load until such time as it paid to scrap it. Such an arrangement would serve for many years to come, and could be easily handled by a central authority. The question of purchase should be of interest to the consuming public as well as to supply engineers. The case of the Water Board, how-

ever showed that public interest was sometimes aroused too late. When the Act constituting the Water Board was under consideration the consuming public took very little interest in the matter, with very unfortunate results. The purchase price in the case of the Water Board was too high, and a similar danger was likely to exist with regard to the electric supply industry in 1931. It was very important that consideration should be given to the payment of a reasonable purchase price at the proper time. From the tables given by the author, it appeared that the price charged by local authorities was less than in the case of companies; that should in no way discredit the companies, as these had done all the pioneer work.

Mr. LEON GANTER said that the future prosperity of electric lighting was bound up with the study of scientific methods of illumination, and considerable progress was now being made. He had recently visited many of the chief Continental and American cities, and he believed that if the lighting of the City were completed on the present lines it need not fear comparison with any of them.

Mr. A. H. LAW said that Sir Charles Parsons had always appreciated the enterprise displayed by Mr. Bailey at the time when the first steam turbine was installed at Manchester Square; without that enterprise, the progress of the steam turbine might well have been delayed. With regard to the power supply of London even if concentration were not advisable, some form of communication would appear to be useful, so as to enable the different companies to keep down their capital cost. He believed that some such idea occupied Mr. Bailey's mind when he installed the single-phase 100-period alternators, as he had then requested the designers to consider the possibility of future adaptation to three-phase 50-period work.

Mr. G. W. MASCOUD anticipated that within the next 20 years the supply of electricity and its application in workshops, &c., would be trebled. As an illustration of the advantage of electricity over steam, he would say that, in changing from steam to electric power, there had been a saving of 35 per cent. in expenditure. The old steam engine had been replaced by a large motor, but in the first stage it had been necessary to couple the motor to the existing shafting, and it was found that the energy absorbed by the shafting and belting was about 35 per cent. of the whole. The displacement of boilers and engines added 50 per cent. to the productive plant.

Mr. BAILEY, in reply, said it had been a source of satisfaction to him to be able to bring up to date the figures which he had given 23 years ago.

### Standard Clauses for Street Lighting Specifications.

By A. P. TROTTER.

(Abstract of paper presented at a meeting of the ILLUMINATING ENGINEERING SOCIETY on April 15th, 1913.)

A JOINT Committee consisting of members of the Institution of Electrical Engineers, the Institution of Gas Engineers, the Institution of Municipal and County Engineers and the Illuminating Engineering Society in 1911 commenced the consideration of a draft specification for street lighting, and it was provisionally agreed that the specification should be based on illumination, the standard of comparison to be the minimum horizontal illumination at a height of 3 ft. 3 in. above the ground level. Several members of the Committee objected to the choice of illumination instead of candle-power, and it was agreed that the present author should prepare a statement supporting the former, while Mr. H. T. Harrison should prepare a statement of objection to it. An attempt will be made to present and to amplify the two statements and to discuss the general subject in an impartial manner as possible.

During the last few years, a real necessity for better street lighting has arisen, owing to the increasing speed of motor traffic. Neither the gas nor the electrical engineer is afraid of competition; on the contrary, they thrive on it, and the public gains more than anybody.

Illumination depends on the quantity of light falling on or received by a surface. It has nothing to do with the colour or reflecting power of a surface. A surface facing a source of light of 1 C.P. and at a distance of 1 ft. from it, or 16 C.P. at 4 ft., or 100 C.P. at 10 ft., receives unit illumination, and this is called 1 foot-candle.

The brightness of an unpolished surface depends on two factors—the illumination, and the proportion of light which the surface can reflect. A dark grey surface reflecting 5 per cent. of the light falling on it may have exactly the same appearance as a pale-grey surface reflecting 25 per cent. if the former receives five times as much illumination as the latter. The quality called brightness (or surface-brightness, to distinguish it from the intrinsic brightness of a self-luminous or translucent body) is, therefore, a product of the two factors illumination and the coefficient of diffused reflection.

If the illumination is up to a certain specified standard, it does not concern the public whether it is produced by a few lamps of large candle-power or by more lamps of less candle-power, or whether tall or shorter posts are used, within certain limits. The lamps must, of course, be so arranged that they are free from glare, and must be placed to the satisfaction of the surveyor, so that they do not interfere with the traffic or with the amenities.

One of the objections, from a contractor's point of view, to the illumination basis of a specification is that it gives him some trouble in calculating and designing the scheme. He considers that, so long as the lamps give the specified candle-power, his responsibilities should end there, and the purchaser must arrange the lighting to suit the needs of the case.

On the other side is the municipal or county engineer or surveyor

Experienced men of this profession have studied the needs of their district, know what the contractors can provide, and understand how to use it when they have got it. But we find that while each man knows his own job, he sometimes has a difficulty in appreciating the needs of a totally different district, and cannot generalise, or even explain the principles on which he successfully designs his street lighting.

It seems better that the lighting authorities should settle what it is they want to buy, and, having specified it, leave details to the competitive skill and wider experience of contractors. What, then, are these authorities "out to buy"? Not lamps, not candle-power, but illumination. So long as there is as high illumination in the main streets as the town can afford, and as much in the side streets as the ratepayers desire, candle-power *per se* does not concern them, and need not greatly trouble their engineers or surveyors.

Another objection to the illumination basis arises from the impression that it is easier to measure candle-power than illumination. The draft specification which will be found in Appendix A recognises several classes of illumination, the lowest having a minimum of 0.01 foot-candle on a horizontal plane 3 ft. 3 in. above the ground. While these classes are of importance so far as quality is concerned, they cover only about 20 per cent. of the street lighting of this country. It is proposed that the balance of 80 per cent. shall be measured by candle-power. The most enthusiastic supporters of the illumination basis agree that there are instrumental difficulties in measuring very low illuminations.

There is also an instrumental difficulty in measuring illumination which falls on a horizontal screen at a large angle of incidence. The draft specification does not provide that the screen shall be horizontal. If desired, it can be inclined to face any lamp, or, in other words, to receive the direct ray at zero angle of incidence.

In the case of that class of street lighting which constitutes by far the largest proportion, and particularly in the extreme case such as the lighting of a country road, the lamps serve mainly as beacons. The illumination on the ground or on any other surface is only useful in the immediate neighbourhood of each lamp. Candle-power is obviously, then, the basis. It is an advantage that the light shall be thrown to a distance, and it is therefore proposed that the candle-power shall be measured in the direction of the thoroughfare, at an angle of  $10^\circ$  below the horizontal. This means that the ray strikes the ground at a distance from the post measured along the street 5.67 times the height of the lamp. As it is convenient to make the measurement at 3 ft. or 4 ft. from the ground, this must be subtracted from the height of the lamp. With a 20-c.p. lamp 12 ft. high, a photometer 4 ft. high will receive the  $10^\circ$  ray if it is placed 45 ft. 4 in. from the post. The illumination on a photometer screen facing the lamp will be 0.0094 foot-candle. For the more brilliant, though less frequent classes of lighting, where there is no difficulty in measuring the illumination produced, there are several reasons for adopting this as a basis instead of candle-power. The first one has already been mentioned. The public wants light, not lamps. Another reason is that this allows the fullest scope for invention, economical spacing, and minimum cost. A third is that if more than three or four lamps contribute the lighting of any part of a street, the resulting effect cannot be obtained by measuring the candle-power of each lamp from that position. The addition of these candle-powers gives no indication of the lighting of the spot in question, unless it is reduced by calculation to the resulting illumination. Nor does the measurement of the illumination on a screen facing each lamp in turn help matters, since it never faces them all at the same time. But if a horizontal screen is set up at this spot it receives illumination from each lamp, and the illuminations are automatically added together, and may be measured simultaneously.

The two advantages of the horizontal plane are that: (1) if the illumination on it is sufficient, that on the other planes must be better; and (2) the illuminations received from all neighbouring lights add themselves together and give one single quantity which may be measured by one single observation. The economy of time and saving of calculation is enormous.

When the lighting of a street is judged, as the specification recommends, by the minimum illumination, the labour is again largely reduced. It is found in practice that it is very easy to find the minimum illumination, and this extends over a considerable area.

An objection to the horizontal plane measurement is that it takes account of reflected light from buildings. Experiment shows that in ordinary West End London streets, with painted stucco, the difference, as measured on the photometer, is extremely small, and is generally beyond the practical limits of error.

Reflected light from the sky is of greater importance. This must be reckoned with in accurate candle-power photometry by narrowing the field of view, and it is one of the reasons why illumination photometry must give place to candle-power measurements when the light is feeble.

For these and other reasons a considerable majority of those who have given attention to this matter agree that the illumination received on a horizontal plane is the best measure of the lighting of a street.

A photometer for use in a test-room may be graduated directly in candle-power, but an instrument to be used in the streets at various distances from the source of light must be graduated in foot-candles. The reading, multiplied by the square of the distance in feet, gives the candle-power.

Take a case from the table in Appendix A: A lamp 12 ft. high, the photometer set up 3 ft. 3 in. from the ground, and 50 ft. from the lamp-post (fig. 1). As we do not want to know the actual distance of the lamp from the photometer, but the square of that distance, we take  $(12 - 3.25)^2 + 50^2 = 2,577$ . Let the illumination measured on the photometer screen directly facing the light

be 0.029 foot-candle. Then the candle-power of the lamp is  $0.029 \times 2,577 = 75$ .

The illumination which would be received on a horizontal screen is less than 0.029 in the same proportion that the height of the lamp is less than the slant distance from the lamp to the screen. The slant distance, the square root of 2,577, is 50.77. The ratio  $8.75 : 50.77$  is 0.1725, and this, multiplied by 0.029, is 0.005, the

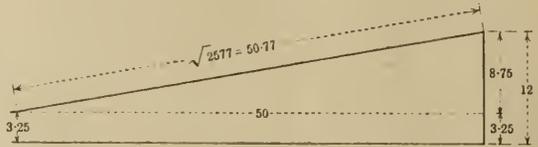


FIG. 1.

illumination required. Or the angle of incidence may be calculated or measured. It is easier to measure it to  $1^\circ$  than to level the photometer to that accuracy. To calculate it, find the tangent. This is the ratio of the horizontal distance to the height;  $50/8.75 = 5.71$ . The angle is about  $80^\circ$ , and the tables give the cosine 0.1725, the ratio required. Another lamp 50 ft. away doubles the illumination, making 0.01, for which the table is calculated.

This is a case in which the illumination on the horizontal plane would be difficult to measure with some photometers if there were only one lamp, on account of the feeble illumination, 0.005, and the large angle of incidence; an error of  $1'$  makes 10 per cent. difference at this angle. But when the illumination received at the midway point from the two lamps is measured, the reading 0.01 should give no difficulty, and a slight inclination of the photometer towards one lamp is balanced by its inclination away from the other. Some calculation is needed to find the candle-power, more is required to deduce the illumination from it, but none whatever is necessary if the illumination is measured directly on a horizontal screen.

Assuming, then, that for the higher classes of street lighting the illumination received on a horizontal plane 3 ft. 3 in. above the ground is to be the basis of the estimation of the lighting, we have to consider how this has to be treated.

In all these classes some attempt is made towards uniform distribution. The mean value suggests itself as the one to be considered, but if this is investigated it will be found to involve a considerable amount of calculation.

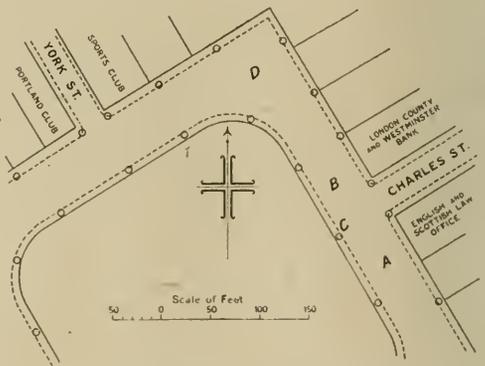


FIG. 2.—PART OF ST. JAMES'S SQUARE.

A little consideration shows that, while the mean illumination of a street may be up to a reasonable standard, it may have alternations of dazzling brilliance and dismal darkness. This proposal may therefore be discarded.

Some have suggested that the average between the best and the worst parts should be taken; but the area of the former always exceeds that of the latter, and the ratios extend in practice over such wide limits that this comparison will not serve.

The most satisfactory test appears to be the simple minimum illumination. Any excess of light may be regarded as a voluntary benefaction from the lighting authority or an unavoidable concession by the contractor. The draft specification provides that the height at which it is proposed to place the centre of light of each type of unit above the street surface is to be given in the schedule to the tender. This gives the lighting authority an opportunity to control excessive light.

The surveyor members were asked to visit some streets for the purpose of judging what kind of classification would be possible. In the first place, they excluded the lighting of thoroughfares of a special character, where the lighting is more than is usually necessary for ordinary traffic. They thought that for any public lighting

purposes streets might well be grouped under three headings:—  
(a) First-rate main lines of thoroughfare; (b) auxiliary roads and relief main roads; (c) side and unimportant streets.

It appeared desirable that this purely qualitative classification should be checked by quantitative measurements, and Mr. K. Edgecumbe, Prof. J. T. Morris, and the author undertook to make a series of tests on the basis suggested by the draft specification, namely, the minimum illumination on a horizontal plane 3 ft. 3 in. from the ground, as well as the maximum illuminations.

About 88 photometric measurements were made, besides measurements of distance and angle, at 31 places. A Trotter photometer was used. No difficulty was found in comparing lamps of different colours.

The work began in St. James's Square at about 7 p.m.

Fig. 2 shows the positions of the first four sets of measurements, A, B, C, and D.

The highest maximum was found in Bayswater Road near Victoria Gate (2.28 foot-candles), and this was 67 times the minimum, giving a larger ratio than in any other street measured on that evening. The ratio of maximum to minimum in Harley Street was 18, being less than in any other of the streets measured. The lighting of the Borough of St. Marylebone is so uniform that no lower illumination could be found in that district.

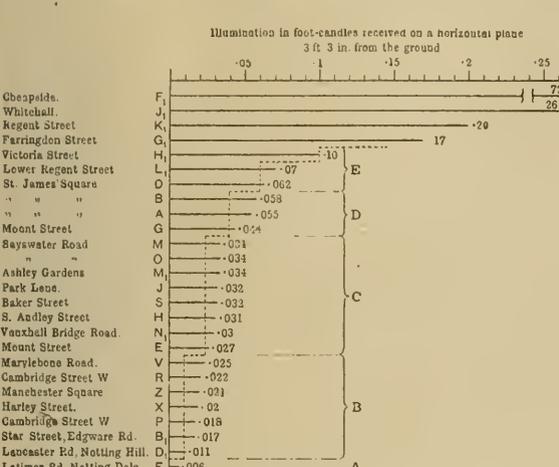


FIG. 3.—RESULTS OF PHOTOMETRIC MEASUREMENTS.

By inadvertence, the class letters are not the same as those suggested in the specification. A represents the lowest class, viz., minimum below 0.01 foot-candle. B is from 0.01 to 0.025. C is from 0.025 to 0.04. D is from 0.04 to 0.06. E is from 0.06 to 0.1.

The results of these photometric tests—which are set out together with others in fig. 3—are rather remarkable when they are compared with the report of the surveyor members. It shows that they so accurately classified the streets by eye that, when the measurements of minima are arranged in order, they fall exactly in the classes. The class (a) has an illumination on a horizontal plane 3 ft. 3 in. from the ground, not less than 0.025 foot-candle. The minimum illumination in class (b) varies from 0.025 to 0.015, and in class (c) it falls below 0.015.

This agreement is noteworthy. It shows that the judgment by eye by experienced men is in accordance with careful photometric tests; that photometric tests of illumination are not mere scientific experiments, but confirm quantitatively in definite figures the judgment of the eye; and, lastly, that the surveyor members seemed to have been unconsciously influenced by the minimum illumination in each case, for the maximum illuminations show no sort of agreement. Another result of these tests is to show that the ratio of maximum to minimum illumination is not a matter of importance, and it was agreed by the Committee that this point, which had appeared in the first preliminary draft, should be dropped. If the measurements had been made at the centre of the road they would have been slightly higher, because the minimum places were not always in the middle of the street.

On discussing the proposed classification there appeared, at first, to be a difficulty in dealing with those cases of brilliant street lighting which were not included in the report by the surveyor members. It was decided to invert the order, and to begin with the most extensive, and therefore very important class, in which the minimum is below 0.01 ft.-candle, which will be measured by taking the candle-power of the lamps. This class was not designated. The other classes are as follows:—

- A. Minimum at least 0.01 ft.-candle
- B. " " " 0.025 " 3
- C. " " " 0.04 " "
- D. " " " 0.06 " "
- E. " " " 0.1 " "

This leaves some 20 letters available for such higher classes of illumination as the progress of civilisation may call for, classes which electric light and gas engineers will be happy to provide when invited.

A table originally calculated by Mr. Haydn T. Harrison to show the candle-power required to produce a minimum illumination of

0.01 foot-candle on a horizontal plane 3 ft. from the ground, midway between two lamps of a given height and distance apart, is given as a graph in fig. 4. The lamps are supposed to give equal candle-power in all directions. The graph shows the economy of placing the lamps as high as possible, subject to practical considerations. Tall lamps in a narrow street waste much light on the walls of the houses.

When the Committee had reached this stage they were asked to consider a draft specification which, while incorporating some of the principles on which the majority seemed to be agreed, directed that the surveyor should fix the position and height of all lamps, and adjudicate on refracting lenses and reflectors. It was suggested that candle-power should be measured at two angles—20° and 50° with the horizontal. This was fully discussed at several meetings, and attempts were made to reconcile or to amalgamate the two somewhat different drafts.

It was finally agreed to put forward a draft of "Standard Clauses for Inclusion in a Specification of Street Lighting."

These clauses were accepted by the Council of the Institution of Electrical Engineers. The Council of the Institution of Municipal and County Engineers suggested some useful drafting amendments. The Council of the Illuminating Engineering Society accepted the

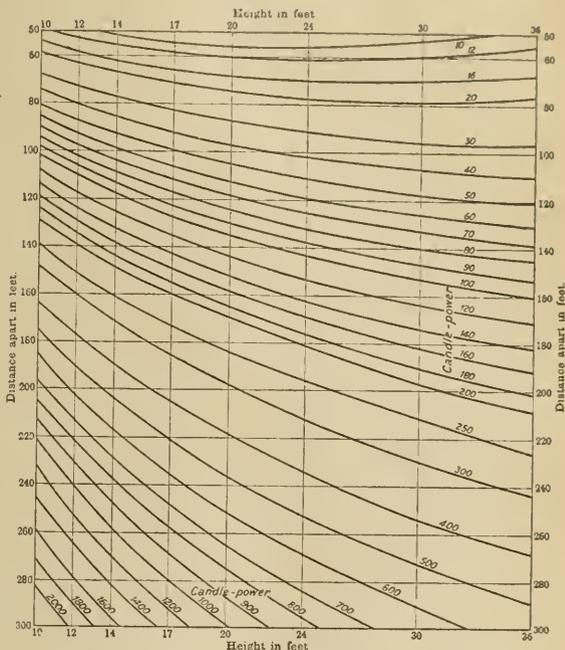


FIG. 4.—GRAPH OF TABLE PREPARED BY MR. HAYDN T. HARRISON, giving the candle-power necessary to produce a minimum illumination of 0.01 foot-candle on a horizontal plane 3 ft. 3 in. above the ground, the lamps being at various distances apart.

clauses as a draft and tentative specification. The Institution of Gas Engineers, while fully appreciating the valuable work which had been done, regretted that they could not agree with the fundamental basis of the suggested specification, namely, the stipulation of illumination with a stated foot-candle minimum measured on the horizontal plane.

The Joint Committee, in these circumstances, were reluctant to take any further steps until an attempt had been made to review the problem and to give an opportunity for a full debate upon it.

Meantime the author has been invited to contribute a paper before the Illuminating Engineering Society dealing with some aspects of street lighting. It occurred to the Council that the platform of the Illuminating Engineering Society might be utilised for an open discussion on the tentative specification prepared at a joint meeting of the four bodies interested. This proposal met with the unanimous approval of the Joint Committee. The present paper is the result.

**Accident.**—A telephone foreman lineman, named T. H. Birch, whilst repairing a wire at the rear of Scitcliffe Hall, Todmorden, last Saturday week, slipped on some rocks and fell a distance of 25 ft. into a brook. He suffered a fractured collar-bone and breast bone, and a pair of pliers in his pocket penetrated 2 in. into his body. His workmate, Henry Forrest, unable to reach the injured man, climbed the telephone pole, and by means of his pocket instrument, telephoned to the exchange station at Todmorden for help. On the arrival of the ambulance and doctors they had to lower a stretcher to the water, where the injured man still lay, by means of ropes. In the rescue operations Forrest was disabled by a boulder which became dislodged.

**THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.—FESTIVAL DINNER.**

On Wednesday last week the festival dinner of the Institution was held at the Trocadero Restaurant; Mr. George Sutton presided, and about 120 supporters of the Institution and guests were present. Unfortunately, a considerable number of gentlemen were prevented from attending, and sent messages of regret, including Lord Vaux, Sir E. Spencer, Sir J. Wolfe-Barry, Dr. Ferranti, Mr. Rutherford, Mr. Hirst, Mr. Daddell, Mr. Kingsbury and Mr. Garcke.

After the loyal toast, the president rose to propose "The Electrical Trades Benevolent Institution," remarking that he was anxious to secure the autographs of those gentlemen who had not already supplied them. The toast, he said, was the real business of the evening; it was a pleasure to meet old friends, but the main purpose of their being there was to do honour to the toast. It was but a young Institution, and the funds were very small; they wanted to make those funds very much larger. They were in their seventh year, and the funds amounted to only £4,000—a sum that was not worthy of the electrical industry in 1913. Mr. Garcke at the annual meeting told them that there were 500 millions sterling of British capital invested in the industry in the United Kingdom, and nearly 500,000 persons were employed. A large proportion of the latter, it was true, were outside the scope of the Institution, but there was a large number left within it. Many of them knew the difficulty of collecting funds for a charitable society, even in a country famous for generations beyond all others as a philanthropic nation; and since the State had added philanthropy to its functions, it was enormously more difficult to raise funds. But the National Health Act and Old Age Pension Act, good or bad as they might be, had not done away with the necessity for the work of that Institution, which was needed just as much as ever. The objects of the Institution, as set forth on its note-paper, were "to grant pensions and dispense temporary relief to deserving and necessitous persons who are or have been engaged in the electrical trade in the United Kingdom as employers, managers, teachers, or on the engineering, designing, drawing, sales or office staff, or in other similar capacities, or to their dependents"; they left out those who were more directly interested in the State Acts. The primary object of the Institution was to grant pensions—but no pension could be granted from a capital of £4,000, though a great deal of good had been done by small grants of money. His experience showed that it was much easier to get money from those who had not a great deal to spare than from those who were well-to-do. The directors of prosperous firms were often afraid lest they should do with other people's money what they ought not to do, and thought they had no right to contribute; he entirely disagreed with that view. Some companies did grant sums of money; their names appeared on the published lists, but the shareholders never did, and never would, object to the board of directors doing what was right in this respect. Again, some large firms had their own provident funds, and said that they looked after their own people—let others look after theirs. But it was only the large firms that could have their own provident funds, and this Institution had been created to look after the employés of the small firms. Small donations were essential to the Institution, but the backbone of such a society must be the list of members. The Committee could measure their liability if they had a big membership list; but who could measure the good the Institution could do if they gave it the funds? The poor derelicts of the industry who had gone to pieces on the rocks—who was going to help them? He would ask his hearers to use all their persuasive powers to enroll members for the Institution. The *Times* had said that the men who controlled the electrical industry had no understanding of the arts of popular persuasion, and looking at the funds one might agree; but he did not believe it, and he wanted them to show that they had it by getting a large accession to the membership. If employers would become annual subscribers of even a small amount, they could recommend their employés to become members, and at the next festival dinner they would meet under vastly more favourable circumstances.

Mr. A. Bruce Anderson, vice-president, supporting the president's appeal, said that hitherto he had been engaged in pleading the case of men who were able and willing to work, but could find no work to do; but the claims of those who were not able to work could not be denied. He had been asked to bring to their notice a form of bequest, and a form of application for membership, and to draw their attention to the privileges of subscribers. If they paid £1,000, they could nominate a person for a pension of £40. Of the three great virtues, faith, hope and charity, the greatest was charity; they were all in need of it, but that form of charity for which the chairman appealed in such sincere and earnest terms was the easiest to supply, and he hoped there would be a generous response.

At a later stage the president announced, amid applause, that the contributions received in connection with the dinner amounted in all to the sum of £854 6s.—almost exactly double the amount subscribed last year.

Mr. E. Byng, proposing the health of the president, said no one deserved better of them than he; they had only to look at his list to see how hard he had worked all the year. The speaker did not think the support the Institution received from the electrical trades was at all worthy of the industry, which was stingy and improvident. No one knew how soon he might need help from the

Institution. If the staff of every municipal station subscribed only £5, the result would be an income of about £3,000 a year. He was sincerely moved by the president's remarks, and would offer a donation of £100 on condition that nine others would do the same within three months. Mr. H. Hirst had promised to give £100, and the president had already given that amount, so only seven more were needed; let them endeavour to find the seven, and the result would be £1,000 to the funds. Mr. Sutton, acknowledging the toast, said that if he had been of some little service to the Institution he had been rewarded; he hoped his service had not ended with that dinner. He was especially pleased that his health had been proposed by the son of his old friend; they ought to take advantage of his excellent offer, and set a good example for next year.

During the evening a capital programme was performed, the artists including Miss Ada Forrest, Mr. T. E. Gatehouse, Mr. Falkner Lee, and Mr. Archie Naish, with Mr. Charles Bassett at the piano, and the festival was in all respects very satisfactorily celebrated.

The following is a list of donations and subscriptions received or promised before the Dinner. The subscriptions are marked with an asterisk:—

**CHAIRMAN'S LIST.**

The Chairman	£100 0 0	H. A. C.	£1 10 0
Henty's Teleg. Works Co.	100 0 0	Hatton, R. J.	1 10 0
Elec. Contractors' Assn.	50 0 0	Highton & Son, Ltd.	1 10 0
Babcock & Wilcox	20 0 0	Houlton, J. N.	1 10 0
Gill, Arthur B.	10 10 0	Howard, A. H.	1 10 0
Glover, W. T., & Co.	10 0 0	Jacoby, A. M.	1 10 0
Johnson & Phillips	10 10 0	J. G.	1 10 0
Anonymous	5 0 0	J. A. N.	1 10 0
Frankenburg, L., & Sons	5 5 0	Kynch, Ltd.	1 10 0
London Elec. Wire Co.	5 5 0	Le Bas, Edward, & Co.	1 10 0
Marconi's Wireless Teleg. Co.	5 5 0	Leste, E.	1 10 0
Taylor, G. E.	5 5 0	Lord, F. A. B.	1 10 0
Bath, Henry, & Son	3 3 0	Louis Behrens & Sons	1 10 0
Helshaw, T. O.	3 3 0	Maxter, J. W.	1 10 0
Enthoven, H. J., & Sons	3 3 0	Meyer, Montague L.	1 10 0
Merton, H. R., Co., Ltd.	3 3 0	Mills, P.	1 10 0
Wilkins, Campbell & Co.	3 3 0	Morris Ashby, Ltd.	1 10 0
Sullivan, H. W.	3 0 0	Nettlefold & Sons	1 10 0
Barclay Bros.	2 2 0	Newly & Sons	1 10 0
Bergbell & Young, Ltd.	2 2 0	Potter, W. J.	1 10 0
Bullard, King & Co.	2 2 0	Potter Bros.	1 10 0
Campbell, Donald, & Co.	2 2 0	Rashleigh, Phipps & Co.	1 10 0
Catchpole, E., & Sons	2 2 0	Reade & Co.	1 10 0
Crompton & Co.	2 2 0	Reeves, E.	1 10 0
Deacon, Samuel, & Co.	2 2 0	Rickett, Smith & Co.	1 10 0
Fox, George, & Sons	2 2 0	Roxby, J. W.	1 10 0
Frankenburg, L., & Sons	2 2 0	R. J. & N., Ltd.	1 10 0
Middleton, V. G.	2 2 0	Schwann & Co.	1 10 0
Rennis, J. T., Son, & Co.	2 2 0	Smith, James	1 10 0
Sunderland, Ltd.	2 2 0	Spencer, Ed., & Co.	1 10 0
Tanner, A. B.	2 2 0	Syder, P.	1 10 0
Till, Ed., & Co.	2 2 0	Thames Ditchfield & Co.	1 10 0
Tyler & Freeman	2 2 0	Tucker, Geo.	1 10 0
Watson, R. & W.	2 2 0	Wansbrough, E. C.	1 10 0
White, Wm. & Co.	2 2 0	Walton, W. H.	1 10 0
Windschugel, Chas., & Co.	2 2 0	Wayne, Morgan J.	1 10 0
Atkinson, Jewellery B.	1 10 0	Whaley, S. W., & Co.	1 10 0
Adams Bros.	1 10 0	Baxter, J. M., & Co.	1 0 0
Arnold & Co.	1 10 0	C. E. T.	1 0 0
Ashworth, H.	1 10 0	Hudson, T.	1 0 0
Barlow, H. Dudley	1 10 0	Pond, E. J.	0 15 0
Barnes, J.	1 10 0	Anderson, F.	0 10 6
Bean, Wesley & Co.	1 10 0	Bradfield, J. E.	0 10 6
Beyer, Fred.	1 10 0	Crisfield, J. H.	0 10 6
Bishop, W. J.	1 10 0	Everitt, A. W.	0 10 6
Bolton, Thomas, & Sons	1 10 0	Hedgcock, A. J.	0 10 6
Bradfield, W. W.	1 10 0	Hunter, F. C.	0 10 6
Bradshaw, R. A., & Sons	1 10 0	L. & J. H. R.	0 10 6
Brownson, R. L.	1 10 0	L. & W.	0 10 6
Carless, Caspel & Leonard	1 10 0	Mal Jointing Co.	0 10 6
C. H. A.	1 10 0	Monarch Typewriter Co.	0 10 6
Church Street Mfg. Co.	1 10 0	Nichols, W. H.	0 10 6
Connell, E.	1 10 0	Oscar Jones & Co.	0 10 6
Cotter, Wm., & Sons, Ltd.	1 10 0	Polybank, W. J.	0 10 6
Cheswood, E. S.	1 10 0	Roffey, A. F.	0 10 6
Dussek Bitumen Co.	1 10 0	Rusby & Newton	0 16 6
E. A. P.	1 10 0	W. B. & Co.	0 10 6
Easton, C. J.	1 10 0	Wilson, L. E.	0 10 6
Easton, J. J.	1 10 0	Bertram, C.	0 10 0
Electrical Co.	1 10 0	Glasgow Steel Roofing Co.	0 10 0
Emmie, J. F., & Co.	1 10 0	Arkel, H.	0 5 0
Espir, Fernand	1 10 0	Blyth, T. J.	0 5 0
F. W. & S.	1 10 0	Thornby, E.	0 5 0
Fuller, J. Leslie	1 10 0	Mann, E. C.	0 5 0
Gaskell & Grocott	1 10 0	Smith, E. R.	0 5 0
Graves, T.	1 10 0	Anonymous	0 2 6
		Bill, J. C.	0 2 6

**OTHER CONTRIBUTIONS.**

American Hard Rubber Co.	£0 10 6	Cantic Switch Co., Ltd.	£21 1 0
Adair Electrical Co.	2 2 0	Chaplin, H., & Co.	1 10 0
Automatic Standard Screw Co.	0 10 6	Clay, C. B.	1 10 0
Baker, B. B.	0 2 6	Coates, C.	10 10 0
Barkham, C.	0 10 6	Concordia Elec. Wire Co.	3 3 0
Barr, Mooring, & Co.	1 10 0	Conrad, C.	3 0 0
Barwell, James, & Sons	0 10 6	Cook, A. H.	0 5 0
Bates, W.	0 2 6	Cook, W. W.	0 10 0
Baugham, A. H.	0 10 6	Cookson & Co., Ltd.	1 10 0
Beaver, A. G.	1 10 0	Cooper, B. G.	0 10 0
Becker, R.	0 10 6	Cramb, A. C.	0 10 6
Becker, R., & Co.	0 10 6	Cranmer & Cheshire	1 10 0
Berridge, Geo., & Co.	1 10 0	Cryselco, Ltd.	1 10 0
Best & Lloyd, Ltd.	1 10 0	Charles & Dible	1 10 0
Birmingham Lighting Co.	1 10 0	Clark, W.	1 10 0
Bishop, S. & C., & Co.	0 5 0	Clark, E. J.	1 10 0
Blackburn, Starling, & Co.	2 2 0	Davidson & Co., Ltd.	1 10 0
Bonnella & Son, Ltd.	1 10 0	Davies, Kent & Stewart, Ltd.	0 10 6
Bowden, G. Harland	0 10 6	Devonshire, J.	2 2 0
Brimson Lamp Works	2 2 0	Digby, T. J.	5 5 0
British Electric Calibrated Fuse Co.	1 10 0	Digby, T. J.	0 10 6
Brit. Thomson-Houston Co.	10 10 0	D. P. Battery Co., Ltd.	0 10 6
Brunds, F. H.	0 10 6	Eek, Justus	3 3 0
Burney, Gray	2 2 0	ELECTRICAL REVIEW.	10 10 0
Burt Bros.	1 10 0	Electricity, Proprietors of	1 10 0
Burton, Col. H.	1 10 0	English Bros., Ltd.	0 10 6
Baldwin, J. H.	0 10 6	Ender, C. M.	0 10 0
British Oxygen Co., Ltd.	1 10 0	Esson, W. B.	2 2 0
Cannon, A. V.	0 10 0	Esson, W. B.	2 2 0
		Farmer, R. H.	10 10 0
		Farmloe, T. & W., Ltd.	2 2 0

Foll, A. L. C.	£0 10 6	Newman, F.	*£0 10 0
Forster, J., & Co.	1 1 0	Northern Electric Wire Co.	1 1 0
Fox, H. C. J.	*0 10 0	Prange's, N. W.	0 10 0
Galworthy, Ltd.	*1 0 0	Pollard, Wm., & Co., Ltd.	1 1 0
Garbe, Lahmeyer & Co.	*0 10 0	Radcliff, H.	0 1 0
Garke, E.	*10 0 0	Plumtree, J. S.	*0 10 6
Gilbertson, H.	0 1 0	Porter's Electric Traction Co., Ltd.	0 7 6
Gillespie & Beales	1 1 0	Prior, E.	*1 1 0
Glahou & Robson	0 5 0	Reole, R.	*0 10 0
Gorben, J. M.	*1 1 0	Ridgeway Bros., Ltd.	*0 10 6
Gray & Marten, Ltd.	0 10 0	Pirelli, Ltd.	2 2 6
Groves, J. & B.	0 10 0	Precco, Cardew & Snell	*2 2 0
Hammond, Rehl., & Sons	1 1 0	Petersen, M.	2 2 0
Hardy & Padmore	*0 10 6	Paul Fauschert Porcelain Works, Ltd.	2 10 0
Harrison, Haydn	0 10 6	Quance, F. G.	*0 10 0
Hart Accumulator Co.	*0 10 0	Quilman, Carl	1 1 0
Hartmann & Braun	*2 0 0	Ridgeway, L.	*0 10 6
Hellbut, Symons & Co.	5 0 0	Richards, W. L.	*0 10 0
Hillier, P. B.	0 2 6	Risley, D. S.	*0 10 0
Hill-Jones, T.	1 1 0	Rogers, B.	0 10 6
Hewetson, H., & Co.	0 10 6	Richard Johnson, Clapham and Morris, Ltd.	1 1 0
Hebb, W. E.	*0 10 0	Rwinburne, J.	1 1 0
Hobbs, W. E.	0 10 0	Spencer, Sir Ernest	2 2 0
Holophane, Ltd.	*2 2 0	Starkey, W. J. S. Barber	*0 10 6
Holmes, F. J.	*1 1 0	Stark & Robson	*1 1 0
Home & Rowland	1 1 0	Senders, Wm., & Co.	*1 1 0
Hooper, A. A.	0 1 0	Sohnmann, Wm., & Co., and assistants	0 10 0
Hornsby, Richard, & Sons, Ltd.	*1 1 0	Silcock, Chas.	1 1 0
Howard, A. J.	*0 10 0	Sloan Electrical Co., Ltd.	*2 2 0
Hudson, Edmunds & Co., Ltd.	0 7 6	Sparrow, N.	*0 10 0
Hunt & Co., Ltd.	*1 1 0	Stolzenberg Patent File Co.	*1 1 0
Hurst, A., & Co.	*2 2 0	Stranach, H. S.	0 1 0
Hay, G.	1 1 0	Straus & Co., Ltd.	*2 5 0
Hirst, H.	10 10 0	Swinton, A. A. Campbell	*0 10 0
Jaeger Bros.	*1 1 0	Snell, J. F. C.	*1 1 0
Jeffs, F. J.	0 10 6	Sterling Telephone Co.	*3 3 0
Judd, W.	*1 1 0	Stobson, Wm., & Sons, Ltd.	*1 1 0
Kidd, G. W.	0 10 6	Sun Electricals, Ltd.	*3 3 0
Kahn, Harry	2 2 0	Spies Bros. & Co.	*1 1 0
Kilston & Co.	1 1 0	Spicer Bros., Ltd.	1 1 0
Koettgen, C.	*5 5 0	Standard Cable Mfg. Co.	3 8 0
Kolle, H. W.	*2 2 0	Schall, W. E.	1 1 0
Korting & Mathieson	*5 0 0	Schuster, W. E.	1 1 0
Kingsbury, J. E.	2 2 0	Smyngton, Wm.	2 2 0
Leach, W. E.	1 1 0	Sugden & Hextall	1 1 0
Lampitt, C. B.	1 1 0	Spratt, L. W.	1 1 0
Lax, H. G.	1 5 0	Thacker, F. C.	*0 10 6
Leach, F. M.	*1 1 0	Thomas, N. F.	0 1 0
Leaf, H. A.	1 1 0	Thomas, Miss W.	*0 10 0
Leflwich, F. A.	0 10 0	Thompson, W. P., & Co.	*1 1 0
Leach, T. W., Ltd.	1 1 0	Trotter, A. P.	*2 2 0
Linalto Co.	1 1 0	Tucker, J. H., & Co.	1 1 0
Llewellyn, D.	*0 10 6	Turner, L. V.	0 1 0
Locke, Lancaster, & Co., Ltd.	*1 1 0	Turner & Burger	0 10 6
London Zinc Mills, Ltd.	0 10 6	Taylor, Tunnick & Co., Ltd.	*2 2 0
Lund, Humphries, & Co.	*0 10 0	Unwin Bros.	*1 1 0
Lund Electric Firm	1 1 0	Vacuum Oil Co.	1 1 0
Lind & Co., Ltd.	0 10 6	Venner & Co.	*1 1 0
Madgen, W. L.	*2 2 0	Voigt & Haeffner, Ltd.	2 0 0
Maurloe, G.	0 1 0	Von David, G.	2 2 0
Mehne, J. G.	1 0 0	Washington & Co., Ltd.	0 10 6
Meyer, Arthur, & Co., Ltd.	2 2 0	Wardroper, A. K.	0 2 6
Miles Bradley Co.	1 1 0	Wallach Bros.	*1 1 0
Mill, Fred., & Co., Ltd.	0 10 6	Wallis-Jones, Regd. J.	*1 1 0
Money, H. W.	0 1 0	Worrell & Payne	0 10 6
Moody, G. T.	2 2 0	Waddie & Co., Ltd.	*0 10 6
Moore, F. C.	*0 10 0	Watt, Scott, Ltd.	2 2 0
Morgan Crucible Co., Ltd.	1 1 0	Whitehouse & Co., Ltd.	*0 10 6
Morris, H. N., & Co., Ltd.	1 1 0	Wilkinson, H. D.	*2 2 0
Morrison, Alex.	*0 10 0	W. J. B.	0 5 0
Moul, H. E.	*1 1 0	Ward & Goldstone	*3 0 0
Morton, E. R.	*0 10 0	Wilkins & Wright	1 1 0
Moers, Ltd.	0 5 0	Wick, H. C.	*1 1 0
McWhirter, Wm., & Co.	1 1 0	Wallace Bros. & Co.	2 2 0
Myers, Leo M.	1 1 0	Winter, F.	5 0 0
Nage, Harry	*0 10 0	Yendall, E. R.	0 0 6
Nixon & Sons, Ltd.	0 5 0		
Newman, F.	0 10 6		

disposal to get a reasonable grasp of the local commercial conditions and the prospects of trade. In this connection the British Consul at Vladivostok in a recent report points out that such travellers as were in a position to visit Eastern Siberian centres appeared to carry away the impression that there does really exist there a market for British goods, and that, if any effort is ever to be made to take advantage of it, the present is the time to make it. Among other orders placed at home recently, may be mentioned brick-making machinery, crucible steel, lathes, and workshop equipment, motor-boat engines, refrigerating machinery, &c. British portable engines continue to hold their own, and the import of corrugated iron and flat sheets, always important, is increasing in volume.

The Amur Railway, which is making rapid progress, and should be completed except for the bridge over the Amur at Khabarovsk in 1915, is opening up a large area hitherto untouched; the Russian Government is taking in hand quite a variety of important undertakings, including the proper equipment of Vladivostok Harbour, with extensive electrical installations, the dredging of the approaches to the Amur, and very large building operations for the naval and military departments in various parts of the country; the colonisation authorities are improving the means of communication, and the settlement on the land of peasants from European Russia is progressing under more satisfactory conditions than has been the case in the past. What is more important still, Russian labour is being introduced in place of Chinese on all works depending upon Government, and is being encouraged on private enterprises. On all sides are visible signs of the fixed policy of Russia to develop the Amur Province and populate it with her own people. In addition the exploitation of the natural resources of the country encouraged by a liberal and sympathetic attitude on the part of the administration, is finding the capital which is essential to it.

The purchasing power of the community is, therefore, increasing; it will be interesting to see whether British manufacturers will maintain their aloof and distrustful attitude towards it or whether they will make some serious effort to establish themselves in a market which they have been content hitherto to leave untouched.

It should be at once said that the despatch of an occasional traveller will not effect this object, nor will the distribution of the most alluring catalogues be of much avail. British firms must be actively and efficiently represented on the spot, and until this is done no real improvement in the position can be hoped for. They must bear in mind that German trade has gained predominance here by starting from small beginnings when the Russian occupation was in its infancy, and that it has grown up with the country; that the large German stores having Vladivostok as their centre of operations were founded 40 or 50 years ago, are thoroughly familiar with the wants of the inhabitants, and have accustomed them to the use of German goods; that they have a perfect acquaintance with the language, have opened branches in the various centres as their growing importance seemed to justify it, and have trained and capable technical staffs. Being on the spot and organised so as to gauge the financial stability of their clients, they can—what is all-important here—give credit where circumstances justify it and have a hold over purchasers which distant firms can never obtain.

The foregoing will hardly sound encouraging to firms desirous of working up business in Vladivostok, but no good object can be achieved by minimising the disadvantages under which they must labour if desirous of making an effort to repair the indifference of the past. The lines on which such an effort should be made, in the opinion of the Consul, have been sketched in the course of correspondence between the Consulate and the Commercial Intelligence Branch of the Board of Trade, where further information might be obtained.

An important point to be remembered, particularly in the case of machinery, is that packing of goods for delivery to Vladivostok should be very carefully executed. Cargo for Vladivostok, unless sent *via* Shanghai by fast steamers, is generally three months or more on the way, and has, more particularly in the winter months, to go through extremes of temperatures. Bright parts of machinery must, therefore, be protected and thoroughly coated with anti-rust composition. Hay and straw must not be used, and parts must not be left loose in cases, but must be carefully secured. Great care is recommended in despatching, so as to ensure that no portions or fittings of machinery be omitted, since it is generally impossible to replace anything here, or, if supplies can be obtained, they are very dear. Another point worthy of attention while on the subject of machinery is the importance of sending in good time full specifications and working plans. When supplying boilers, certificates of factory tests must always be sent, and it must be remembered that the requirements of Russian law must be studied and complied with.

**Building Trades Exhibition.**—In addition to the firms mentioned in our last issue as showing at this exhibition, which closes to-morrow at Olympia, Messrs. C. JENNINGS & Co., of Bristol, have on Stand No. 164, Row H, an exhibit of woodwork, fretwork screens and arches, doors in various designs, stairs, windows, "Teakard" block flooring, and electric light casing.

**Strikes.**—On Monday last week the labourers and semi-skilled workers at the Preston Works of Messrs. DICK, KERR & Co., LTD., came out on strike in respect of a dispute regarding wage advances. New terms were offered by the firm on the following day and accepted, work being resumed on Wednesday.

It is announced that a strike at the works of the Hoffman Manufacturing Co., at Chelmsford, which had affected 1,800 men and girls, was settled on Tuesday night. Men over 21 years of age, with six months' service, are to be paid a minimum of 5d. per hour.

The following contributions have also been received in the course of this year:—

Moulton, Lord	£1 1 0	Anderson, A. Bruce	*£2 2 0
Ferranti, Ltd.	5 5 0	Samuelson, G. B.	*2 2 0
Berry, H. H.	1 1 0	Bastien, C. O.	*2 2 0
Electromotors, Ltd.	*2 2 0	Ireland, A. J.	*1 1 0
Ruberoid & Co.	*1 0 0	Fleming, Miss M.	*0 10 0
Bishop, G. H.	1 1 0	Sargen, Miss E. M.	0 10 6
Nash, E. A.	*1 1 0	Hawes, F. B. O.	*1 1 0

Further contributions were received during the dinner, of which a list will be given later.

**BRITISH TRADE IN THE RUSSIAN FAR EAST.**

WHILE we are so busily engaged upon schemes for foreign trade expansion, we need to be reminded occasionally that there are vast tracts of territory which, if we have not actually overlooked them, we have to all appearances treated as not being worth our while—at any rate in their present undeveloped state. We have had put before us particulars of a scheme under which it is hoped that British firms will shortly devote themselves aggressively, and with considerable profit, to one of these vast fields. We refer to Siberia, where the opportunities for British engineering and other manufacturers seem to be very great. We hope to give fuller particulars in our next issue, but in the meantime we may quote here from one of the latest Consular reports issued regarding that part of the world.

The ELECTRICAL REVIEW has previously drawn attention to the fact that British firms are rather neglectful of the opportunities for trade extension which exist in the Russian Far East. The position recently has remained pretty much what it always was, with, perhaps, a slight tendency towards improvement. The number of travellers representing British firms has certainly shown an increase, and instead of following the previous practice of dashing through Vladivostok on the way to or from some other country, and spending a few hours, or at the most a couple of days, in the district, those who came had generally sufficient time at their

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**GERMANY.**—The Board of Trade desires to call the attention of manufacturers and shippers in this country to the fact that in accordance with the German regulations for the importation of merchandise by rail, goods so entering Germany (even goods in transit) are now required to be accompanied—apart from the ordinary consignment note—by a special declaration, in duplicate, on a form prescribed, which is to be filled up, both in French and German, by the sender of the goods, and in which (among other particulars) the nature of the goods has to be entered with the terms of the descriptions used for such goods in the German Customs Tariff. The net weight of the goods has also to be given in respect of parcels containing goods subject to different rates of duty. The fact that this special declaration is being sent must be noted by the consignor on the consignment note. A copy of the form of declaration prescribed may be seen by persons interested at the offices of the Commercial Intelligence Branch of the Board of Trade, at 73, Basinghall Street, E.C.

**HOLLAND.**—The Dutch Customs Authorities have decided that zinc bars for battery cells only cut to measure, but not prepared for use in any other manner, are to be admitted free of duty. Lubricating apparatus for the automatic greasing of machines is also to be admitted free of duty.

**ST. LUCIA.**—In accordance with the Canada—West Indies agreement the Government of St. Lucia have decided to put into operation a preferential tariff in favour of British goods, the preference to be given to amount to one-fifth of the duty leviable on foreign goods. The date of coming into force will be fixed subsequently.

**ITALY.**—The Italian Customs Authorities have decided that dry batteries for small electric hand lamps are to be dutiable at the rate of 30 lire per 100 kg. (25 lire = £1, kilogram = 2.204 lb.).

**VENEZUELA.**—The Venezuelan Commercial Code provides that the contents of packages of goods shipped to Venezuela must be declared on the Consular Invoice by giving the name of the article, the material of which it is made, and the quality or condition which distinguishes it from any other article of the same name covered by a different class of the tariff. The Code also provides that if these particulars are not set out in the Consular Invoice the importer will be fined a sum of from £5 to £40 at the discretion of the Director of the Customs House where the goods were imported. Duty is also levied on such cases under the highest class of the tariff under which articles of the kind can be assessed for duty.

In a dispatch from H.M. Minister at Caracas, which has recently been received at the Board of Trade, it is pointed out that in cases in which a fine is imposed by the Custom authorities, there is no remedy unless the consignee at once petition the Venezuelan Minister of Finance, on stamped paper, urging a remission or reduction of the fine on the ground of there having been no intent to defraud the Customs. When such a petition is lodged, a nominal fine equivalent to £1 may be substituted for the fine originally imposed.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 8,115. "Luminous electric devices." L. H. WALTER. April 7th.  
 8,123. "Incandescent electric lamps." E. P. BECKWITH. April 7th. (Complete.)  
 8,124. "Incandescent electric lamps." E. P. BECKWITH. April 7th. (Complete.)  
 8,128. "Dynamos." C. T. MASON. (Convention date, April 23rd, 1912, United States.) April 7th. (Complete.)  
 8,130. "Process for the regeneration of oil employed as transformer oil and the like for use for electrical purposes." SIEMENS SCHUCKERTWERKE G.M.B.H. (Convention date, April 6th, 1912, Germany.) April 7th. (Complete.)  
 8,173. "Mode and apparatus for sending and reproducing telegraphic signals." H. KAHLER and P. KAHLER. (Convention date, April 6th, 1912, Germany.) April 7th. (Complete.)  
 8,188. "Telephone exchange systems." D. H. KENNEDY and J. W. TRAINER. April 7th.  
 8,198. "Electric glow lamp." C. B. HERRMANN. (Convention date, December 16th, 1912, Germany.) April 7th. (Complete.)  
 8,223. "Electric lamps." F. WESTWOOD. April 8th.  
 8,240. "Apparatus for photographically recording electrical measurements and for like purposes." SIEMENS & HALSKER Akt. Ges. (Convention date, April 10th, 1912, Germany.) April 8th. (Complete.)  
 8,244. "Electric appliance for use in hairdressing." J. D. MARINKS. April 8th.  
 8,267. "Electric collectors for tramway and like vehicles." A. HELFENSTEIN. (Convention date, April 18th, 1912, Austria.) April 8th. (Complete.)  
 8,273. "Electrical indicating apparatus for use on steam trains." W. WHITE and G. H. GARDNER. April 8th.  
 8,299. "Construction of electrical alarm attachments to clocks." J. BOWIE and A. M. CARNEGIE. April 9th.  
 8,300. "Method of construction of medical shocking coils." J. BOWIE and A. M. CARNEGIE. April 9th.  
 8,301. "Electric arc lamps." ENGINEERING AND ARC LAMPS, LTD., and A. T. DOWDELL. (Additions to 15,678/11.) April 9th.

- 8,308. "Means for and method of applying automatic instantaneous switches to the protection of electric generators." A. M. TAYLOR. (Addition to 7,141 of 1910.) April 9th.  
 8,338. "Electric water-heaters and the like." E. W. LANCASTER. April 9th.  
 8,352. "Process of electrolysis and apparatus therefor." K. S. GUTTERMAN. April 9th. (Complete.)  
 8,371. "Ignition device for bombs and mines." F. EICHBAUER. April 9th.  
 8,395. "Electric heaters for liquids." C. O. HASELL. April 9th. (Complete.)  
 8,409. "Electric switches." VOIGT & HAEFFNER Akt. Ges. (Convention date, July 8th, 1912, Germany.) April 9th. (Complete.)  
 8,412. "Telephones call apparatus." REBERS, LTD., and F. HOLDEN. April 9th.  
 8,416. "Electric arc lamps." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 9th.  
 8,417. "Manufacture of a material suitable for electrical insulation and other purposes." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 9th.  
 8,424. "Electric lighting vacuum lamp." L. G. BAASIER. April 10th.  
 8,445. "Means for connecting lamp-holders to bracket or pendant tubes, or the like wire conduits." G. ST. J. DAY. April 10th.  
 8,464. "Electrically-driven clocks." P. A. BENTLEY. April 10th.  
 8,467. "Balance weight suspension with double conductor-supporting cord for electric lighting." A. SCHUCHARDT. April 10th. (Complete.)  
 8,469. "Process for protecting storage batteries and cells against shocks and knocks, and for preventing the disintegrating of the active substance of the plates." F. SABLON. (Convention date, May 14th, 1912, France.) April 10th. (Complete.)  
 8,475. "Method of and apparatus for generating and storing electricity." J. V. SZYDLEWSKI. April 10th. (Complete.)  
 8,485. "Magnetic separators." H. J. H. NATHORST. (Convention date, April 18th, 1912, Sweden.) April 10th. (Complete.)  
 8,530. "Electrical contacts or connections." J. DODDILL. April 11th.  
 8,547. "System of and electric control for track switches of tramways and the like." R. GEMMING. April 11th.  
 8,561. "Method of utilising the blow of a door knocker or like implement to cause the ringing of an electric bell attached thereto." G. W. BRACK. April 11th.  
 8,562. "Electric telegraphy." R. APPELBAED and H. W. MALCOLM. April 11th.  
 8,568. "Incandescent electric lamp." C. CRIST. April 11th.  
 8,584. "Ignition and priming devices for internal-combustion engines and the like." C. G. NOBIS, JUN., and L. DONSON. April 11th. (Complete.)  
 8,590. "Reflectors for electric incandescent lamps." F. W. FUTER. April 11th.  
 8,597. "Arc lamps." N. A. HALBERTSMA. (Convention date, April 19th, 1912, Germany.) April 11th. (Complete.)  
 8,601. "Electricity motor meters of the mercury type." COMPAGNIE POUR LA FABRICATION DES COMPTES ET MATERIEL D'USINES A GAZ. April 11th. (Complete.)  
 8,622. "Means for use in directly measuring small variation or differences in electrical resistances." HARTMANN & BRAUN Akt. Ges. (Convention date, May 8th, 1912, Germany.) April 11th. (Complete.)  
 8,615. "Prepayment automatic telephones." L. BREGUET and FABRES BREGUET et Cie. April 12th. (Complete.)  
 8,624. "Automatic systems of train control by means of separately actuated contactors." SIEMENS BROS. DYNAMO WORKS, LTD., and A. M. DUXE. April 12th.  
 8,665. "Electric switches." L. RASCH. April 12th.  
 8,675. "High-potential electrical insulators." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 12th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1911.

ELECTRICAL DISTRIBUTION SYSTEMS. British Thomson-Houston Co. and E. B. Wedmore. 28,805. December 21st. (Addition to No. 11,979 of 1908.)  
 SYSTEMS FOR STARTING INTERNAL-COMBUSTION ENGINES AND THE LIKE. C. F. Kettering. 28,903. December 22nd. (April 17th, 1911.)

### 1912.

CONTROL OF ELECTRIC MOTORS FOR ELECTRICALLY-OPERATED DIVING SYSTEMS. CROFTON & Co., J. C. Macfarlane and H. BURCK. 4,955. February 28th. (May 13th, 1912.)  
 METHOD OF, AND APPARATUS FOR, UTILISING TRANSFORMED AND PRIMARY CURRENTS. W. DUBILIER. 6,909. March 20th.  
 RELAYS FOR ELECTRIC CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) 7,014. March 21st.  
 TELEPHONE SYSTEMS. E. A. MELLINGER. 7,100. March 22nd.  
 ELECTRICAL APPARATUS FOR PROTECTING THE HULLS OF SHIPS AND OTHER SUBMERGED STRUCTURES FROM BARNACLES AND OTHER FORMS OF AQUATIC LIFE. J. E. JAMES and W. T. SMITH. 7,817. March 26th.  
 ELECTRICALLY-OPERATED AUTOMATIC PIANO AND LIKE PLAYERS. J. T. FIBLEY. 7,870. March 26th.  
 ELECTRIC AND AUTOMATIC CONTROL OF ENGINES, DYNAMOS AND BATTERIES. L. SUNDERLAND and G. C. PILLINGER. 7,875. March 26th. (Addition to No. 29,944 of 1909.)  
 TELEPHONE APPARATUS. E. GRISINGER. 7,462. March 27th.  
 BRUSH HOLDERS FOR DYNAMO-ELECTRIC MACHINERY. Akt. Ges. BROWN, BOVERI et Cie. 7,577. March 27th. (May 8th, 1911.)  
 APPARATUS FOR ELECTRICALLY RECORDING THE AMOUNT OF COAL SUPPLIED TO STEAM GENERATORS. W. WHITE and A. E. LANGLEY. 7,885. April 1st.  
 ELECTRIC MOTOR CONTROL SYSTEMS. British Thomson-Houston Co. (General Electric Co.) 8,611. April 11th.  
 WELDING. R. S. KENNEDY and British Arc Welding Co. 8,967. April 16th.  
 CORRUGATED SECONDARY BATTERY BOX. E. J. CLARK. 10,766. May 7th.  
 TELEPHONES. R. LAGUS. 11,578. May 11th.  
 TELEGRAPH APPARATUS. E. POPE. 11,605. May 15th.  
 SECURING ELECTRICAL CONTACT WITH, AND CONTINUITY OF THE WIRE ARMOURING ON ELECTRIC CABLES WHERE THE CABLES ARE JOINED TOGETHER, OR WHERE THEY ARE CONNECTED TO APPARATUS. A. HEPBURN. 13,171. June 4th.  
 ELECTRODES FOR ARC LAMPS. British Thomson-Houston Co. (General Electric Co.) 13,375. June 6th.  
 ELECTRICALLY-DRIVEN TILLER MACHINES. W. WORTMANN. 15,688. July 4th.  
 ELECTRICAL SWITCHES. A. H. KLING and B. D. HORTON. 16,229. July 11th. (July 11th, 1911.)

# THE ELECTRICAL REVIEW.

Vol. LXXII.

MAY 2, 1913.

No. 1,849.

## ELECTRICAL REVIEW.

## THE COMPETENT PERSON.

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In our "Legal" columns of last week and this week will be found the report of an appeal case in which the interpretation of the Home Office Regulations is brought into question.

The facts of the case are, briefly, as follows: At the Finchley sub-station of the North Metropolitan Electric Power Supply Co., the cleaning of certain resistances was being carried out on March 25th, 1912, by a young man named Shapcot, who was, as directed by Rule 28 of the above-named Regulations, working under the direction and supervision of another man, who was of mature age, and whose name was Styles. Shortly after starting this work, Shapcot's wrist came into contact with an insufficiently insulated conductor, the potential of which was 6,000 volts above earth, and he was killed.

On June 26th, 1912, the company was convicted, at the Highgate Police Court, of having committed breaches of Rules 18 (*d*) and 28 of the Regulations. Proper screens not having been provided, as required under Rule 18 (*d*), the Bench inflicted a fine of £25, with £5 5s. costs: and on the ground that Shapcot was not a competent person over 21 years of age, but was, notwithstanding, employed to do work where technical knowledge or experience was required in order to avoid danger, a fine of 40s., with nominal costs, was imposed.

The company appealed against both convictions, feeling that in the first instance the fine of £25 was far too heavy—"a savage penalty," as their counsel expressed it—and that in the second instance there should not have been any conviction at all. Their ground was that, if the decision of the Highgate Bench was allowed to stand, it would appear to be illegal to employ any youth under 21 years of age in a generating station or sub-station. The effect of any such interpretation of the Regulations—which have, of course, all the force of an Act of Parliament—might be unmistakably serious, for several reasons. One is that no person could begin to get works experience until he had come of age, which would place electrical work beyond the means of many; and another reason which has been put forward is that the poorer undertakings might suffer financially by reason of the higher cost of older men. We may parenthetically remark that, in our opinion, but little importance attaches to the latter contention; supply authorities, whether company or municipal, are notoriously bad payers, and the wage question, especially where juniors are in question, will not greatly affect them.

As in many other instances, the wording of the Regulation is not as clear as it might be. From Rule 28, which appeared in our report last week, it appears as if a competent person may be under 21 if the work is such that technical knowledge is required, unless that work be repairs, alterations, extension, cleaning, or "such" work. A cleaner, however, must be of age as well as competent, and

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(J. A. Berly's).

# 1913 EDITION.

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must be accompanied by an authorised person. Not even an authorised person may do "such" work by himself. The object—worthy and laudable—of the Rules is the avoidance of danger, but their interpretation is not always easy.

It was contended, in reference to the screens, that a passage 2 ft. 6 in. wide, existing between the side which was dead and that which was alive on the occasion of the fatality, was a division within the meaning of the requirement, and counsel urged, not without some show of justification, that no amount of screening could prevent a man from going where he might be in danger, if he wished to go there. The contention, however, is specious. A passage is for people to walk along, and it is not part of its function to act as a means of preventing people from stepping across from one to the other side of it. And instructions, whether written or verbal, will not prevent rash persons from exceeding the limits of prudence. The argument is worthy to rank with that of the opposing counsel, who thought that the fact of his being killed was, to some extent, evidence of the man's not being competent.

The appeal came before a special sitting of the Middlesex Quarter Sessions, at Caxton Hall, on Monday, April 21st. The result, as our readers have already been informed, was that the fine of £25 was reduced to one of 10 guineas, and the second conviction was quashed. It was held that within the technical meaning of the regulation Shapeot was an authorised person.

We may say that, on the evidence, we agree with this decision. The young man appears to have had training which should have fitted him to carry out, especially under the supervision of Styles, who was an authorised person as defined by the Regulations, the work which he was on this occasion called upon to do. The question of age does not, and ought not to, enter into the matter. Had the cable with which he came into contact been dead, instead of alive, or had it been screened off effectively so that he could not, except by wilfully transgressing, have touched it at all, the young man would not have met his death. The Home Office never took steps to see whether its requirements were carried out, and Mr. Ram said in his evidence that the duty of complying with the Regulations was on the occupier. Quite so, but we do think that the Government could be a great deal more useful than it is in these matters, if advice were given as to what should be done, and if inspections were more thorough. The Board of Trade has to administer some of the means for securing safe operation, and the Home Office others of them. Then the Local Government Board has a say as to the spending of money (by municipalities) upon this, as upon other objects. Between the lot of them it is by no means an easy matter to be always sure of steering the right course, and Nemesis inevitably follows fast upon discovered error in respect of any of them.

We suppose it goes without saying that the chief officials of electricity undertakings invariably try to the best of their ability to carry out everything that is necessary for the safety of the people employed. Nobody wants men killed on his works. But it does not improve the situation if, after a fatality, the Home Office comes along and says:—"You should have done such-and-such things, although we are not bound to see that you do them; and, in any case, you ought not to have employed that person to do the work, because, although we have not told you what a competent person is, we do not consider that he was one."

It is well that on occasion means can be found to straighten out these tangles; but it were better by far if the making of the tangles could be altogether avoided.

#### The Electric Vehicle and the M.E.A.

SINCE the days when, at the Crystal Palace motor shows, it was not such a stranger as it is now at Olympia, we have frequently had occasion to refer to the advantages of the electric battery vehicle for certain classes of town work, for which it is particularly suited.

That its possible sphere of usefulness has certain economic limits at present will not be denied, but even so, an excellent case can be made out for its use in this country just as much as in the States, where cleanliness, and simplicity of control and maintenance, coupled with reliability, are important factors, and the journeys can be limited to, say, 50 or 75 miles at a time. Under such conditions the battery vehicle can defy all other forms of road traction, and under far less favourable circumstances it has apparently satisfied keen American business men in the matter of both cost and convenience. Take, as an example, the American Express Co., which has close on 300 electric trucks in use in various cities and towns, where the conditions vary widely—it is quite certain that no philanthropic motive induced this firm to adopt the electric in preference to, say, the petrol car for this service. But the fact that of the 20,000 "electrics" in use in the States, some 6,000 are of the commercial type, and that in a country where practically a million motor-cars of all kinds are in use, is to us a sufficient answer to those, not always disinterested, people in this country, who will not stop to consider the possible utility of the electric vehicle.

The matter is one which, of course, directly affects central-station engineers, many of whom, it is only fair to say, fully appreciate the situation and would have welcomed the opportunity to help the movement forward if a good battery vehicle had been commercially obtainable in Great Britain in the same way as it has been for some time in the States. Mainly to this fact, no doubt, is due our backwardness, and we can therefore congratulate ourselves now that this state of affairs, so unworthy of us as an engineering people, is about to be remedied by the Arrol-Johnston Co., a third of whose new works in Scotland has been specially designed for the building of electrical battery vehicles. We trust that this firm, and any others who are able, will make the most of the occasion presented by the forthcoming June convention of the Municipal Electrical Association in London, where the reading of a paper on "Electric Vehicles," by Messrs. Seabrook and Watson, seems to offer an opportunity for practical demonstrations of electric vehicles to some hundreds of representatives of electricity supply undertakings, including engineers, and what is possibly more important in this case, chairmen of electrical committees.

Seeing is believing, and the sight of a few business and pleasure vehicles of the battery type on this occasion will bring conviction to the right people far more readily than an acre of reading matter culled from American sources.

It is somewhat surprising, when one comes to consider the matter, that our American friends have not given more attention to electrical vehicle business in English towns, in view of the good roads, cheap electricity, and absence of home competition in this country.

Had they taken advantage of the lethargic temperament of the British vehicle builder, and secure in the extended knowledge of the "electric" which they alone possessed, introduced the latter as energetically as their *confrères* have been introducing cheap American petrol cars, it is safe to say that our streets would not be, as they now are with slight exception, remarkable for the absence of electric battery vehicles.

As we briefly intimated in our last issue, a scheme has been prepared to enable British manufacturers to make a combined attack upon a market that they

have so far neglected. Expert students of Siberia have deplored our apathy toward what is a vast and now rapidly developing territory, where engineering requirements are already large and will in course of time be enormous. Germany and the United States have been alive to the opportunity, and the traders of those two countries have secured engineering business to the tune of many millions a

year. Yet we have been repeatedly and credibly informed that there is a marked preference among the Russian peoples for British manufactures! The present engineering imports into Siberia are valued at about £15,000,000. As Russian factories are unequal to meeting machinery and allied needs for Russia, it is imperative that there must be importation, both for European Russia and especially for the widespread territory of Siberia, with its mining, agricultural and other industries. Probably few of our readers are aware at what a rapid rate progress is being made in Siberia. By too many of us it is regarded chiefly as a place of banishment and of terrible winter, but there is quite another and more correct aspect to be put before us if we will take pains to find out the real state of things. The Russian Government is taking energetic action to foster industrial development, population—by immigration and otherwise—is growing rapidly, imports are rising, the engineering imports being already nearly as large as those into Russia, and there are fine possibilities in respect to agriculture, timber, mining, and so forth. Though neither an engineering nor an electrical example we may cite an illustration—maybe it is somewhat exceptional—of what is taking place. Novo-Nikolaievsk (formerly Obi) seven years ago had a population of 100. To-day owing to the growth of the butter trade and agricultural interests, it is a thriving town of 33,000 inhabitants! This is more suggestive of gold-fever than of dairying. There are many rich mining areas that have scarcely been touched, and what is of considerable importance, the Russian Government policy is favourable to machinery importation.

Briefly stated, the reasons why British traders have not been so successful as their competitors in Siberia are these:—Absence of suitable representation, reluctance to give credit, distrust of Russian business, and excessive profit-seeking by middlemen. These points might each be elaborated here, but it is not necessary. Suffice it to say that the successful experience of other countries shows that on the whole the results attending the long-credit system have not been unfavourable, and that the secret of success lies in having the right men resident in the country, getting into touch with the actual buyers, learning and meeting the full requirements of the market. The country is too large for individual firms to hope to cover it efficiently without enormous expense, and in view of the present early state of developments such outlay would hardly be warranted in the case of electrical or small engineering firms single-handed. But we cannot afford to leave matters as they are, unless we are going to be content for so fine a field to be lost to British trade for many years, and perhaps permanently. Our hope, therefore, must be in a sort of amalgamation of interests, a number of manufacturers putting down so much money as an investment and acting in combination. This course has been recommended by the British Consul at Vladivostok, and by others who know the prospects as well as the state of competition.

Such a scheme has been drawn up by Mr. Arthur G. Marshall, of Westminster, to work under the title of the British Engineering Co., of Siberia, and it is now receiving preliminary consideration at the hands of several of our firms. The scope of its activities will embrace railway and light railway equipments, electric lighting plant and materials, engines and boilers, and all sorts of agricultural, mining and general machinery equipments.

The new company, when it gets to work, will have registered offices in London, with branches in Western Siberia at Omsk, at Vladivostok for Eastern Siberia, and at Ekaterinburg for the Ural mining district. With the carefully worked out details of the concern it is unnecessary to deal here; but firms who desire to obtain fuller information would do well to get into touch with Mr. Marshall, who has originated the proposal after study of the market at close quarters, and after engineering trading experience in various parts of the world. Any undertaking likely to assist British manufacturers legitimately to secure a fair share of trade in the world's vast territories which are awakening to the call of civilisation, has our best wishes for its success.

## ELECTRIC BATIK WORK.

[BY OUR BERLIN CORRESPONDENT.]

BATIK work has been practised from time immemorial by the natives of Java, and consists in producing patterns by means of liquid wax on a bright fabric, paper or the like, which is eventually dyed.

Such parts of the fabric as correspond to the pattern having been covered with hot liquid wax, the whole is dipped into a dye-stuff liquid, when the covered portions are unaffected, whereas the remainder is dyed uniformly.

After drying, the same fabric (which is now parti-coloured) can again be covered with a pattern which, by the Batik process, is preserved in the former colour, whereas the



FIG. 1.—ELECTRIC BATIK PENCIL IN USE.

background takes a darker hue, and the same operation can be repeated several times until the background has become quite dark.

After removing the wax by washing the whole piece of fabric with petrol (gasoline), the various colours are brought out most effectively on the dark background. Wonderful colour effects are thus obtained such as can be ensured by no printing process, the fabric being permeated entirely with colour, which is best appreciated on holding the fabric against the light.

The possibilities of Batik work are by no means so limited as would appear at first sight. The same process can, in



FIG. 2.—SPECIMEN OF BATIK WORK.

fact, be applied to wood stained in several hues (or engraved), as well as to metal dyed or etched by chemicals. Especially beautiful etchings can thus be produced on copper, brass, &c.

The instrument used by the Javanese in applying the wax is some sort of small funnel fixed to a handle, with a fine opening in which the wax is heated over a coal fire. Similar attachments, or else closed reservoirs terminating underneath in a point and small opening, are used in Europe where Batik work has been introduced. In connection with all these devices, the wax must, however, be re-heated from time to time (over an alcohol, gas or gasoline flame),

and cools rapidly during operation. This lack of uniformity in the temperature of the wax, of course, entails a number of drawbacks. While the liquid wax immediately after heating flows out very freely and is liable to produce too thick lines or even blots, the flow soon slows down as the wax cools.

In order to ensure an absolutely uniform temperature of the wax, a German lady, Frau Gertrud Lamprecht-Gewecke, of Nuremberg, has devised an electrically-heated Batik pencil. Apart from uniformity in the thickness of lines.

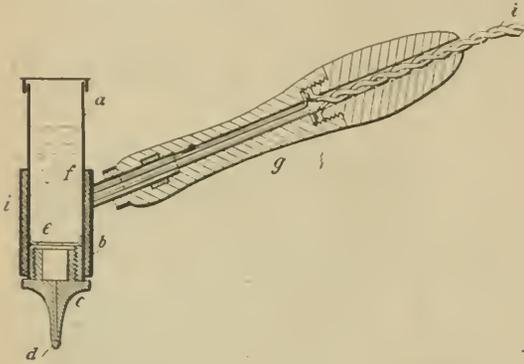


FIG. 3.—SECTIONAL VIEW OF ELECTRIC BATIK PENCIL.

this ensures considerably more rapid work (the continual re-heating being dispensed with) and far greater ease and accuracy.

The electric Batik pencil is represented in longitudinal section in fig. 3, *a* being a cylindrical wax-holder, to the lower part of which is screwed a mouth-piece *c* with a fine bore *d*. A fine sieve *e*, placed in the wax-holder above the mouth-piece, will retain any impurities of the liquid wax *f*.

The wax is heated by the heating coil *b*, the wires from which pass through the handle *g*, being connected in its interior with a flexible cord *i*, by means of which the Batik pencil can be joined up directly to a contact box for 110 or 120 volts (or through a series resistance to higher pressures). The Batik pencil can be used with continuous as well as alternating currents, its consumption being about the same as that of a small or medium-sized incandescent lamp.

## TRAMWAY CURVES.

By ARTHUR J. BOUSFIELD, A.M.I.Mech.E.

EVEN a cursory examination of the lay-out of some of the curves on street tramways reveals the fact that the question of super-elevation of the outer rail has been ignored, and that the rails are either horizontal or have the super-elevation in the wrong direction.

This is very often due to the Highways Department overruling the advice of the tramway engineer, and recent accidents and derailments show how serious this disregard of the laws of motion and gravity may be. When a car is swinging round a curve it tends to leave the rails and follow a straight line tangent to the curve at that point, the restraining force keeping it in a circular path being the reaction of the rail against the wheel flange. The measure of this force is the same as the centrifugal force due to the weight, direction and velocity of the car, and is given by—

$$cf = \frac{wv^2}{32r},$$

where *w* is the weight of the car in lb.; *v* the velocity in ft./sec.; *r* the radius of curve in feet.

As the centre of gravity of a car is above rail level, this force has a twisting moment tending to overthrow the car. With a 10-ton car, having its c.g., say, 7 ft. above rail level, this amounts to 5,250 lb. ft., or, say, equal to the effect of two 1-ton screw jacks, one at each of the inside axle-boxes, trying to overthrow the car. To counteract this

force we must use the force of gravity by raising the outside rail; the weight is now acting on an inclined plane and in opposition to the twisting moment.

The super-elevation in inches necessary is given by—

$$G \frac{v^2}{2 \cdot 66 r},$$

where *G* = gauge in feet, *v* = velocity in miles per hour, *r* = radius in feet. With minus super-elevation, the wider the gauge and the higher the c.g., the greater the danger. Given correct super-elevation, the pressure and consequently the wear on the outer rail is reduced, and if the c.g. is raised without increasing the total weight, the pressure on the outer rail is still further reduced. This point should not be lost sight of in the design of locomotives, water-tank cars, &c.

The reduction in pressure on the outside rail due to super-elevation is often as much as 15 per cent. Super-elevation should not exceed 4 or 5 in. as cars moving slowly would be liable to leave the rail on the inside of the curve. Trouble with the Highways Department on account of interference with the crowning of the road and drainage can generally be met, when raising the level of the outside rail, by a judicious remetalling or paving of the surface of the road over a sufficient area on that side of the road. It is surprising what can be done by stealing an inch here and there. When the necessary super-elevation cannot be obtained by this means, the speed of the cars must be reduced to a safe figure, but where there is minus or no super-elevation on a curve at the foot of a gradient, the curve is never safe, and the first car that gets out of control ever so little is in grave danger.

Another source of trouble in maintenance and derailment on curves is the practice of laying out all curves in arcs of circles. This is often necessary in this country owing to Board of Trade restrictions as to the minimum clearance between car and curb, but wherever possible curves should be spiral or parabolic, the radius of curvature increasing as the curve approaches the straight.

The length of the rectangular lines enclosing the curve should not be less than 48 ft. This easement of the curve avoids the nasty knuckle-joint effect at the entrance of the curve, and materially decreases the excessive wear at this point. Starting from a position at the centre of the curve, governed by curb clearance, the curve can be easily laid out in the well-known way of drawing a parabola by means of three road pins and two lengths of line.

Many engineers widen the gauge at a curve, and tables, presumably based on railway experience, are published regarding this in technical hand-books, but the writer is of the opinion that a tramway curve should be kept the same gauge as on the straight, unless the wheel base length and radius of curve are abnormal.

Initial widening of the gauge at curves results in the car progressing round the curve in a series of short straight lines, and giving a jolt at each change of direction, resulting in well-defined and localised wear.

## THE HUMPHREY PUMP.

[COMMUNICATED.]

THE Humphrey pump having proved so great a success at Chingford, this great invention must take its place in the industrial world for what it is worth. What will it do for electricity? At the first blush its effect might appear to be in a direction inimical to electrical methods. It will oust the electrically-driven centrifugal pump in many cases where water-produced electricity is not the source of power, for what compound of steam or gas engine and electrically-driven pump can hope to compete in economy of initial cost or in running cost with a direct gas-driven pump using only 1 lb. or so of fuel per water horse-power?

But this very fuel economy will serve to make the pump an aid to electrical development. The big gas engine has its disadvantages, and some engineers object to it and do not consider it has a good and steady turning moment. With a Humphrey pump, a steady turning moment can be obtained

by the use of a turbine driven by a waterfall artificially produced by the gas pump. In this way the pump may be found to do more for the electrical industry than it will do against it.

The great pumps at Chingford are extremely interesting to watch when at work. There is an oscillating column of water in a high tower of about 14 ft. diameter at the water surface, and there is a dome-shaped gas chamber carrying four sets of spring opened or spring closed air and gas and exhaust valves. And there is some very light and simple mechanism which serves to lock these different groups of valves, which are automatic in their movements but for this controlling lock. All movements being slow and deliberate there is no noise, and yet at each explosion in the chamber about 12 tons of water are sent into the new reservoir. But the flow to the reservoir is steady and continuous, although it is the outcome of 10 to 12 additions per minute each of a dozen tons of water. The successive additions of masses of 12 tons are shown by the rise of water in the water tower, the four oscillations in which take place while all the time the steady flow goes on to the reservoir. The one end of the great oscillating mass of water is always moving forward and the other end is alternately moving in both directions, the water in the tower acting as a part of the gas engine and also as a flow equaliser.

A curious feature of the whole apparatus is its certainty of action combined with a certain casual sort of go-as-you-please motion, which could not obtain had the whole machine—if we may call it a machine—not been accurately worked out. This quality of the pump differentiates it from the gas engine, which has the disadvantage that accrues from every stroke of the piston being of equal length, thus compelling exhaust before expansion has been carried far enough. In the Humphrey pump, expansion is carried to such a point that the gas chamber is scavenged on the working stroke and the burned gases are placed next the exhaust valve. In this way there is a stratum of clean air between the charge and the residual exhaust, and there is also a stratum of clean air between the water piston and the burned air. With clean anthracite this may be a matter of no moment, but it adds a further safeguard where fuels of less purity are employed.

The Chingford pumps are not merely a witness to Mr. Humphrey's engineering genius, but a monument to the courage of Mr. W. B. Bryan, who acted on his convictions when he accepted this pump.

It is not too often that the engineer of a great undertaking has the courage of his convictions in respect of novel appliances. To such lack of courage, or of ability to realise when a novel appliance ought to be accepted, we may trace the ruin of too many men of genius in engineering affairs.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### The Preservation of Creosoted Poles.

If Mr. Wade will kindly do me the favour of reading my article again, he will not, I think, find himself in serious disagreement with the views expressed. I, too, am a strong advocate of creosoted poles, but there is nothing to be gained by claiming more for the creosoting process than is set forth in my brief contribution on the subject, which appeared in the ELECTRICAL REVIEW a fortnight ago.

Mr. Wade's suggestion of cutting notches and boring holes in poles *before* they are creosoted is more interesting than convincing. How could anyone state beforehand the number of notches that would be required, or whether a pole would require 2 ft. cutting off to maintain the symmetry of the line? These things could perhaps be arranged by a small contractor having a short telephone line to equip, but when a few hundred poles are involved, as is frequently the case on our English railways, a large stock has to be kept. These poles are demanded from the dépôt as and when required, after which they are armed on the ground.

Several years ago, the late Mr. Langdon wrote as follows:—"It is neither desirable nor necessary that the timber of telegraph poles should be completely charged with creosote." With these words I entirely agree—not because the deceased gentleman once said so, but because 20 years' practical experience has taught me that Mr. Langdon was quite right.

"Communicated."

### Prospects in Electrical Engineering.

As the advertiser referred to by Mr. Black in your last issue in connection with the above, permit me to remark that I have a suspicion your correspondent belongs to that type of engineer correctly described by himself in the ninth, tenth and eleventh lines of his letter, and has made poor progress in even that study, as he apparently is quite unable to discriminate between appointments having probabilities and those having possibilities; such being the case, it is not surprising he is dissatisfied; lack of perspicacity and jealousy of the other man usually reaps its own harvest.

H. L. Alderton,

Guildford, April 28th, 1913.

### Salaries and Wages.

By a printer's error you have printed the word "minimum" where it should have been "maximum," as underlined in red on the enclosed copy. Will you please correct this, as it is of vital importance to the value of the whole scale.

A. Hugh Seabrook,

General Manager.

St. Marylebone Electric Supply,  
April 28th, 1913.

[We regret the error, which occurred on page 670 of our last issue; in the sub-heading "Minimum Wages for General Employment," the first word should have been "maximum." The correction is, as Mr. Seabrook points out, of vital importance.—EDS. ELEC. REV.]

Many members of the electrical profession will feel grateful to Mr. A. Hugh Seabrook for the trouble he has taken in giving a detailed account of the classification and maximum wages of the various grades of workers under the jurisdiction of the St. Marylebone Electricity Supply Committee.

This method of grading is a great improvement on those of numerous supply authorities, preferably municipalities throughout the kingdom, who promote men simply by seniority, *i.e.*, by the length of time men have been in their service, but which is, on moral principle, radically wrong.

In doing so they are merely copying the Government, and often give this reason as their justification: but, alas! the Government's policy is not always the wisest, and whatever reasons are put forward by them in commendation of this mode of procedure, it certainly should not be applied to central station engineers, with whom ability and brains are absolutely essential.

The principle is unjust, because it does not encourage a man to develop any initiative. Again, it is only fair where there are three men each in charge of a shift at a power station, and each have equal responsibilities devolving on them, that they should be paid equal wages.

There are numerous electricity supply works where one man receives a considerably bigger wage than another, though both undertake the same amount of responsibility, and yet the man who receives the least wage may be married, and have had a far wider engineering experience than the other, who besides, perhaps, being single, has not the same amount of ability.

I must point out that although the above applies to a very considerable number of electricity companies, I am dealing more particularly with the methods of municipal councils, who, there is not the slightest doubt, do their best in matters of management as far as their knowledge permits, yet who are nevertheless instructed and tacitly governed by the chief engineers, and

this is because they are ignorant on matters appertaining to the real working of the stations.

It should be the duty of the councils governing all municipal electricity supply undertakings, which are not supposed to be run as financial concerns, to pay a man not only a living wage, but according to the amount of responsibility he is required to undertake, before any attempt be made to relieve the rates, &c.

If a man be worth employment at all he is entitled to a living wage, but alas! how many well trained men there are in the central-station profession, who, it is little suspected by the general public and even the municipal council, have responsibility to the extent of thousands, and yet are eking out a mere subsistence.

I ask the question, if a chief engineer of an electricity supply works is worth, say, £20 per week, generally speaking, what are his charge engineers worth?

Although the answer to this question cannot be made with any mathematical accuracy, yet even a guessed amount would be considerably more than the latter receive for their work in many instances.

In conclusion, let us hope and trust that many municipalities and private companies will follow the example of the St. Marylebone electric supply—abolish the rotten method of promotion by seniority, and advance men according to their abilities, and pay them in proportion to the amount of responsibility they are required to undertake, then we shall have the right man in the right place, and everybody will be satisfied.

A. C. Black.

#### Nunits and Abbns.

I hope you will not often coin new words of this sort. There is no doubt that the craze for abbreviations is being carried too far, but by the law of survival of the fittest, the useless ones will die a natural death.

Few who have not seen "Milestones" will remember that "cab" is short for "cabriolet." Again, whoever talks of "a taximeter cab," when "taxi" is available?

It is told of an eminent professor that, hearing one of his staff mention the word "ammeter," he said severely, "Why do you say 'ammeter'?" You might just as well say 'vomiter!'"

A. K.

#### The Prevention of Accidents in Electric Lifts.

Referring to the article which appeared in the issue of the ELECTRICAL REVIEW of the 18th inst. under the above heading, I should like to say that, although there are many so-called "Safety Locks" for lifts on the market, I have not until the last few weeks seen a lift lock which is absolutely safe, inasmuch as they all depend for mechanical locking on the motion of the cage itself (distinction should be made between locking and latching). The action of practically all modern lift locks, with the exception of the one mentioned above, is as follows:—

When the gate or door is closed, the latch or hook portion on the gate engages with the locking mechanism in such a manner that a gate must be latched (not locked) before the electrical locking can take place. When this has been accomplished the locking mechanism is ready for the mechanical locking to be carried out, and this is done by means of a spring or gravity-controlled lever which is held out of the locking position by a striking plane on the cage while same is standing at a floor, and which lever is, when the cage has moved a certain distance from the floor, released and allowed to move into such a position that it mechanically locks the gate which cannot be opened until the cage arrives at that particular floor again. It is easily seen that such mechanism cannot be quite certain in action, as the spring or gravity-controller lever may very easily fail, and the cage could then move away from the floor, and the gate afterwards be opened when the cage was not opposite the opening. There are also various other faults which would entail a long description to enumerate.

The lock mentioned above which has within the last few weeks been placed on the market by a firm of well-known lift engineers, is the only one which successfully overcomes all the defects which have up to the present existed in lift

safety locks. With this lock, the gates or doors must be both electrically and mechanically locked (not merely latched) before any movement of the cage can take place, and the locking action depends in no way upon the motion of the cage. Also, the gate cannot be opened while the cage is passing the floor, but only when the control current has been cut off by the operator or the control gear, and the cage is opposite the floor at which it is desired to stop, thus preventing persons who are waiting for the lift at various floors stopping the cage as it passes the floor by opening the gate. This lock will, therefore, be seen to be unique in its action and absolutely safe.

I would suggest that it is high time that the question of safety locks for lifts should be considered seriously by those responsible for regulations regarding the safety of the public, and measures taken to prevent death traps being fitted to lifts under the name of "safety locks."

W. J. F. Cooper.

London, April 24th, 1913.

#### BONECOURT BOILERS.

AN interesting brochure has been issued by the Bonecourt Surface Combustion, Ltd., describing the Bonecourt boiler, which is fired with gas, and attains an extraordinarily high thermal efficiency, approaching 95 per cent. One of these boilers has been in use at

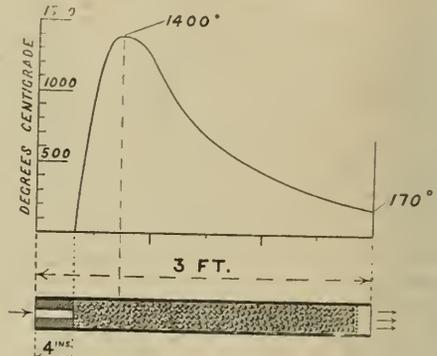


FIG. 1.—TEMPERATURE DIAGRAM FOR BONECOURT TUBE, FOR BOILING AT ATMOSPHERIC PRESSURE.

the works of the Skinningrove Iron Co. since November, 1911, and a repeat order has recently been placed with the makers. A boiler exhibited at Olympia in October last, was described in our pages at the time. A special type of boiler for outputs up to 11,000 lb. of steam per hour, and for working pressures up to 225 lb. per sq. in., has been designed for the company by Mr. Michael Longridge; the section and elevation of one of these are

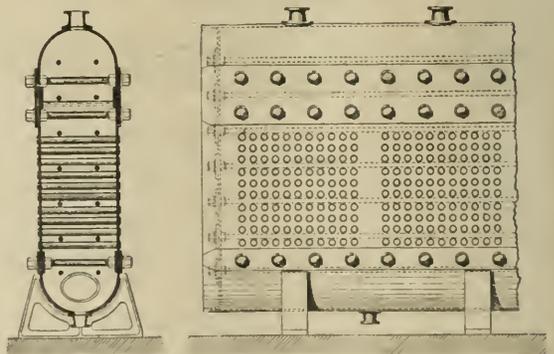


FIG. 2.—BONECOURT BOILER, RECTANGULAR TYPE.

shown in the accompanying illustration (fig. 2), in which it will be seen that full advantage has been taken of the rapid transfer of heat from the flue gases to the water by reducing the length of the boiler to 3 ft., making the length the smallest dimension. Sections of the type shown can be joined together to make different sizes of boiler; for instance, three such sections make a boiler having an evaporation of 33,000 lb. per hour. The filling of the tubes, and the distribution of the heat flow, is illustrated in fig. 1; they are packed with lumps of refractory material, and at the entering

end of the tube a fire-clay nozzle is placed, which prevents combustion of the gaseous mixture until it reaches the refractory filling and keeps the active heat of combustion away from the metallic joints of the boiler. A pressure of about 20 in. w.g. suffices to force the gases through the tubes. The combustion takes place on the surface of the refractory lumps at the entering end of the tubes, and is complete in about 6 in.; the transfer of heat is so effectual that the gases leave the tube at a temperature not greatly in excess of that of the steam in the boiler.

The output can be controlled by throttling the flow or by varying the speed of the fan, and a reduction of one-third can be obtained with a trifling drop in efficiency. Further control is effected by shutting off the gas supply to groups of the tubes, which can be heated up again within about one minute, so that a very high degree of flexibility is attained.

One of the chief reasons for the efficiency of the system is the fact that complete combustion is secured with only 1 per cent. or 2 per cent. excess of air; the refractory lumps also break up the current of gases, producing a turbulent flow which ensures their repeated contact with the tube. Thus the efficiency of the heating surface is greatly increased, a normal evaporation of 20 lb. of water per hour per sq. ft. being attained with tubes 3 in. in diameter. When the tubes are of 3 in. diameter they need only be 3 ft. long, but tubes of larger diameter can also be used, their length being increased to meet requirements as to the final temperatures of the gases (as for superheating). With tubes of larger diameter, a higher rate of evaporation per sq. foot is obtained, some tests with 6-in. tubes 6 ft. long showing a normal evaporation of 28 lb. per sq. ft. per hour, or 40 per cent. higher than with tubes 3 in. in diameter. In either case the boiler can be forced to 80 per cent. overload with little loss of efficiency. Compared with other gas-fired boilers, a great economy of floor space is secured, the evaporation per sq. ft. of floor space being nearly four times as great as with water-tube boilers, and still better in comparison with the Lancashire type. The simplicity of the construction of the boiler is also greatly in its favour. A feed-water heater is constructed on the same principle, which reduces the temperature of the flue gases to less than 300° F.

The boiler is suitable for use with the incombustible waste gases from furnaces or gas engines, as well as with all kinds of combustible gas. In comparing it with a coal-fired boiler, allowance must, of course, be made for the gas producer, which can be of any efficient type.

Already the makers have received many inquiries from all parts of the world, for boilers to work in connection with coke-oven and other gas supplies, and with ammonia recovery plants, and there can be no doubt that the system will be of great utility in many applications.

**NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.**

**“Polar” Propeller Fans.**

THE WILSON-WOLF ENGINEERING Co., LTD., of Bradford, send us some particulars of their new “Polar” (registered) propeller fans, which they have just placed on the market for the 1913 season.

These fans are for direct-current circuits, being medium power fans, specially suitable for installation where the cost of the firm’s well-known “Arctic” fans is not justified.

The “Polar” fans run at a slightly higher peripheral speed than the corresponding sizes of “Arctic” fans, and discharge about 10 per cent. less air, but on account of their higher speeds, they can be fitted with smaller motors, with a corresponding reduction in first cost. They are remarkably silent in running, but are only designed for dealing with free air conditions.

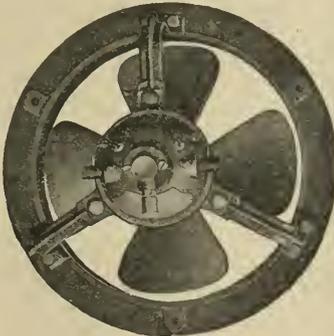


FIG. 1.—“POLAR” PROPELLER FAN.

A novel feature is that the blades are reversible; in order to change the direction of the discharge of air, it is only necessary to alter the direction of rotation, the fans being equally efficient in either direction. One standard construction is therefore suitable for any direction of discharge.

The rings are circular and can be quickly fixed (for vertical or horizontal discharge) in any position, while the motors, which are dust-proof, follow the firm’s usual practice, and are fitted with combined thrust and journal ball bearings.

We illustrate one of these fans in fig. 1.

**A Large Sign.**

A large electric sign, recently built for Messrs. Mann, Crossman and Paulin, the brewers, at Stratford, is said to be the largest of its kind erected in this country.

This sign, shown in fig. 2, is 100 ft. long and 42 ft. high from the bottom of the hoarding to the top of the figure; it stands 10 ft. out of the ground, so the total height is 52 ft.

Osram lamps are used for illuminating this sign, there being 100 32-watt, 250-volt, 176 10-watt, 105-volt, and two 17-watt, 295-volt lamps employed.

In the winter months the lamps are kept burning at least six hours a day, and during the summer months 3½ hours a day, a total



FIG. 2.—LARGE ELECTRIC SIGN.

of some 1,700 hours per annum. The lamps are exposed to all conditions of weather, and are said to have given every satisfaction.

The Borough Theatre Billposting Co. erected the sign, the electrical work in connection with which was carried out by the West Ham Electricity Department.

**The Frantz Suction Cleaner.**

MESSRS. SCHOLEY & Co., LTD., of 151, Queen Victoria Street, E.C., are introducing a new suction cleaner which possesses novel features. The handle is made to actuate the switch; the flexible cord is looped up on hooks attached to the shaft; an observation glass is



FIG. 3.—UNDERSIDE OF NOZZLE, SHOWING BRUSH.

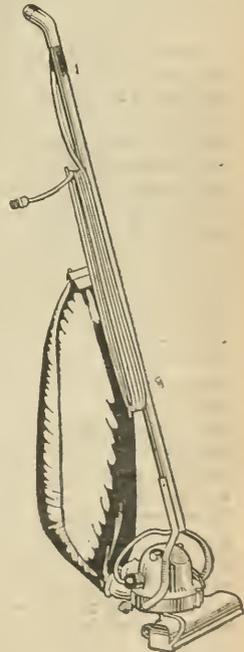


FIG. 1.—FRANTZ SUCTION CLEANER.

provided to enable the dirt to be seen on its way to the bag, which can be removed in a moment; the yoke or fork can be locked in any position for special work; in addition, there is a revolving brush in the nozzle, driven by an air-blast which issues from an outlet in front of the nozzle, the combination of blast, brush and

suction being, it is claimed, three times as effective as suction alone. The metal parts are mainly of aluminium, and the cleaner weighs only 9 lb. The usual appliances can be attached to it for cleaning walls, crevices, &c., and for blowing air into inaccessible corners. Fig. 4 shows the complete apparatus, and fig. 3 is a view of the nozzle from below, showing the brush.

#### Diamond Die Polishing.

Now that manufacturers of electric filament lamps are taking measures to meet the approaching season, their attention might be drawn to the patent multi-way diamond die-polishing machine, introduced last season by MESSRS. WERTHS & CO., of 41, Aldersgate Street, London, E.C.

We understand that some of the larger lamp works have already from 10 to 30 of these 10-way machines in use, and that the great economies they now effect in their die-polishing department are helping them considerably to bring their cost of production down to a very desirable figure.

This ingenious and automatic polishing tool is said to pay for itself in a short time by the mere saving in diamond powder, quite apart from the large and accurate amount of work it renders possible, and the protection and the keeping in shape of the draw-holes which it ensures. One polisher can easily attend to a number of these machines. The adoption of the multi-way machine seems worthy of the serious consideration of those lamp manufacturers who have so far retained their older equipment. Wire drawers, also, might reconsider their old diamond die-polishing methods, in view of the advantages claimed for the new machine introduced by Messrs. Werths.

#### X-ray Reflectors for Shop-Window Lighting.

The accompanying illustration shows an "X-ray" silvered-glass reflector, introduced by the B.T.H. Co., of Mazda House, Queen Victoria Street, E.C., for shop-window lighting. These lighting units are fixed close up to the ceiling of the window, immediately

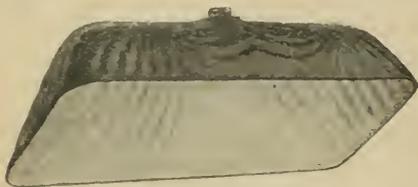


FIG. 5.—B.T.H. X-RAY REFLECTOR FOR TWO MAZDA LAMPS.

behind the fascia board, and are arranged in a single evenly-spaced row. This arrangement gives a more uniform and diffuse illumination than could be obtained from lamps hung in the field of vision.

#### Silica Lamp Laboratory Outfit.

THE WESTINGHOUSE COOPER-HEWITT CO., LTD., have lately placed on the market a special laboratory outfit, which is being extensively adopted by business firms and others who are desirous of investigating and applying to commercial purposes the properties of ultra-violet rays. These rays are emitted in such quantity that it is necessary for operators who are using the outfits to protect their eyes and skin from the rays. Sufficient protection is provided by screening the lamps with a sheet of ordinary commercial glass. Amongst the properties of ultra-violet rays are the production of fluorescence in many substances; their bleaching effect, which makes their use of extreme value to firms who are desirous of testing fastness of colours in the products that they manufacture, and also of testing the quality of the dyes that they are using; and their remarkable power of sterilisation.

**An Electric Motor Dust Cart.**—A novel three-wheel electric motor dust cart has recently been put in service near Berlin. The vehicle, which was built by Messrs. Gebhardt & Harborn, of Schöneberg, Berlin, is fitted with a small tip body, and is used for the collection of the refuse swept up in the streets. The motive power is supplied by a battery of 20 150-ampere-hour cells, which supplies current to an electric motor built integral with the single front road wheel; the motor is of the direct-current type, and drives the front wheel through reduction gearing. The vehicle can be driven in either a forward or backward direction, the reversal of the battery current being effected by means of a patented form of switch. The speed of the machine is between 15 and 19 miles per hour, and it is stated that a distance of no less than 90 miles can be covered on a single charge of the battery. An automatic device for sanding the streets is also provided on the vehicle, the distribution of the sand being effected by a small electric motor supplied with current from the main battery. In order to increase the sphere of utility of the machine, the refuse collecting body is made detachable, thus rendering the vehicle available for other classes of work.

## PARLIAMENTARY.

### Chesterfield Corporation Bill.

This Bill, for a system of railless traction, came before a Select Committee of the House of Commons last week, the proceedings being very protracted on account of the opposition offered on behalf of the Midland and Great Central Railway Companies and the Derbyshire County Council.

MR. ROWLAND WHITEHEAD, K.C., who appeared for the Bill, said its object was to give the Chesterfield Corporation authority to run trolley cars and motor-omnibuses along certain routes which radiated out from the borough into adjoining districts. On certain of the routes they were asking for powers to run motor-omnibuses and railless trams, but it was not intended to run the two vehicles simultaneously. The object of getting omnibus powers for the trolley routes was that the Corporation might first test the routes from a passenger point of view, to ascertain whether they would be justified in going to the expense of installing railless traction. Regarding the opposition of the Midland Railway Co., that was on the question of bridges, and the Corporation would be quite ready to meet the company in regard to any specific bridge, and in order to meet the objections of the Great Central Railway Co., they had arranged to fix a weight limit for the vehicles of 6 tons, plus the load. The company also objected to the Bill on the ground that the proposed buses and trolley cars would unfairly compete with them, but he should ask the Committee to say that the extra facilities the Corporation proposed to give to people to travel to outlying districts would, in the end, benefit the railway company.

Evidence in support of the Bill was given by MR. C. P. MARKHAM, the chairman of the Staveley Iron and Coal Co., and a member of the Chesterfield Town Council. Witness gave it as his opinion that it was very essential that the villages should be linked up with Chesterfield in order to give facilities for the outlying population to come into the town.

Replying to MR. TALBOT, K.C., for the Midland Railway Co., Witness said the Corporation did not intend to make a big start—they would feel their way in the matter, and as a commencement he suggested three motors. He did not expect there would be any considerable loss or any considerable profit on the undertaking; but it was put forward as a public convenience.

MR. ERNEST SHENTAL, the chairman of the Corporation Tramways Committee, stated that he and his colleagues had visited Rotherham and examined the working of the trolley system. In his opinion, they had a much better outlook for such a system at Chesterfield than was the case at Rotherham.

In cross-examination by Mr. Ram, K.C., for the Derbyshire County Council, witness said he had heard that Rotherham only got its trolley system because it consented to pay a contribution to the county rates in respect of the county roads over which the cars ran.

Replying to the Committee, Witness said he did not agree with Mr. Markham that three cars would be sufficient to start with—he would certainly go in for more than that.

MR. ROBERT ACLAND, the engineer to the Chesterfield Electric Lighting and Tramway system, gave evidence as to the cost of the scheme, which, he said, had been prepared on his estimates. The cost for the erection of the necessary car-sheds, depôts and other buildings was put down at £2,000, and £33,780 was included in the estimates as the cost of overhead equipment and the construction of other works necessary for working and lighting the trolley vehicles. The cost of the trolley vehicles would be £6,400, and for the provision of motor-omnibuses and expenses in connection with their running, he had put down another £16,000. Personally, he felt confident that the scheme would be a financial success.

MR. C. J. SPENCER, the general manager of the Bradford City Tramways, said that they had had the railless trolley system of tramways in operation in his City since June, 1911. At the request of the Chesterfield Corporation, he had examined the proposed scheme, and he agreed that the estimates of the previous witness in regard to capital expenditure were fair. His (Mr. Spencer's) estimates of the total capital expenditure for the nine routes proposed, came out at £53,948. He estimated that the annual receipts would amount to £28,210, while the annual capital charges and working expenses would amount to £26,513. He estimated for 12 motor-omnibuses and for 15 trackless trolley cars. He reckoned that there would be a surplus profit of about 3 per cent. per annum on the capital outlay.

Evidence in support of the Bill was also given by MR. A. R. FEARNLEY, the general manager of the Sheffield Corporation Tramways, who said he agreed that the estimates put forward were reasonable and sufficient for the purposes of the scheme.

MR. TALBOT, K.C., addressing the Committee in opposition to the Bill on behalf of the Midland Railway Co. said it was monstrous that his clients, who were large ratepayers in the district, should have burdens placed upon them in order that a system might be built up which would be in direct competition with them.

MR. J. W. HOLTON, county surveyor, who gave evidence against the Bill on behalf of the Derbyshire County Council, said that the Chesterfield Corporation only had control of one-twelfth of the main roads over which the proposed trolley-cars would run, and of one-fifth of the district roads. It would be necessary to widen a good part of the main roads if trolley-cars and motor-omnibuses were to use them with safety, and the greater part of the cost would fall upon the ratepayers outside the district. In that event he thought it only just to the ratepayers of the county that any

excess cost which could fairly be shown to be due to trolley and bus traffic, should be paid wholly by those who benefited by it, and not spread over the county as a whole.

Cross-examined, Witnesses agreed that, supposing the Corporation did not proceed with the scheme, and it was carried out afterwards by a private company, the County Council would not be able to secure the widening of the roads, or get any contribution; he thought it was generally conceded that the present law was inequitable.

After hearing further evidence, the Committee found the preamble of the Bill proved, subject to the conditions that the minimum width of the roads should be made 17 ft. with a 4-ft. footpath. They also required a clause to be inserted in the Bill making the Corporation liable for damage arising out of the extraordinary use of the roads, such damage to be assessed at the end of three years by arbitration between the Corporation and the county.

### Hastings Tramways Bill.

LORD BATH'S Select Committee of the House of Lords commenced the consideration of the Hastings Tramways Bill on April 18th. The Bill was promoted by the Hastings Tramways Co., and the object was to allow of the double line of tramways passing along the sea front, which are now operated by the Dolter surface-contact system, to be worked by the overhead trolley system. The line is about 1 mile 6 furlongs in length, and the remainder of the 17½ miles of tramways are worked by the overhead system. Mr. Lloyd, K.C., Mr. Hutchinson, K.C. and Mr. Tyldesley Jones appeared for the promoters; Mr. Freeman, K.C. and the Hon. E. Charteris represented a number of owners and ratepayers; and Mr. Talbot, K.C. and Mr. R. Bury appeared for the Hastings Corporation.

MR. LLOYD, for the promoters, said that the conduit system had been tried at Blackpool along the sea front and had failed there, for the same reason that it would fail at other seaside places. The sea beat over the front and filled the conduits, and sand and shingle also got in the conduits and interfered with the electrical connections. The company had spent £32,000 in equipping the line, and whether they reverted to the overhead system or some other, that expenditure would be largely nullified. He submitted that it was in the public interest that the present restriction should be removed, and that the company ought not to be hampered by the aesthetic considerations of a few frontagers.

MR. J. E. WALLER gave evidence in support of the Bill, and said he had satisfied himself that the conduit system was impossible in Hastings. It was true the conduit system was in operation in London, but wherever they could the London County Council put up the overhead system. At one time the conduit system was in operation at Blackpool, but after some years it became unworkable, and it had been replaced by the overhead system. He did not think the poles of the overhead system would be detrimental to Hastings, and he thought the lighting standards on the promenade could be replaced by combined standards for light and traction purposes.

A number of local witnesses were also called, and stated that they saw no objection to the overhead system along the sea front.

MR. TALBOT, K.C., addressed the Committee for the Corporation, and submitted that the opposition was not a sentimental one, but a matter of vital importance to the town. The Corporation had received overwhelming representations from the residents asking them to oppose the overhead system by every means in their power.

SIR M. FITZMAURICE was called by the Corporation, and said that as a result of his examination of the tramway along the Front, he saw no reason why the conduit system should not be workable there. He found the tramway generally in a bad condition.

After hearing a great deal of local evidence in opposition, the Committee rejected the Bill.

### Wimbledon and Sutton Railway Bill.

ON Tuesday last week, Lord Sanders's Committee of the House of Lords considered the Bill of the Wimbledon and Sutton Railway Co., which asks for extended time for purchase of land and completion of the railway, 5½ miles in length, between Wimbledon and Sutton.

MR. HONORATUS LLOYD, K.C., for the promoters, explained that the Act authorising the line was passed in 1910. At that time the promoters, who were a syndicate of local landowners, were unable to find the necessary capital, amounting to £350,000. An arrangement had since been made with the Metropolitan District Railway Co. to carry out the scheme and to raise capital to the extent of £550,000, with borrowing powers up to one-third. The Bill sought to extend the time for the construction of the railway to 1918.

After hearing evidence from MR. A. H. STANLEY in support of the measure, the Committee found the preamble proved.

## LEGAL.

### IMPORTANT APPEAL CASE *re* FACTORY ACTS.

(Concluded from page 676.)

MR. BODKIN said there were two convictions before the Court and separate questions raised in regard to each of them. The justices at Highbury in regard to the conviction under Regulation 18 imposed a penalty of £25 and costs upon this company, and on the other conviction they imposed a penalty of £2 and nominal costs. His submission was that a fine of £25 under the circumstances was a penalty which bordered almost upon a savage penalty. The reason for his saying that was that the particular method which had been adopted in regard to this switchboard ever since it existed was exactly the method which was being carried out on March 25th, and the company *bona fide* believed, and had strong grounds for believing, they were doing the work on lines that absolutely complied with the regulations of the Home Office. If they had been tried for the manslaughter of Shapcot, that was probably about what the penalty would have been. It was altogether out of proportion to the offence, if there was an offence. As to the conviction under Regulation 28, it appeared to be a mere matter of routine, but as a matter of fact it was a question of the most supreme importance, as he would show the Court. For nine years this station had been open, and the gentleman who complained had never been inside it. It was all very well to say that it was for the company to comply with the regulations, but if the Home Office officials went down and inspected, surely the process of cleaning was a process which was specifically mentioned in these regulations, and it would not be above the duty of a Home Office Inspector to say: "When cleaning is going on, what do you do?" But there was never a single suggestion, or the least attempt to assist, or the least hint as to what should be done, and the company all along continued to do this work in the way which they *bona fide* believed was in compliance with the regulations themselves. It was his submission to the Court that on March 25th the switchboard, which meant and included this particular room, was arranged so as to secure that the work might be carried out without danger, or, alternatively, if that was not so, that the conductors could be made dead in sections. Where the work absolutely was to be done the section was absolutely dead, so that Styles said he would not have had the slightest hesitation in clambering about in any part of it, and handling any piece of metal in it. There was a passage 2 ft. 6 in. wide existing between the dead side and anything which was alive upon the other side. In the regulations there was no definition of "division," and not a hint anywhere as to what it might be. Here they got a fixed corridor 2 ft. 6 in. wide, which he submitted was a division within the meaning of that regulation, fixed and permanent. The section on the right could be made dead, and, therefore, absolutely safe, and unless a person crossed that division to the left-hand side, there was nothing which involved danger. This was what these gentlemen of the highest skill and position connected with the engineering side of this great company believed to be a division within the meaning of the regulations, and it was provided for that express purpose of keeping the right side away from the left. He asked if that was not a reasonable construction of the regulation. Could it be said that the company were to be held responsible if a man disobeyed his orders when he went to a place where he was told to do his work in a certain way? His point was that they could not make the occupier of a factory liable when a man acted contrary to his duty and outside the scope of his duty, and in this case Shapcot ought never to have gone outside the section which had been rendered dead for his accommodation. Coming to the Regulation No. 28, he submitted that it was practically incomprehensible as it stood. In order to get a clearer idea of what it meant they had to get the definition of "authorised person," and it would be noticed that an authorised person was the occupier, or contractor, or a person appointed or selected by the occupier to carry out certain duties incidental to the generation and use of electrical energy. He supposed that "duties incidental" included cleaning and keeping up to a proper pitch the machinery and appliances which were used in connection with the generation of electricity. The definition went on further to say: "Such person being a person who is competent for the purposes of the regulation in which the term is used." But for his friend's opening statement he would have submitted that there was no evidence whatever before the Court that Shapcot was not a competent person for the purposes of the particular regulation in which the term was used. Styles's evidence was that he had known him for four months, and had seen him daily, and he had described him as a very cute man in his work. An authorised person need not be of full age. The reason for that was that under the regulations the responsibility was put upon the occupier or the contractor to select or appoint the authorised person. Regulation 28 dealt with repairs, alterations, extensions and cleaning, and an authorised person must be competent according to the skill and knowledge to do the particular kind of work which the regulation dealt with. His point was that under Regulation 28 Shapcot was an authorised person, and he did not cease to be an authorised person because he did cleaning work under Styles, who was also an authorised person. It was perfectly ridiculous to say an authorised person might be under 21 years of age, but that the moment they put an authorised person with another one he ceased to be an authorised

**Second and Third Readings.**—In the House of Lords, on April 23rd, the Crowborough District Gas and Electricity Bill, and Dundee Corporation (Improvements and Tramways) Bill, were read a second time. On 29th ult. the Richmond (Surrey) Electricity Supply Bill was read a second time. In the House of Commons, on 25th ult., the Herne Bay Gas and Electricity Bill was read a third time.

person and must be over 21 years of age. If, under Regulation 28, the authorised person need not be of full age, but if the competent person who was to work with him must not also be an authorised person; that was to say, if two authorised persons were not entitled to work together, then all the companies who carried on work of this kind would find the gravest possible difficulty in training and teaching those who were to go on in their profession as electrical engineers. The only way of training a man to be competent was to assign him to act with another competent man in different departments of the work until he fully comprehended the whole of it. Shapcot came as a youth to the company, and after being there a time, was examined by Mr. Hunt, the engineer, and promoted to another station, and then had a further promotion and came back to the Finchley station. In that way he was learning his profession, and in time would have got to the same position as Styles. He was set to do the work of cleaning under Styles, but he was an authorised person to do that work, and he did not cease to be an authorised person because a senior person was working with him. This was a matter of extreme importance, because young men came from school and college and entered these places to learn the practical part of their profession. This youth had arrived at the time when he was competent to do cleaning, and he was the authorised person to do it, and was none the less authorised because he had a more skilful mate to assist him. No person would have run any risk on the section in question if he had only done as he was told, and he submitted that the Court must look at every phase of the matter. If the Court considered his submission under Regulation 18 was not correct, then he submitted if the conviction was upheld that the penalty of £25 was not a proper penalty to impose on the company in view of all the circumstances.

After the luncheon interval, MR. BODKIN said if he had said anything too strong in regard to the Home Office, he hoped they would not forget the context with which he was dealing, which was that a word of suggestion or inquiry would have told the company what was the Home Office's view of the regulations, and that would have put them on their guard. He hoped nothing he had said would be understood to be derogatory to Mr. Ram's undoubted authority in this matter. That was not the view of the company or of himself in submitting their views.

MR. PERCY MAURICE HUNT, engineer-in-charge of the Finchley sub-station, examined by MR. BODKIN, said he had been at the station eight years. Shapcot had been there about 10 months, and was introduced by one of the staff. He understood that Shapcot had been at a technical college, and when he came to the company's employ, he examined him. Shapcot's duty was to assist the charge attendant. After a time Shapcot was promoted to Edmonton, and at the time he (witness) questioned him. Afterwards, as a further promotion, Shapcot came back to Finchley, and he examined him as to his knowledge, and was satisfied. That was about four months before the accident. Shapcot was assigned to work with Styles, and was fully qualified to do the work he was called on to perform. He had frequently seen Shapcot at work, and had made inquiries from Styles about him, and he regarded him as one of the best of their assistants. For the past 18 months the method of cleaning had been precisely as Styles described. He was aware of the regulations, and it was on his instructions that the method of cleaning was carried out. There was no need for Shapcot to have gone where he did to carry out his work. He regarded Shapcot as an authorised person for the purpose of this cleaning. It was within his knowledge that it was the practice of other companies to employ authorised persons with other authorised persons. He had worked on a high-tension system when 17 years old.

MR. GRAY: Do I understand that, so long as you tell your men not to do certain things or go to certain places, you consider you comply with the regulations, even although the places they go to are dangerous?—I cannot answer that "yes" or "no." If I considered the assistant had sufficient knowledge to undertake the work, I should instruct him to do that work, and at the same time I should consider he was authorised to do it.

I want to know whether you are of opinion that you comply with the regulations so long as you tell a man not to do certain things?—That is my view. I take upon myself the responsibility of giving these instructions.

Do I understand that, even if it is an easy and simple thing to make a particular place absolutely safe, you do not consider you need do so if you tell a man not to go there?—I do not agree that it is an easy thing to do.

You agree that, if it is an easy thing to do, it is your duty to make it absolutely safe?—Yes.

I suggest to you that, in this particular room, it was a perfectly easy and satisfactory way to make this current transformer absolutely safe by shutting off the isolating switch?—On that particular occasion, the answer is "yes."

Can you tell me, then, why it was not done?—Because it was an instruction that the pressure limits shall be cleaned every Saturday night. Our extra-high-tension switch arrangements with regard to feeders vary considerably. One Saturday night we may have a feeder in use, which on another Saturday night we have not, and therefore, for the purpose of this cleaning, it was necessary to instruct the men to carry it out in such a way that it could be carried out every Saturday night.

Is there any reason why you should not instruct Styles to use his judgment as to putting off that isolating switch?—I should object to issuing instructions which cannot be carried out always. I have to satisfy myself that the instructions are such that they can always be carried out. If I allowed the charge attendants to either do the cleaning or leave it under certain conditions, I should not consider it satisfactory.

Notwithstanding the serious danger which might result to the

assistants?—I think it is safer to lay the conditions down on which cleaning can be done in perfect safety.

In further cross-examination, witness said the system had always been the same in that station. He considered they complied with the regulations before they came out. He considered that the deceased went to the most inconvenient place he could for carrying out the work he had to do. In the ordinary working of the station they had a stand-by which could be used, and the whole of the section in which the deceased was working could be made dead, but this was not a simple matter to do. They had a lighting supply, and to make feeders dead would involve previous arrangement; but he admitted that it could be done, and in that case no accident could have occurred. This particular room was the most dangerous room in the station, and it was practically certain that anyone coming into contact with 10,000 volts would be killed. He could not possibly suggest why Shapcot went on to the oil cells.

Answering the CHAIRMAN, Witness said that, pending the settlement of the case, they were not carrying out this weekly cleaning. He only remembered one Home Office Inspector being in the station prior to the accident. The Home Office had never made any suggestions about this cleaning.

MR. A. H. POTT, chief engineer of the Metropolitan Tramways Co., said he was also in charge of the traction sub-station for the Power Co. The room in question was erected under his superintendence. The corridor separated the right-hand series of cells from the left. Had Shapcot obeyed instructions, it was possible for him to have done his work and have been in absolute safety. Mr. Hunt could not go and give a different set of instructions every time the cleaning was done, and it was better to have general instructions which would cover all conditions. He thought the less one was hampered with screens the better. He considered that the gangway was a permanent division. The company had never wished to do anything but what was perfectly right in regard to the regulations.

In cross-examination by MR. GRAY, Witness said that since the accident they had put a guard in front of the isolating switches, but that could not be called boxing them in. To box in these isolating switches would not be a easy thing, because they were not on the ground.

MR. E. T. RUTHVEN MURRAY, engineer-in-chief of the appellant company, said he knew the switchboard room, and knew the way in which the cleaning of the resistances was carried out. He thought that the less switching was done the better.

Cross-examined by MR. GRAY, Witness said he thought it was highly probable that Shapcot, thinking he knew all about the work, ran into a place of danger thoughtlessly.

MR. GRAY, addressing the Court, submitted that Shapcot was neither an authorised nor a competent person. Each witness had said that they would not go where the deceased went; and the obvious reason why he did so was in consequence of his not being competent. In such a room as he was working in there was danger in every place, and to be competent a person had to have more knowledge than that of merely being able to clean. He further submitted it was never intended that an authorised person was to be a lad of 17 or 18, who was brought in to do work under the eye of someone else. In the rules definite alternatives were laid down to minimise the chance of accident, but one of these alternatives was not that of merely telling a person not to do a thing. It could have been made quite impossible for a man to get on to the oil cells at all, but nothing was done. Respondents had now admitted that they had put guards round the isolating switches, and if that had been done before, the regulations would have been complied with. Whilst he agreed that the appellants did not mean to disobey the rules, yet he contended that they did not appreciate them properly and they had not done sufficient.

The CHAIRMAN said the Bench were unanimous in their decision. As regarded the conviction under Regulation 18, they were of opinion that the appellants should have opened the switch, which would reduce that point of danger. Therefore, in that case, they thought the appeal must be dismissed, but that the penalty should be reduced to £10 10s. With regard to the conviction under Regulation 28, they were of opinion that within the technical meaning of the regulation Shapcot was an authorised person, and in that case the appeal was allowed. They made no order as to costs.

#### WELSBACH GAS CO. AGREEMENT.

JUSTICE BAILHACHE, sitting in the King's Bench Division, had before him the case of the Welsbach Gas Co. v. Ehrlich & Graetz, which came before his Lordship under an arbitrator's award in the form of a special case.

MR. COLEFAX, K.C., who appeared for the Welsbach Gas Company, said the matter had regard to an agreement of March 23rd, 1910, by which the Welsbach Co. undertook to take from Ehrlich & Graetz, who are a firm in Germany, manufacturing tungsten-filament lamps, a certain number of lamps. The vital clause in the agreement was that by which it was agreed that if there was a reduction in the selling prices of these tungsten lamps—which (said counsel) were supplied by other companies, although in this country they were controlled by a body called the Osram Co.—Ehrlich & Graetz should make certain allowances to the Welsbach Co. in respect of the stock of lamps supplied by Ehrlich & Graetz, and held at the date of the reduction by the Welsbach Co. Two such reductions, in fact, took place, in April and in August, 1911. Before August, 1911, the Welsbach Co. had, for the purpose of a

reconstruction, entered into an agreement, dated May 15th, 1911, by which it agreed to transfer its business, stock, &c., to a new company, and questions of law arose here as to the binding character of certain paragraphs of the agreement of March 28th, 1910, and as to whether it in fact terminated on December 31st, 1910, or three months later, as contended by Ehrich & Graetz, or not. The determination of the allowances that were due to the Welsbach Co. would turn upon the Court's decision as to whether the vital clause was binding at the time of the two reductions, and his case was that it was. The question in effect was whether the Welsbach Co. were entitled to two sums of about £600 and £5,000. If the clause in regard to the allowances was operative when the first reduction was made, then his clients were entitled to the first amount, and if it was operative at the latter date, their claim to the further sum of money would arise.

The various agreements and documents were handed to his Lordship, who was informed that the new company were not parties to the arbitration.

Mr. COLEFAX said he represented the old company, and the question was what they were entitled to recover upon the true interpretation of the documents. He submitted that as the clause in question said in effect: "Whenever any reduction is made, then in respect to the stock held by the Welsbach Co. there shall be three payments by the Electrical Co.," it was an agreement that was subsisting at the dates when both these reductions were made.

Eventually, after hearing Mr. Morton Smith (for the other side) Mr. JUSTICE BAILLACHE decided that on the terms of the agreement Mr. Colefax's clients succeeded on the first item of £600, but in regard to the other item, which involved a point under the reconstruction, he could not secure judgment.

Mr. COLEFAX said he took it that his Lordship had held in effect that as regarded the second amount his clients could not sue, but that the rights as to that attached to the new company, and could not be dealt with in that application.

His LORDSHIP said that was so. He added that he thought Mr. Morton Smith's clients should pay the costs.

Mr. MORTON SMITH said that, as each party had succeeded, he thought there should be no costs. They had succeeded as to the biggest item, the £5,000 odd.

Mr. JUSTICE BAILLACHE, however, adhered to his previous decision.

#### VALDEMAR POULSEN PATENT EXTENSION.

In the Chancery Division on April 24th, Mr. Justice Warrington heard an application in regard to the petition for the extension of the term of letters patent granted to Valdemar Poulsen relating to a dictating machine. The application was to fix a day for the hearing of the petition.

Mr. BYRNE, for the petitioner, said he understood from Mr. Cartmell, who appeared for the Board of Trade, that, for the convenience of the law officers of the Crown, the petition should not be taken this term. Perhaps the best course would be for his Lordship to mark the petition not to be taken before the first day of next sittings. They would try to arrange between now and the end of the present term to have the hearing fixed for some particular day on which the law officers could appear. Counsel also asked his Lordship to authorise the necessary arrangements to be made for the use of the electric current in the Court in the working of a model of the machine at the hearing.

His LORDSHIP: You can make such arrangements as are necessary. The petition was accordingly marked "not before the first day of next sittings" for hearing.

#### WESTFALLEN v. L.C.C.

ON April 24th, before his Honour Judge Gurner and a jury, in the West London County Court, William Thomas Westfallen, described as a switchboard attendant, and residing in Fulham, sued the London County Council for damages for personal injuries.

COUNSEL for the plaintiff stated that in December, 1910, his client, who was in the naval reserve, entered the defendants' employ at their Hammersmith sub-station, the supply for which came from the chief station at Greenwich. His duties from the first were those of switchboard attendant, under a charge engineer whose place he had for five weeks filled through that official falling ill. The rules of the L.C.C. were particularly strict as to the duties of these switchboard men. No. 1 was to the effect that "no work whatever, either cleaning or otherwise, is to be done in any sub-station or any high-tension feeder or switchboard without the authority in writing of the charge engineer on duty at the time; such authority must be given directly to the person or persons who are to do the work, and is not transferable." Another rule provided that "every charge engineer on duty at the time must himself see that the insulating plugs have been drawn, and that they are not replaced before everything is safe." He will be "held responsible for any accident which may occur while he is on duty, notwithstanding any instructions he may have given to other persons." Plaintiff, who was on night duty, on a morning in December last, was ordered by the charge engineer on duty to clean the switchboard, and after placing a pair of steps to enable the official to reach the higher cells over the transformer, opened the wire guard to start the cleaning. He did not observe whether the plugs had been drawn, but following

the practice which was usual, proceeded to dust. At once he received a shock of 3,800 volts, which threw him on the ground. The charge escaped by the middle finger of his right hand, which was burned to a cinder, and had to be amputated, and the great toe of his left foot, which was also burned. He received a terrific shock, and when picked up by the charge engineer, was found to have wounds on his forehead and on the occiput, from both of which blood was oozing. His injuries were dressed at the West London Hospital, and he was laid off duty for some time, but was now at work again. In consequence of this occurrence, the charge engineer had been reduced in station, and his pay had been curtailed.

Plaintiff gave evidence in support of this statement, and in cross-examination admitted that he had not looked to see if the plugs were drawn, because it was no part of his duty.

Counsel: Whether it was your duty or not, do you mean to say that you did not look to see if the plugs were drawn when you knew you might receive a shock of 6,000 volts and be killed?

Plaintiff: I only did what we had been in the habit of doing. The charge engineer previously had always drawn the plugs before we started to clean. He further said that during all the time he had been at the station he had only drawn the plugs once—the charge engineer usually attended to that.

REGINALD STANLEY GOOD, superintendent of the sub-station, said that in an account of the occurrence dictated and signed at the time, plaintiff said that in consequence of domestic worry he omitted to look to see whether or no the plugs were drawn.

Counsel for the County Council urged that there was contributory negligence on the plaintiff's part.

The jury found a verdict for the plaintiff, and assessed the damages at £135.

Judgment was entered for that amount, with costs.

#### FULLALOVE v. L.C.C.

ON April 24th Mr. Justice Latham entered judgment for £150 against the London County Council, as owners of the electric tramway system, in an action brought by a carman named Fullalove, heard in the King's Bench Division before a common jury. The man was driving a van on October 29th last in the Jamaica Road, Bermondsey, in the direction of the Tower Bridge, and in order to pass a stationary cart he had to go upon the tramline, when a tramcar came up behind him, striking the van in the rear with such force that the plaintiff was thrown into the road and the wheel of the van passed over his legs, breaking two bones of one of them. He remained in hospital for about a month, and subsequently for five weeks he was kept at a convalescent home.

## BUSINESS NOTES.

**Meter Approved.**—The B. of T. has approved of the Bat meter type H.T.R.—constant pressure two-wire c.c., deposited by the BAT METER CO., LTD.

**Patent Restored.**—An order has been made restoring Patent No. 19,296, of 1908, for "Improvements in or relating to coated iron or steel sheets" (Edwin Norton).

**Osrams in India.**—Among the Osram lamp-selling methods employed in India is the running of a motor-car by representatives of the General Electric Co. (India), Ltd., for business trips to mills and factories within a radius of 30 miles of Calcutta. We understand that there are more than 50 mills in the area, all having Osrams installed in considerable numbers. The car has the words "Osram Lamps" plainly printed on the sides, and there is an attaché case at rear containing the various types of lamps; the samples carried therein are stated to have been carried daily without change for nine months, and only one filament has broken.

**Lamlok Specialities.**—Among orders lately received by Mr. C. H. Jeffcoat for these specialities, was one for the equipment of 20 theatres of the "London Theatres of Varieties" and others from Great Eastern and Great Northern Railways, London Coliseum, Queen's Hall, Empire, Harrod's.

**Underfeed Stokers.**—The following is a list of some stoker contracts recently executed by the UNDERFEED STOKER CO., LTD.:—

Pernambuco Tramways, six "E" and six heater; Carlisle Corporation Electricity Station, one "E"; Burgh of Ayr Electricity Station, 2 "E"; Sd. Energia Electrica de Cataluna, San Adrian, Barcelona, 16 travelling grates; South-East Kent Electric Power Co., four "E"; Metropolitan Carriage, Wagon & Finance Co., four "E"; Italian State Railways, two "E"; Gebrüder Sulzer (for Japan), two travelling grates.

**Book Notices.**—*The Motor Manual.*—Compiled by the staff of *The Motor*. London: Temple Press. Price 1s. 6d. net.—When a book has reached its sixteenth edition, and over a quarter of a million copies have been sold, it is of little use to consider its merits; the voice of the people has spoken. All we need do with the *Motor Manual*, therefore, is to say that the new edition has just been issued; it has been drastically revised, and rearranged in a more natural order, and additions have been made including over 100 new illustrations. The *Manual* is indispensable to the motorist.

"*Journal of the Institution of Electrical Engineers*," No. 218, Vol. 50. London: E. & F. N. Spon, Ltd. Price 5s.—The issue for April, 1913, contains the following papers: "A Single-phase Motor with Pole-Changing Windings," by J. S. Nicholson and B. P. Haigh; "The Aims and Works of the International Electrotechnical Commission," by Prof. S. P. Thompson; "Apparatus for Improving the Power Factor of A.C. Systems," by Prof. Miles Walker; "The Use of a Large Lighting Battery," by F. H. Whysall; "The Mechanics of Electric Train Movement," by F. W. Carter; "Change of Energy Loss, with Speed in Continuous-Current Machines," by Prof. W. M. Thornton; "Address to the Students' Section," by Dr. A. Russell.

"Liquid Air, Oxygen, Nitrogen," by Georges Claude. 1913. London: J. & A. Churchill. Price 18s. net.

"The Motor Manual." 1913. London: Temple Press, Ltd. Price 1s. 6d. net.

"Single-Phase Commutator Motors." By F. Creedy. 1913. London: Constable & Co., Ltd. Price 7s. 6d. net.

"Manual of Wireless Telegraphy and Telephony." By A. F. Collins. 1913. London: Chapman & Hall, Ltd. Price 6s. 6d. net.

"*Transactions of the Illuminating Engineering Society*." Vol. VIII, No. 2. February. 1913. New York: The Society. Price 75 cents.

"Sand Available for Filling Mine Workings in the Northern Anthracite Basin of Pennsylvania," by N. H. Darton; "Second Annual Report of the Director of the Bureau of Mines for 1912"; "The Cementing Process of Excluding Water from Oil Wells as Practised in California," by R. Arnold and V. R. Garfias; "Accidents from Mine Cars and Locomotives," by L. M. Jones. Washington: Government Printing Office.

**Bankruptcy Proceedings.**—**JOHN MITCHELL** and **FREDERICK MITCHELL** (lately trading as Fred. Mitchell & Co.), electrical engineers, 97, Stockport Road, Ardwick, Manchester, and 58, Ashton Old Road, Openshaw, Manchester.—The public examination of the above named debtors, was held at the Court House, Quay Street, Manchester, last week, when it transpired that the debtor, Frederick Mitchell, was formerly employed as a journeyman electrical engineer, and in March, 1908, purchased a business formerly carried on by Messrs. Cooper & Ormerod, at Stockport Road, Ardwick. He had no capital of his own, but his mother lent him £45. His brother, John, who afterwards came into partnership, also lent him £50. In 1912 they transferred the works to Ashton Old Road, Manchester. At first the business was fairly successful, the joint capital, after deducting liabilities having increased to about £300 in June, 1910. For 1911 and 1912 rough balance-sheets were prepared, but these were destroyed. Debtor did not know what the figures were, but they disclosed a reduced turnover. They afterwards undertook more work than they had capital to carry out, their contracts being mostly with speculative builders. In 1911 a number of actions were brought against them for non-payment of accounts, and they lost contracts through being unable to execute contracts in hand. Debtor attributed his failure to lack of capital, legal expenses and bad debts (£308). He had no private assets, and was now employed as an insurance agent. The debtor, John Mitchell, stated that he joined the business in June, 1911, and gave corroborative evidence. Debtors' joint liabilities were scheduled at £202, and their joint assets amounted to only £12, leaving a deficiency of £190. The examination was closed.

**SAMUEL BROOKES** (trading as the Netherton Tube Fittings Co.), Netherton.—May 9th is the last day for the receipt of proofs for dividend, by the trustee, Mr. A. M. Fairbairn, 1, Priory Street, Dudley.

**A. G. ADAMSON**, electrical engineer, Acton, lately Christopher Street, E.C.—Fourth and final dividend 2½d. in the £, payable April 30th, at 14, Bedford Row, W.C.

**Dissolutions and Liquidations.**—**MESSRS. A. SEAGE AND CO.**, manufacturing electrical engineers, of Cambridge Works, Hammersmith, W.—Messrs. A. Seage and W. M. Dodd have dissolved partnership. Mr. Dodd will attend to debts, &c., and will continue the business.

**COMPAGNIE GENERALE ELECTRIQUE DE LA CHAMPAGNE, LTD.**—This company is winding up voluntarily. Mr. H. T. McConville, 65, London Wall, E.C., is liquidator. A meeting of creditors is called for May 8th. Creditors should send particulars to the liquidator by May 23rd.

**ELECTROLYTIC ALKALI CO., LTD.**—This company is winding up voluntarily, as already announced. Mr. W. H. Alexander, 24, North John Street, Liverpool, is liquidator. A meeting of creditors is called for May 7th. Creditors should send particulars to the liquidator by June 9th.

**ROSSENDALE BELTING CO., LTD.**, Manchester.—Winding-up order made April 21st.

**ADAMS MANUFACTURING CO., LTD.**—A meeting of creditors will be held at Winchester House, E.C., on Friday, May 9th.

**MARSH, SON & CO., LTD.**—This company is winding up voluntarily, with Mr. R. W. Brown, 12, Old Square, Lincoln's Inn, W.C., as liquidator.

**Private Arrangement.**—**LEONARD HIGGINS**, electrician, trading as L. Higgins & Co., 339, Stockport Road, Longsight, Manchester.—The creditors interested herein were called together recently, when a statement of affairs was presented showing liabilities of £411, all of which were due to trade creditors. The assets were estimated to realise £83, from which had to be deducted £31 for preference claims, leaving net assets of £52, or a deficiency of £359. It was reported that the debtor started trading in partnership with a brother in April, 1903, when they had a joint capital of about £50. The partnership was dissolved in December, 1911, and since that date the debtor had traded alone. The dissolution was not gazetted, but all the creditors were notified of the change. Proper books of account had not been kept, and there was not a complete record of the cash takings. Proceedings had been commenced by creditors, and it was said that there were unsatisfied judgments. The debtor stated that he had carried out certain contracts on which he had lost money. After discussing the position, it was decided that, failing an offer of 4s. in the £ the debtor should be requested to file his petition.

**Trade Announcement.**—It is announced that the business of the late Mr. T. J. Serle, of **MESSRS. T. J. SERLE & SONS**, electrical engineers, of East Street, Taunton, will be continued by the family.

**Catalogues and Lists.**—**MESSRS. H. W. BUTLER & CO.**, Craven House, Kingsway, W.C.—A serviceable little desk blotter has been received.

**MESSRS. MICKELWRIGHT, LTD.**, Well Works, Alperton, Middlesex.—12-page illustrated price list of resistances for cinematograph and other service, "Wright" number indicators for music halls, theatres, &c., auto-transformers, dimming and battery charging resistances, &c.

**MESSRS. DRAKE & GORHAM, LTD.**, 66, Victoria Street, Westminster, S.W.—32-page pamphlet (No. 201) giving numerous illustrations, brief particulars, and prices of various fittings for indirect and semi-direct lighting—with plain and mirror reflector bowls, silvered reflectors, moulded composition bowl fittings with silvered reflectors, alabaster bowls, Silurian and Equilux glassware, silk-covered opal dishes, Holophane glassware, and a number of "Hellenic" type fittings.

**THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD.**, 179, Wardour Street, London, W.—Several publications have been issued regarding their various manufactures for the electrical equipment of cinematograph theatres. One entitled "Pictures" contains reprints of regulations relating to the use of electricity, &c., in such theatres, and gives illustrated particulars of Westinghouse electrical equipments, and a long list of these entertainment houses that they have fitted up. The second is entitled "There's gold in it," and consists of a collection of testimonials from managers. A third "What Electricity can do for you," gives particulars and prices of "Auriga" drawn wire lamps, Holophane glassware, electric irons, toasters, kettles, radiators, fittings, &c.

**THE STOLZENBERG FILE CO., LTD.**, 210-212, Bishopsgate, London, E.C.—Catalogue (48 pages) fully detailing, with effective illustrations, their Stolzenberg system of filing and office organisation. From among a number of applications of the system we may select for mention the use of the files as tender covers and as catalogue covers—a number of examples executed for electrical and engineering firms being shown.

**MESSRS. SEEAR, PAGE & CO.**, 16 and 17, Devonshire Square, London, E.C.—Illustrated lists describing the "Maytag" electric washing machine. Copies will be sent to electrical contractors who are interested.

**THE WILSON-WOLF ENGINEERING CO.**, Thornton Road, Bradford.—List giving descriptive particulars and list of prices of "Polar" propeller ventilating fans, also spare parts and speed regulators.

**MESSRS. VEHTYS, LTD.**, King Street, Covent Garden, London, W.C.—Folder No. 721 (four pages), detailing—with illustrations and prices—various lines of "Aston" knife switches, circuit breakers, fuses, lampholders and distribution boards, designed to comply with the Factory Act Regulations.

**MESSRS. L. ANDREWS & CO.**, 2, Whitworth Street West, Deansgate, Manchester.—Price list of rubber valves, washers and sheets, asbestos, garden and delivery hose, &c.

**MESSRS. LANDIS & GYR, LTD.**, 28, Denman Street, London, S.E.—Leaflet describing their switchboard meters for S.P., A.C. circuits and three-phase circuits with balanced loads. Dimension sketches and diagrams of connections are given.

**THE BRITISH THOMSON-HOUSTON CO., LTD.**, Rugby.—List No. 2,450 contains full description of, also tabulated price, dimensional and shipping data concerning, their potential transformers.

## LIGHTING and POWER NOTES.

**Abingdon.**—The promoters of the Abingdon Electric Supply Co., Messrs. Edwards & Armstrong, of Bristol, have deposited with the borough surveyor plans for a generating station to be erected in Wootton Road.

**Barton-on-Umber.**—A prov. order for electric lighting has been applied for, with the consent of the U.D.C., by Mr. F. Hopper, J.P., head of a well-known local manufacturing concern,

and a local company is being formed to carry on the undertaking. Already the buildings are being erected, and a contract entered into with Messrs. Crompton & Co., Ltd., for cables, plant, &c., at £10,270. The Urban Council has decided to take electricity for public lighting.

**Bexley.**—The U.D.C. has decided, in the event of a demand arising, to hire out electric cooking apparatus. The Council has also decided to allow members of the staff to canvass in their spare time for new consumers, at a remuneration of 3d. per point and 6d. for each cooker and heater connected to the mains.

The L.G.B. has forwarded sanction to a loan of £1,520 for E.L. purposes.

The Council has adopted the recommendation of the electrical engineer to encourage the use of arc lamps for private lighting, and offers to provide lamps, supply current, and maintain the lamps at prices ranging from £6 10s. to £9 per annum.

The Council has also adopted the following revised scale of charges for current:—Private houses for all purposes: A fixed charge of 2s. 6d. in the £ on the rateable value, plus a flat rate of 1½d. per unit net, or a flat rate of 6d. Shops and business premises: A fixed charge of £10 per kW. per annum, plus 1½d. per unit net, or a flat rate of 6d. Outside shop lighting: A flat rate of 4½d. per unit net, with 400-watt lamps as the minimum size.

**Blackpool.**—On April 23rd, two new generating sets were formally started up, this being the seventh extension which has been made since the works were opened. A 1,500-kw. turbo-alternator has been supplied by the British Thomson-Houston Co., and is the largest lighting unit installed in the works. The addition of this 1,500-kw. unit brings the total plant capacity for lighting up to 4,300 kW. The other addition was a new 800-kw. turbo-generator for traction purposes, supplied by the Brush Co., which brings the plant capacity for tramways purposes up to 2,250 kW., while the total plant capacity of the works, including the two new turbos, is now 6,500 kW. The work has been carried out to the specifications of the electrical engineer, Mr. Charles Furness, who is to be congratulated on his successful efforts to bring the installation up to date, and on the inauguration of a forward commercial policy.

In connection with the inauguration of the new plant, the works were thrown open for inspection, and a cooking and heating exhibition was held. Some 2,000 visitors took advantage of the occasion, and we understand that many inquiries have resulted from the cooking demonstrations on the Tricity, Eclipse and Ferranti ovens.

**Brora.**—The village of Brora, noted as having the most northerly coal mine in the kingdom, is having its paraffin street lamps replaced with 30 electric lamps each of 25-c.p. A local supply company has the contract, and Messrs. Edmundsons are carrying out the scheme.

**Bushbury.**—The B. of T. has granted the Wolverhampton T.C. a prov. order, enabling it to supply energy within the parish of Bushbury, which is in the area of the Stafford R.D.C.

**Bushey.**—The U.D.C. has been informed that the Colne Valley Electricity Supply Co., Ltd., do not intend to proceed with the application for powers to supply electricity within the area of the Council. As this difficulty has been removed, the Council will proceed with negotiations with the Watford U.D.C. for a supply of current for the district, and a draft agreement is to be prepared.

**Canada.**—It appears that there is trouble in connection with the Hydro-Electric Commission's staff. A correspondent says that General Manager Sweeney was recently dismissed from his position at the instance of Chairman Ellis, of the Commission, and forthwith retaliated by trying, unsuccessfully, to get the chairman removed. Meanwhile Manager Sweeney's dismissal was followed by the resignation of 10 other officials—the head of every department in the service, including the chief engineer, the general superintendent, the distributing and operating engineers and others.

The city of Toronto is to submit by-laws to purchase the undertakings of the Toronto Electric Light Co. and the Toronto Electric Railway Co. The street railway concession has eight years to run, and it has been generally assumed that it would not be renewed. The price asked for these concerns is between 20 and 30 million dollars, and a Bill giving the Council power to complete the purchase has been rushed through Parliament although the Council is not unanimous as to the proposed purchase.

The Shawinigan Water and Power Co. has announced that it will add another 20,000 H.P. of plant to its No. 2 power house, which will give the company a capacity of 80,000 H.P.

The Toronto Hydro-Electric Commission (the municipal system) reports that on December 31st, 1912, there were 13,858 meters in use, 300,000 lamps connected, 33,824 street lamps in use, and a connected load of 54,655 H.P. with a peak load of 17,198 H.P.

**Chilworth.**—The South Stoneham R.D.C. has granted the request of the Southampton T.C. to be allowed to supply current to Chilworth Towers and to other property in that district.

**Continental Notes.**—RUSSIA.—According to the German Consul at St. Petersburg the Russian official notices contain the grant of a concession to an Englishman, Mr. C. H. Stuart, for the installation of electric generating stations in the Caucasus. These stations will be situated on the River Terek and Lake

Goktcha, and power to acquire land on mortgage for the erection of distribution mains is included in the concession. The details of the concession are: (1) the erection of a temporary hydroelectric station on the Terek, near the village of Gwlet of a minimum capacity of 15,000 kW., with transmission lines to Tiflis and Vladikavkas; (2) a permanent hydroelectric station on the Terek, near the Larz Post station of a capacity of 40,000 kW., to which the lines to Tiflis and Vladikavkas are to be connected; and (3) one or two permanent stations on Lake Goktcha in the region between the lake and the watermeet of the rivers Tarsetchala and Akstala of a minimum capacity of 40,000 kW., with mains at Tiflis. The concession is for a term of 75 years. At the expiry of this period the whole undertaking reverts to the Fiscus. After a lapse of 30 years the Government has the right to buy out the undertaking, subject to one year's notice. The concessionee has the right to hand the concession over, with the approval of the Russian Government, to a Russian or foreign company.

The temporary station aitema must be submitted to the Viceroy in 3 years, the permanent station on the Terek in 3½ years, and those on Lake Goktcha in 6½ years from the date of signature of concession, respectively, and the respective duration of the constructional work is to be 2½, 6 and 7 years from the day the Viceroy approves the plans. It is said that constructional work will begin this spring at the Terek hydro-electrical station.

The report for 1912 of the Société Electrique de Saint Petersburg, which has just been issued, shows that during last year the plant at the generating station of the company was increased by a 6,700-H.P. engine and dynamo and two new boilers. The mains of the company now extend 290 miles, an increase of 22 miles in the 12 months. Including the public lighting, current is now being supplied to lamps, motors, &c., equal to 299,784 hectowatts.

**BULGARIA.**—Some interesting trials have recently been made at the generating station in Sofia, of the Compagnie d'Electricité de Sofia et de Bulgaria, in the firing of the steam boilers with the residues from Roumanian petroleum. The tests have proved so successful, that all the boilers at the station have now been adapted to burn this fuel. A new steam turbine and generator of 2,200 H.P. has also recently been installed.

**SPAIN.**—Two new 1,000-H.P. gas engines utilising the waste gases from the blast furnaces are being installed in connection with the electric power station at the Baracaldo works of the Sociedad Altos Hornos de Vizcaya, at Bilbao. At the Sestao works of the same company it is proposed to adopt electric driving in connection with the various iron and steel rolling mills, and to this end a battery of Babcock & Wilcox boilers and two 3,000-kw. steam turbines and dynamos are being installed.

What is described as being the first electrically-lighted light-house in Spain has lately been completed at Cape Villaro, near San Sebastian. The lighthouse, which is 82 ft. high, is fitted with a small steam-operated generating plant to furnish the necessary current for the special arc lamp, the power of which is sufficient for the rays of light to be seen at a distance of about 32 miles. A petrol-vapour lamp has also been installed to act as a reserve in case of temporary failure of the electrical apparatus.

**BELGIUM.**—All the steam engines in connection with the collieries of the Société des Charbonnages du Hasard, at Trooz-Foret, have now been discarded, the various plant being now entirely electrically operated.

**FRANCE.**—A new electricity generating station has lately been completed on the bank of the canal between Caen and the sea by the Société d'Electricité de Caen. The station, which has been designed for subsequent enlargement as the demand for energy increases, at present contains two 2,000-kw. steam turbo-alternators and an 800-kw. double-current turbo-generator, to give 800 kw. three-phase and 300 kw. continuous current. In addition to supplying current for lighting and power purposes in the town of Caen, the company is also already furnishing a supply to Cabourg and Trouville, and arrangements are in hand for supplying the town of Bayeux and other centres in Calvados.

**Cuckfield.**—The R.D.C. has decided to take no action with regard to the draft prov. order for electric lighting issued to the Mid-Sussex Electric Light and Power Co.

**Dromore.**—At a resumed B. of T. inquiry into a proposed electricity supply scheme for Dromore, the opposition of the gas interests and local ratepayers was heard. As regards the former, the witnesses included Mr. J. H. Abady, the well-known gas expert, as well as Mr. Pye, engineer to the Chichester Gas Co.; and, altogether, most strenuous efforts were made to persuade the inspector that Dromore gas at 5s. 3d. per 1,000 cu. ft. is much superior to electricity at the proposed price, 6d. per unit.

**Dover.**—Sanction has been received from the L.G.B. to the borrowing of £300 for the purchase of transformers.

**Dudley.**—Complications are not unlikely to arise in connection with the sale of the Corporation's electricity undertaking. The draft agreement provides that after the transfer the Corporation shall continue to be responsible for the repayment of the loans, the purchasers, however, providing the wherewithal as the loans become due. The annual charge under this head amounts to about £5,000. The question of security has been raised, and it is now believed that an Act of Parliament may be required before the purchase, which was to date from March 25th, 1912, can be carried through. It may be added that the works are now being

carried on by the intending purchasers, with an electrical engineer specially retained by the T.C. to safeguard its interests. The question, it is expected, will come before the T.C. at an early date.

**Erith.**—The U.D.C. has decided to take no further steps with reference to the offer of the Woolwich B.C. to supply energy in bulk, it being considered that no advantage would be derived from such a supply.

**Glasgow.**—It is reported that the various police boxes in the city are to be fitted up with electric hot-plates to enable constables on night duty to make themselves a cup of tea or other hot drink. The boxes are also to be fitted with an electrical arrangement whereby the superintendents at the various stations can switch on a red light when they wish to communicate with the man on the beat.

**Harrogate.**—Mr. George Wilkinson, the borough electrical engineer, has presented a report to the Electricity Committee, on the possible development of heating and cooking by electricity and its effect on the Corporation's electric supply undertaking. He estimates that a consumer using electricity for cooking and heating would use 10 times as much current as for lighting, and on that basis, if half the consumers in Harrogate adopted electrical cooking and heating, the total number of units sold would increase from 862,673, the present number, to over 4,000,000 per annum. With a view to encouraging the electric cooking, he suggested the following scale of charges:—A fixed charge of 1s. per quarter per 30-watt lamp (or the equivalent) installed, each light point to be rated at 30 watts minimum. A fixed charge of 2s. 6d. per quarter per kW. installed in cooking plant and electric radiators, &c. A flat rate of 3d. per unit for all electricity consumed, the tariff to be subject to 5 per cent. discount for prompt payment of account. The conditions to be imposed are as follows:—(a) That the establishment shall be entirely and exclusively illuminated by electricity; (b) that every lamp be assessed for the fixed charge excepting the bathroom, w.c. and boxroom lamps, and one lamp in the basement (where there are cellars); (c) that cooking and heating plant is installed equal to at least four times the total capacity of the electric lamps.

**Ham (Surrey).**—The Twickenham and Teddington Electric Supply Co., Ltd., has applied to the B. of T. for consent to use overhead lines from Twickenham to Ham for the purpose of supplying current under the E.L. Order, 1904, at a pressure of 3,000 volts.

**Hull.**—The Electricity Committee has had under consideration the proposed heads of agreement for the taking in of Hesse into the area of supply of electricity. The agreement included the payment by the Hull Corporation of £462 to the Hesse authority, towards the cost of obtaining a provisional order. It was resolved that the proposed agreement and terms be set out on the minutes, and that the matter be decided upon at the next meeting of the City Council.

**India.**—TATA HYDRO-ELECTRIC SCHEME.—We recently referred to the progress which this company is making with its power scheme, in connection with which we are given to understand that the total capacities of the motors and transformers to be applied to the textile mills and flour mills in the Bombay district, which are to derive their power from the mains of the above company, will exceed 36,000 H.P., and 40,000 K.V.A. respectively. At the present time, 27 textile mills and two flour mills are to be electrified, and the whole of their equipment is being manufactured by the British Westinghouse Co. It includes, besides motors and transformers, the complete control gear for each mill. We hope to be able to give a detailed list of the mills and their equipment at an early date, when the final points regarding the equipment are settled. The Westinghouse Co. are to be congratulated upon securing such an important section of the Tata Co.'s electrification scheme.

**Itchen (Hants.).**—The U.D.C. has been informed that the B. of T. has granted its application for a prov. order for electric lighting, and the necessary deposits are to be made.

**Japan.**—Our contemporary, *Electricita*, of Milan, announces that the municipality of Tokio has discussed a project to borrow, approximately, £6,000,000 for electrical installations, and has decided to contract an immediate loan of £1,400,000 and the balance next year.

**Leicester.**—The Borough Education Committee has decided to expend £1,700 on electric lighting and new machinery for the additions to the industrial schools at Desford.

**Lisnaskea (Co. Fermanagh).**—At a meeting of the Fair and Markets Committee, matters in connection with the scheme for the lighting of the town by electricity were further considered. It was decided to form a company with a capital of £1,000.

**Liverpool.**—At a meeting on Friday, last week, of the Corporation Tramways and Electric Power and Lighting Committee, it was decided, on the casting vote of the chairman (Alderman F. Smith), to abolish the Electrical sub-Committee. The latter was only formed at the commencement of the present municipal year, five months ago, it being felt that the growth of the electricity undertaking had been such that it ought to be dealt with by a separate sub-Committee. At the time of its inauguration there was

considerable party feeling displayed over the appointment of chairman, several names being submitted and rejected, and ultimately Mr. W. J. Bailew was elected.

**London.**—METROPOLITAN ASYLUMS BOARD.—In view of the general adoption of metal-filament lamps at its institutions, and as the expenditure on such lamps might possibly exceed the limit laid down by the L.G.B., the managers consider that lamps of this description should be obtained direct from the manufacturers, and they have accordingly made application to the L.G.B. for its sanction to this proposal.

**Luton.**—At the last meeting of the T.C., the electrical engineer submitted a long report on proposed extensions to the electricity station and plant, which had been rendered necessary owing to the increased demand for current. The existing buildings, the report states, are filled to the utmost extent with plant, and it would, therefore, be necessary to erect a complete additional station as an extension to the existing one. Having gone carefully into the matter, the engineer thinks it would be unwise to extend the station on exactly the same lines as hitherto, because by so doing, it would limit the ultimate capacity of the station to about 9,000 kW., and there is every reason to believe that the rapid growth of the undertaking will continue. He advises, therefore, that the engine room be extended a distance of 63 ft. in one span, and that the roof be raised to a height of 25 ft. under the travelling crane so as to allow for the larger units that it will be necessary to install in the future. This, he thinks, will be sufficient to accommodate the two 1,000-kw. sets required at present, a 500-kw. converter, a new E.H.T. switchboard, and space for a further 5,000-kw. unit in the future. It will also be necessary, the engineer continues, to extend the boiler-house to accommodate two additional water-tube boilers, and as there is at the present time no provision for the storage of coal, he advises an extension of the boiler-house for approximately 85 ft.; also a new chimney shaft of sufficient capacity to deal with the maximum number of boilers it would be possible to install in the future, at the extreme end of the new boiler-house. The coal bunkers will be erected over the boilers with a holding capacity of about 1,500 tons. This scheme, the engineer points out, will enable a further extension to be carried out to the engine room at a minimum cost, which will accommodate an additional 10,000 kW., and by adding a wing to the boiler house an additional four boilers could ultimately be installed which would bring the maximum capacity of the station up to about 19,000 kW. Based upon preliminary tenders, the engineer estimates the cost of these proposals as follows: Buildings and chimney shaft, £6,787; coal bunkers and coal-handling plant, £7,555; boilers, economiser and feed pump, £6,555; two 1,000-kw. turbo-alternators and condensing plant, £9,500; one 500-kw. converter, £1,443; switchboard and connections, £1,100; cooling tower, pipework, travelling crane and details, £3,356; sub-station and converting plant, £3,000; provision for mains required during the next two or three years, £5,000; total, £44,296. When the actual tenders are placed, this estimate, the engineer states, will be somewhat reduced. Comparing the capital cost per kW. installed with that which has already been carried out, the cost of the existing station, excluding feeders, distributing mains, services and meters, amounts to £18.75 per kW. installed, while the proposed extension, excluding mains and distributing plant, but including the accommodation provided for future plant will be £18 per kW., and when the additional plant is installed for which provision is made in these proposed buildings, the total cost of this new station will be reduced to just over £8 per kW. installed, which, the engineer thinks, is an extremely low figure. Concluding, he advises that, immediately, application be made to the L.G.B. for the amounts required. The Electricity and Tramways Committee reported having given careful consideration to the engineer's report, and stated that it was strongly of opinion that, having regard to the future requirements, any lesser scheme than that proposed by the engineer will not be economical, bearing in mind the restricted site, and the anticipated rapid increase (based on past experience) of the demand for energy. It accordingly recommended the adoption of the engineer's report, and that application be made to the L.G.B. for sanction to the borrowing of £44,296, the estimated cost of the works.

Alderman Wilkinson, chairman of the Committee, in moving the adoption of the report, said that the question had been brought about by the marked success and tested usefulness of the undertaking generally to the inhabitants, and to the large consuming trading public. In the early days of the undertaking it was anticipated that electricity for motive power would be largely sought for by the staple trade, and he believed it was now a fact that those who had not equipped their factories in this way were very considerably handicapped. With regard to the proposed expenditure on mains, &c., the demand for current from the Stanley Street, Regent Street, and Chapel Street neighbourhood had become such that the mains there needed strengthening. It was also proposed to take a H.T. main to the neighbourhood of the Skefko Works, and to establish a transforming station to which current would be sent at a high voltage, and there be reduced to the normal working voltage. The recommendation, after the matter had been thoroughly considered in Committee, was unanimously carried.

The assessment on the electricity undertaking has been reduced from £6,000 gross and £3,000 rateable to £3,500 and £1,500 respectively.

**Mid-Sussex.**—The B. of T. has granted a prov. order for electric supply to the Mid-Sussex Electric Light Co., for the Hayward's Heath district, in which town the generating station will be. The local authorities concerned have secured purchasing clauses in the order.

**Plymouth.**—The electrical engineer has submitted to the Lighting Committee of the B.C. that, in view of the growing demand for electricity, additional machinery should be provided as soon as practicable. He recommends that a turbo-generator shall be installed, together with the necessary auxiliaries, and that a larger cable shall be substituted for the existing No. 3 feeder, a portion of the cable displaced to be used as a short feeder at Prince Rock; also that an additional distributor and inter-connector be laid from Mutley Plain to Lipson Road and Tothill Avenue. He estimates the cost of the proposed plant at £5,500, and cost of the alterations and additions to pipework, switchgear and cables at £2,000. The report was approved, and tenders are to be invited for the necessary machinery.

**Portsmouth.**—As a result of the heavy storm on Tuesday evening, which caused flooding in parts of the town, both the tramway and electricity services were interfered with, the latter failing in the central part of the town.

**Rawtenstall.**—The borough electrical and tramways engineer having reported that new plant will be necessary at the electricity works at an early date, the Committee has instructed him to prepare a statement showing what plant is required, and a Sub-Committee has been appointed to consider the matter.

**Stalybridge.**—It was reported at a meeting of the Stalybridge Joint Tramways and Electricity Board, on April 24th, that the L.G.B. had sanctioned further borrowing powers of £39,255 for electricity purposes.

**Summerseat (Lancs.).**—Messrs. J. Hoyle & Sons are installing a hydro-electric plant at their spinning mill, including a 265-h.p. Boving turbine working on a head of 25 ft. This plant will supplement existing steam plant.

**Swinton.**—No decision has yet been come to by the Swinton and Pendlebury Council regarding the particular system of electric street lighting to be adopted for the contemplated extensions. A deputation has just visited Rawtenstall to inspect the system in use there.

**Trowbridge.**—The first report and balance-sheet of the Trowbridge Electric Supply Co., Ltd., has just been issued. In their report the directors state that the period under review is the first complete year in the working of the undertaking, and the progress made is most satisfactory. The result of the year's working shows a profit of £196, and a disposable balance of £205, which the directors recommend should be dealt with as follows:—To 5 per cent. interest on preference shares (already paid), £49; to depreciation reserve fund, £100; to general reserve fund, £50.

**U.S.A.**—According to an American contemporary, a transmission line some 275 miles long is to be built by the Pacific Light and Power Co. from a new plant about 60 miles east of Fresno, to Los Angeles. This line will be designed for a pressure of between 150,000 and 175,000 volts. It is claimed that climatic conditions are such in this section that 200,000 volts or more may be used on future transmission systems.

**Walthamstow.**—The question of extending the supply to Highams Park is being considered in connection with the proposed supply to Woodford.

**Weaverham.**—The B. of T. has granted a prov. order for electricity supply to the Weaverham Electricity Supply Co., Ltd., of Northwich, the area of supply comprising the parishes of Weaverham-cum-Milton, Acton, Cuddington and part of Oakmere.

**Wick.**—This town, the centre of the Scotch herring fishing trade, is shortly to have an electric supply. Messrs. Edmundsons, who are already responsible for the undertakings in several towns in Scotland, are the promoters of the scheme.

## TRAMWAY and RAILWAY NOTES.

**Airdrie.**—A conference has been held at Airdrie between members of the Corporation and members of the Glasgow Corporation Tramways Committee, with reference to a scheme for the linking up of the Glasgow line from Baillieston to Coatbridge.

**Ashton-under-Lyne.**—There is a profit on the tramways for the past year of £3,000, which is the largest amount recorded since the inception of the undertaking 10 years ago. Last year there was a profit of £2,000.

**Australia.**—A New South Wales wheat farmer is reported to have introduced a mammoth wheat harvester at Molong, which comprises three strippers and a winnower. It is driven by three electric motors deriving energy from a generator on an oil tractor which draws the machine along.

**Birmingham.**—The Tramways Committee has considered the report of Mr. Baker, the general manager, on the question brought before the Committee by a deputation, headed by the Bishop of Birmingham, of allowing tramway employés facilities for attending Divine service on Sunday mornings. It was decided to communicate with the Bishop, stating that a large majority of the men do not appear to have an aversion to working on Sundays, the work being considerably lighter than on week-

days. In any case, however, men who are desirous of attending Divine service can do so by notifying their depot inspector, when arrangements can easily be made, as the duties are always most popular, and there would be no difficulty in finding substitutes.

**Blackpool.**—Mr. C. Furness, general manager of the tramways, reported to the Tramways Committee on Thursday, last week, that the estimated income for last year was £62,000, but the actual income had been £71,166 which was a record for the tramway department. The previous year's income was £65,310. The total working expenses were £39,682, and the disposable balance £18,331, compared with £10,053 in the previous year, also a record. The reason for the increased revenue was the fact that during the year the number of cars was increased. The revenue from the circular cars alone was £7,902, an increase of £1,857, the passengers carried by those cars numbering 595,800. The receipts per car-mile were 2s. 8½d. The total number of passengers carried during the year was 11,321,148, an increase of 981,429, the receipts per car-mile being 1s. 4½d. It was proposed to contribute £5,000 to the relief of the rates, and place the balance of £13,331 to the permanent-way renewal fund. The year's receipts for electricity were £40,333, and the disposable balance was £6,226, which would have been greater but for the fact that the cost of coal was £3,000 more.

**Continental Notes.**—GERMANY.—After preliminary labours extending over several years, the A.E.G. scheme for the construction of an electric railway between Geandbrunnen and Bixdorf (Neukölln) has advanced a further stage towards realisation. The project received the sanction of the supervising authorities a year ago, the contract between the company and the Berlin City Council was passed in February, 1912, and now the final step has been taken as the Minister of Public Works has presented the concession for the Prussian Royal consent. As in the case of the existing Berlin elevated and underground railway, the new railway will also be partly high level, and partly built below the street surface. The concession is for a period of 90 years, although the municipal authorities will have the right of acquisition at the expiration of 30 years, and at succeeding terms of five years. The municipal authorities will have a share in the gross receipts per mile of line, and the share percentage will rise in proportion to the growth in the gross receipts per mile. It is estimated that the construction of the railway will occupy a period of seven years, and the expenditure is computed at £4,250,000. One half of the capital will be raised by the issue of ordinary and preference shares in a new company to be eventually formed, and the other half will be provided by the floatation of a loan, the interest on which will be guaranteed by the municipal authorities. In expectation of the Royal consent, the A.E.G. has already made preparations for commencing the work in the near future by the issue to a financial syndicate of A.E.G. bonds amounting to £1,500,000, which sum is required for the expropriation of property and other preliminary works. The bonds bear interest at the rate of 5 per cent. for the first five years, when the rate will fall to 4½ per cent., and the A.E.G. will be recouped for this outlay by the new railway company at a later date. The issue has been taken over by the syndicate at the price of 97½ per cent., and the subsequent issue to the public will be at par value. The railway scheme is the largest individual undertaking which the A.E.G. has hitherto embarked upon.

The lower house of the Prussian Diet has passed a Bill authorising the spending of £1,250,000 on preparations for the electrification of the Berlin City Circular and Suburban Railways. It was originally intended to electrify all the lines at a cost of £2,500,000. It was mentioned that electric traction would save £300,000 per annum over steam traction, and that to meet the liabilities due to the new work, a revised tariff would be introduced, to bring in £400,000 more a year.

**ITALY.**—The Provincial Council at Parma has just given its assent to a scheme, which will have the effect of developing the electric tramway system of that city and its suburbs considerably.

The lines in the city now in the hands of the National Italian Railway and Tramway Co. and the lines to Zibello, Busseto, Soragna, Borgho S. Domino, Rocca, Bianca Mano, Noceto, Medesano, Langhirano, Traversetolo and Montechio, upon all of which steam cars are now run, will be taken over and worked electrically, although the freight service will still be worked by steam. Beyond this two new lines are to be laid down. The cost of this re-organisation is estimated at over £900,000.

**FRANCE.**—The municipal authorities of Paris have recently put in service a new motor dust cart, the feature of which is that it is drawn by an electric *avant train* or motor fore carriage, which can be readily detached from a full vehicle and attached to an empty one.

A concession has lately been granted for the construction and working of an electric railway between Morez (Jura) and Saint Cergues, near the Swiss frontier.

The last horse tramway in Paris has just been electrically equipped, viz., the Pantin-Opera line, on which an electrical service was inaugurated last week.

**Dalkeith.**—The T.C. has unanimously decided to support the scheme for the Lothians railway, a Bill for which is again to be presented in Parliament. With a view to meeting some of the former objections, the scope of the scheme is being extended, and it is proposed to lay down a railway all the way from Arncliffe Collieries, Gore Bridge, Midlothian, along by Thorniebank, following up by Smeaton, and continuing *via* Monktonhall to the Forth.

**Glasgow.**—Some time ago a special Committee was appointed to report upon the provision of an additional supply of power at Pinkston power station, and at a recent meeting has recommended that two additional turbo-alternators be obtained

for the station, one of 5,000 kw. and the other of 2,000 kw., and that the general manager be instructed to prepare the necessary specification and form of tender and obtain offers for the erection of the alternators; and in the meantime to advertise for sale one or more of the reciprocating engines at Pinkston power station.

The general manager has been instructed to get 1,000 additional bell punches from the Bell Punching and Printing Co.

**Halifax.**—The Tramways Committee has declined to accede to the request of residents of the district to extend the tramways from the present terminus at Skircoat Green to Dudwell Lane. The outlay for a double line would be £1,700 and for a single line £1,100, and the Committee considers that an adequate return for such expenditure is not possible.

**Keighley.**—Two B. of T. representatives—Major J. W. Pringle and Mr. A. P. Trotter—visited Keighley on Thursday, last week, and inspected the railless trolley system which has been constructed by the Corporation. The route is from Ingrow tramway terminus through Cross Roads to Hebden Road, Haworth, and powers have been obtained to run through Oxenhope. The total length of the new section is 1 mile 1,400 yards. Messrs. Clough, Smith & Co., of London, under the direction of the Cedes Electric Traction Co., Ltd., have erected the overhead gear, and a "Cedes-Stoll" car was used for the inspection. The cars are to carry 28 passengers each.

**London.**—In connection with a recent Southwark inquest, attention was drawn to the convenience of the existing electric ambulance service, and the jury, in returning their verdict, unanimously expressed the opinion that electric ambulances should be provided throughout the metropolis, and requested that their views should be forwarded to the various authorities concerned.

**Manchester.**—The agitation for an all-night tramway service in Manchester has recently been revived, and last week a deputation representing various organisations affiliated with the Manchester Trades and Labour Council appeared before the Tramways Committee to urge the institution of an all-night service. The deputation also suggested that the time was ripe for the introduction of a system of halfpenny fares. The Committee is to give consideration to the questions raised by the deputation.

**Nelson.**—The report of the year's working of the electricity and tramways department shows that the income of the tramways is the largest so far attained, the total profit being £1,888, or £1,437 more than estimated. The through service of cars to Colne and Trawden has again proved beneficial, though an important defect is pointed out in there being only a single line. The laying of a double set of lines, the report adds, will need to be considered in the near future.

**Newcastle-on-Tyne.**—The new tramways routes from Jesmond Road to Chillingham Road and to the borough boundary at Benton, and also to Newburn, will be opened this month. A prov. order has been received for laying the new lines from Westgate Road to St. Nicholas Square and the High Level Bridge, the intention being to carry passengers from the end of the bridge to different parts of the city.

**Rawtenstall.**—At the T.C. on Thursday, Alderman Coupe (chairman of the Electricity and Tramways Committee) regretted that the tramways had made a loss on the year's working of £526, largely accounted for by the heavy cost of repairing the track, upon which £1,250 had been spent during the year. Traffic receipts had increased from £24,311 to £26,700. It was proposed to allocate £1,500 from the rates in aid of the tramways. The electricity department had had a successful year, the profit amounting to £2,642, against £2,358. The income was £10,494, or £1,368 in excess of the previous year. He said that, other tramways of about the same route mileage, the average journeys were 89, and the revenue 7s. 11d. In Rawtenstall, the figures were 156 and 16s. 7d. In earning capacity, however, Rawtenstall was practically the lowest, the average earnings on 33 similar-sized undertakings being £3,800 per route-mile per annum, whereas Rawtenstall's was only £2,100, while, in the larger towns, the average was £7,500 and the maximum £17,300. That meant that Rawtenstall had an insufficient population, even with the high earnings per head, to make the tramways pay their way. As to the electricity department, the capital expenditure at the electricity works per unit sold was one of the most favourable in the country. The generating costs were amongst the lowest in the country, and lower in many cases than in some of the very large towns.

At the same meeting of the T.C., the financial arrangement with Bacup Corporation in regard to the tramway was approved, and it was resolved that, in pursuance of the Rawtenstall Corporation Act of 1907, the sum of £30,742 be lent to the Bacup Corporation for tramway purposes at 3½ per cent. per annum.

**Salford.**—The B. of T. has appointed Mr. Robert Hammond referee to settle the price to be paid by the Corporation for electrical energy supplied by the Eccles Corporation in respect of a portion of the tramways.

**U.S.A.**—The company operating in Cleveland, Ohio, has found it necessary to introduce a variation of the P.A.Y.E. system on its cars. In the morning the entering cars, which pick up passengers along the route, are operated on the pay-as-you-enter plan. In the evening, however, with traffic conditions reversed, with a view to speeding up the loading of cars, a pay-as-you-leave arrangement is adopted, the passengers paying as they get off at different points on the route. Under these conditions it is stated that a car can be loaded with 100 people in 70 seconds.

The Brooklyn Rapid Transit Co. is now building 100 centre entrance cars of a similar type to the one introduced experimentally

last year, and referred to by us. The type is described as a double-ended straight-sided body with low-step passenger entrance, and two exits in the centre of the car, and arranged for collection of fares as the passengers enter. The doorway containing the entrance, and an exit on either side, is 6 ft. 6 in. wide, the sill being 14 in. above the rail; the car floor on either side of the entrance platform is 10 in. higher, and slopes upwards towards the ends. Two 10-H.P. motors are fitted, and the car seats 58 passengers.

## TELEGRAPH and TELEPHONE NOTES.

**A Large Telephone Cable.**—In his recent annual report, Mr. Theo. N. Vail, president of the American Telephone and Telegraph Co., referred to a new type of cable, providing 900 pairs (1,800 wires) in the space formerly required for 600 pairs. The conductors will be No. 22 B. & S. gauge; thickness of lead sheath, ½ in.; diameter overall, 2½ in.; approximate weight per ft., 9½ lb.—*T. and T. Age.*

**Imperial Wireless Service.**—On Wednesday last week the Select Committee on the Marconi contract continued the examination of Mr. Rose, solicitor to the Poulsen Co., who said that their object in fighting against the Marconi contract was to secure the opportunity of establishing a trans-Atlantic service. Major Archer-Shee, M.P., repeated his statement that he had never held any financial interest in the Poulsen Co., and denied that he had been concerned in any conspiracy to blacken the character of Ministers.

Mr. Granville, formerly nominal editor of the *Eye-Witness*, gave evidence regarding articles written for that paper by Mr. Cecil Chesterton, and said that the latter, with Mr. Belloc, had for motive an attack upon Jews, as Jews.

On the following day Mr. A. R. Orage, editor of the *New Age*, was examined, and afterwards Mr. Hilaire Belloc, who disclaimed any enmity towards Jews, but refused to answer questions regarding articles in the *Eye-Witness*.

Mr. A. A. Campbell Swinton was called, and said that in April, 1910, he made tests of the Poulsen system over a distance of nearly 1,000 miles, and reported thereon to Mr. Charles Kerr, as an absolutely independent expert. He had never had any shares in any wireless company. Up to the time of the disclosures in the *Matin* case he had not believed it possible that Ministers had dealt in Marconi shares of any description; he had thought they were all far too clever to do so foolish and dangerous a thing.

Mr. E. T. Powell, editor of the *Financial News*, was next examined, and stated that the City believed that a powerful syndicate, including people in high positions, was responsible for the whole of the Marconi operations. It was reported that an account at a bank was opened on behalf of the syndicate and reached about £70,000, but that a person attempted to withdraw the whole amount in small notes, as though desiring to conceal the dealings with the notes. A large business was done in English Marconi shares by way of Hamburg.

On Monday, when pressed by the Committee, Mr. Powell stated that he had heard the name of Mr. Winston Churchill mentioned in America as one of three Ministers who had dealt in the shares, but said he believed the rumour to be absolutely false. He had also heard, but had no evidence, that Mr. Godfrey Isaacs might have been responsible for starting the rumours with regard to Ministerial dealings.

Mr. Winston Churchill appeared before the Committee, and when asked whether he had had any dealings in Marconi shares, protested vehemently against the "very insulting charge," which implied that he had kept silence while his colleagues came forward and disclosed their position, and was supported by nothing but tittle-tattle. He had never had any interest in any telegraphic shares.

Mr. Powell's examination was concluded, and Mr. C. H. Palmer, acting editor of the *Financial Times*, was called.

The Committee adjourned until Wednesday.

Both in the Committee and in the House of Commons, a movement is on foot to bring the investigations of the Committee to an early end. Yesterday the report of the Technical Committee was to be presented.

**New Cable.**—The section of the Eastern Telegraph Co.'s new London—Hong-Kong cable between Penang and Colombo has been laid by the *c.a. Colonia*.

The Malta section to Alexandria has already been laid. The new cable will cost about £1,500,000, and will be the largest cable ever laid. It now takes about 2½ hours to transmit a 20-word message from Bombay to London, and a further hour or hour and a half for the message to be sent from Colombo to Bombay. By the new cable, on a message from Colombo to London, a saving of 3 hours and 50 minutes will be effected in transit, while on a message sent to Bombay there will be a saving of 2 hours and 20 minutes. This great saving of time is due to the fact that by the new system a message is mechanically transmitted from section to section of a cable and is not relayed by hand until it reaches its ultimate destination, thus avoiding or reducing to a minimum the chances of mutilation in retransmission. Under the present system a message has to be deciphered and retransmitted at Lisbon, Gibraltar, Malta, Alexandria, Aden and Bombay.—*T. and T. Age.*

**Post Office Progress.**—On Thursday last week Mr. Herbert Samuel, on the Post Office vote, referred to the reductions which had been effected in cable rates, including cheaper week-end telegrams at one-fourth the old rates, and cheap Press rates, which had resulted in an immense increase of cable traffic. The Pacific Cable Board reported that in three years the traffic had doubled. He regretted the delay in establishing a chain of Imperial wireless stations, due to the investigations of the Select Committee on the Marconi contract, but sites had been provisionally selected in England, Egypt, India and South Africa, and were being selected in East Africa and the Straits Settlements. The small coastal stations in this country showed an increase of traffic of 15 per cent., and new stations were being erected.

The department on taking over the National Telephone Co.'s undertaking found that heavy arrears of construction had accumulated, pending the transfer; in London, 30,000 subscribers had to be transferred to different exchanges, and there was great difficulty in securing a sufficient amount of skilled labour, while the stormy weather had caused almost unprecedented damage to overhead wires, calling off about 3,000 men who would otherwise have been employed in connecting up new telephone subscribers and developing the system. In London, since the transfer, the staff had been increased by 25 per cent., and the wages paid were 15 per cent. higher, on the average, than under the company. Complaints had been reduced by 50 per cent. compared with the early part of last year; 162,000 miles of additional wires had been laid down, and 20,000 new subscribers had been connected. In the whole country £1,000,000 had been spent on the improvement of the exchange system, apart from the trunk system, and a larger sum would be spent this year. Last year, 98 new exchanges were opened, and this year 220 more would be opened, several being on the automatic system. The trunk traffic showed an increase of 9 per cent., and the London trunk wires were being increased from 520 to 700. A new loaded telephone cable was being laid between England and Ireland; similar cables had been laid to France and Belgium, and the Continental traffic showed a very remarkable increase. The rates to France would be reduced 50 per cent. from July. Communication would be opened with Switzerland, and, if possible, with Germany. Rural party-lines were being taken up quickly; 1,000 subscribers were connected, and 500 were being connected. The telephone call offices in villages had been increased to 2,000. Nine local advisory committees had been formed, and 12 more were being formed. A Departmental Committee was dealing with the revision of rates of charge. Various reforms had been made in connection with the postal and telegraphic services. A tube railway would be constructed for Post Office purposes alone, six miles in length, from Paddington to Whitechapel, costing £1,000,000. The wages of the telephone operators and clerks had been raised, but the electrical staff had not benefited equally, and steps had been taken to remedy this grievance. In the whole country the Post Office employed 233,000 people.

**Submarine Bells.**—The North-German Lloyd have decided to equip their steamers with submarine bells of a similar type to those fitted to light ships.

**Telephone Progress in Europe.**—According to the *Revue Pratique de l'Electricité*, France stands much behind both Germany and England in the matter of telephone facilities. In Germany in November last there were about 1,200,000 telephone stations, that country occupying second rank among the nations of the world in this respect, but falling far behind the United States, which is easily first with 10,000,000 stations. France takes fifth rank only with 250,000, being behind Canada with 300,000, and England with about 700,000. The first automatic telephone network installed in Europe was set up at Hildesheim, in Hanover, in 1908, the old system of Ströwger being used. At the present time there are 12 networks in operation. The semi-automatic system is also employed, notably at Dresden, Leipzig and Posen. Fresh installations of both systems are under way, the German Postal Department being very favourably disposed towards them. In France the first trials of these systems are only now being made, the former system at Nice and Orleans and the latter at Marseilles and Angers. As regards the telephone charges, those ruling in Germany are very much lower than what are current in France. They are fixed, not according to population, but to the number of subscribers to a particular network. According to statistics compiled in July last, Berlin, with a little over 2,000,000 inhabitants, possesses 139,428 stations, whereas Paris with nearly 3,000,000 inhabitants has only about 95,000. The equipment installed, both public and private, is about the same in both countries, but the "money-in-the-slot" system is totally unknown in France. The charge in Germany is 0'10 mark (about 1d.), which compares with the 2d. exacted in this country. The use of the slot system is being extended in Germany as in this country, it being installed in hotels, restaurants, hairdressers' shops, &c., for the use of their customers.

**Time Service.**—The Post Office has issued particulars of the improved and extended time service which is now offered to the public. The Greenwich time signal will be transmitted once daily to master clocks at distributing centres, from which hourly signals will be transmitted to subscribers, who will provide their own wiring and clocks. The charge is £6 per annum for a single subscriber, £3 each to a pair of subscribers, and £2 each to three or more subscribers on one circuit within a radius of 2 miles from the distributing centre. Under the new system 20 circuits from the Central Telegraph Office suffice for the whole country, instead of 200 circuits formerly required.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—May 14th. Generating plant for Darwin Radiotelegraph Station, Northern Territory. See "Official Notices" April 11th.

**VICTORIA.**—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

May 16th.—One 15-ton overhead travelling crane, for the Melbourne City Council. See "Official Notices" to-day.

June 2nd.—20,000-volt H.T. switchgear and L.T. switchgear and accessories, for the Melbourne Suburban Railways. See "Official Notices" to-day.

June 11th.—Switchgear and instruments, for the Melbourne City Council. See "Official Notices" April 25th.

**TASMANIA.**—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

**QUEENSLAND.**—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" April 11th.

August 27th.—Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

**Austria.**—May 8th. The Austrian State Railway authorities at Tarnow are inviting tenders for an installation of electric lighting at the railway station at Tarnow.

**Barnes.**—May 19th. Feeder and distributor cables, for the U.D.C. See "Official Notices" April 25th.

**Barrow-in-Furness.**—May 7th. Electric light installation at the workhouse, for the B.G. See "Official Notices" April 25th.

**Belfast.**—May 19th. Circulating-water pump, for the Corporation Tramways and Electricity Committee. See "Official Notices" April 25th.

**Belgium.**—May 13th. The municipal authorities of Wekenraedt (province of Liège) are inviting tenders for the concession for the public and private electric lighting of the town.

**Bootle.**—May 13th. Boiler and pipe coverings for Marsh Lane electricity works. Borough Electrical Engineer's Office, Pine Grove.

**Canada.**—WINNIPEG.—May 15th. City Light and Power Department. Two three-phase generators of 5,000 kw. for direct connection to 6,800-H.P. water turbines; also spare parts. Chairman, Board of Control. Deposit, £205. Particulars, Board of Trade Com. Intel. Department in London.

**Cleckheaton.**—May 10th. Slack coal (1,500 tons) for the U.D.C. electricity works. Mr. J. B. Linfield, Clerk.

**Felixstowe and Walton.**—May 5th. One 150-kw. Diesel-driven d.c. generating set for the U.D.C. See "Official Notices" April 18th.

**France.**—The French State Railway authorities (Bureaux du Service Electrique, 4E, Rue de Rome), Paris, are at present inviting tenders for the supply of 15 electric capstans (continuous current) for the railway coal depot at Levallois and the goods station at Batignolles, Paris.

**Glasgow.**—May 9th. Cables, meters and arc lamp carbons for a year, for the Corporation. See "Official Notices" April 25th.

May 26th.—Two steam turbo-alternators, with condensing plant (5,000 kw. and 2,000 kw. respectively), for the Corporation Tramways Department. See "Official Notices" April 25th.

**Grimsby.**—Pipework, extension of Klein cooling towers, conduits, seven-way D.P. distribution board and motor-driven rotary air and water extraction pumps and circulating pump, for the Corporation. See "Official Notices" to-day.

**Hoylake and West Kirby.**—May 5th. One 400-kw. alternator and triple-expansion Belliss engine, and evaporative condensing plant, for the U.D.C. See "Official Notices" April 18th.

**Italy.**—May 13th. The Italian State Railway authorities in Rome are inviting tenders for two sets of engines and dynamos for the Rimini railway works. It is specifically stated that foreign firms may compete for the contract.

**King's Lynn.**—May 5th. One 400-kw. steam dynamo with condensing plant and pipework, for the Corporation. See "Official Notices" April 18th.

**London.**—May 7th and 9th. Electrical installations at (a) Elthorne Road Special School, Holloway, and (b) Wilton Road Central Elementary School, Hackney. See "Official Notices" April 25th.

May 13th.—One 20-ton overhead band crane, for the Shoreditch sub-station. See "Official Notices" April 25th.

The Highways Committee is to invite tenders from selected firms for two hydraulic accumulators and a pump for the third section of the central car repair depot.

**Manchester.**—May 8th. Steelwork for foundations of 15,000-kw. turbo-generator, engine house, floor extensions and air ducts and cast-iron floor plates. Forms of tender, &c., obtainable from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall, Manchester. Deposit £1 1s.

**Mexborough.**—May 30th. Lancashire boiler, for the U.D.C. electricity department. See "Official Notices" April 25th.

**Peterborough.**—May 6th. One 500-kw. D.C. steam turbine generating set and two steam boilers, for the Corporation. See "Official Notices" April 25th

**Plymouth.**—The T.C. has decided to invite tenders for a year's supply of coal for the electricity works. Particulars from the Electrical Engineer.

**Rathmines and Rathgar.**—May 19th: Electrically-driven jet condensing plant, for the U.D.C. See "Official Notices" to-day.

**Rochdale.**—May 14th. Electrically-driven induced-draught plant, for the Corporation electricity department. See "Official Notices" April 25th.

May 21st.—Boiler feed pumps, for the Corporation Electricity Committee. See "Official Notices" to-day.

**Rotherham.**—May 6th. Twelve 26-ft. lengths of British standard tram-rails, section No. 4, for the T.C. Mr. E. B. Martin, Borough Engineer.

**Salford.**—May 19th. Tenders invited for 10 car bodies and 10 Brill trucks. General Manager, 32, Blackfriars Street, Salford.

May 9th.—New switch house. Specifications, &c., obtainable from Borough Electrical Engineer, Electricity Works, Frederick Road, Pendleton.

**Sheffield.**—May 5th. Excavations, retaining walls and extension to water service reservoir at Neepend Power Station, including valves, pipework, &c., for the Corporation. See "Official Notices" April 18th.

**South Africa.**—*The African World* states that orders for electrical machinery and material will shortly be forthcoming at Wellington, and Umata and Cape Province, where the ratepayers have approved electric lighting schemes to cost £10,000 and £7,000 respectively.

**Spain.**—The Minister of Marine invites tenders from foreign manufacturers for two long-distance wireless telegraph installations which are required for the two cruisers *Extremadura* and *Ivo de la Plata*, as well as two wireless telegraph experimental stations for the Spanish "School of Application."—*Board of Trade Journal*.

**Walthamstow.**—May 28th. Natural draught cooling tower, for the U.D.C. Electricity Department. See "Official Notices" to-day.

**Warrington.**—May 13th. Traction battery and reversible booster, for the Corporation. See "Official Notices" April 25th.  
May 13th.—Feeder pillars and high and low-tension cables, for the Corporation. See "Official Notices" to-day.

### CLOSED.

**Australia.**—An Australian contemporary states that the municipal electric supply plant at Gawler (S. Australia) is to be added to shortly, Messrs. McLean & Co. having received a contract for a Gardner suction gas engine, Cambridge gas producer and a 65-kw. Sterling alternator, for £1,767.

**Bexhill-on-Sea.**—The T.C. has accepted the tender of Messrs. Crompton & Co., Ltd., for a new switchboard, at £329.

**Blyth (Northumberland).**—Messrs. Reside & Co., Ltd., Brighouse, have received the contract for the complete electrical installation at the new Government buildings.

**Canada.**—The directors of the Cedar Rapids Power Co., Montreal, have awarded the contract for the completion of the hydro-electric development works of the company to Fraser, Brace and Co., of New York. The price involved is \$3,000,000.

**Croydon.**—The T.C. has accepted the tender of Callender's Cable & Construction Co., Ltd., for cables for a year.

**Dewsbury.**—The tender of the Union Cable Co. for one mile of electric cable, for £158, has been accepted by the Corporation.

**Dover.**—Subject to the usual sanction, the T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., at £2,893, for the construction of tramways in connection with the proposed pier scheme.

**Heston and Isleworth.**—At the U.D.C. meeting last week, Mr. Shuff, on the presentation of the report of the Electricity Committee, directed attention to the fact that it recommended acceptance of the tender of the Union Cable Co. for cables, notwithstanding that the figures quoted by that firm were in the aggregate £400 in excess of those submitted by the Electrical Engineering and Equipment Co. Mr. D. Bonnett said the second firm named was a foreign firm, and its goods were manufactured abroad. The tender recommended was by an English firm, and it was considered better to give the contract at home, as the Council would then be able to exercise better control over the supply. Mr

Shuff pointed out that £400 was a considerable difference, and thought it did not matter whether the firm were English or foreign so long as it could be depended upon. Furthermore, it was due to the ratepayers that the lowest tender should be accepted, and he moved, as an amendment, that the Council accept the tender of the Electrical Engineering and Equipment Co. Mr. Bonnett said the Council should understand that the tender was at so much per mile, and the Committee did not know how much they would ultimately require. It would certainly be an advantage to have the work done in this country, as the chairman and engineer could test it readily. Mr. Meyers was of opinion that for the reasons stated it was better to place the contract with an English firm. He doubted whether in the end the difference would be more than £50. The amendment was lost by 12 votes to 4, and the tender of the Union Cable Co. was then accepted.

**Huddersfield.**—The Electricity Committee has accepted the following tenders:—

E. Green & Son.—Economiser.  
W. T. Henley's Co., Ltd.—Cable.  
A. Crowther.—Lead piping.

**India.**—The whole of the recent contract for supplying the silent chain drives required for the equipment of the new shops of the Bombay, Baroda and Central India Railway has been awarded to the Westinghouse Brake Co., Ltd., makers of the Westinghouse-Morse silent rocker-joint chains.

**London.**—STEPNEY.—The following tenders were received by the B.C. Electricity Committee for two 5,000-kw. turbo-alternators, with condensers, accessories and switchgear, for extensions at the Limehouse generating station. The various prices quoted by certain of the tenderers include turbines of their own manufacture coupled to various makes of condensing plants and alternators. (Alternative tenders not to specification are excluded.):—

Escher, Wyss & Co. (recommended).—At 1,500 r.p.m., £38,031.  
Dick, Kerr & Co., Ltd.—At 1,500 r.p.m., £41,215.  
Richardsons, Westgarth & Co., Ltd.—At 1,500 r.p.m., £41,223, £42,500, £43,208, £43,249, £43,937, £44,696, £45,345.  
Willans & Robinson, Ltd.—At 1,500 r.p.m., £41,089, £41,788, £42,590, £43,369, £43,580, £44,350, £46,910, £49,130; at 3,000 r.p.m., £43,670, £44,860.  
Belliss & Morcom, Ltd.—At 1,500 r.p.m., £43,195, £45,265, £46,573.  
Brush Electrical Engineering Co., Ltd.—At 3,000 r.p.m., £43,500.  
Howden, J. & Co., Ltd.—At 1,500 r.p.m., £41,665, £42,329, £43,749, £45,415, £45,679.  
Parsons, C. A. & Co., Ltd.—At 1,500 r.p.m., £45,591, £46,482, £46,643, £47,484; at 3,000 r.p.m., £41,495.  
British Westinghouse Elec. & Mfg. Co., Ltd.—At 1,500 r.p.m., £47,027.  
British Thomson-Houston Co., Ltd.—At 1,500 r.p.m., £47,750.  
Maschinenfabrik Oerlikon.—At 1,500 r.p.m., £50,091, £50,480.

The Committee recommends the acceptance of the tender of Messrs. Escher, Wyss & Co. at £38,031.

**L.C.C.**—The Highways Committee hopes to report on the tenders for two 8,000-kw. steam turbo-generators on May 6th.

The Stores and Contracts Committee has accepted the following tenders:—

Portland cement for the tramways department.—J. Byford & Son, Ltd. (£277), and the Empire Portland Cement Co., Ltd. (£5,070).  
Clean river ballast for tramways department.—W. Cory & Son, Ltd. (£760), H. Covington & Sons, Ltd. (£887), and T. Scholey & Co., Ltd. (£1,729).

**HOLBORN.**—The B.C. has accepted the tender of Messrs. Marryat and Place, at £77 10s., for installing electric light at the High Holborn public convenience, at present lighted by gas. Tenders were also received from Barlow Bros. & Co., H. J. Cash & Co., Ltd., Duncan, Watson & Co., Rashleigh, Phipps & Co., and James Willats and Son.

**Luton.**—The T.C. has accepted the tender of Messrs. Macintosh & Co., Ltd., for an annual supply of vulcanised bitumen insulated cables.

**Walthamstow.**—The U.D.C. has accepted the following tenders for annual supplies:—

Cables.—Union Cable Co., Ltd.  
India-rubber-covered wires.—Liverpool Electric Cable Co., Ltd.  
Box compound.—Dusseck Bitumen Co.  
Chatterton's compound.—Sun Electrical Co., Ltd.  
Pure rubber tape.—Wm. Geipel & Co.  
Compound and black adhesive and white linen tape.—Siemens Bros. & Co., Ltd.  
P. and B. tape and paint.—R. W. Blackwell & Co., Ltd.  
Lead sleeves for joints and leading sealing ends.—Callender's Cable Co., Ltd.  
Cut-outs and counterweight sets, opal shades, lead blocks and enamelled iron shades, key switchholders and opal shades, gear wheels and armature coils.—British Westinghouse Co., Ltd.  
Tinned copper fuse wire.—London Electric Wire Co. and Smiths, Ltd.  
Zinc rods, porous pots and glass jars.—G. Braulick.  
Dry cells and sal ammoniac.—Fryke & Palmer.  
Carbons for open arcs, 18 mm. and 12 mm., metal and non-metal-cored carbons.—Bran Electrical Co., Ltd., for Conrady carbons.  
Do., 13 mm. and 9 mm.—H. G. Mayer & Co., for Schiff & Co.'s carbons.  
Carbons for enclosed arcs.—H. G. Mayer & Co., for Schiff & Co.'s carbons; Siemens Bros. Dynamo Works, Ltd., for Siemens carbons.  
Ordinary meters, prepayment meters for pennies and shillings.—Chamberlain & Hookham, Ltd., and Ferranti, Ltd.  
Prepayment meters for sixpences.—Ferranti, Ltd.  
Hour meters.—Electrical Co., Ltd.  
Incandescent lamps.—Electrical Manufacturing and Supplies Co., Ltd.  
Pinion wheels, trolley beads, trolley head bushes and trolley globes.—J. W. Rowlands & Co.  
Trolley wheels and brass terminals.—The Anti-Friction Metal Co., Ltd.  
Rubber sleeves, galvanised span wire and controller fingers.—Imeson and Finch.  
Rubber cap and trolley booms.—Brecknell, Munro & Rogers, Ltd.  
Steel tires.—John Brown & Co., Ltd.  
Soldering fluid, china bridge fuses, steel conduit, brass arc lamp hooks, insulated hoses, steel conduit, &c., and staples, Sinclair insulators, chimney brackets, roof brackets and pole steps, incandescent lamps, phosphor-bronze.—General Electric Co., Ltd.  
Switches, ceiling roses, &c., dust shot, fuse wire, lead, bell wire.—Edison and Swan Co., Ltd.  
Braided silk and workshop tex, compound for glands, jointing material.—W. T. Henley's Telegraph Works Co., Ltd.

**Macclesfield.**—Messrs. Hick-Diesel Oil Engines, Ltd., have secured a contract from the New Electricity Co. of Macclesfield, Ltd., for two 210-h.p. Diesel engines.

**Sweden.**—In addition to three large hydraulic turbines supplied to the Trollhättan Works, recently described in our pages, Messrs. Boving & Co., Ltd., have received from the Swedish Government an order for three turbines for the new installation at Elfkärleby, which will ultimately have an output of more than 100,000 h.p. Each turbine will develop 15,000 h.p., with a head of 16 m., and will consist of two pairs of wheels on a common horizontal shaft, passing about 3,500 cu. ft. of water per second. The turbines, which will be by far the largest of this type built in Europe, will be constructed at the company's works at Kristinehamn.

**Tyldesley (Lanes.).**—The U.D.C. has accepted the tender of Messrs. Simplex Conduits, Ltd., for metallic-filament lamps for street lighting.

**Woolwich.**—The B.C. has accepted the tender of the General Electric Co., Ltd., at £5,351, for a 1,500-kw. turbo-alternator, complete with turbine by Willaas & Robinson, and condensing plant by the Rees Roturbo Co., Ltd. 18 tenders were received.

### FORTHCOMING EVENTS.

**Society of Engineers.**—Saturday, May 3rd. At 8 p.m. At the Holborn Restaurant. Bohemian concert.

**Salford Technical and Engineering Association.**—Saturday, May 3rd. Visit to the Economiser Works of Messrs. E. Green & Son, Ltd., Wakefield.

**Institution of Electrical Engineers (Newcastle Section).**—Monday, May 5th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Phase Advancing," by Dr. G. Kapp.

**(Students' Section).**—Wednesday, May 7th. At 7.45 p.m. At the Institution, Embankment, W.C. Annual general meeting.

**(Birmingham Section).**—Wednesday, May 7th. At the University, Birmingham. Annual general meeting.

**(Dublin Section).**—Thursday, May 8th. At 8 p.m. Meeting at the Royal College of Science, Dublin.

**Faraday Society.**—Wednesday, May 7th. At 8 p.m. At the Institution of Electrical Engineers. The following papers will be read:—"A Redetermination of the Elastic Modulus of Aluminium," by F. J. Brislee, D.Sc.; "The Density of Aluminium," by F. J. Brislee, D.Sc.; "On the Potential Due to Liquid Contact" (Part III), by A. C. Cumming, D.Sc., and Elizabeth Gilchrist, B.Sc.; "Note on the Electrolytic Determination of Copper in Solutions containing Nitric Acid," by Elizabeth Gilchrist, B.Sc., and A. C. Cumming, D.Sc.; "New Experiments on Colloids," by T. A. Coward; "Overvoltage," a communication from Prof. J. W. Richards.

**Concrete Institute.** Thursday, May 8th. At 7.30 p.m. At Denison House, 296, Vauxhall Bridge Road. Paper on "Stability of Brick Chimney-Shafts," by Mr. H. Cane.

**Royal Institution.**—Saturday, May 10th. At 3 p.m. Lecture on "Humphrey Internal-Combustion Pumps," by Mr. H. A. Humphrey. (Lecture I.)

**Physical Society.**—Friday, May 16th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Experiments to Detect Rays from Radium A," by Drs. W. Makower and S. Russ.

### THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week—

**Monday, May 5th.**—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 6th rate of E.P., and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.  
**Tuesday, May 6th.**—"B" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 6th rate of E.P., and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.  
**Wednesday, May 7th.**—All Companies. Annual musketry at Purfleet.  
**Thursday, May 8th.**—"C" Company. Drills, &c., as for May 5th.  
**Friday, May 9th.**—"D" Company. Drills, &c., as for May 5th.  
**Saturday, May 10th.**—Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.  
For Officer commanding L.E.E.

### NOTES.

The "Point Fives."—A meeting of the "Point Fives" was held at the Great Northern Hotel, Bradford, on Friday, April 18th. Mr. Thomas Roles in the chair. Messrs. W. G. Pickavance, of Wrexham (February, 1913, Norwich system, plus ½d.); Harold Gray, of Accrington (April, 1913, Norwich system, plus ½d.); and S. E. Fedden, of Sheffield (April, 1913, Norwich system, plus ½d.), were duly elected members of the Association. Mr. F. W. Parse, who is going to Carlisle, could not be formally elected, as he was not at the time of the meeting in charge of an undertaking conforming with the articles of association, but it was decided that he should be invited to attend the special meeting on May 23rd. Mr. Allen, of Carlisle, will cease to be an ordinary member when he takes over his duties at Wolverhampton, but he was unanimously elected an honorary member for 12 months, to give him time to introduce a 5d tariff in Wolverhampton.

The Chairman gave a valuable and interesting address, a report of which will be given later; this was followed by a long discussion, and arising therefrom, it was decided that a special meeting should be held at the Institution of Electrical Engineers on Friday, May 23rd, to consider the following matters:—(a) Standardisation as far as practicable of electric cookers; (b) Standardisation of the rateable value plus ½d. per unit tariff for domestic supplies.

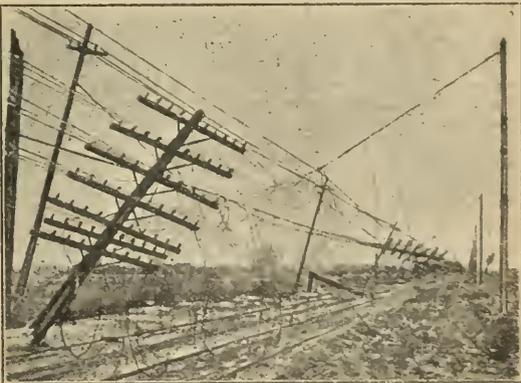
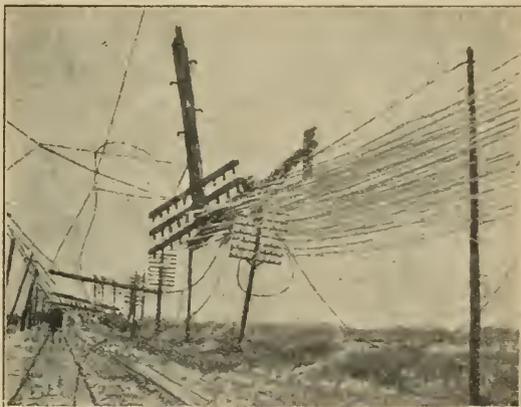
The next ordinary meeting will be held on Tuesday, June 17th,

in London, during the I.M.E.A. Convention week (Mr. Blackman, chairman). It was decided that this should be an open meeting, which anyone interested in the objects of the Association could attend. There will be the usual dinner at 7.30 (tickets 3s. 6d., morning dress), followed by the chairman's customary five minutes' address, and then a discussion. Messrs. Bowden, Blackman, and the hon. secretary, were appointed a Sub-Committee to make the necessary arrangements. All who wish to attend this meeting should send in their names to the Hon. Secretary, 19, York Place, Baker Street, London, W., as early as possible, and then the Sub-Committee will make further arrangements as to the place of meeting, &c.

With regard to electrical publicity, it was decided that owing to the moribund state of the Electric Supply Publicity Committee, the Association must, for the time being, make its own arrangements for its members' requirements, and a sketch by Messrs. J. Miles & Co., 68 70, Wardour Street, London, W., was approved, to be enlarged for poster purposes and reduced for postcards; 1,000 postcards are available and 10,000 postcards. The members of the Association are to have the first call on these quantities, but after that Messrs. Miles & Co. are entitled to dispose of any which are available to anyone who asks for them. The price of the posters is 28s. per 100, plus 7s. 6d. for over-printing name and address, and the postcards 16s. per 1,000; printing on reverse side extra. Applications to be sent to the hon. secretary, who will notify Messrs. Miles & Co. to complete the order.

Although no resolution was passed, it was felt strongly that this question of publicity was one which the electrical industry could not afford to neglect any longer, and a lead was looked for from the Industrial Committee of the Institution of Electrical Engineers as to what must be done in this direction.

**Storms and Telephones.**—An idea of the disastrous effects of the March storms in the United States on overhead lines may be gathered from the illustrations which we reproduce herewith from the *Telephone Engineer*—out of a large number of extraordinary views. In February the Chicago Telephone Co. and the Central Union Telephone Co. lost 2,500 poles in northern



Illinois, and the wires were coated with ice in some cases 2 in. thick, to say nothing of branches of trees. Just before Easter many of the lines that had been put right went down again, as the figures show. The lower view is of a "tangle of toll lines, trolley wires and electric light wires" in Chicago; the other illustrates the fantastic positions that may be assumed by broken poles, of which our contemporary gives many examples.

The *Electrical World* states that owing to the Ohio and Indiana floods about 100 miles of cable, 300 miles of wire and 2,000 men were used by the Western Union Telegraph Co. in making temporary repairs. It is estimated that the damage to the property of the Western Union Co. will amount to over \$250,000.

**Annual Dinner.**—BOURNEMOUTH.—Some 50 persons sat down at the Gervis Hall Restaurant, Bournemouth, on Monday last week, at the staff dinner of the Bournemouth and Poole Electric Supply Co., Ltd. Mr. A. H. Sanderson, chairman of the company, presided. Mr. W. D. Brightman, secretary of the company, proposed "The Directors," and the chairman replied. The dinner was cooked electrically, and Mr. Sanderson mentioned in the course of his remarks that they had cooked the dinner for 50 with only 24 units. A 16 lb. 6 oz. sirloin of beef weighed 13 lb. when cooked, and a saddle of mutton (14 lb.) weighed 11 lb. 3 oz.—showing surprisingly little loss. Dr. Hosker, a director, proposed "The Staff," and in doing so said that the joints if cooked by coal or gas would have lost 1 lb. more each, or speaking of cost, 1s. per joint. Mr. E. L. Ingram, the chief engineer, replied. He said that electric heating and cooking was going ahead by leaps and bounds, and like a rolling stone it was gathering force as it went. The other toasts were "The Guests," replied to by Mr. Crosbie (Ferranti, Ltd.), and the chairman.

**New Electric Restaurant.**—On Wednesday evening last, the Brompton and Kensington Electricity Supply Co. held a dinner at its new electric restaurant at 254, Earl's Court Road, S.W., to celebrate the inauguration of the latter. About 30 guests took part in the proceedings, which included the inspection of the equipment, which is designed to cook for from 150 to 200 diners at a time.

**Club Concert.**—The second annual Bohemian concert of the G.E.C. Athletic Club will be held to-morrow (Saturday) evening, at 7.30 p.m., at the Talbot Restaurant, London Wall. During the evening the Davis Challenge Cup, which has been won by the G.E.C. football club, will be presented.

**Institution and Lecture Notes.**—LONDON ASSOCIATION OF FOREMEN ENGINEERS.—On Saturday the Association held their sixtieth anniversary banquet at the Cannon Street Hotel. The company present numbered close upon 300, and among those supporting the Chairman, Mr. Alfred Herbert, were Sir H. F. Donaldson, Rt. Hon. C. Scott Dickson, Sir R. A. Hadfield, Prof. J. D. Cormack, and delegates from kindred associations in Leeds, Middlesbrough, Newcastle, Woolwich, Birmingham and Glasgow.

After the loyal toasts had been honoured, the Chairman, in proposing that of "Prosperity to the Association," remarked that it offered a great many advantages; the first of its objects was philanthropy; next, education by means of papers, discussions and visits; thirdly, the bringing together of men in fellowship and freedom of speech, and giving one the opportunity of learning another man's point of view.

Mr. J. Harrington, secretary, in responding to the toast, said they prided themselves on the fact that every member was a picked man: they had a splendid organisation, the resources of which were entirely at the disposal of engineering employers, for whose help they were deeply grateful. A list of donations to the super-annuation fund, amounting to over one hundred pounds, was read.

Mr. Eggleston, President of the Association, in proposing the toast of "The Chairman," mentioned that 20 years ago the firm of which the chairman was the head employed only 20 men—now it numbered considerably over 2,000.

The toast of "The President" brought a very successful evening to a close.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS.**—The last meeting of the Yorkshire Branch was held at Sheffield on Saturday last. A paper on "Cable Jointing and Junction Boxes, &c." by Mr. C. Jones, was read. The paper stated that cable manufacture had been brought to a great pitch of perfection, and faults with the cables owing to inherent defects were few. A successful cable system depended upon the quality of the cable joints and the manner in which the cable ends terminated and were sealed. The following were elected to office for the ensuing year: President, Mr. H. H. Jenkins (Sheffield); vice-presidents, Messrs. F. E. Armstrong (Sheffield), D. Bowen (Leeds) and W. Maurice (Sheffield); secretary, Mr. J. A. McLay (Leeds).

The monthly meeting of the EAST OF SCOTLAND BRANCH was held on Friday last at Dunfermline. Mr. J. McCann, Carronhall Colliery, submitted a paper on "The Installation and Manipulation of Coal Cutters."

On April 12th Mr. H. Painter, B.Sc., F.C.S., lectured before the BOURNEMOUTH NATURAL SCIENCE SOCIETY on "The Life and Work of Lord Kelvin."

**The B.E.A.M.A.**—We are informed that the following firms have recently become members of the Association:—

Alley & MacLellan, Ltd.  
Peter Brotherhood, Ltd.  
Dowsing Radiant Heat Co., Ltd.  
Electrical Apparatus Co., Ltd.  
George Ellison.  
J. H. Holmes & Co.  
Premier Accumulator Co., Ltd.  
Wandsworth Electrical Manufacturing Co., Ltd.  
Whipp & Bourne.

The firm of Jaeger Brothers has become an associate member.

**Village Lighting.**—A correspondent informs us that in a Yorkshire village some of the residents have been experimenting with low-voltage electric lamps fed from Leclanché cells, with which 3 or 4 C.P. can be obtained—not a bad substitute for a small oil lamp in a small room. The eagerness of the people to get rid of the nuisance of oil lamps may be inferred from the fact that one of them said he would willingly spend £25 to obtain electric light. It may be that, with metallic-filament lamps, electric lighting

with primary batteries in a small way can be accomplished without inordinate expense, although the Leclanché battery is not suitable for the purpose; but it will only mean exchanging one mess for another. The incident, however, emphasises the fact—which has been well shown in our columns—that there is a real demand for electric light in villages.

**Appointments Vacant.**—The I.C.C. Highways Committee proposes to appoint a superintendent of the central cable repair depot of the tramway department on the permanent staff at £300 per annum. The present superintendent, a member of the temporary staff, has resigned. Assistant electrical engineer (first grade) for the Electric Light Department, Lagos, Southern Nigeria (£350); assistant mains engineer, for the Dover Corporation (£100). See our advertisement pages in this issue.

**A Large Order for Electrical Motor Vehicles.**—The General Electric Co., of Schenectady, U.S.A., has secured an order for 29 commercial electric motor vehicles from the New York Railways Co. The machines range in capacity from 10 cwt. to 5 tons.

**Inquiries.**—The makers of the Britelite lamp, and also of corrugated steel transformer cases, electrically welded, are asked for.

**Fatalities.**—HEBBURN.—The inquiry into the explosion at Hebburn-on-Tyne on March 30th, by which Annie Gray, 66, and George Alexander Collinson, 43, were killed in a house in Lyon Street, was resumed by Deputy-Coroner R. A. Shepherd, on April 24th. The inquest had been adjourned to permit of an investigation of the condition of the electric cable which had been laid in front of the house, and a section of the cable, lying in a charred wooden trough, was placed before the jury.

W. T. Newlands, agent for the owner of the house, stated that immediately after the explosion he went to the house, and noticed a blue flame burning underneath the window. He endeavoured to extinguish it by means of water, but could not, but succeeded by putting wet lime on it. On the same afternoon he saw a man employed by the Northern Counties Electricity Supply Co. trying to light lamps in the neighbourhood, but they would not light. On the following morning he returned to the house and experienced a smell as of burnt india-rubber and pitch. This he smelt again, but more strongly, when the cable was taken out.

H. Paterson, surveyor to the Hebburn Urban Council, said that as the wrecked houses were dangerous, he ordered them to be pulled down. When he saw the result of the explosion he concluded that it had been underneath the ground floor. He could find no trace of coal gas, but he found a smell that he recognised when the cable was taken out. When the cable was exposed it was found to have been fused, and part of the cable was burned out; the wooden trough was charred.

W. Bates, an electrical engineer of Ashington, who was employed by the Northern Counties Co. when the cables were laid in 1902, said the contract was carried out by Callender's Cable Co. The cables were generally laid near the house walls. In answer to the Deputy Coroner, witness said he thought when the cables were laid, and before they were completely covered with bitumen, they were strained so that one lay on top of the other, instead of side by side, and they were consequently too near the surface.

C. Vernier, mains engineer of the Newcastle-on-Tyne Electric Supply Co., said he had carried out work valued at over a million pounds, and had had 13 years' experience of cable laying. The negative cable in question had fused for about 6 ft., and the neutral cable for a small space. The cable had probably been pulled tight enough to bear on the sharp edge of the mitted joint in the troughing. In an examination of the cable in question, he saw indications of the bitumen being charred at a very high temperature. He did not think that the bitumen gas given off would cause an explosion merely through contact with the air. It was somewhat difficult to account for the igniting of the gas. It could hardly have been fired by the arc, because, in that event, the explosion would have occurred outside the house too. It was possible, as an explanation, that the fumes given off by the burning bitumen would, in the very high temperature that would be set up, ignite and cause the explosion. He would be surprised to know that the quantity of bitumen charred would give off sufficient gas to cause so violent an explosion. The copper had been vaporised, and very little could be found. From the facts before him, he could not find any explanation but that the explosion was due to the fusion of the cable. In reply to questions, witness said that, if the cables had been laid in the middle of the road, there would not have been the same likelihood of an explosion, but similar explosions might occur where they had the same chain of circumstances. The company were considering the question of the position of the cables.

The jury returned a verdict that the deceased met their deaths as the result of injuries received in an explosion of bitumen gas generated by the fusing of an electric cable.

The force of the explosion was so great, that Mrs. Gray and Collinson were blown through the ceiling of the latter's house into the house above.

**Association of Electrical Station Engineers.**—An open general meeting was held at Salisbury House, London, E.C., on April 24th, to receive the hon. secretary's report of progress and for organising purposes. About 80 gentlemen attended.

The chairman (Mr. Chas. F. Wade) opened the meeting with a short statement of the aims and objects of the A.E.S.E. for the benefit of those who had not attended previous meetings. The hon. secretary (Mr. W. J. Ebben) then gave an account of the history of the Association from its inauguration in the columns of the ELECTRICAL REVIEW to the present date. He stated that although the Asso-

clation was only formed in London during January this year, already successful branches had been formed at Dublin, Manchester, Bradford, Grimsby, Birmingham, Liverpool and Glasgow, and there was every prospect of a branch being formed at Middlesbrough during the coming month. Branches had not yet been formed for the Newcastle-on-Tyne and South Wales districts, although there were enough members in these districts to form successful branches, as up to the present no one had been found willing to undertake the position of local secretary. Some difficulty had been experienced owing to electrical stations being so scattered, but it was pleasing to note, though engineers of a good number of outlying stations could not attend meetings at the various centres they were quite willing to join the Association, and in the majority of cases the whole of the technical staff had made application for membership. All applications for membership were being dealt with as quickly as possible, in the first place by local committees and finally by the London Committee. He also stated that a sub-committee had been appointed to make a rough draft of rules, &c., which were to be submitted to the branches for approval and finally ratified at a conference of delegates representing the whole of the United Kingdom. This conference was to meet as soon as practicable.

After a short discussion on the secretary's report, the question of a decided policy for the Association, to be embodied in the rules, was raised, which produced a very lively and lengthy discussion, and it was resolved that, owing to the importance of this question, it should be further discussed at the next general meeting. All those present who were not already members put down their names as prospective members, and from statements made by several gentlemen present, a great influx of members is to be expected at once in the London Section.

A vote of thanks was given to the hon. secretary for his "spade work" on behalf of the A.E.S.E., and Mr. Ebben, in reply, stated that he hoped all present would endeavour to obtain members, as numerical strength was of the utmost importance. The next open general meeting was arranged for Thursday, May 22nd, at the same time and place as above.

A meeting was held at the Y.M.C.A., Glasgow, on April 23rd, to continue the organisation of the Glasgow and West of Scotland Branch. The routine business of the Branch having been transacted, future arrangements were discussed, and it was resolved that another meeting be called as soon as the date of the London Conference is fixed, when representatives will be appointed to attend. It was also resolved that all other meetings should be of a social character. Mr. A. W. Lamont, 52, Quarry Street, Hamilton, is the hon. sec. for the Glasgow Branch.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The Birkenhead Corporation Electricity Committee has resolved to recommend the appointment of Mr. G. P. SHALLCROSS as electrical engineer at a salary of £400 per annum, in succession to Mr. Wm. Wyld.

In consequence of his appointment as city electrical engineer at Carlisle, Mr. F. W. PURSE has handed in his resignation as chief electrical engineer to the Watford undertaking, and it will take effect as from May 31st. To fill his place, the Committee has appointed Mr. A. W. BARHAM, at present chief assistant, at £250 per annum. Mr. Barham has been granted the same privileges as were allowed to Mr. Purse in connection with pupils and free supply of electricity. Applications are invited to fill the position of chief assistant.

Mr. H. F. STREET, general manager of the tramways undertaking at Southampton, has resigned this position owing to the enormous increase in his dual work, and he is from October 1st next to devote the whole of his time to the electricity undertaking, his salary to remain at £600 a year.

Mr. W. T. GREEN has been recommended for appointment to the position of assistant manager of the Leeds electrical department in succession to Mr. Chas. N. Hefford, who has been appointed manager. Mr. Green has been chief clerk of the department. The salary connected with this position is £450.

Mr. HUGH H. McLEOD, engineer to the Mountain Ash Electricity Works, has resigned.

The Whitby U.D.C. Electricity Committee has recommended the appointment of Mr. J. W. PIGGOTT to take charge of the Electricity Works. Mr. Piggott is at present the mains superintendent, and his promotion is consequent on the resignation of Mr. L. H. King from the position of manager.

Mr. FRANK TIMMS, late of Messrs. Armstrong, Whitworth and Co., Ltd., has been appointed to the position of installation engineer and canvasser, under the Tynemouth Corporation Electricity Department.

Mr. C. A. NICKSON, of Manchester, has been appointed clerk of works in connection with the proposed new generating station at Bolton.

The Nelson Corporation has appointed Mr. G. F. TAYLOR as electrical engineer and tramways manager, in succession to the late Mr. Dacre Helme. Mr. Taylor, who went to Nelson in 1901, was assistant to Mr. Helme.

**Tramway Officials.**—The members of the electrical and tramways department, East London, South Africa, met in the Club Room on the evening of March 28th, to wish farewell to Mr

H. D. DOUGLAS, rolling stock and permanent way superintendent, on his leaving the department for Melbourne, Australia. Mr. J. Mordy Lambe, town electrical engineer and tramways manager, presided. Mr. Lambe referred to the work of Mr. Douglas, especially the laying of new tramway tracks. He stated that Mr. Douglas was the first to build a tramcar in South Africa. On behalf of the combined department, Mr. Lambe presented Mr. Douglas with a gold Albert and a medallion suitably inscribed. Before the concert the Kafir boys of the car-shed presented Mr. Douglas with a silver-mounted pipe.

The Glasgow T.C. at its next meeting is to be asked to approve of the following increases of salaries of head officials in the tramways department:—MR. JAMES DALRYMPLE, general manager, £1,000 to £1,250; MR. L. MACKENNON, traffic superintendent, £600 to £625; MR. JOHN FERGUSON, chief engineer, £600 to £625; MR. E. T. GOSLIN, electrical engineer, £550 to £600; and MR. J. K. WILSON, secretary and treasurer, £400 to £450.

Mr. H. B. HARRIS, engineer in the Croydon Corporation tramways department, has resigned.

Mr. J. FREDERIC JONES, M.I.E.E., joint manager of the Madras electric tramways, has been granted six months' leave of absence, and expects to arrive in London about May 26th.

**General.**—MR. GEO. B. CROCKATT and MR. G. H. M. FOWLER have left the Reason Manufacturing Co., Ltd., of Brighton, with whom they have been associated for many years in the respective capacities of sales manager and works manager.

Mr. CLAUDE W. HILL has removed to St. Augustine's Mansions, Vincent Square, Westminster, S.W.

It is announced that the RIGHT HON. C. B. STUART WORTLEY, K.C., M.P., has been appointed chairman of the board of the London and Suburban Traction Co., Ltd.

The *Times* contains the following announcement:—"The marriage arranged between Gundred Eleanor, only daughter of Alexander Pelham Trotter, and HORACE COURTHOPE BECK, youngest son of the late Joseph Beck, will take place on Friday, May 30th."

At Addiscombe, Cheshire, on April 21st, the marriage took place of MR. LEES CALVERT, A.M.I.E.E., and Miss Grace L. Heather, youngest daughter of Mr. Henry Heather, of Reigate.

MR. ROBERT MAULE is retiring from the directorate of the Edinburgh and District Tramway Co., after serving over 10 years.

**Obituary.**—FRANCIS B. BADT.—We regret to learn from the pages of the *American Electrical Review* that Mr. F. B. Badt died at Chicago on April 12th. Mr. Badt went to America in 1881—ten years previously he served in the Franco-Prussian War, and was decorated by the Emperor. His career in the States began with the U.S. Electric Lighting Co. of New York, and later he entered the service of the Western Electric Co., the United Edison Manufacturing Co., the Thomson-Houston Co. and the General Electric Co., and in 1894 he took up the post of general manager of the Siemens & Halske Electric Co. of America. Three years later he started an engineering business of his own. An inventor of many devices, and an expert in patent cases, he was also a frequent writer for the technical Press and the author of a series of handbooks, some of which had a considerable sale on this side of the Atlantic. Mr. Badt was 64 years of age. The editors of this journal keenly feel the loss of one whom they were privileged to count among their personal friends.

MR. JULIUS ZIMMERMANN.—The death took place, under tragic circumstances, on Thursday, April 24th, of Mr. Julius Zimmermann, for 20 years director of G. Straus & Co., Ltd., of 211, Upper Thames Street, E.C. The business is being carried on as heretofore under the sole management of Mr. Charles Frank, who, since the start of the company, has had the charge of the electrical department.

MR. W. S. LEECE.—The death took place on April 24th, of Mr. Wm. Samuel Leece, traffic manager of the tramways at Douglas, Isle of Man. He was 44 years of age.

MR. A. DANSON.—The death is announced of Mr. Alfred Danson, who had for some time held a responsible position in the Birkenhead Corporation Electricity Department.

MR. JOHN TROTTER.—We regret to record the death, at the age of 59 years, of Mr. John Trotter, who had been chairman of Crompton & Co., Ltd., for a good many years. The deceased gentleman was a deputy governor of the Union of London and Smiths Bank.

MR. T. JAMES.—The death occurred last week of Mr. Thos. James, who had for some years been in business as an electrician in Oak Street, Llangollen. He was only 35 years of age.

The friends of Mr. W. EVERETT GIBSON (of Dick, Kerr & Co., Ltd.) will regret to learn that his wife passed away on April 25th. Mr. Gibson may be assured of their and our sincere sympathy in his bereavement.

## CITY NOTES.

### Calcutta Tramways Co., Ltd.

The ordinary general meeting of the shareholders of the above company was held on Thursday last week at 1, Queen Victoria Street, E.C., Mr. E. C. Morgan presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 695), said that referring first to the capital account they would see that there had been added the sum of £66 for ground, representing the deposit paid on the purchase of a small freehold plot of land at Shambazar, for the purpose of providing a turning loop to facilitate working, and £3,719, the cost

of a new high-tension cable, to meet the demands of the increasing traffic. These two items, aggregating £3,785, brought up the amount over-spent on this account to £41,398. With regard to the revenue, another record had been made in traffic receipts, the increase over last year amounting to nearly £15,000. Although the Royal visit was responsible for some of this, it was to the steady growth and expansion of the business, following on the increasing popularity of the service, that they mainly attributed the result. The largest proportion of the aggregate increase in expenditure was under the power expenses, due to outlay under various heads, and including the cost of a thorough overhaul of the whole plant. Included also under this heading was the cost of the removal from Howrah, and the installation at Nonapokur, of their largest Diesel engine, which was not required at Howrah, and which was of considerable service to them in reinforcing their Calcutta plant. In addition to the amount expended in thoroughly overhauling the power house plant, the whole of which had been charged against revenue, certain expenditure had been incurred in additional plant for the purpose of adding to the general efficiency of the plant as a whole. This additional cost had been written off against the reserve account, to strengthen which an extra £5,000 had been set aside this year, making the total contribution £15,000. One of the beneficial effects of this expenditure would be seen in the substantial decrease in the fuel costs. The small increase in traffic expenses was, of course, owing to the increased mileage run, whilst the increase under maintenance and repairs was principally due to the provision of a new cross-over road, in the erection of a public shelter at esplanade, store buildings, &c., and of additional flat wagons, and a motor-car. The result, after debiting fixed charges, was an available balance of £54,028, which the directors were proposing to deal with, by the payment of a final dividend at the rate of 10 per cent. per annum, making 7½ per cent. for the year, placing £15,000 to reserve, and carrying forward £4,626. The Calcutta Improvement Trust was still considering various schemes for the general improvement of the city, but they understood that no definite work had yet been decided upon. The directors, at the request of the staff, had agreed to the establishment of a provident fund upon the basis of the company contributing an amount in proportion to the contributions of the employees. The directors felt sure that the shareholders would agree with them in thus bearing testimony in a tangible form to the good work of their very able managers and staff, which had produced such excellent results and conducted to the friendly relations which now existed between themselves and the Calcutta authorities. With the system in first class order, and a capable organisation maintaining a thoroughly efficient service, they looked forward with every confidence to the continued prosperity of the company.

SIR HENRY KIMBER, B.E., M.P., seconded the motion.

Replying to a SHAREHOLDER, the CHAIRMAN said he was not a prophet, and he could not say whether the increased dividend would be permanently paid. He could say, however, that the line was steadily progressing, and that last year's results were not of the nature of a "sprt."

The report was adopted.

### National Telephone Co., Ltd. (in liquidation).

The report of the Liquidator to the shareholders of his acts and dealings, and of the conduct of the winding-up, for the period from January 26th, 1912, to January 25th, 1913, states that the winding-up resolution became effective on January 25th, 1912. At midnight on December 31st, 1911, the property, &c., of the company sold to the Postmaster-General had been handed over to him, upon terms providing (*inter alia*) for payment of interest on the amount of purchase money from time to time unpaid at the rate of 3 per cent. per annum, until June 30th, 1912, and thereafter at the rate of 5 per cent. per annum. The most important work in the liquidation has been the preparation of the company's claim against the Postmaster-General, and its proper presentation before the Railway and Canal Commission. On February 9th, 1912, the company made formal application to the Court to settle and determine the amount of the purchase money. On June 10th, 1912, the hearing commenced, and it continued for 72 days, concluding on December 12th, 1912.

It was agreed that in the first instance the evidence should be directed solely to the value of the company's plant, which formed the chief part of the items composing the claim. During the progress of the case, and in response to intimations from the Court, it became necessary to endeavour to agree—

(a) The basis costs of the labour, material and freight in respect of plant, without regard to other necessary charges more or less founded upon them. These costs were ultimately agreed at £20,430,345.

(b) The value to be allowed for lands and buildings and all other items (except plants) included in the claim. This was agreed at £2,055,468.

There was then left to the Commission to determine what were the proper additional charges to be allowed to the company incident to the construction of its plant, and what sum should be deducted for depreciation.

On January 13th, 1913, the majority of the Commissioners awarded the company the net sum of £12,515,264 and costs. One of the Commissioners was of opinion that this sum should be reduced by £247,189, the amount allowed by his colleagues for the cost of raising capital.

On February 3rd, 1913, the Postmaster-General gave notice of his intention to appeal against so much of the judgment of the Commission as awarded to the company £247,189 for the cost of raising capital and £150,000 for the cost of obtaining subscribers' agreements. A cross notice of appeal by the company has since been served upon the Postmaster-General. The appeal and cross appeal have not yet been heard, and await the decision of the House of Lords upon a preliminary question raised by the company whether or not the judgment is subject to appeal.

Of the total amount awarded, viz., £12,515,264, the following payments have been made by the Postmaster-General, together with certain sums representing interest:—

January 29th, 1912, cash	£3,000,000
July 29th, 1912, 3 per cent. Exchequer bonds	4,000,000
February 7th, 1913	3,000,000
	£10,000,000
Leaving a balance of	£2,515,264

From the payments received from the Postmaster-General, and from the company's assets, the liquidator has been enabled to pay off the amounts due to the holders of debenture stocks and the nominal amounts of the capital to the holders of the first, second and third preference shares. There has also been paid the nominal amount of the capital to the holders of the preferred stock, together with a premium of 5 per cent. payable under the special resolutions creating such stock. As against the balance of £2,515,264 still unpaid, the Postmaster-General claims to be entitled to set off the rentals for unexpired terms and other sums due from the company, amounting in the aggregate to a sum of upwards of £1,700,000. Cross accounts between the Postmaster-General and the company are now the subject of careful investigation. A number of statements are annexed to the liquidator's report, one of these (f) the statement of affairs as at January 25th, 1913, being given below:—

### STATEMENT OF AFFAIRS, JANUARY 25TH, 1913.

LIABILITIES.	
Sundry creditors, including Postmaster-General...	£1,748,049
Provision for loss on realisation of Exchequer bonds	350,000
Deferred stock	3,725,000
Estimated surplus—	
As per realisation account	137,470
	£5,960,519
ASSETS.	
Postmaster-General—	
Balance of purchase money	£5,515,264
Postmaster-General—	
Estimated balance of interest on purchase money	226,381
Estimated value of other assets	2,000
Accrued interest on bankers' deposits	235
Balances at bankers to meet unrepresented warrants	8,709
Cash in hand and on deposit with bankers	207,929
	£5,960,519

In order to determine the rights of the various classes of stock and shareholders, proceedings have been taken at the expense of the company before Mr. Justice Swinfen Eady, but no final decision has yet been given. With the sanction of Mr. Justice Swinfen Eady a payment to holders of deferred stock, equal to 15s. in the £ of their respective holdings, has been made.

No provision is included in this statement of affairs for further costs incident to the appeal, for other proceedings now pending, and for the winding-up of the company, but it is anticipated that these will be met by the taxed costs to be paid by the Postmaster-General under the order of the Railway and Canal Commission.

### Oldham, Ashton and Hyde Electric Tramways, Ltd.

THE annual meeting was held on April 23rd, at Electrical Federation Offices, Kingsway, W.C., Mr. Emile Garcke presiding.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 696), the CHAIRMAN said that the past year had been the best that the company had ever had. The traffic receipts which amounted to £33,375, exceeded those of 1911 by £1,900, and those of 1907, which was the best previous year by £600. Practically in every respect the position showed improvement. The number of passengers carried—six million, compared with 5,700,000; the average receipts per passenger were 1'32d., as against 1'31d.; the average expenditure per passenger was '84d., compared with '88d., and the proportion of expenses to receipts had been reduced from 67 per cent. to 63 per cent. The cause of that general improvement was the prosperous condition of the various trades throughout the district. They had also benefited by other people's misfortunes. The curtailment of the local train services during the coal strike caused a large number of people to travel by the tramways. As far as it was possible to forecast the outlook for 1913, if they might take the opening months of the year as a criterion, it was hopeful, and they looked forward to at least as good results as for 1912. Out of the larger profit they had placed £4,000 to provision for renewals account, as against £2,000 last year. An interesting feature in the balance-sheet was the fact that the capital subscribed, together with the reserve fund, now equalled the capital expenditure. The life of the track, in the opinion of the company's engineer, had been greatly improved and lengthened by the work which had been carried out by means of the Woods-Gilbert rail planer. By the use of that apparatus they would be able to get several years' further life out of the rails, and thus postpone capital expenditure for renewal.

MR. J. VINCENT KITCHENER seconded the motion, and the report was adopted.

### Rangoon Electric Tramway and Supply Co., Ltd.—

For 1912, a dividend of 5 per cent. is to be paid on the ordinary shares, £751 being carried forward.

### Direct United States Cable Co., Ltd.

THE meeting of this company was held at Winchester House, E.C., on Tuesday. Mr. C. E. Gunther presided, and before moving the adoption of the report, he alluded in suitable terms to the sudden and quite unexpected death of their late chairman, Mr. E. M. Underdown. Up to the end Mr. Underdown was engaged upon the affairs of the company, as only two days previously he had accompanied their secretary down the Thames to inspect the ship that was leaving to repair their main cable. His death came as a great blow to his colleagues on the board. He was associated with that company almost from its inception. He joined the board on the reconstruction of the company in 1877, and had been chairman since 1896. Probably there was no man who had a more complete knowledge of the problems affecting the handling and working of cables than Mr. Underdown possessed, and his great experience in that direction, and in legal and commercial matters, had been of the utmost value to the company at all times, and in particular was it of the greatest assistance when the difficult and protracted negotiations were in progress with the Western Union Telegraph Co. two years ago, which resulted in the lease that was now in existence. He went on to express sincere sympathy with the family in their great bereavement.

Continuing, the CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 691), said that dealing first with the revenue account, they would see that they had received the rent provided for under their lease with the Western Union Co.; and, in addition, they received income from their investments amounting to £19,453. That provided for a dividend at the rate of 4 per cent. for the year and writing off £10,000 as a further provision on account of market depreciation of investments, which had been rendered necessary on account of the great fall in the prices of the better class securities. The balance of revenue was transferred to the reserve fund as usual, viz., £20,104. They might remember that when they met last year their main cable was interrupted, and it cost nearly £40,000 to complete that repair. The total expenditure in connection with the maintenance of cables for the year amounted to £42,240, to meet which they had had to draw upon their reserve fund. He regretted also to have to inform them that the main cable was again interrupted, and they were faced with an expenditure that might, and probably would, exceed the cost that they had to meet last year for maintenance, and as this would very seriously deplete the amount of the reserve fund, the board felt that it was in the best interests of the shareholders that they should on that occasion not pay any bonus in addition to the dividend of 4 per cent. The only item he need refer to in the balance-sheet was that of cable on hand, which amounted to £72,489, which was very much in excess of the amount usually appearing under this head. It was due to the fact that they had had to manufacture a length of 500 miles of new cable, which possibly, though they hoped it would not be so, would have to be inserted in connection with the repair upon which they were now engaged. He might say, with regard to these interruptions, that never before in the history of the company had two deep-sea interruptions in the main cable taken place so close together as these two, and they trusted that it would be many years before they were called upon to meet such heavy expenditure again. The fact, however, that these interruptions did occur, and the knowledge that their repair called for the expenditure of such large sums of money, rendered it imperative that the reserve fund should be kept at as high a figure as possible.

MR. JOHN VABLEY seconded the motion, which was unanimously adopted, no questions being asked.

### Indo-European Telegraph Co., Ltd.

THE meeting of this company was held at the offices, 18, Old Broad Street, E.C., on Tuesday, Mr. J. H. Tritton presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 695), said he turned naturally to the question which had been occupying their close attention now for some time, viz., that of a considerable addition to their capacity for carrying traffic. This addition was more than ever necessary. Traffic tended to increase, and, moreover, was carried year by year at increasing speed. This was partly due to the demands of the senders, and partly to the improvements constantly being made in telegraph apparatus. There was, however, in spite of the vigilant supervision of their lines, no corresponding means of overcoming the constantly-present danger of interruptions, which, however short they might be, had a serious effect on their traffic whilst they continued. The object of the directors had been to add one complete wire throughout the system, and he was glad to say that the arrangements for this addition were very nearly complete. The British and German Governments had agreed to lay a new cable across the North Sea, and this, when accomplished, would set free a conductor in one of the existing cables for the use of the company. They would then have three wires, one in each of three cables, separated by considerable distances, and it was most unlikely that they would then be subject to a total interruption caused by all cables being disabled at the same time. As negotiations for the concurrent extensions of their working agreement with the Postmaster-General, and of their concession from the Imperial German Government, were still pending, it was not advisable to make any definite announcement at present. With a natural desire to simultaneously obtain extensions of all their concessions, application was also made to the Russian Government. Having regard, however, to the fact that their present Russian concession still had some 12 years to run, they received the perfectly reasonable and not

unexpected reply, that it was too early as yet to take the matter into definite consideration. He wished to make it perfectly clear that whatever extensions they might or might not obtain, their concessions were secure in any case to 1925, and, further, nothing stood in the way of the achievement of their immediate object viz., the addition of a wire to their system from London right through to Teheran. If, as they hoped, the new North Sea cable was laid within a few months the other sections of the new wire would be ready to be linked up with it. Turning to traffic results, their main traffic, viz., that with India, showed a steady and gratifying increase, and there had naturally been an abnormally heavy Turkish traffic. The other traffics were well maintained. Deferred telegrams as a class also showed a considerable increase, and appeared adequately to fulfil the purpose for which they were introduced. Traffic prospects for the year 1913 were also fairly good, but he must again sound a warning note. The company had heavy fixed charges in respect of outpayments to its concessionary Governments—fixed charges because a reduction of tariff did not necessarily mean that their outpayments would be reduced in proportion. He thought that in the near future the directors would have to face further reductions. He must remind them that telegraph companies were more subject to criticism, perhaps, than any other public concern, and, provided that they were in a prosperous condition, the public thought they had a right to insist upon lower rates. That company had shown in the past its readiness to meet legitimate demands for reductions, and they were ready to do so in the future, provided they were not jeopardising the interests of the shareholders. He would remind them, however, that, as far as code telegrams were concerned, and these formed 90 per cent. of the total, their customers got very good value for their money, and, he believed would admit this fact if asked. The shareholders had, no doubt, read with considerable interest the paragraph in the report dealing with wireless telegraphy. They would remember that it was necessary to extend the scope of the memorandum and articles of association of the company. The memorandum of association was drafted 45 years ago, and was drawn up for a specific purpose, viz., to work a system of telegraphs over wires within fixed limits. This so restricted the directors that it became most advisable to place a revised and extended memorandum of association before the shareholders. It received their approval and the sanction of their concessionary Governments and of the High Court. One of the earliest advantages reaped by the company was to free the hands of the directors, so that they could examine critically any proposals that might be submitted to them in connection with wireless telegraphy, with the result that they eventually took over the Galletti patents for wireless telegraphy and telephony. The directors were convinced that in taking this step they acted in the best interests of the company. He need scarcely tell them that the directors had had the benefit of the opinion of experts upon this system, both from the scientific and the patent point of view, and these opinions were considered satisfactory. Reviewing, briefly, the relation of wireless to its elder sisters in telegraphy, he said that telegraphy without wires, cables or conductors of any kind would represent financially everything most desirable in communication over long distances. The science had, however, hitherto, in spite of years of experimental work, not reached a stage at which the tangible conductor might with safety be discarded in favour of the ether, no known system having been found to overcome certain difficulties of transmission. In the Galletti system, however, the directors had been offered one that had new and self-evident advantages in the theory on which it was based. Those advantages were, of course, in many respects of a technical nature, and were at the moment more or less confidential, the system being still in the experimental stage, but the chief claims made by the inventor for the system were that by its use a much larger proportion of the power used was made available in the aerial at the transmitting end, and therefore at the receiving end also, than by any other system. The current used was direct current, and the view held by most experts to-day was that transmission by direct current was preferable to alternating current. From a business point of view the Galletti system appealed to the directors for two reasons. Its main patents were such as to give it a perfectly independent position amongst contemporary wireless systems; and, further, the inventor was willing to transfer his control over the system to this company, both of which, of course, were very important considerations. An agreement was therefore entered into with Mr. Galletti by the directors on behalf of the company, in virtue of which Mr. Galletti transferred all his patent rights in his system to a company formed and controlled by this company, viz., "Galletti's Wireless Telegraph and Telephone Co., Ltd.," the consideration being that this company should find the working capital necessary to establish the system on a basis of commercial utility. Further, the company had entered into an agreement with Mr. Galletti whereby he gave his services to the company for a specific period. The liability of this company to find the above-mentioned working capital was limited under the agreement to £34,000, of which £32,200 had been found up to the end of 1912. Some further moderate expenditure during 1913 would be necessary to complete the experiments. The directors proposed to pay a visit to Switzerland during the next few days for the purpose of witnessing a demonstration of telegraphy and telephony by the Galletti system over distances short to begin with but which would be extended as experiments progressed. In Switzerland there were two stations fully equipped, and working would be shown in both directions. The telegraphic signals would be transmitted and recorded by the Wheatstone automatic system. They fully expected that Mr. Galletti would be ready to demonstrate his long-distance experiments at the same time. A transmitting station had been installed by the company at

Leschaux, some 60 miles distant from Geneva, but on French territory, where Mr. Galletti would experiment with high power with the object of reaching very distant stations. He would like to mention that the directors acknowledged with gratitude the kind assistance of the British and French Governments in carrying out experiments. Turning to the accounts, the revenue from message receipts showed an increase of £10,984. The combined commercial and maintenance expenses showed an increase of £4,587. This was due under both headings mainly to a certain increase of remuneration to the staff due, in Russia and Persia particularly, to the increased cost of living, and to the continuing replacement of their instrument batteries by accumulators. Depreciation on the company's investments during the year under review absorbed the sum of £10,813. The directors now proposed the usual final dividend, absorbing £14,875, and a bonus of 20s. per share requiring £17,000, both free of tax. They also proposed to provide out of profit the sum of £32,200, represented by the Galletti investment, which would thus stand in the next balance-sheet free of cost to the company. They again recommended a special distribution out of interest upon certain investments and advance accounts of 15s. per share, free of tax, carrying forward £13,655 to the credit of 1913.

MR. C. HOLLAND seconded the motion, which was carried unanimously.

### British Westinghouse Electric and Manufacturing Co., Ltd.

THE directors report that for the year ended December 31st, 1912, the accounts show continued progress, and indicate that the company has had a good share in the general trade improvement. Competition is still very keen in the electrical and allied industries, but the prices obtained are slightly better than in the previous year. The gross profit amounts to £157,871, from which fall to be deducted:—Depreciation on works, machinery, plant, &c., £43,450 (in addition to £6,300 provided for redemption of prior lien debentures for the year), expenses on surplus land and buildings £3,033, interest on 6 per cent. prior lien debentures £13,650, interest on 4 per cent. mortgage debenture stock £49,654, leaving a balance of £48,084. From this balance has to be deducted the amount required for the prior lien redemption fund £6,350, proportion of expenses of issue of prior lien debentures £660, leaving a net profit for the year of £41,074, as against £20,708 last year. Adding to this the balance brought forward from 1911, £25,825, there is a balance of £66,899 to the credit of profit and loss account, which it is proposed should be carried forward. The accounts would have shown a still more satisfactory result but for the coal strike, the inconvenience from which was felt throughout the year. On the credit side of the balance-sheet the item "Underground Electric Railways Co. of London £95,681," is still held in suspense, as the loss, whatever the amount may finally prove to be, has not yet been ascertained. The company's appeal to the House of Lords, referred to in the last report, was successful, and the matter has been referred back to the arbitrator for further consideration. As is the usual practice, a substantial amount has again been charged against revenue for the maintenance of works and plant, in addition to which £49,750 has been applied to depreciation. Orders received during the year, for both the home and export markets, show an appreciable increase over those of 1911, and the directors state that the business of the current year similarly shows an increase over that of the corresponding period of 1912. Mr. C. A. Park, managing director, resigned his position in December, and a successor has not yet been appointed.

The meeting is called for Monday, May 5th, at Hamilton House, Victoria Embankment.

### North Metropolitan Electric Power Supply Co., Ltd.

THE annual meeting was held on April 23rd at Electrical Federation Offices, Kingsway, W.C., Mr. E. Garcke presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 693), said he was glad to be able to congratulate the shareholders that, notwithstanding the anxious time they had passed through in connection with the coal strike and other troubles of the same kind, they were able to report further continuous progress of the company, and to recommend a dividend on the ordinary shares of 10 per cent. for the year, as compared with 9 per cent. for 1911. At the meeting last year, he referred to the serious condition of affairs which the coal strike was producing, and told them that the cost of production was likely to be abnormally high. He was sorry to say that those anticipations as to increased expense of production had been fulfilled. On the other hand, he was glad to say that they were able to maintain a continuous supply, and any increase in the rates was avoided. The revenue was adversely affected by the strike. For a period of about 10 weeks no coal was delivered to their stations under their ordinary contracts and they were compelled, towards the end of the period, to arrange with the Metropolitan Electric Tramways Co. to reduce their tramway service, and they also had to request the various authorised distributors who took bulk supplies from them to restrict their demands as far as possible. Such, however, was the inherent possibility for expansion in the district, that notwithstanding those circumstances, the output increased very much in the same ratio as had been the case in preceding years. Last year they sold 29 million Board of Trade units, which, compared with about 26 million in 1911, an increase equivalent to 10½ per cent. The revenue for the year

amounted to £143,000, as compared with £132,800 for 1911, an increase of about £10,000, or about 7½ per cent. Unfortunately, the expenditure showed an increase of £10,000. Of that increase about £7,500 might be said to be due to increased output, so that the abnormal increase of expenditure amounted to about £3,500, primarily due to the higher price of coal, and also to some extent to increased rates and taxes. Those adverse conditions had come to an end, and he hoped that during the current year they would be able to show further progress in their output, accompanied by an increased net profit. Last year they received 6 per cent. on their investments in the North Metropolitan Electrical Power Distribution Co., as compared with 5 per cent. in 1911. That company received electricity in bulk from them, and distributed it in various growing districts in the North Metropolitan area. The net revenue had been debited with £2,000 in accordance with the trust deed to secure the debentures, and £25,000 had been placed to the credit of the depreciation account which now amounted to £78,850. The amount required for the dividend on the preference shares was larger than in the preceding year, because a further issue of preference shares was made last year. The capital expenditure during the year had amounted to £50,670. He might remind them how very consistently the business of the company had expanded. In 1905 the output was 5 million units, the next year 8 millions, the following year 11 millions, the next 14 millions, then 16 millions, then 21 millions; in 1911 it was 26 millions, and last year, as he had already told them, 29 millions. That was a pretty steady and satisfactory expansion of the business, and having regard to the industrial developments that were taking place in the large area over which they had tenure, the board had reason to feel very sanguine in regard to future prospects.

SIR ERNEST SPENCER seconded the motion, and the report was adopted.

An extraordinary meeting was then held. The CHAIRMAN proposed a resolution to the effect that of the amount which the company were authorised to borrow, a sum not exceeding £42,500 be raised by the issue of further mortgages to rank *pari passu* with the existing mortgages issued by the company. He said he had told them how rapid had been the progress of the company, and the increase of the business naturally involved extensions to the power houses. A large extension was almost completed at Brimedon, and at Willesden the extension was well in hand. In order to cope with the demands, it was also necessary to extend the Hertford station almost immediately, and further arrangements would have to be made at St. Albans in the near future.

SIR ERNEST SPENCER seconded the proposition, which was adopted.

**Prospectus.**—*The Electrical and Industrial Investment Co., Ltd.*—The list was to close on Wednesday in an issue at par of £85,180 4½ per cent. first debenture stock, and £92,955 5½ per cent. second debenture stock in this company. The trustees of the debenture-holders are the Electric and General Investment Co., Ltd. At December, 1912, the company held investments of the net book value of £462,671. Of this amount, 26·74 per cent. represents holdings in electric power and traction (combined) undertakings; 24·28 per cent. tramways and omnibuses; 18·97 per cent. electric lighting and power; 10·03 per cent. railways; and the remainder is in commercial and industrial, oil, financial, tea, coffee, and rubber, telegraph and telephone, and other classes. Nearly 80 per cent. of the total are in the form of debentures, debenture stocks, preference shares and stocks, &c., the remainder being ordinary shares and stocks, loans and syndicates, &c. The revenue account for the first seven months ended December last showed a profit of £11,325, after paying all administration expenses. The company entered into agreements at June, 1912 with the liquidators of the City of Birmingham Tramways Co., Ltd., for the purchase and sale of the assets and property of the latter, and with the B.E.T. Co., Ltd., whereby that company guaranteed the subscription of 180,000 ordinary shares and 60,000 preference shares in consideration of an option. Our readers are familiar with the objects of the company. At the meeting reported in our issue of February 21st, 1913, the chairman, Mr. E. Garcke, said it was intended to raise a little further capital by the issue of 4½ per cent. debenture stock, and so reduce the average cost of their capital.

**Cuba Submarine Telegraph Co., Ltd.**—The report of the directors for the half-year ended December 31st, 1912, states that the total receipts for the period were £19,074 and the expenses £7,085, leaving £11,988, plus £7,743 brought forward, making £19,731 to be dealt with. £2,000 has been placed to the pension fund, and £2,000 added to the general reserve fund, which now stands at £94,000. The dividend on the preference shares will absorb £3,000, and leave £12,731, out of which the directors recommend the payment of a dividend at a rate of 6 per cent. per annum on the ordinary shares, free of income-tax; the balance, £7,931, being carried forward. Following the suggestion made at a recent meeting for holding the general meetings annually instead of half-yearly, the board have decided to adopt that course, which is in accordance with the articles of association. The company's financial year will run from January 1st to December 31st; the yearly meetings being held in April or May and an interim dividend being payable in October.

The meeting is called for May 7th.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended March 28th amounted to 890,782, compared with 854,021 units in the corresponding four weeks of 1912.

**Stratford-on-Avon Electricity Co., Ltd.**

THE report for 1912 states that, after writing off £200 to reserve and depreciation account and building sinking fund, the net revenue account shows an available balance of £558, which the directors recommend should be appropriated as follows: Directors' fees, £50; 3½ per cent. dividend, £257; carrying forward £251.

Year.	rated.	Units gene. sold.	Units Light. ing.	Heat. ing. Power.	Used Heat. ing. works.	Unac. counted lor.	8.c.p. lamps con.	Max. load price	Average price	
1911	192,411	142,366	62,489	79,395	10,522	89,585	10,100	16,858	120	2.781.
1912	192,473	131,777	74,940	40,895	10,081	18,000	12,061	12,150	120	3.30d.

**Callender's Cable and Construction Co., Ltd.**

THE directors' report for the year ending December 31st, 1912, shows that there is a balance at the credit of profit and loss of £97,088, plus £58,531 brought forward, making £155,620. From this must be deducted interest on debenture stock, £13,500; dividend on preference shares, £10,000; appropriation for depreciation of buildings, plant and machinery, £8,691; appropriation for depreciation of office furniture, £230; expenses incurred by this company in connection with the formation of Callender's Share and Investment Trust, Ltd., £5,200; making together £37,624; leaving an available balance of £117,995. It is proposed to pay a dividend on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, being 10s. per share (whereof 5s., less income-tax, was paid on November 1st, 1912, and 5s., less income-tax, will be paid on May 15th), £17,500; pay a bonus of 5s. per share, less income-tax, on May 15th, £8,750; and to carry forward £91,745. The operations of the company for the past year have again produced results which are highly satisfactory, the profit on the year's operations exceeding that of 1911 by more than £20,000. This result has been arrived at in spite of the heavy, and in many respects useless expenditure, forced on the company by the two great strikes of the year, that of the coal miners in the Spring, and that on the River Thames last Autumn. Both seriously interfered with the company's operations, and entailed wasteful expenditure of several thousands of pounds. The strike on London River threatened at one time to close down the company's works, but, thanks to the arrangements which had been made in advance, to the excellent facilities which the company has for handling materials, and to the energy of those in the service of the company, less inconvenience was caused to customers than might have been anticipated. Considerable trouble, owing to labour unrest, has been experienced in the engineering department during the year. The difficulties have now been arranged, and this department is in full work, and has important unexecuted orders in hand. The general trade of the company continues to expand both at home and abroad. The shops are full of orders, and inquiries for future work point to the likelihood of continued good business. This applies not only to underground mains, such as the company has manufactured for many years past, but to telephone cables now made at Erith, and to the rubber wire business carried on in conjunction with this company by the Anchor Cable Co. at Leigh, Lancashire. The increase in output during last year, especially for the Colonies and abroad, rendered it necessary to provide further capital, and the directors decided to raise that money by means of a subsidiary company, which has now been formed under the title of Callender's Share and Investment Trust, Ltd. Full details of the arrangements with the Trust Co. were contained in the prospectus of that company. This company incurred expenses in connection with the formation of the Trust Co. amounting to £5,200, and the whole of this amount is written off the profits of this year. As usual, all machinery, plant and appliances at the factory, and on outside contracts at home and abroad, have been maintained in the highest state of efficiency, and the cost of so doing has been debited against the year's accounts. The Anchor Cable Co., Ltd., has also experienced a highly satisfactory year's working, and the profits (which have been in excess of those of any previous year) have enabled its directors not only to maintain the dividend of 15 per cent., but to increase the amount of its carry forward. The other undertakings in which this company is interested are all making satisfactory progress. The directors express their deep regret at the death of Mr. Henry Drake, which occurred in February last. Mr. Drake's connection with the Callender Cable business dated from its commencement in 1872. He was chairman of this company from its formation until last year, when, owing to failing health, he found it necessary to relinquish that position. His colleagues wish to put on record their recognition of the valuable services which he rendered to the company for so many years.

The meeting is called for May 8th.

**Anchor Cable Co., Ltd.**—The directors' report for the year ending December 31st, 1912, states that the profit amounted to £16,359, plus £5,488 brought forward, making a total of £21,847. From this must be deducted—interest on debenture stock £2,250, depreciation on plant and machinery £2,750, written off investments £1,489, leaving an available balance of £15,358. It is proposed to pay a dividend of 15 per cent., absorbing £8,719, and to carry forward £6,639. The business of the company is making steady progress, both in this country and abroad. In the course of the year the directors called up £5 per share on the 1,500 partly paid ordinary shares. This call has been paid in full, so that all shares issued are now fully paid. The plant and machinery have been maintained in first-class order, and all costs of so doing have been charged against the year's account.

**Metalite, Ltd.**

THE adjourned ordinary general meeting of shareholders of this company was held on Tuesday at the offices, Christopher Street, Finsbury, Mr. J. T. Bentley presiding.

The CHAIRMAN said he had to apologise for the absence of their chairman, Mr. Stewart, who had suffered a family bereavement during the last few days, and who was in Scotland attending the funeral. He had also to inform them that Mr. Joseph Metcalf, his other co-director, had been lying on a sick bed for some weeks, and was quite unable to attend the meeting. They would remember that at the adjourned meeting held there on February 2nd it was further adjourned to that day in order that the company's accounts should be completed and audited and presented to the shareholders. However, the directors had found that impossible owing to the fact that a Receiver for the first mortgagees, namely, the bank, had been appointed, and the directors had no funds in hand belonging to the company to discharge the same, and the auditors and others were not prepared to complete the accounts without a cash payment, which the directors did not feel justified, in the present stage, in advancing. They had devoted the whole of their attention, first, to making suitable arrangements with the bank to avoid a sale of the company's assets, which had been done, some of the debenture-holders coming forward to advance the necessary amounts. In the second place, they had devoted their energies to evolving a scheme of recapitalisation, which the directors considered was absolutely essential if the company was to be resuscitated and ultimately to become successful. It was hoped that that scheme might have been put before them informally that day, but, of course, in the absence of the chairman, that could not be done. All shareholders would, however, in a very short time receive copies of the proposals, and an extraordinary meeting would be called with a view to carrying the proposal into effect or otherwise, as the shareholders might deem fit. Meantime, they had been able to arrange with the second and the third series debenture-holders not to press their claim for principal and overdue interest, so that no further complications were likely to arise in putting forward such a scheme. Being single-handed that day, he was afraid he could say nothing further on the matter just at the moment, except to again assure them that the scheme, out of the many that had been placed before the directors, was, in their consideration, the best; and although in the nature of things it had to be somewhat drastic, at the same time it was the soundest proposal, in the directors' opinion, that gave them any likelihood of success under the circumstances. He concluded by moving that the meeting stand adjourned until Friday, May 30th.

MR. LEE said he would formally second the resolution, as it seemed to him that there was nothing else to do. It was a very unfortunate position. He had tried to get a little information about the matter only that morning, but in the absence of the chairman he did not see that they could do anything but consent to the adjournment.

The resolution was carried with one dissentient.

**Gravesend and Northfleet Electric Tramways, Ltd.**

THE twelfth ordinary meeting of the above company should have been held on Monday, at the offices of the Electrical Federation, Kingsway, W.C., but it was postponed.

The report for the year ended December, 1912, states that the total revenue amounted to £11,668, as compared with £11,554 for 1911. After deducting all expenses chargeable to revenue, including repairs and maintenance, and £1,800 for debenture interest, there remains a balance of £2,603, plus £567 brought forward, making an available balance of £3,170. Out of this the directors propose to place to reserve £600, to renewals fund £600, one half-year's preference dividend, completing the full dividend on the 6 per cent. cumulative preference shares to June 30th, 1907, £1,200, carrying forward £770. In the preceding year £1,000 was placed to a joint reserve and renewals fund (which has now been divided into two separate accounts), and one half-year's dividend on the preference shares was paid; £6 10s. has been expended on capital account during the year, the amount of that account standing at £119,601.

The passengers carried numbered 2,800,401, as compared with 2,816,099 in 1911; average receipts per passenger '96d. (against '95d.). Mileage open 6'47 route miles; 18 cars.

**La Plata Electric Tramways Co., Ltd.**—The report states (says the *Financier*) that the total receipts on revenue account for the year to December 31st amounted to £53,179, and the expenditure to £43,397, leaving a balance of £9,782. After providing for debenture stock and other interest (£2,799), and writing off the whole of the balance of defalcations account and expenses in connection with a special investigation of the books for the past three years—viz., £2,513—there remains £4,468, which, with £23 brought forward, leaves a balance available of £4,492. The directors recommend a dividend at the rate of 6 per cent. per annum on the preference shares, covering the period from July 1st to October 31st, 1911. This will absorb £3,893, and leave £598 to be carried forward.

**Victoria Falls and Transvaal Power Co.**—The *Times* states that the net earnings of this company, including those of the Rand Mines Power Supply Co., for the quarter ended March 31st amounted to £105,259.

### Cork Electric Tramways and Lighting Co., Ltd.

THE directors' report for the year 1912, states that the receipts were £57,576, and the expenses £35,596, plus £1,555 brought forward, making £23,536, less interest on debentures £4,600, leaving £18,936. Of this amount, £6,163 was paid on July 1st and January 1st, for the half-yearly dividends on the 5 per cent. cumulative preference shares; £6,500 added to reserve for depreciation and renewals; £1,661 written off, as per revenue account, and the balance is to be disposed of by paying 3 per cent. dividend on the ordinary shares, £3,450, and carrying forward £1,262.

The lighting and power business again shows satisfactory progress, agreements for 140 connections being concluded during the year. The additional connections represent a total gain of 252 kw., as against 462 kw. in 1911. The total lighting and power receipts were £1,238 in excess of the previous year. The revenue is still being affected by the extended use of metallic-filament lamps, but additional consumers have been obtained as the result of their introduction owing to their economy and the excellent light given. The traffic receipts show a decrease of £827, this being mainly attributable to the wet summer of last year. The early closing of the shops on Wednesdays has also resulted in loss of revenue both in lighting and traffic receipts. The expenses were very heavy—£2,270 in excess of the previous year—the increase being mainly due to the enhanced price of coal and heavier maintenance charges for the lighting and power cables. The Cork Corporation have wood paved certain streets, and in order to meet the Corporation and fall in with city improvements the company have been put to extra expense in relaying portions of the permanent way which would not otherwise have been necessary. The three reserve items appearing in the 1911 accounts, viz., premium on shares issued £2,952, premium on debentures issued £211, and depreciation and insurance £28,978, in all £32,141, have been transferred to a reserve account for depreciation and renewals. The directors have written off £1,561 as per revenue account and transferred £6,500 to reserve for depreciation and renewals, as compared with £1,753 and £6,500 respectively for the previous year. Cable renewals have been carried out at Cork and Queenstown during the year at a cost of £2,201. This expenditure has been charged against the reserve account. The capital expenditure during the year has been mainly expended on house services, cables and public lighting. No shares or debentures have been issued during the year.

Year.	Miles open.	Passengers carried.	Traction.		Lighting and power.		
			Average fare.	Car. mileage.	No. of cars.	No. of 8-c.p. lamps (equivalent) connected.	
1909	9-89	5,349,041	1-06d.	864,228	35	2,013	129,156
1910	9-89	5,704,971	1-07d.	839,473	35	2,181	129,403
1911	9-89	5,865,523	1-07d.	891,417	35	2,368	155,583
1912	9-89	5,695,103	1-06d.	898,153	35	2,529	163,774

The annual meeting was held on Monday at the office, 83, Cannon Street, E.C., Mr. A. R. Monks presiding.

The CHAIRMAN, in proposing the adoption of the above report, said that dealing first with the balance-sheet, it would be seen that the share and debenture capital remained as at December 31st, 1911. The three reserve accounts appearing in the 1911 balance-sheet had been consolidated, and they had now the one account, "Reserve for depreciation and renewals." This reserve had been increased by £6,500 out of the past year's revenue and debited with the expenditure on renewing cables at Cork and Queenstown, £2,200, which gave a net increase of £4,300 for the year, leaving the reserve at £36,440. Sundry creditors and outstandings amounted to £6,322, as compared with £3,602 at December, 1911—a reduction of £2,280. On the other side, the capital expenditure, after deducting the amounts written off house services, wiring consumers' premises, &c., showed a net increase of £1,455, which was almost entirely expended on connecting up the additional private and public lighting business secured last year. The large amount against work in progress was mainly for additional power station plant. To meet the increasing demands they were installing a further 900-kw. generator set, which they hoped would be in operation next autumn. He might say in this connection that all the available space in the power house had been occupied with plant, so that they were removing one of the original 200-kw. sets so as to provide space for the new set. The capital expenditure for this old 200-kw. set would be written off in the accounts for the current year. Sundry debtors and outstandings £14,261, compared with £14,749 at December, 1911, a reduction of £488. Taking the revenue, the gross receipts for the year showed an increase of about £400. The traffic receipts were disappointing, being £827 less than in 1911, but this was mainly attributable to the very wet summer they had last year—in 1911 they had exceptionally fine weather. Lighting and power receipts were £1,238 in excess of 1911, which was a satisfactory increase, taking into consideration the effect of the extended use of metallic-filament lamps and the early closing of shops on Wednesdays. The expenses were heavy, being £2,270 in excess of the previous year. Traction expenses were lower, but there were increases of £1,250 for the power house, £900 lighting, and £170 for general expenses. Considerable repairs were carried out on the permanent way, and their expenses in this connection would have been lower had it not been for the Corporation deciding to wood-pave certain of the main streets. In order to meet the Corporation, they relaid portions of the permanent way which, in the ordinary way, would not have been carried out for a few years. They also renewed last year seven car bodies, making 15 renewed out of revenue to the end of 1912. The increase in station expenses was mainly for coal and maintenance of plant. As higher prices were ruling for coal, their expense under this head were likely to be heavy again this year. The bulk of the

increase in lighting and power expenses was for maintaining cables. In general expenses, they had £93 for the new charge under the National Insurance Act, which would cost the company in future about £200 per annum.

Mr. W. B. H. MARTINDALE seconded the motion, and the report was adopted.

### Constantinople Telephone Co.

THE report of the Société Anonyme Ottomane des Téléphones de Constantinople (as printed in the *Financier*) states that unfortunately the inception of the company corresponded with the outbreak of the war between Turkey and Italy, and for the whole period of the company's existence the general conditions have been so disturbed as to militate very considerably against the progress of the construction of the company's plant. Considering these difficulties, satisfactory progress has been made, although the date of the opening of the service will be later than that originally planned. Intimation has been given to the Turkish Government from time to time as the various interruptions of work occurred, due to causes beyond the company's control. One of the first problems that had to be dealt with was that of securing sites for the three large exchange buildings at Stamboul, Pera and Kadiköy, and the company has now purchased sites eminently suitable to the general design of the system. Good progress has been made with the buildings, and it is hoped that shortly the installation of the exchange equipments will be begun by the Western Electric Co. and the French Thomson-Houston Co., who are jointly responsible for this work. In the early part of 1912, the company made a contract with the British Insulated and Helsby Cables, Ltd., for building underground conduits and pole routes, and supplying and laying the necessary cables, and notwithstanding the various delays which have occurred from time to time, chiefly owing to the war, a large portion of this work has been completed. On December 31st, 1912, there were constructed 84 km. of underground duct, and 17 km. of pole route; 18 km. of cable had also been installed, containing 3,600 km. of circuit. Early in 1912, the general manager organised a contract department for the purpose of securing subscribers, and in spite of the disturbed business conditions at Constantinople, orders had been obtained on December 31st for 2,999 stations. The number of orders secured exceeds the original expectations of the directors as to the development to that date, and as the work of securing new orders still proceeds at a satisfactory rate, having regard to the existing conditions, it is confidently anticipated that the business of the company will be substantially in advance of preconceived ideas. It will be necessary, in the course of a short time, to issue further capital, and resolutions to this effect will be submitted to the shareholders in general meeting. The new capital, when authorised, will be issued as and when required for construction purposes. In order to be in a position to undertake the work should the Turkish Government decide to establish telephone systems in other towns through private enterprise, the board propose to ask for powers for obtaining and working telephone concessions in other parts of the Ottoman Empire.

### Metropolitan Electric Tramways, Ltd.

THE directors' report for the year ended December 31st, 1912, states that the revenue, including £35,000, the dividend and bonus receivable upon the company's investment in the North Metropolitan Electric Power Supply Co., amounted to £518,025. After adding the balance brought forward from 1911, and deducting all expenses chargeable to revenue, including an addition of £26,780 to the reserve for reconstruction and renewals, there remains a balance of £57,375 available for dividends and further reserves, and the directors recommend that of this there be placed to reserve account, £10,000; dividend on the preference shares for the year, £25,000; dividend on ordinary shares at the rate of 5½ per cent. (including interim dividend of 2½ per cent. paid in October, 1912), £21,771; leaving to be carried forward, £604.

The reduction of capital, resulting from the conversion of the issued deferred shares into ordinary shares under the scheme confirmed by the shareholders last August, has received the sanction of the Court. The reduction amounted to £25,612, and has been applied to writing off preliminary expenses (£92,651) and writing down capital expenditure by £142,950. £5,377 4½ per cent. debenture stock, and £2,500 6 per cent. debenture stock was bought and cancelled last year under the provisions of the trust deeds. At December 31st last, the issued debentures and share capital was:—

Debenture capital—£355,719 in 4½ per cent. debenture stock; £247,600 in 6 per cent. debenture stock.  
Share capital (as reduced)—£500,000 in 5 per cent. cumulative preference shares of £1 each, fully paid; £395,832 in ordinary shares of £1 each, fully paid; 78,601 in new ordinary shares of £1 each, fully paid (resulting from the conversion of £314,016 deferred shares), ranking for dividend as from January 1st, 1913, and in all other respects *pari passu* with the 395,832 ordinary shares.

The directors regret to report that the profit derivable from the operation of the tramways and light railways shows a decrease of £24,348. The figures are as follows:—

	1911.	1912.
Traffic receipts ... ..	£460,544	£460,544
Working expenses... ..	307,294	331,642
	£153,250	£128,902

This unsatisfactory result is attributable to the heavier competition from motor-omnibuses. In order to meet this increasing competition and to maintain the company's hold upon the traffic in the districts served by the tramways, the directors found it necessary to augment the car services, and while this policy has

enabled the company to maintain its receipts, the working expenses are higher by £21,348, and the receipts per car-mile have dropped from 10'5d. to 9'63d. It is anticipated that the alliance entered into with the London General Omnibus Co. at the close of the year will bring about the co-ordination of the omnibus and tramway services in the company's area and a consequent improvement in the company's revenue.

The purchase by the L.C.C. of the company's tramway between Finsbury Park and Manor House was completed in August last, and thereupon the through running arrangements referred to in the last report came into operation. The satisfactory results obtained from the first through service worked jointly by the L.C.C. and the company have led to a further agreement, under the terms of which through running will be extended to all routes of the Council and the company converging at Manor House Junction.

The scheme for the consolidation of the company's interests with those of the London United Tramways, Ltd., became binding in December last. The directors anticipate that the consolidation of the interests of the two tramway companies will effect substantial economies in administration and a reduction of working expenses generally.

The company is promoting a Bill in the present session of Parliament to authorise the installation of the railless traction system over a route connecting the company's tramways in Wood Green and Tottenham with the light railways belonging to the Walthamstow Urban District Council. The new system will, if sanctioned by Parliament, take the place of the light railway authorised by the Tottenham-Walthamstow Light Railways Order, 1906, and will also open up a new area which at present is not served by the company's system.

The board of the North Metropolitan Electric Power Supply Co., in which the company holds 30,000 fully paid and 10,000 £5 paid ordinary shares of £10 each, have declared a 6 per cent. dividend upon the ordinary share capital, together with a bonus at the rate of 8s. per fully-paid share. The power supply business continues to show a satisfactory expansion; the total number of units sold during 1912 amounted to 29,231,099, an increase of 10.5 per cent. over the figure for the preceding year. A supply of electrical energy has been commenced in the district of Hadley, and during the present year arrangements are to be made for supplying the East Barnet area. The North Metropolitan Electrical Power Distribution Co., Ltd., which takes electrical energy in bulk from the power supply company in Barnet, Enfield, Hertford and St. Albans, has had a successful year, and has paid 6 per cent. upon its ordinary share capital, the whole of which is held by the power supply company.

	1911.	1912.
Mileage open (at December 31st) .. .. .	56,750	56,250
Passengers carried .. .. .	89,908,677	91,508,593
Car-miles run .. .. .	10,481,118	11,492,370
Average receipts per car-mile .. .. .	10 59d.	9 63d.
Average receipts per passenger .. .. .	1 23d.	1 21d.
Number of cars in stock (at December 31st) ..	292	312

The annual meeting was held on April 23rd at Electrical Federation Office, Kingsway, W.C., Mr. E. Garcke presiding.

The CHAIRMAN, in proposing the adoption of the above report, said that the year had been a very eventful one in the history of the company. The five chief events had been, first, the coal and the transport workers' strikes; secondly, the conversion of the deferred shares of the company into ordinary shares; third, the motor-omnibus competition which they had had to meet; fourth, the arrangement made with the Underground Railway Co. of London, which effected an amalgamation of the Metropolitan Co. with the London United Tramways Co., and secured a working arrangement with the L.G.O. Co.; and fifthly, the question of the through running of tramcars from and to their system to and from the L.C.C. tramway system. The mere enumeration of those heads would convince them that the directors had had a very busy time with the affairs of the company during the past year, for they would see that the condition of affairs had been quite abnormal. The whole work, however, had been immensely interesting, because the situation had been exceptionally difficult, and they were especially grateful to the shareholders for the support they had given to the proposals which the board felt it their duty to make. On the other hand, the directors were able to congratulate the shareholders on having acted upon their advice. There could be no doubt about it that, if the shareholders and the board had not acted unitedly in those various delicate and difficult negotiations, the company would not have come out of the crisis as well as it had. They had reduced the dividend on the ordinary shares from 6 per cent. to 5½ per cent., but he might now confess that that result was better than he expected, in view of the competition between the motor-omnibuses. They would be struck, in the revenue account, by the similarity between the traffic receipts for the two years—they were £260,500 in each year. Although they obtained the same receipts in the two years, last year they carried more passengers and ran more car-miles; that was to say, they took less money per car-mile, and received less per passenger; in other words, they had to do more work and get less profit. They had to do that in order to maintain their hold on the traffic. Last year power and running expenses were £18,500 higher, and maintenance and renewals were £8,000 more. He was pleased to say, however, that insurance was £3,000 less, and that economies had been effected in other directions, but the fact remained that it had cost them about £24,000 more to earn the same income on their tramways as in the preceding year. That unfortunate feature was due almost entirely to the motor-omnibus competition. If it had not been for the improved dividend they had received from the Electric Power Co., and to the fortunate circumstance that they were able to collect under the head of sundry receipts some profits which had accumulated, the payment of an ordinary dividend of 5½ per cent. would have been out of the question. He thought the directors were entitled to take credit for foresight and prompt action in regard to the situation in which the company found itself when confronted with increasing motor-omnibus competition. At a relatively early stage they decided to provide motor-omnibuses of their own, so as to meet competition by competition of the same kind. The result was

quite effective, and at the special meeting last December he explained the course of events which had taken place, and which had resulted in the formation of the London and Suburban Traction Co., so as to establish a unity of interests between the Underground Railway Co., the London General Omnibus Co., the M.E.T. Co., and the London United Tramway Co. An important development as affecting the travelling public had been the arrangement made with the L.C.C. for the running of through cars. They anticipated that before many months were over through running would be established on all the routes converging at the Manor House. Those through running arrangements, unfortunately, involved additional capital expenditure, for they had to equip their cars for the conduit system. The capital expenditure had been as much as £111,000. Of this amount £25,600 had been spent on additions to and improvements of their rolling stock, and about £76,000 had been invested in debenture stock of the M.E.T. Co., and in preference shares of the London United Tramways, now exchanged into shares of the London and Suburban Traction Co. All the formalities were now nearly completed, and they hoped very soon to have the shares and the debentures of the new company officially quoted on the Stock Exchange. As to the prospects of the new company making sufficient profits to maintain and improve the dividend which the shareholders had received in the past, sufficient time had not elapsed since the formation of the new company to enable him to say very much more than he said at the special meeting last December. He could, however, assure them that the prospects were good, although he feared they would take somewhat longer to realise than they had anticipated. The negotiations which were proceeding with a view to the reduction of the competition between motor-omnibuses and tramways and for the co-ordination of the general traffic facilities were very complex and difficult, and while all the parties concerned were apparently doing their utmost to bring about less competitive conditions, the protection of the respective interests required a careful study of the facts and figures before they came to decisions which might have far-reaching consequences. The profits of the London and Suburban Traction Co., to which most of them were now looking for their dividends, were dependent upon the earnings of the London United Tramways and the M.E.T. Tramways and Light Railways, on the North Metropolitan Electric Power Supply and Distribution Co.'s, and last, but not least, upon the working of the 350 motor-omnibuses belonging to the M.E.T. Co., and an interest in 22 further motor-omnibuses owned by the Gearless Motor Omnibus Co. One important outcome of the amalgamation of interests was that the M.E.T. omnibuses, as they were put into service, took their place in the general omnibus system of London without any competition or hostility. Unfortunately it took a good deal of time to get those buses delivered and put into service. So far they had only succeeded in getting 100, but more were being delivered and passed by the police every week, and in the course of this year they hoped to have a very substantial addition to the fleet. It would be obvious that the revenue this year from that source would not be so much as it would be in subsequent years. The remaining profits of the London and Suburban Co. would be derived from investments in the Electric Power Supply and Distribution Co.'s, and those profits should be not only progressive, but they appeared to be assured. He could not speak of the future prospects by mentioning figures—those of them who had converted their holdings into shares of the London and Suburban Co. would, in due time, be informed of the position and prospects—but having presided for 11 consecutive years over those meetings, he could not say good-bye to the shareholders without expressing the conviction that they did the right thing to form the new company and amalgamate the various interests, and that those shareholders who made the exchange would not have cause to regret their action.

SIR ERNEST SPENCER seconded the resolution, and the report was adopted.

### Willans & Robinson, Ltd. and Reduced.

The directors have issued their accounts for the half-year ended December 31st, 1912, showing, after allowing £3,265 for depreciation, £5,176 for debenture interest, and £372 for the upkeep of the Queen's Ferry Works, a profit of £154. This improved trading result is mainly due to the increased volume of work referred to in the last report. During the opening months of the present year a large volume of further orders has been obtained and at somewhat better prices, a result largely attributable to the improved position of the company in anticipation of the rearrangement of capital and its attendant advantages. The directors therefore have every reason for hoping that the improving tendency as shown by the half-year's accounts will be maintained and augmented. The revised articles of association, as approved by the shareholders at the January meetings, were confirmed by the High Court on the 4th ult., and took effect from that date.

The meeting is called for May 6th at Cannon Street Hotel, E.C. The directors are raising additional preference capital, to which existing shareholders are entitled first to subscribe.

**River Plate Electricity Co.**—The net revenue for the year 1912 amounted, says the *Times*, to £41,175, as against £37,200; the dividend on the ordinary stock is 10 per cent., the same as for 1911; £18,000 is again placed to general reserve; £30,000 of the premium received on the issue of ordinary shares is also carried to general reserve, making that fund £145,000; and £10,416, as against £7,659, is carried forward.

### Johnson & Phillips, Ltd.

THE eighth annual general meeting was held on Thursday last week at Winchester House, E.C., Mr. Robert W. Blackwell presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 654), said that the accounts were a distinct improvement upon those of the past four years. The gross profit for 1912 amounted to £28,324, an advance of £9,924 over the figures for 1911. The sum of £6,000 had been first charged to revenue for maintenance of buildings and plant—that being the same as was taken in 1911, but a considerable increase over the amounts apportioned under this head during the previous years of the company's existence. Adding to the profit the balance brought forward from last year, they had to deal with a total of £29,357. From that they had to deduct directors', trustees' and auditors' fees and the £13,000 which they were required to devote annually to the service of the first debenture debt, which two items were as usual. Interest on the second debentures was somewhat higher than last year, as the total issue of £50,000 had now been outstanding for a considerable period. There was also the cost of issuing the £50,000 of second debentures, £2,006, which represented the difference between the face value of the issue and the net result to the company therefrom. They had allotted £2,500 more to depreciation on machinery and plant than last year, and they had written £1,306 off patents, licences, &c., which reduced that item to £10,000, a most reasonable figure. After those payments there remained a balance to carry forward of £3,315. While he freely admitted that the report was by no means all that the shareholders might properly desire, he would say that in his humble opinion the property of the company was steadily improving in value, and its business was regularly increasing along safe and conservative lines. The turnover had somewhat increased, and it was satisfactory that the improvement had been shared by every department of the works. So far as the present year was concerned they had got good orders, and their shops were running fairly full. The sundry creditors and bills payable at the date of the balance-sheet amounted to £84,299, while there was owed to them £125,931. The stocks and work in progress figured at £135,362, and they had £15,367 cash in hand. The stocktaking had been done on thoroughly safe lines. During the year they had added £3,077 to the capital account, as against £9,000 in 1911, which represented certain new machinery. Moreover they had done a great deal during the year to bring the works into a more up-to-date condition. The present state of affairs showed that they were on the way towards better things, but naturally they must husband their resources and build up for the company a strong financial position.

MR. T. DENCE seconded the motion.

Replying to a SHAREHOLDER, the CHAIRMAN said it was a little difficult to explain shortly just why the company fell into more or less bad days. At the time the company was floated trade went very badly for about three or four years, and all similar companies had very troublesome times except those who had at their command a large amount of practically liquid capital. As a consequence of their not having sufficient capital, the business fell off. They also had to remember that very large sums of money had been invested by many individuals in the cable trade in the equipment of manufacturing plants of the very greatest possible efficiency, and they were able to meet those bad times with the assistance of the good times they had previously enjoyed. Johnson & Phillips had to struggle through as best they could. All along they had been greatly handicapped by the conditions under which the first debentures were placed—the £13,000 per annum which they had to place at the service of the first debenture debt had always been a load upon the company. The directors had to face the fact that they must build up the company out of its own resources, and they had been struggling for some years past, and not without success, to bring the whole plant of the concern up to where it should be, and to conserve such an amount of money as would strengthen its position, and enable it to meet competition successfully.

The report was then adopted.

## STOCKS AND SHARES.

Tuesday Evening.

DISHEARTENING and disappointing are two of the terms which were heard most frequently in the Stock Exchange this week, in connection with the latest developments abroad. It had been really thought that the situation admitted of peaceful solution, and certainly nobody was prepared for King Nicholas and Essad Pasha to go log-rolling as they have done. The immediate result was to lower prices practically all round the Stock Exchange, rather from protective purposes than on account of any rush to sell. Austria's action precipitated a slump on this (Tuesday) afternoon, and the House, at the time of writing, is very doleful.

The Home Railway market felt the full force of the imbroglio, which it was ill prepared to stand, because of a bull account that had been reared in certain of the speculative issues. Prices promptly turned tail. Metropolitan fell 1, and so did Districts, these two escaping comparatively lightly in the *malaise*: while the Central London Ordinary and Deferred stocks both braced up, though the improvements, of course, came before the foreign political news grew grave. The firmness continues amongst prior charge stocks. District Debenture at 139 is a point up, and various other small rises—scarcely sufficient to be marked in the nominal quotations—have occurred.

The accident last Saturday morning on the District, whereby traffic was badly impeded for several of the busiest hours of the day, gave rise to speculations as to what would happen if anything similar happened to one of the Tube lines, where there is less room to move than there is even on the District Railway. Metropolitan Electric Tramway shares are  $\frac{1}{2}$  down; but no further falls have occurred in British Electric Traction issues.

The news from Mexico is read as being somewhat alarming, and most of the stocks and shares connected with that country have given way during the past few days. Nervousness is not mitigated by the difficulty of obtaining authentic information with regard to what is actually going on. Mexico Tramway Seconds have given way, and the Common shares fell  $\frac{1}{4}$ . Mexican Electric Light bonds fell 1, and Mexican Light and Power Common shed 3. The Company's bonds, with Monterey 5's, weakened a little. The stocks of nearly all the railway companies operating in Mexico have been offered with liberality. At the same time, it is stated in some quarters that the disturbances in Mexico are being fomented for reasons not entirely disconnected from finance; but any irresponsible rumour about Mexico does duty nowadays to affect the markets in Mexican securities.

Most of the few changes which have occurred this week amongst foreign railway and tramway issues are due to the marking of the prices *ex-dividend*. Brazil Tractions, for instance, are *ex*  $\frac{1}{2}$ , but are 2 points lower in addition. British Columbia Deferred is *ex* 4. Columbo bonds  $\frac{1}{2}$ , and so forth, allowing for which, the real changes are insignificant. Rio Tramways bonds and Sao Paulo are both being bought for investment. The Anglo-Argentine division keeps steady, apart from a decline of  $\frac{1}{8}$  in the Company's Second Preference shares. Northern Light and Power bonds have been marked up 5 to 20.

Amongst English Electricity Supply prices the principal changes are confined to  $\frac{1}{2}$ . County Preference gained this fraction, which was lost, however, by Charing Cross Preference and Kensington and Knightsbridge Ordinary. County First Debenture regained its small fall of last week, and Metropolitan First Debenture stock rose 1, though the Seconds lost a like amount. The market in the shares is extremely quiet.

Advance particulars were circulated early in the week of a forthcoming issue of £700,000 5 per cent. Consolidated Debenture stock by the Consolidated Gas, Electric Light and Power Company, of Baltimore, at the price of 96. Underwriters were offered 2  $\frac{1}{2}$  per cent., and there was a rush on their part to take advantage of it. The prospectus showed last year's profits to have covered the Debenture interest 10 times over.

The Telegraph market is quiet, with small falls in Amazons, Direct United Cable, Indo-Europeans, and West India and Panama Ordinary, though the Second Preference shares of the last-named are  $\frac{1}{2}$  up at 10  $\frac{1}{2}$ . Cuba Ordinary rose  $\frac{1}{2}$  on the dividend declaration. American Telephone stock at 133 is again easier, in sympathy with the depression prevailing in the American railroad market, which, so far, has little for which to thank the advent of the new President. Indo-Europeans went back to 60, although the report is a good one. The company is experimenting with a new wireless system.

National Telephone Deferred stock fell to 17  $\frac{1}{2}$ , but hardened to 20  $\frac{1}{2}$  upon the publication of the figures showing how much money will be left over for division amongst proprietors of this stock. Marconi, after active passages, settled down to the neighbourhood of 4  $\frac{1}{2}$ , the market being a dullish one. Sellers came in of Canadians and Americans. Marconi Preference fell  $\frac{1}{2}$ . Oriental Telephone Company are firm upon a satisfactory report. The Constantine Telephone Company, according to its report, is getting along as well as can be expected, all things considered. The £5 Preference shares are quoted at 4  $\frac{1}{2}$  middle.

Babcock & Wilcox Ordinary are *ex* 1s. 9d. dividend, allowing for which the shares show a rise of a few pence. Callenders rose  $\frac{1}{2}$ , but Henleys Preference at 4  $\frac{1}{2}$  display a small fall. The principal rise in this department has been secured by India-Rubber shares, which spurred to 11  $\frac{1}{2}$ . British Westinghouse Debenture stock rose 1 on the publication of the report for the year 1912. Castner-Kellners have hardened to 3  $\frac{1}{2}$  on substantial support from the provinces. The rubber share market is dull, the heavy supply of the raw stuff every fortnight at Mincing Lane being the main reason for the depression.

**Stock Exchange Notices.**—The Committee have appointed special settling days as under:—

Thursday, May 16th.—Water Softeners (France), Ltd.—25,000 vendors' shares of £1 each, fully paid (Nos. 55,001 to 78,250).

Water Softeners, Ltd.—130,000 vendors' shares of £1 each, fully paid (Nos. 62,501 to 182,500); and a further issue of 17,600 shares of £1 each, fully paid (Nos. 182,601 to 200,600).

And ordered the undermentioned to be quoted in the Official List:—

British Columbia Electric Railway Co., Ltd.—Further issue of £750,000  $\frac{1}{2}$  per cent. perpetual consolidated debenture stock.

**Eastern Extension, Australasia and China Telegraph Co., Ltd.**—The directors announce a dividend for the quarter ended December 31st of 2s. 6d. per share, together with a bonus of 4s. per share (or 2 per cent.), free of tax, making a total distribution of 7 per cent. for 1912.

**Craigpark Electric Cable Co., Ltd.**—Net profit for year ended March, 1913, £7,437. A dividend of 5 per cent. is to be paid on the ordinary shares.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations April 29th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations April 29th.	Rise + or Fall	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	1911. 6	94-104	..	5 18 5	Kensington & Knightsbridge, Ord	5	9 81	74-74	..	5 14 8
Do. 4 1/2 % Pref. ....	10	4 1/2	89-94	..	4 11 9	Do. 4 % Deb. ....	5	4	90-98	..	4 6 0
Do. Second 8 % Pref. ....	10	8	10-102	..	5 14 3	Kent Elec. Power, 4 1/2 % Deb. ..	Stock	4 1/2	78-80	..	5 12 6
Do. 4 1/2 % Deb. Stock ..	Stock	4 1/2	90-98	..	4 11 10	London Electric, Ord. ....	8	2 1/2	12-14	..	4 0 0
Edmonton & Kensington, Ord. ....	5	10 10	84-92	..	5 5 8	Do. 8 % Pref. ....	5	5	47-54	..	5 17 1
Do. 7 % Cum. Pref. ....	5	7 7	82-84	..	8 18 10	Do. 4 % First Mort. Deb. ....	Stock	4	91-94	..	4 5 1
Central Electric Supply, 4 % Guar. Deb.}	100	4 4	95-98	..	4 1 8	Metropolitan ....	5	4	81-87	..	5 6 8
Obaring Cross, West End & City	5	5 5 1/2	44-5	..	5 0 0	Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	42-44	..	4 17 4
Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	42-44	..	4 17 4	Do. 4 1/2 % First Mort. Deb. ....	Stock	4 1/2	98-101	+1	4 9 8
Do. "City Undertaking" }	5	4 1/2	82-84	..	5 2 10	Do. 8 1/2 % Mort. Deb. ....	Stock	8 1/2	82-85	..	4 2 4
Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	82-84	..	5 2 10	Mildland Electric Corporation }	100	4 1/2	99-102	..	4 8
Do. Do. 4 % Deb. ....	100	4 4	91 1/2-93 1/2	..	4 5 7	Newcastle-on-Tyne 5 % Pref., Non-Cum.}	5	5 5	42-47	..	5 5 8
Chelsea, Ord. ....	5	5 5 1/2	44-5	..	5 0 0	North Metropolitan Power Supply, 5 % Mortgages (Red.)}	100	5 5	97 1/2-100 1/2	..	4 12 6
Do. 4 1/2 % Deb. ....	Stock	4 1/2	96-99	..	4 10 11	Notting Hill, 5 % Non-Cum. Pref.}	10	5 6	92-102	..	5 11 7
City of London, Ord. ....	10	8 8	12-13	..	5 6 8	Oxford ....	5	7 1/2	67-68	..	5 13 9
Do. 8 % Cum. Pref. ....	10	8 8	12-13	..	4 10 7	St. James' and Pall Mall, Ord. ....	5	10 10 1/2	7-7 1/2	..	5 11 1
Do. 5 % Deb. ....	Stock	6 6	116-120	..	4 8 4	Do. 7 % Pref. ....	5	7 7	64-72	..	4 18 7
Do. 4 1/2 % Second Deb. ....	100	4 1/2	100-102	..	4 8 8	Do. 8 1/2 % Deb. ....	100	8 1/2	84-87	..	4 3 8
County of London, Ord. ....	10	6 6	10 1/2-11	..	5 9 1	Smithfield Markets, Ord. ....	5	5 2	7-13	..	7 5 8
Do. 6 % Pref. ....	10	6 6	11 1/2-12 1/2	+1	4 19 0	South London, Ord. ....	4	5 5	23-28	..	7 7 8
Do. 4 1/2 % Deb. ....	Stock	4 1/2	104-106 1/2	..	4 10 0	Do. 5 % First Mort. Deb. ....	100	5 5	97-100	..	5 0 0
Edmundson's, Ord. ....	23	Nil	100-100 xd	..	Nil	South Metropolitan, 7 % Pref. ....	1	7 7	15-17 1/2	..	6 17 11
Do. 6 % Cum. Pref. ....	6	Nil	44-48	..	6 7 2	Do. 4 1/2 % First Deb. Stock ..	100	4 1/2	94-97	..	4 11 3
Do. 6 % Non-Cum. Pref. ....	6	..	1 1/2-2	..	6 0 0	Urban, Ord. ....	23	Nil	1-3	..	..
Do. 4 1/2 % First Mort. Deb. ....	100	4 1/2	81-84	..	6 0 0	Do. 6 % Cum. Pref. ....	5	2 1	28-34	..	..
Folkestone ....	5	6 6	44-5	..	6 0 0	Do. 4 1/2 % First Mort. Deb. ....	100	4 1/2	83-86	..	5 2 8
Do. 6 % Cum. Pref. ....	5	6 6	44-5	..	4 17 10	Westminster, Ord. ....	5	10 10	83-9	..	5 11 1
Do. 4 1/2 % First Deb. ....	100	4 1/2	90-92	..	5 16 2	Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	5-6 1/2	..	4 3 9
Hove ..	6	9 9 1/2	72-73	..	..	..	..	..	..	..	..

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ....	6	6 6	5-5 1/2	..	5 14 8	Monterey Rly. Light & Power, 5 % 1st Mort. Deb. }	100	6 6	82-85	-1	5 17 8	
Calcutta, Ord. ....	5	6 6 1/2	62-74	..	5 19 4	Montreal, L., H. and Power ..	\$100	8 8 1/2	229-234 xd	..	8 17 0	
Do. 5 % Pref. ....	5	6 6	44-53	..	5 5 8	Northern, L., Power and Coal, 5 % 1st Mort. Bonds.}	\$500	6 6 1/2	15-25	+5	..	
Calgary Power, 1st Mort. Bds.}	100	5 5	95-95	..	5 17 8	River Plate, Ord. ....	Stock	10	217-227	..	4 8 0	
Canadian Gen. El. Com. ....	\$100	7 7	116-119	..	5 12 0	Do. 6 % Non-Cum. Pref. ....	Do.	6 6	105-110	..	6 9 1	
Do. 7 % Pref. ....	\$100	7 7	120-125	..	5 14 3	Do. 5 % Deb. Stock ..	Do.	5 5	100-102	..	4 8 0	
Cordoba L., Power and T., Ord.}	1	8 8	44-5	..	6 4 2	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb. }	100	4 1/2	100-102	..	4 8 3	
Do. 5 % Deb. ....	100	5 5	94-96	..	6 4 2	Shawinigan Water, Capital ..	\$100	6 6	187 1/2-142 1/2	..	8 10 2	
Elec. L. and P. of Coochabehra, 3 % Bonds }	100	6 6	83-95	..	6 6 4	Do. 5 % Con. 1st Mort. Bonds }	\$500	6 6	107-109	..	4 11 9	
Elec. Supply Victoria, 5 % 1st Mort. Deb. }	100	6 6	90-93	..	5 7 6	Do. 4 1/2 % Per. Deb. ....	Stock	4 1/2	4 1/2	101 1/2-103 1/2	+1	4 7 0
Elec. Dev. Ontario, 5 % 1st Mort. Bonds. }	\$600	5 5	95-97	+1	5 3 1	Toronto Power, 4 1/2 % Deb. }	Do.	4 1/2	98 1/2-100 1/2	..	4 9 6	
Kalgoinie Elec. P. and L., Ord. }	10/-	Nil	1-1	..	Nil	Vera Cruz L., P. and T., 5 % 1st Mort. Deb. }	100	5 5	91-94	..	5 6 5	
Do. 6 % Pref. ....	1	8 8	100-102 xd	..	6 8 8	Victoria Falls Power, Pref. ....	1	11 1/2	17 1/2-18 1/2	..	..	
Kaminitiquia Power, 5 % G. Bs. Madras, Ord. ....	\$600	6 6	100-102	-1	4 18 0	West Kootenay Power & Light, 1st Mort. 6 % Gold. }	100	6 6	106-108	..	5 11 1	
Melbourne, 5 % 1st Mort. Deb. }	100	5 5	102-105	+1	4 15 2	..	..	..	..	..		
Mexican El. L., 5 % 1st M. Bds. Mexican L. & Power, Common }	\$100	4 4	81-84	-1	5 19 1	..	..	..	..	..		
Do. 7 % Cum. Pref. ....	\$100	4 4	77-77	-3	5 3 0	..	..	..	..	..		
Do. 5 % 1st Mort. Gold Bds. ....	..	6 6	102-104	-1	6 14 7	..	..	..	..	..		
..	..	6 6	91 1/2-98 1/2	-1	5 7 0	..	..	..	..	..		

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ....	10	4 4 1/2	67-73	- 1/2	6 2 0	Monte Video Telephone, Ord. ....	1	6 6 1/2	1-1 1/2 xd	..	5 6 8
Do. 5 % Deb. Red. ....	Stock	5 5	97-99	..	5 1 0	Do. 5 % Pref. ....	1	5 5	3-3 1/2 xd	..	5 14 3
American Telep. & Teleg., Cap. }	\$100	8 8	132-134	-1	6 19 6	New York Telep., 4 1/2 % Gen. Bnds.}	100	4 1/2	99 1/2-100 1/2	+ 1/2	4 9 6
Do. Collat. Trust ..	\$1000	4 4	92-94	..	4 5 1	Oriental Telep. and Elec. ....	1	8 8 1/2	1 1/2-1 1/2	..	4 2 5
Anglo-American Telegraph ..	Stock	8 8	65-67 xd	..	4 9 7	Do. 6 % Cum. Pref. ....	1	6 6	1 1/2-1 1/2	..	4 15 0
Do. 6 % Pref. ....	Do.	6 6	110 1/2-112 1/2 xd	..	5 7 8	Do. 4 % Red. Deb. ....	Stock	4 4	88-90	..	4 8 11
Do. Del. ....	Do.	80/-	24 1/2-24	..	6 1 10	Pacific and European Tel., 4 % Guar. Debs. }	Do.	4 4	97 1/2-99 1/2	..	4 0 5
Anglo-Portuguese Tel., 5 % } Mort. Deb. }	100	6 6	99 1/2-101 1/2	..	4 18 6	Renter's ..	10	10 10 1/2	11 1/2-11 1/2	..	8 12 0
Chill Telephone ....	6	7 7	71 1/2-73 1/2	..	5 1 1	Do. New Shares ..	10	..	102-111	..	..
Commercial Cable, 8 1/2 % Deb. }	Stock	4 4	83 1/2-85 1/2	+ 1/2	4 13 7	Submarine Cables Trust ..	Cert.	6 6	124-127	..	4 14 6
Cuba Telegraph ....	10	6 6	82-84	..	6 6 4	Telephone Co. of Egypt, 4 1/2 % Deb. Red. }	Stock	4 1/2	96 1/2-98 1/2	..	4 11 5
Do. 10 % Pref. ....	10	10 10	15-17	..	5 17 8	United River Plate Telephone ..	5	8 8	7 1/2-7 1/2	+ 1/2	5 3 3
Direct Spanish Telegraph, Ord. }	5	4 4 1/2	84-87	..	7 2 10	Do. 5 % Cum. Pref. ....	5	5 5	5 1/2-5 1/2	..	4 9 0
Do. 10 % Cum. Pref. ....	6	10 10	6 1/2-7	- 1/2	5 14 4	West Coast of America ..	2 1/2	2 1/2	12-13	..	4 3 4
Direct United States Cable ..	10	5 5	4	..	4 9 0	Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel. }	100	4 4	95-98	..	4 1 8
Direct W. India Cable, 4 1/2 % Reg. Deb. }	Stock	4 4	99-101	..	5 1 5	West India and Panama Teleg. }	10	2 1/2	2 1/2-2 1/2	- 1/2	..
Eastern Telegraph, Ord. Stock }	Stock	7 7	135-138	..	4 8 1	Do. 6 % Cum. 1st Pref. ....	10	6 6	102-103	..	5 11 7
Do. 8 1/2 % Pref. Stock. ....	Do.	8 8	77 1/2-79 1/2	..	4 3 4	Do. 6 % Cum. 2nd Pref. ....	10	5 5	93-10	..	6 0 0
Do. 4 % Mort. Deb. ....	Do.	4 4	94-96	..	5 3 8	Do. 6 % Debs. ....	100	5 5	101-103	..	4 17 1
Eastern Extension ..	10	7 7 1/2	13-19 1/2	..	4 2 6	Western Telegraph, Ltd. ....	10	7 7 1/2	13-13 1/2	..	5 3 8
Do. 4 % Deb. ....	Stock	4 4	95-97	..	8 18 10	Do. 4 % Deb. ....	Stock	4 4	85-87	..	4 2 6
East and S. Africa Tel. 4 % } Mt. De. Maritime Sub. }	95	4 4	98 1/2-101 1/2	..	5 6 8	Western Union 4 1/2 % Fug. Bonds }	\$1000	4 1/2	80-89	..	4 11 0
Globe Telegraph and Trust ..	10	6 6	103-11 1/2	..	6 3 1	..	..	..	..	..	
Do. 6 % Pref. ....	10	6 6	12 1/2-13 1/2	..	5 6 7	..	..	..	..	..	
Great Northern Telegraph ..	10	18 20	30 1/2-32 1/2 xd	..	5 16 3	..	..	..	..	..	
Indo-European Telegraph ..	26	18 13	69-61	- 1/2	5 11 1	..	..	..	..	..	
Maekay Companies Common ..	100	5 5	83-86	..	4 16 0	..	..	..	..	..	
Do. 4 % Cum. Pref. ....	\$100	4 4	89-92	..	4 13 10	..	..	..	..	..	
Marconi's Wireless Telegraph ..	1	20	4 1/2-4 1/2	- 1/2	..	..	..	..	..	..	
Do. 1 % Cum. Partic. Pref. ....	1	17	8 1/2-8 1/2	- 1/2	..	..	..	..	..	..	

\*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ Bs. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railway and tramway companies in the home market. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 29th, Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 29th, Rise or Fall, Present Yield p.c.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railway and tramway companies in colonial and foreign markets. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 29th, Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 29th, Rise or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations April 29th, Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations April 29th, Rise or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

## GAS AND OIL ENGINES FOR ELECTRIC SUPPLY STATIONS.

By A. N. RYE.

FROM time to time a number of articles have appeared in the technical Press dealing with the generation of electricity by gas and oil engines.

Certain of these articles have dealt with private supplies, and have been of considerable interest, but the conditions of public supply are so different from private supply that it is by no means certain that a type of machine which has been satisfactory in one case will be equally satisfactory in the other case: for instance, the question of reliability is of so much more importance to a public supply than to a private plant.

The articles dealing with gas and oil engines for public supplies have, in many cases, been of the nature of estimates, and many engineers are not satisfied that the figures put forward can be obtained in actual practice.

Under these circumstances engineers may be interested in the results obtained in a central station depending almost entirely upon gas and Diesel engines, and where both classes of engines are run in the same power house by the same staff and under the same conditions.

The public supply of electricity in the Island of Guernsey is undertaken by the Guernsey Electric Light and Power Co., Ltd., the supply was started in 1900 from a small station at Les Amballes, equipped with the plant usually installed about that date, *i.e.*, Belliss engines, Babcock boilers, surface condenser, economiser, battery, &c.

At a later date a demand for power developed in the granite quarries at a distance of about 2½ miles from the generating station: as this load increased it became impossible to deal with it from the Les Amballes station, and a new power station was built at St. Sampson's in the centre of this load, and the Les Amballes station was continued principally to supply the lighting demand in and around the town of St. Peter Port.

The first plant installed in 1904 at the new station at St. Sampson's consisted of two gas-driven sets nominally of 180 kw. each, together with pressure gas producers and a battery of 1,200 ampere-hours, 420 volts, capacity. Later in 1908 another set of 220 kw. was added. Early in 1911 a Diesel driven set of 165 kw. was installed, and in

TABLE I.—GAS ENGINES, ST. SAMPSON'S, 1912.

Month.	Units generated.	Tons coal.	Lb. per unit gen.	Per ton.	Cost.	Per unit.
January...	51,720	75	3.2	17/10	£66 17 6	'31d.
February...	50,628	68.5	3.0	"	61 1 6	'29d.
March ...	41,024	60	3.2	"	53 10 0	'31d.
April ...	47,185	46	2.14	"	41 0 4	'21d.
May ...	67,231	58	1.93	"	51 14 4	'18d.
June ...	54,845	52.5	2.14	18/6	48 11 3	'21d.
July ...	67,465	67.5	2.2	19/-	64 2 6	'22d.
August ...	72,172	75	2.33	18/-	67 10 0	'22d.
September	79,527	73	2.06	19/6	71 3 6	'21d.
October ...	101,126	90	2.0	"	87 15 0	'21d.
November	118,739	100	1.9	"	97 10 0	'20d.
December	93,214	84	2.0	"	81 18 0	'21d.
Total ...	844,876	849.5	2.25		£792 13 11	'225d.

December, 1912, another similar set was put down. At the old station at Les Amballes, certain steam plant was dismantled in 1911 and two Diesel-driven sets, each of 135 kw., were installed. Under normal conditions the whole of the load at both stations is carried by the gas and oil-driven plant, the steam plant being used only as a reserve during repairs to the more economical, but less reliable, internal combustion engines.

It will be seen that no engines were installed during 1912, except the last set at St. Sampson's, and this was not running until 1913; consequently in the following figures all the results are from engines which have run at least one year, and the majority for a longer period.

During 1912 the gas and oil engines generated 1,865,236

units, of which rather more than half was generated by the oil engines; consequently both classes of plant had to run for long hours.

Very careful monthly records were kept of the performance of each class of plant, and the accuracy of these figures is proved by the fact that the total of the invoices for coal and

TABLE II.—OIL ENGINE, ST. SAMPSON'S, 1912.

Month.	Units generated.	Weight of oil, lb.	Lb. per unit gen.	Per ton.	Cost.	Per unit.
January...	16,151	31,957	75	51/	£39 15 3	'20d.
February	8,107	6,466	8	56/6	8 1 8	'23d.
March ...	51,831	38,525	70	"	18 6 4	'21d.
April ...	46,965	32,281	687	"	40 9 8	'21d.
May ...	47,315	32,041	677	"	40 3 9	'21d.
June ...	43,976	29,689	675	"	37 4 8	'20d.
July ...	46,624	30,379	651	"	38 2 0	'20d.
August ...	46,053	31,400	67	"	39 7 7	'20d.
September	36,462	24,906	684	"	31 1 8	'20d.
October ...	30,259	21,228	701	65/6	31 0 11	'25d.
November	4,999	3,503	7	"	5 2 5	'25d.
December	35,909	26,515	738	"	38 15 6	'26d.
Total ...	447,685	311,893	696		£397 14 5	'213d.

oil for the year exceeds the sum of the monthly figures by less than 2½ per cent., and this difference is probably due to small losses in storage, &c.

The figures in Tables I, II and III, being abstracts from the monthly records, are worked out on the units generated, the units sold not being available each month.

In comparing the performances of the different types of engine, there are certain points to be taken into consideration.

In the case of the gas engines, it must be remembered that two of these engines are more than eight years old; in 1911, they had got into a bad state of repair, with worn pistons, worn liners, &c., and it was decided to thoroughly overhaul all the gas engines and gas plant. This work was not completed until July, 1912, and the high fuel consumption of

TABLE III.—OIL ENGINES, LES AMBALLES, 1912.

Month.	Units generated.	Weight of oil, lb.	Lb. per unit gen.	Per ton.	Cost.	Per unit.
January...	59,459	40,045	675	54/-	£48 4 5	'19d.
February...	73,010	47,234	645	59/6	62 11 8	'20d.
March ...	54,381	36,813	677	"	48 15 6	'21d.
April ...	34,701	23,335	672	"	30 18 4	'21d.
May ...	39,028	26,247	673	"	34 15 6	'21d.
June ...	33,514	22,006	657	"	29 3 2	'21d.
July ...	34,698	21,827	629	"	28 18 5	'20d.
August ...	45,129	30,285	67	"	40 2 6	'21d.
September	26,857	17,750	66	"	23 10 4	'21d.
October ...	42,388	28,740	678	68/6	43 18 8	'25d.
November	64,648	44,400	688	"	67 17 10	'25d.
December	64,862	44,760	69	"	68 8 11	'25d.
Total ...	572,675	383,444	670		£527 5 3	'221d.

the first three months of 1912 is entirely due to the condition of the plant, and should be neglected when making comparisons. If, then, the months of April, May and June, are compared, it will be seen that there was practically no difference in cost per unit for fuel between the gas and oil engines, but later in the year, although the cost of coal increased, the cost of oil increased in a much greater ratio, and for the months of October, November and December, the gas engines were very decidedly cheaper in fuel cost. This difference in cost is even more marked at the moment of writing, so much so that the Diesel engines are being run as little as possible, and the gas engines as much as possible. This preference for the gas plant is entirely due to the enormous increase in the cost of fuel oil, which has gone up 75 per cent. in price in less than two years.

In Tables II and III, if the "lb. of oil per unit" column is examined, the wonderfully even running of the Diesel engines will be noticed.

Table III shows this to most advantage, because the load factor of these engines is more nearly constant from day to day, and also because the engine in Table II has developed

more defects than the engines in Table III, which have run practically without trouble for the whole of the year.

The running of these Diesel engines shows very clearly one remarkable fact—the full load guarantee being '67 lb. of oil per unit, the actual consumption for the year exceeds the guarantee figures by less than 5 per cent.

Everyone who has had to run steam plant under similar conditions knows that the test results will be exceeded by at least 50 per cent., and even with gas plant it is difficult to keep within 20 per cent. of test figures.

It is quite possible to take one or two individual figures in these tables, and query their accuracy. For instance, in Table III the month of July shows an impossibly good figure under "lb. per unit." There are reasons for this, and other small errors, which it would be tedious to explain, and it was thought advisable to give the figures exactly as recorded without any alterations; that any small error in one month corrects itself later is proved by the close agreement with the figures for the complete year.

Table IV shows the costs per unit sold for 1912 abstracted from the balance-sheet and given in detail, so that the station costs can be seen separated from the distribution costs. It should be mentioned that no part of the cost of the special overhaul to the gas plant is included in these figures.

TABLE IV.—COSTS PER UNIT SOLD FOR 1912.

<i>Generation.</i> —Fuel... ..					33d.
Oil, waste, water, &c. ... ..					08d.
Wages and salaries ... ..					16d.
Repairs—Buildings, plant, tools ... ..					16d.
Accumulators ... ..					05d.
					78d.
<i>Distribution.</i> —Wages and salaries, repairs mains, repairs meters, &c. ... ..					08d.
Rent, rates, taxes and insurance ... ..					07d.
<i>Management</i> ... ..					18d.
Total running costs ... ..					101d.

The above cost is without any interest charges, &c.

$$\text{Efficiency} = \frac{\text{Units sold} \times 100}{\text{Units generated}} = 78 \text{ per cent.}$$

The efficiency figure is given so that direct comparison may be made with the monthly figures which are worked out on units generated; reducing the year's fuel cost to this basis, the result is 257d. per unit generated, the excess over the monthly figures being due to the running of the steam plant under very uneconomical conditions.

The above figures give the facts of the case, but would not be complete without some account of the running of the plant and the opinions formed by the engineers in charge of it.

So far as fuel costs are concerned, there is no doubt that in the special circumstances in Guernsey both gas and Diesel engines are very economical; anthracite peas for gas making can be bought at about the same price as small steam coal, and, in practice, this means that the fuel bill for steam working would be nearly double the cost for generation by gas. The fuel costs of the Diesel engines before the recent heavy rise in the price in oil were practically the same as for gas, but, at present prices, the cost of running the Diesel engines is so heavy, that it is fairly certain that no more engines of this type will be installed until oil prices fall.

Although the internal combustion engines have proved economical in fuel cost, it is certain that part, at least, of this saving must be set aside to pay for the heavier running costs in other directions; for instance, the lubricating oil bill amounts to over 10 per cent. of the fuel bill, and costs probably three times as much as the oil for a steam-driven station using reciprocating engines; while, if turbines are used, this item of expenditure becomes very small. The labour costs are highest for gas engines and lowest for Diesel engines, steam plant taking a position about midway between the two.

As compared with steam, the supervision charges are higher for both gas and oil engines. With internal combustion engines, the repair costs are one of the most serious items, and, in spite of all statements to the contrary, there is no doubt that quite a large amount of the saving in fuel must be spent on repairs.

After two of the gas engines had run for seven years and

the third for three years, they had reached such a condition that repairs costing well over £2,000 were necessary to put them in good order, although large sums had been spent on repairs each year. This statement must, however, be qualified by explaining that these particular engines were of an early type, and there is no doubt that more modern engines could be maintained at a lower cost.

The Diesel engines have not been running sufficiently long to require much in the way of ordinary repairs, and for the greater part of the time all breakages have been covered by the makers' guarantees, but from the experience up to date it seems reasonably certain to expect that the repairs will be more costly than for steam plant, though it is hoped that the cost will not be so heavy as for the gas plant.

Reliability is a point of supreme importance for a public supply. Experience with the gas engines showed that internal combustion engines were not suitable for a public supply without the assistance of a large battery, and it is no exaggeration to say that without the battery it would have been quite impossible to maintain the supply with reasonable economy; there are so many things which may suddenly cause a gas engine to give up working, and it is impossible to guard against them. Therefore, either an extra set must always be running in parallel, thus increasing the fuel, oil and attendance charges, or a battery must be installed.

With this experience as a guide, it was decided that when Diesel engines were installed at Les Amballes station, it would be advisable to alter the battery arrangements, so that an output equivalent to the full load of one Diesel set could be available instantly if one of the running sets failed; this precaution has proved most useful, it allows the engines to be run at practically full load with safety, and it has saved a number of failures of supply that otherwise would have taken place.

It must not be assumed from the above remarks that the failures of gas or Diesel engines are always of a serious nature; the great majority of accidents that might cause an interruption to supply are quite trivial, and can be rectified in a few minutes, but they happen so suddenly that there is no time to run up a spare set. With the gas engines it may be a trifling defect in the ignition gear, or something causing pre-ignition or back firing. With the Diesel engine it may be a needle valve stuck open, or a compressor valve hung up; all of these defects may be of no importance, and the engine may be on load again in a few minutes, but unless a spare set is running, or there is a battery, they may cause an interruption to the supply.

Experience has shown that the gas engines are more subject to these little troubles than the Diesel engines, in fact, the Diesel engines have frequently run for several months without an involuntary stop, whereas the same cannot be said of the gas engines. On the other hand, the Diesel engine failures give less warning, and usually take longer to put right.

There is no doubt that, if a supply depends entirely on internal combustion engines, more spare plant must be installed than in a steam-driven station. In the first place, internal combustion engines cannot be overloaded for emergency purposes, and of even more importance is the fact that a defective steam plant can often be run until the load falls at night, whereas a defect in an internal combustion engine must receive attention without delay. For instance, a leaky valve or a blowing joint on a steam engine can usually wait for attention, but on a gas engine, and more particularly on a Diesel engine, these defects may stop the set at once, and even if they do not do so it is generally advisable to shut down the set without delay to avoid the risk of serious damage, as the high temperature and high pressure of the gases cut the metal surfaces with surprising rapidity and may do much damage in a short time.

Another reason for having plenty of spare plant, particularly with Diesel engines, is the considerable degree of accuracy essential when making adjustments and repairs; this accuracy cannot be obtained on work carried out at night by a tired staff of men racing against time to get the plant on load again.

To sum up briefly, internal combustion engines can give a perfectly satisfactory supply, particularly if batteries are installed; but they are essentially different from steam plant, and must be installed and run with due regard to this fact.

Under favourable circumstances, these machines are economical, but it must not be forgotten that there are other expenses besides the fuel bill, and the fuel bill of the internal-combustion engine must show a handsome saving to justify the use of this class of plant.

Of the two, the Diesel engine appears to have certain advantages for central-station work, but, as long as the market for oil is subject to such severe fluctuations, the use of this engine is likely to be restricted to special cases.

The most useful field for the internal-combustion engine appears to be in small central stations; as the size of the station increases, the advantages of this type of plant decrease, until a point is reached where internal-combustion engines can only pay in exceptional circumstances, and at the present date this point appears to be reached when a station under average English conditions is of sufficient size to use steam turbines of 1,000 kW. or larger.

The results in Guernsey have fully justified the installation both of gas and Diesel engines, the great saving in the fuel bill being more than sufficient to balance the increased costs in other directions.

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## THE DEPUTATION.

[COMMUNICATED.]

"You might arrange to meet the 10 o'clock train on Wednesday and show the deputation from Mudcombe over the destructor." Such were the instructions from headquarters, which brought me to the railway station to scan with anxious eyes the mass of humanity which poured off the train. But there was no need for anxiety; the deputation stood self-confessed; five men in shiny top hats, who walked down the platform as if they owned the place. I approached the group and addressed the gentleman at the head of the procession, who proved to be the Chairman of the Committee, and I was duly presented to the Mayor, the vice-chairman, an Alderman, and, as an after-thought, to the fifth individual, who was the engineer.

At the station entrance they looked round as if expecting some conveyance, but I explained that the destructor was less than five minutes' walk away; however, it took longer than that, because a public-house lay on the route, and, after a hasty consultation, they adjourned within, all except the vice-convenor, who said he would stay outside with me. I assured him that it was not necessary, but he said that he had had a drink already that day, and I soon found that if he had no thirst for liquor he had an insatiable thirst for information, mostly, however, of a useless character. He told me that they had been delegated to visit the principal combined refuse destructor and power stations in the country to find out the best and most economical method of disposing of town's refuse, and wanted to know if at our installation we destroyed it by burning or in some other manner. I told him we burnt it, and that as far as I knew there was no other method of dealing with it. "Oh, yes," he said, "in one of the towns we visited they compress it in hydraulic presses and sell it." I gently suggested that he must be thinking of the tins which were recovered from the refuse, and which were compressed to reduce the bulk, but he stuck to his point that it was the refuse that was compressed, though he could not explain why that destructor should be tacked on to a power station.

When we arrived I understood the reason for his hopeless ignorance, for at the destructor door a gust of wind smothered them with a cloud of fine dust such as a destructor alone can produce, and he decided that he would remain outside to rearrange his notes while the others had a look round. Later on, when I crossed the yard, he was standing beside the screened clinker bin and called me over to ask how much a ton we paid for it; I said "ninepence," thinking he meant to ask how much we sold it for, but he transfixed me with a glittering eye and said, "Don't tell me, young man, that you can buy coal at 9d. a ton; you mean 9d. a hundredweight." I explained that the stuff wasn't coal, but clinker—the residue left in the furnaces after the refuse was destroyed—and that we crushed and screened it and sold it for building material at 9d. a ton;

he didn't seem convinced, and wanted to see the coal that we mixed with the refuse to make it burn. I assured him that no coal was used, that ordinary refuse was quite capable of burning alone, but by that time he was sure that I was a stranger to truth, and looked at me in a manner which showed that he, at any rate, had no doubt that my future was warmly provided for.

I mollified him to some extent by expressing a deep interest in the investigations which he and his party were carrying out, and asked as a great favour that he would send me a copy of their report. He promised to do so, but it has not come to hand, and I fear that I shall now never have the enjoyment that I have looked forward to for months, of reading that report on destructors.

The other members of the deputation were also interesting characters in their way. The chairman seemed anxious to do his duty; he examined everything and wanted everything explained to him. When any of the explanations seemed to him to be important, he would say: "Dear me! How interesting! You might say that over again, very slowly," and then he would start and write it down word for word in longhand.

On several of these occasions the Alderman would break in and say, "Do hurry up, Jenkins, and let's get out of this beastly place: the dust makes my throat awfully dry." I felt a sympathy for the man, and offered him a drink of water, but he seemed to think I was making fun of him, and when the Mayor, who overheard me, laughed, he was quite hurt, and went outside, probably back toward the railway station.

The Mayor, on the other hand, took his duties very lightly. He handed me a list of typewritten questions, and asked me to fill in the answers while he spent his time in dodging out of the way of dust and smoke.

I don't know who drew up the questions, but half of them were silly and the other half were useless, as far as supplying information was concerned; of course, it was easy to see the force of Question 1, which asked for the name of the town; but why Question 2 should ask if you have a refuse destructor beat me; then, when Question 3 wanted to know if it was used in conjunction with a power station, and the deputation was visiting combined plants only, I began to understand why the man preferred to hand the sheets over to be filled up rather than ask the questions.

When the subject of destructors had been exhausted, the remains of the deputation took a walk round the engine room, while I went to the desk to fill up the Mayor's sheets; the chairman of the Committee was just explaining to him, when I left them, that electricity was produced by rubbing copper and vulcanite together; they were standing beside a commutator, and I expect he was vaguely recalling some of his earlier lessons in frictional electricity, and trying to impress the Mayor with the insight which he had into the work of the department. The engineer, who was within hearing, made no comments, but he looked interested.

The deputation were going on to another town in the afternoon, but were not to visit the destructor till the following day, so they borrowed the telephone to ring through and book seats at a pantomime for that evening.

The entry in the visitors' book was characteristic of the deputation—"We are very pleased with our reception, and with all that we saw."

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## PROCEEDINGS OF INSTITUTIONS.

### Faraday Society.

#### GENERAL DISCUSSION ON COLLOIDS.

FOR some years past it has been the practice of the Faraday Society to devote one meeting a year to a general discussion on some physico-chemical subject of special current interest. The subject chosen on the present occasion was "Colloids and their Viscosity," and the discussion took place in the presence of a crowded audience, on the afternoon and evening of March 12th last. As usual, the proceedings opened with the reading of papers by some of the most distinguished exponents of the various aspects of the subject, and the Society is to be congratulated on having induced so many eminent foreign investigators to come to London in order to present in person their contributions to the discussion.

In the absence of the President through indisposition, the chair was taken by MR. EMIL HATSCHKE, himself one of the foremost workers in this field of physical chemistry, and the set speakers were as follows:—

DR. WOLFGANG OSTWALD, of Leipzig: "The Importance of Viscosity for the Study of the Colloidal State."

PROF. VICTOR HENRI, of Paris: "The Measurement of the Size of Colloidal Particles and the Relation of Size to Viscosity."

PROF. WOLFGANG PAULI, of Vienna: "The Viscosity and Electrochemistry of Protein Solutions."

PROF. H. FREUNDLICH, of Brunswick: "On the Rate of Coagulation of  $Al(OH)_3$  sols as measured by the Viscosity Change."

MR. EMIL HATSCHKE: "The General Theory of Viscosity of Two-phase Systems."

Those who took part in the discussion which followed included Dr. S. B. Scheyver, Dr. W. Ramsden, Dr. P. Schidrowitz, Prof. J. W. McBain, Prof. T. Turner, Mr. F. P. Worley and Dr. C. J. Martin. Space will only permit us to indicate in briefest possible outline the scope of the discussion.

We will preface our remarks by stating that a so-called colloidal solution is one in which the solute is in an exceedingly fine state of suspension, too fine to be visible excepting, in some cases, by means of some special contrivance like the ultra-microscope, but still of such dimensions and state that a colloidal solution can always be regarded as consisting of two phases—the solvent or "continuous" phase and the colloidal suspension or "disperse" phase. Colloids can be roughly sub-divided into substances which are not normally in the colloidal state, but can be induced into it by special treatment, such as gold, silver, ferric hydroxide, and other inorganic substances, and those which dissolve at once to form colloidal solutions, organic bodies like gelatine, albumin, starch, agar, &c. In the case of the former type of colloidal solutions, the viscosity differs little from that of water; and hence it is inferred that the "disperse" particles are in a solid state. The viscosity of organic colloidal solutions is mostly very considerable, and the inference is that the "disperse" phase here consists of liquid particles. An albumin sol would thus consist of a dilute solution of albumin, in which are dispersed globules of a much more concentrated solution. This distinction at once suggests how much may be learnt about colloids from a study of so typical a characteristic as their viscosity and its changes, and the study is likely to throw light not only on the constitution of colloidal solutions, but even on that of molten solids and crystalline liquids, usually supposed to be homogeneous. It was this aspect of the subject which was dwelt on by Dr. Ostwald. Mr. Hatschek described the mathematical treatment by which he has obtained formulae for the viscosity of the two types of colloidal systems, assuming one to consist of suspensions of undeformable spheres, and the other of two liquids, freely deformable, in which the disperse phase occupies the larger part of the volume, and assumes a polyhedral structure. An interesting deduction is that the viscosity of the former type of solution is independent of the size of the particles in suspension. Prof. Pauli showed how viscosity measurements have thrown light on the state of ionisation of protein solutions, and he pointed to further possibilities in the study of the constitution of starch, lecithin and other emulsions. It is well known that the first class of colloids referred to above, which consist of minute solid particles in suspension, are precipitated or coagulated by the addition of an electrolyte to the solution by the ions of the electrolyte disturbing in some way the electrical equilibrium of the colloidal suspension. Profs. Freundlich and Ishizake contributed to the discussion a study of these coagulation phenomena, as they occur in an aluminium hydrate colloidal solution, and they ascribe the coagulation to the fact that the minute colloidal particles do not absorb equal numbers of ions. These fluctuations give rise to differences in the charges, and consequently to coagulation.

Direct practical applications of the subject were dealt with in the course of the discussion, chiefly by Dr. Schidrowitz, who spoke on the relationship between the viscosity of rubber and its quality, as shown by vulcanisation tests, and Prof. T. Turner, who drew attention to the importance of the study of viscosity in connection with the properties of metals and alloys. The viscosity of several metals in the fluid state had been found to be only a few multiples of that of water, but as the metals cooled and solidified, of course their viscosity increased. There was a striking resemblance in their behaviour to that of colloidal solutions of the second class, the discontinuous phase corresponding with the less fusible portion of the metal, which first solidified, while the continuous phase was the mother liquor. Prof. Turner pointed out that the fact that when metals which had been cast were first rolled, their density increased, but by further rolling it tended to decrease, had a parallel in the behaviour of colloids, and a very interesting field for further inquiry was thus opened up.

#### Physical Society.

At the meeting held on Friday, April 11th, a paper "On Errors in Magnetic Testing due to Elastic Strain," by MR. A. CAMPBELL and MR. H. C. BOOTH, was read by MR. CAMPBELL.

In magnetic tests on sheet material, considerable errors may occur if the sheets or strips are tested while in bent form. These errors, which are in general agreement with the known effects of compression and tension, were investigated experimentally with one or two forms of magnetic circuit similar to those sometimes occurring in practice. In one method a single length of the strip was bent into ring form, with ends clamped together. This was wound with flexible primary and secondary coils, and tested for permeability and hysteresis, while in the condition of temporary

strain. The temporary strain was then annulled by changing the circular form into a square by sharp bends at four places. The magnetic tests were repeated, and usually a considerable alteration was observed. For example, a silicon-iron ring, 0.3 mm. thick and 50 cm. in diameter (the size used in Richter's method of testing hysteresis and eddy-current losses) showed a decrease of 40 per cent. in the permeability for  $H = 1$ , due to the bending. The hysteresis loss was increased by 19 per cent. In another method, the ends of two strips were clamped in yokes, and tests were made with different amounts of bending. It was found that temporary strain had considerably greater effect on the permeability than equal permanent strain had.

A "Note on Cathodic Sputtering" was read by DR. G. W. C. KAYE. The paper gives an account of the volatilisation of an aluminium cathode in a discharge tube containing helium. The sputtered deposit on the glass indicates that, under the conditions which prevailed, the disintegration was restricted to the edges of the cathode and did not occur elsewhere. Accordingly, the complete outline of the cathode (made by rolling a sheet of aluminium into a nearly complete cylinder) was traced out by the deposit on the walls of the tube. The size of the particles depended chiefly upon the nature of the gas in the tube. The method had been considerably used for preparing extremely high resistances, though the film had to be annealed first. He believed the thinnest films did not accurately obey Ohm's law. The adherence of the film varied with the metal. Gold adhered to glass well, but platinum was easily rubbed off till it had been heated to redness.

A paper on "Vibration Galvanometers with Unifilar Torsional Control" was read by MR. A. CAMPBELL. The author exhibited a moving-coil vibration galvanometer, in which a novel principle is used to obtain the fine adjustment of the control torque requisite for accurate tuning. He has found that in a phosphor-bronze strip under tension the torsional rigidity is considerably increased as the tension is raised. If unifilar (strip) suspensions are used in a vibration galvanometer (whether of moving-coil or moving-iron type) the tuning can be done in just the same way as with bifilar suspension. In the moving-coil instrument, minute hooks on the ends of the strips engage in contact hooks at the top and bottom of the coil, which is easily detachable. With a mirror of 15 sq. mm. area, at 100 cycles per second, a sensitivity of 50 mm. at a metre per micro-ampere can be obtained, the effective resistance being about 70 ohms.

#### Standard Clauses for Street Lighting Specifications.

(Discussion on paper by MR. A. P. TROTTER, presented to the ILLUMINATING ENGINEERING SOCIETY, April 15th, 1913.)

IN opening the discussion, MR. A. P. TROTTER stated that the subject was admittedly controversial, and the object of the paper was rather to stimulate discussion than to indicate conclusions. The field to be covered was so extensive that the nature of the illuminant and its fittings, &c., was left out of consideration by the specification. What had been sought was a specification which would permit certain results to be reproduced by following written instructions, and which would enable borough surveyors and others to determine whether a certain installation was to be regarded as satisfactory or otherwise. The first question to raise discussion in the Committee was whether the C.P. number, spacing and height of lamps should be specified, or whether the illumination to be received should be specified, and the attainment of this result left to the competitive skill of contractors. It had been objected that an illumination specified by its minimum value would be a low illumination, but only in very brightly-lighted streets was a low diversity factor obtained. In ordinary streets, the diversity factor was high, hence the adoption of the minimum illumination as criterion would not involve low illumination. A strong argument in favour of a specification by illumination was that the classification by minimum horizontal illumination agreed with the findings of the eye, and the fundamental aim of street lighting was to produce illumination agreeable to and sufficient for the needs of the eye. It was desired that a specification should be framed which would be acceptable for use all over the country; hence the discussion should be conducted in an unprejudiced and broad-minded manner.

MR. W. H. PATCHELL (chairman of the Joint Committee) said that the Committee had not been able to arrive at definite conclusions in certain respects, and had been faced with three alternatives: the coercion of the minority; the modification of the specification; or the education of people up to the present specification. In the hope of achieving the latter aim, the present discussion had been arranged. The most striking feature in the Committee's work was the surveyors' report, and its corroboration by tests. The curves in the paper showed that the surveyors realised exactly what they wanted, and were able to judge when they had got it, but hitherto it had been very difficult to specify street lighting in such a manner that the desired results could be ensured. This difficulty the specification was intended to remove. Views of the police authorities and motor-drivers had been collected by the Committee.

MR. F. W. GODENOUGH (chairman of Council of the Illuminating Engineering Society) said that the society's aim was to study illumination, and to raise its standard; in the present connection, the sole object was to ascertain what would be a satisfactory specification, enabling the public to secure the type and result of illumination required. Did the draft specification lead to this result, and, if not, in what respects should it be amended?

MR. H. T. HARRISON agreed with the author that lighting authorities "should settle what it is they want to buy, and, having specified it, leave details to the competitive skill and wider experi-



was the case, for instance, in some rectangular gas mantles with which he was experimenting, (the edges being placed across the street in order to reduce the present loss of light incident on side walls). In such cases, Mr. Trotter's method had to be employed, but the speaker would like to see direct-ray substituted for horizontal illumination measurements. In his opinion, Mr. Harrison's table in the paper afforded the best possible argument in favour of direct-ray measurements. For example, a minimum horizontal illumination of 0.01 foot-candle was produced by 33.7-c.p. lamps at 10 ft. height and spaced 70 ft., or by 32.6-c.p. lamps at 36 ft. height and 100 ft. spacing, but it was absurd to contend that the illumination produced was similar in the two cases—as was the practical effect of the specification. The direct-ray test showed a 7:1 distinction between the two cases. The height of the photometer did not affect the conclusion reached by direct-ray measurements, but was of prime importance in the horizontal illumination method since it penalised low lamps—for instance, with 100 ft. spacing, 62-c.p. lamps hung 14 ft. high provided 0.01 ft.-candle minimum horizontal illumination, but 95-c.p. lamps were required to conform to the specification if the height of suspension were only 10 ft.

MR. K. EDGUMBE (member of Joint Committee representing the Institution of Electrical Engineers) stated that he had long been in favour of specifying street lighting by the horizontal illumination to be produced, and this opinion was confirmed by reading the present paper. It had been objected that horizontal illumination measurements were purely physical, and took no account of the physiological aspects and effects of the illumination. The very merit of the proposed basis of specification lay in the fact that it gave results in absolute concord with the classification arrived at by experts who purposely allowed every physiological effect to sway their judgment. It might be quite satisfactory to work on a direct-ray basis, but it was indisputable that minimum horizontal illumination was a reliable criterion of the eye-value of the illumination as a whole. It had been contended that direct candle-power measurements offered the advantage of simplicity in application, but Mr. Trotter—who was in a position to speak with authority—said that there was no difficulty in measuring so low a horizontal illumination as 0.006 foot-candle, and that he would prefer to measure it directly. It did not seem to be generally realised that the specification left the observer free to measure candle-powers and calculate horizontal illumination if he so desired—whether the illumination was less than 0.01 foot-candle or not. The horizontal illumination at a certain point in a certain plane was a definite quantity, but the direct-ray illumination falling on this point had different and unrelated values according to the direction of observation selected. Yet another alternative was the Westminster specification; this controlled the c.p., height and spacing of lamps, the angle at which measurements were to be made and, as a guard against freak lamps, necessitated the proviso that only horizontal reflectors should be used. It was needlessly complicated and was analogous to examining the pedigree of a sheep when what was wanted was a mutton chop!

MR. J. DARCH emphasised the fact that the public was concerned in obtaining illumination, not lamps. Where street lighting was so deficient that the lamps merely acted as "beacons," the effect was actually to make it more difficult to see (owing to the pupillary contraction produced). Only that lighting could be regarded as good which was visually and physiologically efficient and, in the speaker's opinion, the specification ought to take into account glare and physiological effects. The specification did nothing to discourage the exposed powerful lamps now so commonly used, and this was an omission which should be rectified, since contractors and the public were likely to accept the findings of the Joint Committee as a complete and final pronouncement on street lighting desiderata. He suggested that to Clause (3) should be added a statement to the effect that where properly screened lamps were used, 33 per cent. lower illumination than otherwise required, should be permitted. This would give a direct incentive to improvement, and the advantage gained would actually be far greater than the concession granted. A shielded 60-c.p. lamp produced better results than a 200-c.p. lamp bare, but similarly arranged in other respects. Bright moonlight corresponded to about 0.01 ft.-candle, and produced a pleasing illumination, yet a street lighted by present methods, and in which this minimum horizontal illumination was produced appeared gloomy, owing to glare and the effect of pupillary contraction. The latter trouble was not reduced by arranging a row of low c.p. lamps in the street. Most dazzle was produced by the most distant lamps (distance, *per se*, not diminishing their brilliance), and this fact facilitated the arrangement of suitable screening. In many cases, shop lighting overwhelmed the street lighting proper, and it was desirable that legislation should prohibit exposed lamps in or outside shop windows; as long as shopkeepers obstructed bare high c.p. lamps, so long must street lighting remain un satisfactory. Street illumination in the future would be effected by diffuse reflection from house-fronts, breaking away from the utterly mistaken, if natural, evolution of modern street lighting standards from medieval lantern arrangements.

The CHAIRMAN here announced that the discussion would be resumed on April 29th.

### Self-Synchronising Machines.

By DR. E. ROSENBERG, M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, London, April 10th, 1913; also at Manchester and Birmingham.)

If the synchronous motor is to be used on consumers' premises, for doing useful work, it must be able to start easily and

develop an appreciable starting torque. One of the most useful fields of application for the self-starting synchronous motor is for motor-generators. Here a comparatively small starting torque is required unless a heavy fly-wheel is coupled to the motor-generator. If, however, the synchronous motor has to drive a pump or compressor, even with unloading valve, the required starting torque is considerable.

(a) *Modified Induction Motor.*—The synchronous motor works as an induction motor during starting, and it can be used either as a slip-ring or as a squirrel-cage motor. For this purpose we can either make such changes in the induction motor as will enable it to run after starting as a synchronous motor, or we can take the synchronous motor and make such additions as will enable it to start as an induction motor. The ordinary wound rotor of an induction motor can be excited, after full speed is reached, with continuous current. In order to obtain stability and overload capacity, however, it is essential to increase the air-gap and get a ratio of magnetising ampere-turns to armature ampere-turns somewhere in the neighbourhood of two, while, with the ordinary induction motor the ratio is somewhere in the neighbourhood of one-third.

A synchronous motor is liable to hunt if supplied with currents of certain periodic irregularities. It is an absolutely necessary precaution to supply the synchronous motor with dampers which, if sufficiently strong, prevent hunting even with considerable irregularities of the critical periodicity. If we arrange a three-phase rotor in the manner shown in fig. 1, we have a polyphase rotor winding used for continuous-current excitation, serving also as a three-phase damper.

The stator is provided with "star-delta switch" to reduce the starting current, which otherwise would greatly exceed the full-load current owing to the large air gap. The rotor has a three-phase winding; and two of the slip-rings are connected direct to the terminals of the three-phase starter. The other slip-ring can be connected direct to the third terminal of the starter by pushing the lever of the "field rheostat" to the position marked "starting position." If the lever is, on any of the other contacts, the exciter and the field rheostat are inserted between the third slip-ring and

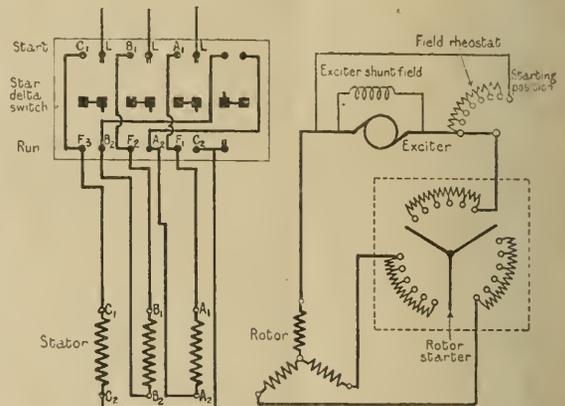


FIG. 1.—DIAGRAM OF CONNECTIONS FOR A SELF-STARTING SYNCHRONOUS MOTOR WITH DISTRIBUTED ROTOR WINDING ARRANGED IN THREE PHASES.

starter. For running, the starter is short-circuited. The exciting current flows into the third phase and is split at the star point, the two other phases each carrying one-half of the current. It is not absolutely necessary to cut the exciter out during starting, especially if a large starting torque is not required.

(b) *Salient-Pole Motor.*—By far the more general and more advisable method for the design of a multipolar synchronous self-starting motor is to use the standard salient-pole magnet wheel with the standard field coils on each pole, and to provide in or near the surface of the pole tips a squirrel cage for starting. With laminated pole-tips, slots are provided and bars of copper or some alloy inserted. Either the bars on all the poles are then connected through rings on both sides of the pole wheel, or only the bars belonging to each individual pole are connected by a copper or bronze collar going round the pole face. If solid pole-shoes are used, a special squirrel cage is not required, the solid pole-shoe in itself presenting a path for the currents induced from the stationary armature.

Two 300-kw. frequency changers built by the British Westinghouse Electric and Manufacturing Co., Ltd., each consist of a 14-pole motor for 60 cycles coupled to a 6-pole generator for 25.7 cycles. The rotor of the 60-cycle motor (fig. 2) has laminated poles fitted with a squirrel cage. The rotor of the 25.7-cycle generator has solid cast steel poles and no other damper. It is quite easy, as tests have shown, to start the set either from the 60 or the 25-cycle side.

Such a machine can be started with the field coils open or short-circuited. If the pole-shoes were laminated and no damper existed, the voltage of an open-circuited field winding, which is wound for, say, 100-voltage excitation, would be many thousand volts, even if the stator is only supplied for starting at a fraction of the normal voltage. The action of the dampers, however, reduces the open-

circuit field voltage to a considerable extent. A quicker start can be obtained with the field coils open-circuited than with the field coils short-circuited. A voltage of 25 per cent. is approximately the minimum which can be used for starting the set.

The starting of the motor itself can be understood fully by applying the rules for the starting of squirrel-cage motors. For a given stator voltage the torque is, within certain limits, proportional to the rotor resistance. The squirrel-cage must bring up the rotor as an induction rotor to a certain speed near enough to synchronous speed to enable the synchronising power of the machine to accelerate the rotor from this point to synchronous speed.

If a cylindrical rotor with distributed winding is not excited, no synchronising power occurs in any position of the rotor beyond a small hysteresis torque. As the hysteresis torque is very small, a machine with smooth cylindrical rotor does not pull into synchronism without excitation. Machines with salient poles show a different behaviour.

Rotary converters are frequently started, like squirrel-cage motors, from low-voltage tappings on the transformers. In general, the procedure is the same as that described for synchronous motors, but there are two or three aggravating conditions. There is a commutator with brushes always short-circuiting a certain part of the armature winding, and the field winding is not excited from an

external source, but generally from the continuous-current brushes of the rotary converter. Commutating poles are frequently added, which fill part of the space between the main poles, their tips not being fitted with dampers like the tips of the main poles. The brushes of rotary converters which are started in this way are very liable to spark, and it is necessary to reduce the ratio between the brush thickness and the distance of brush arms to a considerably lower value than would be required to obtain good commutation when working with continuous current on the commutator. The most violent sparking occurs as a rule when approaching synchronism.

It is not permissible to fit dampers on the tips of the commutating poles as is done on the main poles. When working in regular service with continuous current, the commutating pole should vary its flux as quickly as possible with the changes in the line current to provide the proper commutating field for every momentary value of the armature current. If a damper were fitted to the pole-tip this would prevent sudden changes of the flux, and would make the commutating pole sluggish, and the machine would therefore have a tendency to flash-over with sudden changes of load.

In order to prevent the machine from running at half speed it is necessary to provide during starting a damping winding on the commutating poles, and this is achieved in the simplest way by short-circuiting the commutating-pole winding during starting and opening the short-circuit before switching the machine on to the continuous-current mains.

When the machine locks into synchronism it may show either the right or wrong polarity. Therefore pole-changing devices are always provided for rotaries started in this way.

The sparking on the brushes is as a rule the more objectionable the higher the output and the frequency of the rotary.

A new method introduced by the author allows self-synchronising of the rotary converter with small armature current, prevents sparking on the brushes, and prevents the reversal of the field of the rotary converter. A starting motor is connected in series with the slip-rings of the rotary converter. As a starting motor, an ordinary squirrel-cage polyphase motor is nearly always used, but the explanation of the method is perhaps simplest by assuming a single-phase rotary converter and a single-phase commutator motor for starting (as in fig. 3). There are no starting tappings on the main transformer. One low-voltage terminal B of the transformer is connected direct to one slip-ring B of the rotary converter, while the other terminal A has a straight connection through a single-pole main switch, and another connection if the main switch is open, through the single-phase starting motor. A small switch is shown in series with the single-phase motor, but is not essential.

If the high-tension switch of the transformer and the switch of the starting motor are closed, the main low-tension switch being open, the current will flow through the starting motor into the rotary converter. The starting motor limits the current to a fraction of the full-load current of the rotary, say 30 per cent. The starting motor takes practically the full voltage of the trans-

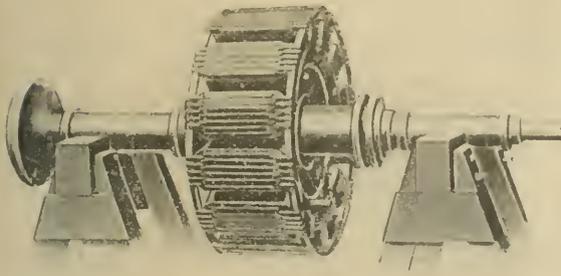


FIG. 2.—ROTOR OF SELF-STARTING SYNCHRONOUS MOTOR.

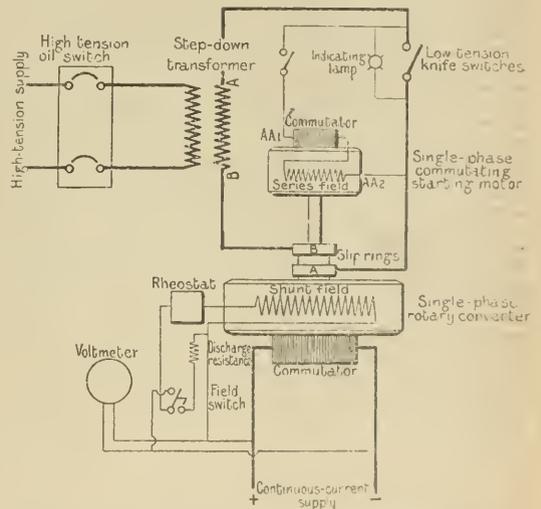


FIG. 3.—DIAGRAM OF CONNECTIONS OF SELF-SYNCHRONISING SINGLE-PHASE ROTARY CONVERTER WITH STARTING MOTOR.

The series connection of starting motor and synchronous machine can, of course, also be used for synchronous motors. For high-tension synchronous motors a low-tension starting motor presents advantages. For this purpose an indirect series connection by means of a series transformer can be used.

There is no objection to using on the direct-coupled starting motor a smaller number of poles than on the main motor. The starting motor then brings the set up to full speed much more quickly, and if the exciting circuit is closed with the proper resistance, the synchronising action of the machine will prevent the starting motor from running through the synchronous speed. If the excitation circuit is not closed, the starting motor will run up to a higher speed, but a later closing of the exciting circuit will soon reduce the speed and cause synchronising.

## DISCUSSION AT MANCHESTER.

PROF. MILES WALKER said that the one thing against the rotary converter was that if anything went wrong with the power station, so that there was a general shut down, it took a long time to get rotaries into commission again. Dr. Rosenberg had now provided a method of starting which was just as easy as with the induction-motor. In a few years' time, more than 90 per cent. of the D.C. power generated in the world would be supplied through rotary converters. Dr. Rosenberg stated that in the synchronous motor it was essential to increase the air gap and get a ratio of magnetising ampere-turns to armature ampere-turns somewhere in the neighbourhood of two, while with the ordinary induction-motor the ratio was somewhere in the neighbourhood of one-third; this gave the reader the impression that the size of the winding on the machine, in order to supply this magnetising current, must necessarily be very much greater on the synchronous machine than on the induction-motor. It must be remembered that in an induction-motor there was in the rotor the working current and the magnetising current from the stator, and the working current was, say, three times the magnetising current, requiring a certain amount of copper. In some experiments made some 18 months ago it was found that, in order to get perfectly stable running, it was necessary to have a current 50 per cent. greater than in the induction-motor. He believed the time would come when no one would be allowed to put in a low power-factor motor except by paying extra for the power consumed.

MR. A. E. MACKENZIE said there was no doubt that it was advantageous to have a machine which could be put on load very quickly. He had seen a large Westinghouse machine started up from rest and ready to put on the line in 30 seconds. To station engineers who had seen their staff struggling from 5 to 15 minutes to bring up a machine, it was something of a revelation.

MR. J. S. PECK said this new system seemed to overcome most of the objections which were raised against the old methods of starting. In looking at the diagrams it appeared ideally simple, but it had required very careful study to dimension all the various elements of the starting motor and the rotary converter so as to get the best results.

MR. HOLLINGSWORTH said he had noticed the difficulty, due to the excitement of the men in the station after a breakdown, in getting the machines into commission again. There was another and a greater field for rotary converters, not in the supply undertakings, but in the works' sub-stations, where they were operated by men in the employ of the consumer.

MR. W. CRAMP asked if, with the additional advantages described, the price of the rotary converter would go up above that of the motor-generator. Certain power station engineers not only demanded that the power factor must not fall below .9, but on an undertaking by the consumer to bring the power factor to unity, they would pay the extra cost of the machinery. It was not clear why a large air-gap should be necessary for synchronous motors. How would the cost of the synchronous motor, with its starting devices, compare with that of the induction motors?

DR. ROSENBERG, in reply, said that in an induction motor they had not a given number of ampere-turns, but in a synchronous motor there was a constant number of ampere-turns. If they could vary the excitation of the synchronous motor for no load, full load and overload, the number of ampere-turns for a small current would not be so high, but in order to get stable running, they must have a large number of ampere-turns. With a salient pole rotor, the mean length of a turn was considerably less than on a cylindrical induction rotor. He agreed that they should try and improve the power factor, and sub-stations which were formerly driven by induction-motors were now being gradually converted to synchronous machines. The question of power-factor in connection with small motors should not be carried too far; they had gained such an enormous advantage in all mills and small workshops due to the simplicity of the induction motor and its operating gear, that it would be a pity to injure this by pressing the synchronous machine with the higher price and the more skilful attendance required for it. A 50-H.P. synchronous motor with exciter would cost at least 50 per cent. more than an induction motor of the same size; perhaps 100 per cent. more. If motors of 300 or 400 H.P. were taken, however, the difference in price would be very little, and it was therefore the larger sizes that should be considered.

## DISCUSSION AT BIRMINGHAM.

MR. F. FORREST said that the self-starting synchronous motor described by the author was too complicated a machine for use on consumers' premises, and there could be very few cases where its adoption for works driving would be advisable or necessary. The induction motor, fitted with a phase advancer, was a much simpler machine for this purpose, and possessed practically all the good operating features of the synchronous motor. The high-pressure self-synchronising motor was likely to find its chief use in connection with motor-generator sets in sub-stations on transmission systems of comparatively high-frequency (50 periods or over). Experience in the past had proved that, on the whole, the synchronous motor was a more reliable machine than the induction motor, chiefly because its stator windings were not subjected to the sudden stress and concentration of potential across the end turns which occurred when an induction motor was switched straight on to the high-pressure supply. In large sub-stations it must be possible, in case of mishap on the A.C. starting apparatus, to get the machine into service by starting up from the D.C. side and therefore synchronising apparatus must be installed as a stand-by to the author's arrangements. The time required for starting and

synchronising rotaries of 1,500 kW. capacity, using induction starting motors was only about one minute, so the author's method did not save much time. The triple-pole switch in the low-pressure A.C. circuit to the slip-rings required with the author's method of starting was a possible source of trouble, especially with large machines, and this switch would not be required with a rotary synchronised in the usual manner.

DR. M. L. KAHN said that Dr. Rosenberg was to be congratulated on his excellent idea of connecting the starting motor of a synchronous machine in series with the main machine, instead of putting it in parallel as had been the usual practice. If a rotary or a synchronous motor with direct-coupled exciter was run up to speed with the field winding connected across the brushes on the commutator of the rotary or exciter, it would excite itself as soon as it was within a certain range of full speed, say 25 per cent. below full speed. The frequency of the voltage induced in the synchronous machine was then considerably below the frequency of the supply, and the slip was greater than the maximum slip at which the machine would pull into synchronism. The voltage on the stator terminals of the induction motor was the resultant of the supply voltage and the voltage of the synchronous machine, which were of different frequency. The resultant voltage would, therefore, vary considerably. As the torque of an induction motor varied approximately with the square of the impressed voltage, the starting torque of the set would also vary considerably. The frequency of the terminal voltage of the induction motor was the resultant of the frequency of the supply system and the frequency corresponding to the speed of the synchronous machine. For the case stated above, the supply frequency might be 50, while the synchronous machine might only have a frequency of 37. All this must have a considerable influence on the starting of the set.

MR. F. J. MOPPETT said that the uses of synchronous machines were, as the author pointed out, decidedly limited, but there appeared to be a field for them in such directions as driving centrifugal pumps, fans, and even line shafts, if arrangement were made to start on light load by means of fast and loose pulleys, clutches or similar devices. In view of the decided advantage to supply authorities, they ought to offer preferential terms to consumers who were prepared to install synchronous machines. He had seen one of the self-synchronising rotary converters in operation, and was struck by the simplicity obtained.

MR. W. E. MILNS (Birmingham Corporation) pointed out that although the self-synchronising motor possessed several features which were appreciated by supply authorities, especially those suffering from bad power factors, it had a very limited use on consumers' premises. The consumer certainly would not pay the extra cost of such machines. Owing to their limited use it was impracticable for supply authorities to give special rates. In Birmingham, an application had been received from a user who proposed to improve the power factor by installing an 80-kw. synchronous machine. The effect of such a machine on a system supplying over 30,000 kW. would not in any way justify a reduction in the price of energy.

## DISCUSSION IN LONDON.

MR. R. ORSETTICH said unfortunately commercial engineers often over-estimated the capabilities of designers, and made misleading statements; he welcomed the author's clear expression of opinion on the starting of synchronous motors. Synchronous machinery had come to the front very much recently, but self-starting synchronous machines had not been much adopted. The synchronous motor was at a disadvantage as regards starting current, compared with the induction motor, and the latter was more suitable for high speed. The author had only mentioned two methods of starting rotaries, but there were four or five; it was strange that the method of starting by an independent motor so generally used here, had not been mentioned, as it was somewhat similar to the author's method. He (the speaker) found the alternating current method of starting quite simple and reliable, and it was a standard method with some firms in America.

MR. A. H. SEABROOK congratulated the author on his system. He (the speaker) was aware of the disadvantages of A.C. starting of rotaries by means of transformer tapplings, and welcomed any scheme for automatic starting. His Council had ordered four 1,000-kw. sets of this type, with Miles-Walker power-factor correctors attached.

PROF. MILES WALKER said ordinary methods of starting, though perfectly simple, were apt to fail in times of stress. The author's method was perfectly automatic; the machine came up with the right polarity the first time, and took only a small current from the line, as compared with starting by means of transformer tapplings. The curves given were valuable as showing how much current was taken in starting synchronous machines.

MR. F. P. WHITAKER read a long contribution on the subject, criticising some of the author's conclusions and advocating the use of an induction motor with one pair less of poles for starting, as being a more efficient method.

MR. H. W. BOSWORTH said very few English firms had given much attention to self-starting synchronous machines, although his firm (Lancs. Dynamo Co.) had built several in sizes up to 1,000 H.P., and their experience was directly opposed, as regards type of machine, to that suggested by the author. His firm believed that the cylindrical rotor with distributed winding gave the best results, and it allowed of high speeds. They had such machines running at speeds up to 3,000 R.P.M., which was much higher than one could get with salient pole machines. For ordinary industrial purposes, with A.C. starting, there appeared to be no need for the complication of an auto-transformer starter. Generally they found it was not possible to get the best results by using

standard induction motors and alternators; specialised design was required. He agreed with the author that the possibilities of such plant had been overlooked.

DR. S. P. SMITH could not quite see how trouble with surging in the squirrel-cage starting arrangement was overcome; the only way seemed to be to synchronise properly, necessitating a separate starting motor; then it seemed rather more K.V.A. would be required for starting.

MR. W. E. BURNAND suggested that in the case of a single-phase job, if a commutator motor or self-starting induction motor were used the expense would be considerable.

DR. ROSENBERG briefly replied to the discussion.

## WATER DIVINATION.

ON Thursday, April 3rd, a party met at Waterloo, by virtue of an arrangement made by our contemporary, the *Sanitary Record*. The destination was kept secret to the last; it was Guildford. The object was to obtain light on the methods of the users of twigs and similar objects in the search for water. We are informed by one who was present at the *séance* and subsequent luncheon, that the several twigmen behaved after the manner of their kind. By what mysticism can a twigman diagnose water vertically below a point and 222 ft. down, such point halfway between two boot-toe drafts on the ground drawn by a rough swing of the leg? Why the third 2, or allowing the third, why not 222'2'?

The Guildford *séance* seems only to have intensified the scepticism which exists about this "dusters-wiveldom" of divination.

Our informant regards the Guildford pantomime as a huge failure on the diviners' part. They had every chance, and could show nothing. If there is a terrestrial influence which affects the nerves of certain of the elect, it is certainly an influence that arises from many sources. Possibly it is some form of radioactivity, for are not clays radioactive, and have not diviners "found" water where only have been proved depths of dry clay far beyond the diviner's 222? Divination, if true, would be always true. If not, of what value is it when a dozen of its votaries, separately tested, do not agree? The truth is that, in any water-bearing area, it is of no consequence where a borehole is put down. In the upper chalk, for example, absolute failure is very rare in known water-bearing areas, for a borehole is almost sure to cut a fissure or to cut a flint bed which is cut by a fissure. Water reaches the borehole by one way or the other. Our informant, who is a hydrogeological expert, says that he will back his opinion with £10, that a borehole put down at a point 3'349 ft. west-north-west of the S.E. leg of the editorial chair of this journal to a depth of 350 ft. below ground level will yield over 1,000 gallons per hour. Moreover, he will stand by this for all the electrical journals in London.

Now it is just such meticulous accuracy foisted on clients that proves his contention that divination is a fraud. He says that people who require water are themselves much to blame. If an engineer and hydrogeological expert says to a client that he may choose for his well just the spot most suitable, if the area, as a whole, is known to be water-bearing, that client will prefer the advice of the twig holder who stumbles about the ground with a twitching face and sweating brow and finally selects a spot between two boot-toe marks. In truth, it does not pay to use geological knowledge, and it does pay to play the necromancer. And will it be believed that the Local Government Board now actually allows the costs of water divination? At one time the fools who employed them were surcharged. Now the L.G.B., which still believes in the efficacy of a 14 days' continuous pump test of a well, adds divination to its beliefs!

We believe a report is forthcoming by the deputation above referred to. It is high time that the daily Press ceased to give its support to the unwarranted pretensions of these dowisers. It is strange how country gentlemen, sensible in other matters, will persist in their beliefs in face of the fact that in a single plot of land half a dozen twigmen will find water at different places, and no two agree.

**Iron Smelting in Norway.**—H.M. Consul at Christiania reports that the Aktieselskabet Hardanger Elektriske Jern og Staalverk, a company formed for the electric smelting of iron near Odda, has resolved to discontinue the undertaking on account of the cost of production, and to let the works to a French syndicate, which proposes to manufacture some kind of fertiliser. The works of this company were the first electric iron-ore smelting works in Norway, and their closing will probably prove a serious blow to the further development of the industry in that country; indeed, one company whose electric smelting works are not yet completed is said to be holding its scheme in abeyance for the time being.

The Aktieselskabet Bandak Electrolytiske Kobberverk—formed to refine copper ore at the Aamdal mines by the Hyblinette process—has decided to close its works from April 13th, owing to an insufficiency of ore in the mine, though the actual refining process is said to have been successful. The local Press states that the company intends to re-erect the copper-extracting works on the coast near the Christiania Fjord, and work is expected to be begun during the coming summer.—*Board of Trade Journal*.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**AUSTRALIA.**—The Australian Commonwealth Customs authorities have decided that trolley frogs used in overhead wire electric tramway systems are to be dutiable as malleable iron castings galvanised, at the rate of 1/4d. per lb. The "Craig" electric safety lamp for miners is to be admitted free of duty.

**UNITED STATES.**—The Board of Trade has just published a return showing, in the form of a comparative statement, the existing rates of duty and the rates of duty proposed under the new tariff now under consideration.

**HOLLAND.**—The Dutch Customs authorities have issued the following decisions as to the duties to be levied on certain electrical goods:—

Collector brushes and collector brush-holders, collectors, armatures and pole cases for dynamos and electromotors, imported separately	free
Coils for dynamos and electromotors, which cannot be definitely distinguished from coils for other electric machines	5% ad val.
Dynamo of small capacity, used like a magnet, also suited for generating current, for charging accumulators and for driving electro-motors	free
Machine for pasting gutta-percha on leather for vamps of boots (the heat required for making the two substances adhere to one another being generated by electricity)	free

**DUTCH EAST INDIES.**—The Board of Trade reports decisions that portable telephone apparatus, testing apparatus for galvanic batteries, and steel wire covered with copper intended for use as electric conducting wire, are to be admitted free of duty into the Dutch East Indies.

**LEEWARD ISLANDS.**—As a result of the Canada-West Indies Treaty, the Government of the Leeward Islands proposes to establish preferential rates of duty in favour of British goods as compared with foreign. The date of coming into operation of this preferential tariff will be notified later.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C.1, and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 8,699. "Electric earthing or bonding clips and the like." T. G. HAN and A. E. INGLE. April 14th.
- 8,711. "Electric apparatus for moving advertisements." E. OSBALDNER, P. KAZINCZY and I. GROSS. April 14th. (Complete.)
- 8,712. "Vacuum light tubes." MOORE-LICHT ART.-GES. (Convention date, April 15th, 1912, Germany.) April 14th. (Complete.)
- 8,738. "Regulators for electric igniting apparatus." J. SCHULZ. (Convention date, November 29th, 1912, Germany.) April 14th. (Complete.)
- 8,741. "Contact and alarm device." A. V. CLORIUS and O. T. CLORIUS. (Convention date, April 13th, 1912, Denmark.) April 14th. (Complete.)
- 8,746. "Electro-pneumatic systems and apparatus for railway signalling." E. C. IRVING and BRITISH PNEUMATIC RAILWAY CO., LTD. April 14th.
- 8,757. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., and W. ALLEN. April 14th.
- 8,792. "System for the combined generation, storage, distribution and utilisation of electric energy." E. V. HARTFORD and L. MASTRANGEL. (Convention date, June 19th, 1912, United States.) April 14th. (Complete.)
- 8,812. "Electrical motor-control apparatus with slow-starting handle for operating the same and the like." W. HALL. April 15th.
- 8,814. "Telephone call-boxes." F. HINDLE and I. BOTTOMLEY. April 15th.
- 8,821. "Receiving arrangement for use in wireless telegraphy and telephony." W. P. THOMPSON. (Ges. für Drahtlose Telegraphie mb.H., Germany.) April 15th. (Complete.)
- 8,823. "Electrical track circuits for railway signalling." J. SATERS and F. B. HOLZ. April 15th.
- 8,831. "Telephone exchange systems." E. R. CORWIN. April 15th. (Complete.)
- 8,841. "Telephone transmitters." J. C. R. PALMER. April 15th. (Convention date, April 15th, 1912, United States.) (Complete.)
- 8,865. "Electric controlling valve for air brakes." H. GALLCSER. (Convention date, April 17th, 1912, Germany.) April 15th. (Complete.)
- 8,866. "Means for controlling the flow of petrol or other fuel or fuels to the carburettor of a motor-car or like vehicle, and for controlling the ignition." M. J. W. PIKE. April 15th.
- 8,878. "Switch-controlling mechanism for electric motors." O. DECKER. April 15th. (Complete.)
- 8,956. "Incandescent body for electric glow lamps and process for the manufacture of such bodies." A. JUSZ. (Convention date, April 15th, 1912, Hungary.) April 15th. (Complete.)
- 8,962. "Electric ovens and the like." R. WEAVING and FERRANTI, LTD. April 16th.
- 8,964. "Ignition dynamos." C. T. MASON. (Addition to 8,128, 1913.) April 16th. (Complete.)
- 8,968. "Arc lamps for projection apparatus." T. F. BAVEN, E. A. GOLDING and H. J. FRANK. April 16th.
- 8,976. "Combined battery box and push." R. H. BYR. April 16th.
- 8,985. "Metal conduits for electrical conductors." R. N. CUNNINGHAM. April 16th.
- 9,008. "Jockey adjustable pulley for adjusting dynamo or other belts on motor-cars, tractors and motor-cycles." C. AYLIFFE and J. AYLIFFE. April 17th.

- 9,003. "Apparatus for electric lighting, heating, and ventilating of railway carriages or other moving vehicles." T. FERGUSON and J. R. JOHNSTONE. April 17th.
- 9,014. "Electric cable couplings." J. STRATTON and E. A. CLAREMONT. April 17th. (Complete.)
- 9,016. "Fuses or cut-outs for electric circuits." V. HOFER. April 17th.
- 9,019. "Electric heating apparatus." F. B. COX. April 17th.
- 9,032. "Galleries and holders for gas and electric globes, lamps, and the like." J. V. WILLIS. April 17th.
- 9,060. "Cells which are sensitive to light and provided with aluminium electrodes, and for which acetone is used as electrolyte." C. BRILLE. (Convention date, April 21st, 1912, Germany.) April 17th. (Complete.)
- 9,070. "Electric-current generators." F. W. HOWORTH. (M. P. Ryder: United States.) April 17th. (Complete.)
- 9,079. "Electric switches." G. INBIO and G. INAIO, LTD. April 17th.
- 9,091. "Brush-holders of dynamo-electric machines and other electric machinery." W. WHITE and T. H. BACON, trading as W. White & Co. April 17th.
- 9,100. "Electrical instruments, glow-lamps, and the like." A. J. DOWNES. April 17th.
- 9,105. "Method of, and means for, heating substances by electricity." T. W. BROADBENT and F. W. DAVIES. April 15th.
- 9,107. "Variable resistances for electrical currents." J. W. WARR. April 18th.
- 9,109. "Apparatus for minimising the destructive action of electric arcs, especially applicable to electric cut-outs and fuses." V. HOFER. April 18th.
- 9,111. "Multiplex telegraphy." E. D. CATHER. April 18th.
- 9,112. "Telephone disconnecter." H. READER. April 18th.
- 9,129. "Means for, and methods of, regulating the pressure of static frequency changers." A. M. TAYLOR. April 18th.
- 9,140. "Thermostats for controlling electric circuits." A. W. PAIM and F. W. ROBER. April 18th. (Complete.)
- 9,144. "Fuses or cut-outs for electric circuits." C. W. COX. April 18th.
- 9,155. "Electric control rope-gripper for lifts or hoists." M. T. MEDWAY. April 18th.
- 9,165. "Observation circuits of telephone systems." SIEMENS BROS. & CO., LTD., and D. A. CHRISTIAN. April 18th. (Complete.)
- 9,167. "Telephone instrument sets adapted for two lines." SIEMENS BROS. & CO., LTD., and E. A. LAIDLAW. (Addition to 25,673 of 1912.) April 18th. (Complete.)
- 9,168. "Registering circuits for automatic telephone exchanges." SIEMENS and HALSKE AKT.-GES. (Convention date, April 18th, 1912, Germany.) April 18th. (Complete.)
- 9,169. "Telephone exchanges." SIEMENS BROS. & CO., LTD. (Siemens and Halske Akt.-Ges., Germany.) April 18th. (Complete.)
- 9,174. "Methods of equalising the load on systems of supply for alternating current electric motors." S. ECKMANN. (Addition to and divided application on 11,597 of 1912, November 14th.) April 18th. (Complete.)
- 9,179. "Electric switches." J. LEVEQUE-PETIT. April 18th. (Complete.)
- 9,201. "Electrical device for the illumination of watches and other articles during the night." L. FRACQUE and L. ROCHER. April 19th.
- 9,202. "Apparatus for indicating and cutting off the current in colliery and other electric mains when leakage occurs." F. C. ANDERSON and C. A. ARCHLEY, trading as Harland Engineering Co. April 19th.
- 9,205. "Automatic telephones." J. M. FURNIVAL. April 19th.
- 9,212. "Enclosed electric switches." V. HOPE and E. THOMAS. April 19th.
- 9,246. "Electrically controlled adjusting apparatus intended particularly for ordnance." F. KAUFF ART.-GES. (Convention date, May 29th, 1912, Germany.) April 19th. (Complete.)
- 9,260. "Variable-speed dynamo-electric machines." L. J. HUNT and SANDY-CROFT, LTD. April 19th.
- 9,261. "Alternating-current dynamo-electric machines adapted for synchronous working." L. J. HUNT and SANDY-CROFT, LTD. April 19th.
- 9,264. "Mounting of carbon brush-holders of magnetoelectric ignition machines." R. BOSCH (firm of). (Convention date, February 22nd, 1913, Germany.) April 19th. (Complete.)
- 9,274. "Brakes for electric vehicles." F. C. V. DI CASTELLETO. (Addition to 9,466, 1912. Convention date, April 20th, 1912, France.) April 19th. (Complete.)
- 9,276. "Electric fuses, lamps, and other devices." A. F. BERRY. April 19th.
- 9,278. "Regulation of electric installations." H. D. EARL. April 19th. (Complete.)
- MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES. P. C. J. WILLIS. (Dunham.) 7,118. March 23rd.
- MEANS FOR REGULATING DYNAMO MACHINES. H. LEITNER. 7,776. March 30th.
- TELEGRAPHY. E. S. HEUTLEY. 7,776. March 30th.
- ELECTRIC INSULATORS. A. H. MULLER. 7,972. April 2nd.
- DYNAMO-ELECTRIC MACHINES. C. A. VANDERVELL and A. H. MIDGLEY. 8,040. April 3rd.
- VOLTAGE REGULATORS FOR ELECTRIC GENERATORS. A. H. OLMSTED. 8,063. April 3rd. (Addition to No. 28,747 of 1911.)
- HIGH-FREQUENCY APPARATUS. W. DUBILIER. 8,196. April 4th.
- RELIEF OF GATE PASSING-INS AND ELECTRIC SIGNALS IN CONNECTION THEREWITH. J. DICKSON and A. CLARK. 8,307. April 6th.
- ELECTRIC TELEGRAPH TRANSMITTING SYSTEMS AND APPARATUS THEREFOR. E. RAYMOND-BARKER. 8,352. April 9th.
- ADAPTABLE TRANSPORT TROLLEY FOR ELECTRIC LIGHT AND POWER PENDANTS AND THE LIKE. A. RIDET. 10,823. May 2nd.
- AUTOMATIC SIGNALLING ARRANGEMENT FOR TRAMWAY LINES OR ELECTRIC RAILWAYS. D. SAMARA. 10,434. May 2nd.
- ELECTRIC CONTROL SYSTEMS. BRITISH THOMSON-HOUSTON CO. (General Electric Co.) 11,466. May 14th.
- SYSTEMS FOR THE ELECTRICAL TRANSMISSION OF POWER AND SIMULTANEOUS TELEPHONIC, TELEGRAPHIC OR SIGNALLING PURPOSES. P. V. HUNTER and W. L. SHAND. 13,355. June 6th.
- ARMOUR'D ELECTRIC CABLES. CALLENDER'S CABLE and CONSTRUCTION CO. and P. HICKS. 14,157. June 17th.
- TROLLEY HEADS FOR ELECTRIC TRACTION. J. B. PARKER and J. SMITH. 15,022. June 27th.
- AUTOMATIC TELEPHONE CIRCUITS. SIEMENS BROS. & CO., LTD. (Siemens and Halske Akt.-Ges.) 18,856. August 9th. (Addition to No. 27,458 of 1909.)
- GALVANIC CELLS. J. T. SZEK and A. EZEK. 18,404. August 10th. (August 12th, 1911.)
- PRINTING SYSTEM. J. BAUMANN. 18,676. August 14th. (August 14th, 1911.)
- PRINTING TELEGRAPH INSTRUMENTS. E. J. KESSIG. 21,352. September 19th. (Patent of Addition not granted.)
- VAPOUR ELECTRIC APPARATUS. P. C. HEWITT. 22,246. September 30th. (October 10th, 1911.)
- TELEPHONE RECEIVERS. BRITISH L. M. ERICSSON MANUFACTURING CO., LTD., and A. BROOKES. 22,252. September 30th.
- INTERCOMMUNICATION TELEPHONE SYSTEMS. BRITISH L. M. ERICSSON MANUFACTURING CO., LTD., and A. BROOKES. 22,253. September 30th.
- METHOD OF PRODUCING HIGH-FREQUENCY OSCILLATIONS. K. ROTTAU. 22,875. October 7th. (October 6th, 1911.)
- ELECTRIC SWITCHES. J. LIDDLE. (Gordon Electric and Manufacturing Co.) 24,892. October 31st.
- TELEPHONES. P. L. JENSEN and E. S. PRIDHAM. 25,856. November 11th.
- APPLIANCES FOR PRODUCING ELASTIC OSCILLATIONS. R. KRAUSE. 28,195. December 11th. (December 10th, 1911.)
- SYSTEMS FOR STARTING ENGINES OR THE LIKE. C. F. KETTERING. 29,070. December 17th. (April 17th, 1911. Divided application on No. 28,503 of 1911, December 22nd.)
- STARTING SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. C. F. KETTERING. 29,083. December 17th. (April 17th, 1911. Divided application on No. 28,503 of 1911, December 22nd.)

## 1913.

- TELEPHONE REPEATER CIRCUITS. E. GRISSENER. 2,929. February 4th. (Divided application on No. 7,482 of 1912, March 27th.)
- TELEPHONE LINES. E. GRISSENER. 2,931. February 4th. (Divided application on No. 7,482 of 1912, March 27th.)
- TELEPHONE RECEIVERS. E. GRISSENER. 3,57. February 11th. (Divided application on No. 7,482 of 1912, March 27th.)
- TELEPHONE SUB-STATION CIRCUITS. E. GRISSENER. 3,760. February 18th. (Divided application on No. 7,482 of 1912, March 27th.)
- SYSTEMS FOR STARTING ENGINES AND THE LIKE. C. F. KETTERING. 4,04. January 7th. (June 15th, 1911. Divided application on No. 29,085 of 1911, December 27th.)
- WIRELESS TELEGRAPH INSTALLATIONS FOR AERIAL VESSELS. L. ROUZET. 4,74. January 18th.
- ARRANGEMENTS FOR THE STATIC TRANSFORMATION OF THREE-PHASE ALTERNATING CURRENT INTO ONE-PHASE ALTERNATING CURRENT HAVING THREE-FOLD THE FREQUENCY OF THE PRIMARY CURRENT. F. SPINELLI. 2,471. January 30th.
- TELEPHONE TRANSMISSION CIRCUIT. H. C. EGERTON. 2,749. February 3rd. (July 18th, 1912.)
- CONTACT MAKE-AND-BREAK DEVICES FOR USE WITH ELECTRIC FLASHING SIGNALS AND THE LIKE. C. de FRETTE. 8,006. February 5th. (February 23rd, 1912.)
- ELECTRIC MERCURY SWITCHES. T. GRUBER. 4,257. February 19th.
- TELEPHONE RECEIVER SUPPORTS. F. S. MAXWELL. 5,802. March 8th.

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & CO., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 8d. (in stamps).

## 1911.

- ENGINE STARTING DEVICE. C. F. KETTERING. 21,065. December 27th. (June 15th, 1911.)
- LOAD-EQUALISING ARRANGEMENTS FOR ELECTRIC GENERATORS. E. C. R. MARKS. (Akt.-Ges. Brown, Boveri & Cie.) 29,178. December 28th.
- ENGINE STARTING DEVICES. C. F. KETTERING. 29,344. December 30th. (June 22nd, 1911.)

## 1912.

- METHOD FOR PRODUCING ELECTRIC OSCILLATIONS OR ALTERNATING CURRENTS. W. P. THOMPSON. (Ges. für Drahtlose Telegraphie.) 16,827. July 19th.
- ELECTRIC BLASTING DETONATORS. J. SOU. 16,668. July 20th. (July 21st, 1911.)
- CONTACT BOX FOR CONNECTING ELECTRIC MOTORS AND THE LIKE TO THE MAINS. E. WALSCH. 18,992. August 19th.
- ELECTRIC MOTOR STARTERS, CONTROLLERS AND THE LIKE. F. J. MOFFET and N. B. ROCHER. 20,118. September 4th.
- ELECTRO-MAGNETIC CUTTERS. "Vulcan" Maschinenfabriks Akt.-Ges. 30,922. September 18th. (October 30th, 1911.)
- AUTOMATIC THERMIC CUT-OUT FOR ELECTRIC LIGHTING AND POWER-TRANSMISSION CIRCUITS. A. TASSO. 21,540. September 21st.
- HIGH-TENSION ELECTROMETERS. M. BAUER. 25,101. November 1st.
- ELECTRO-MAGNETIC PERFORATION OF STRIPS IN ACCORDANCE WITH THE DEPRESSION OF THE KEYS OF A KEYBOARD FOR TELEGRAPHIC OR LIKE PURPOSES. SIEMENS BROS. & CO., LTD. (Siemens & Halske Akt.-Ges.) 26,866. November 15th.
- IGNITION SYSTEMS. C. F. KETTERING. 30,091. December 17th. (April 17th, 1911. Divided application on No. 23,503 of 1911, December 22nd.)
- METHOD OF AND APPARATUS FOR CONTROLLING THE SPEED OF A MOVING BODY AND ITS APPLICATION TO LIFTS, HOISTS OR OTHER ELEVATORS. A. GAZZIGNAIRE. 7,771. March 30th. (April 6th, 1911.)

**Reorganisation of Paris Tramways.**—As already noted in these columns, the reorganised Paris tramway system will be chiefly supplied from generating stations at St. Denis and de Vitry, but the present compressed-air station at Billancourt will also be equipped with 13,500-volt, 25-cycle, three-phase generators. Ring mains will be carried between the three stations and sub-stations will be connected along the sides of the distributing triangle thus formed; this arrangement, which is one of the characteristic features of the scheme, ensures maximum security of supply. The section of the trolley line wires is 67 sq. mm. in Paris, and 87 sq. mm. in the outer areas. The axial conduit system has been preferred to the lateral conduit owing to the easier replacement of the running rails, which are independent of the former system. Further, the slot width of a lateral conduit must be equal to the groove width (35 mm.) of an ordinary rail, whereas this width can be reduced to 25 mm. (sufficient to admit the plough-arm) in the axial system. Provision has been made for 1,100 vehicles—representing an outlay of close upon £1,000,000—including 850 motor-cars carried by two axles on a 1 ft. 10 in. wheel base; 200 motor-cars with specially short trucks with unequal wheels; 100 motor-cars with specially short wheel base (10 ft. 9 in.); and 450 trailer vehicles on equal-wheel bogies. The cars will be electrically lighted and heated, and a few metal-flament lamps, supplied by a small battery, will provide emergency lighting on each car should the main current supply fail for any reason. The Vilette-Place, Nation and Autouci-St. Sulpice routes are already electrically operated, and part of the old accumulator system has been converted to trolley working, and is now operated more rapidly and economically than before.

# ELECTRICAL REVIEW.

Vol. LXXII.

MAY 9, 1913.

No. 1,850.

## ELECTRICAL REVIEW.

## MARCONI CONTRACT: ADVISORY COMMITTEE'S REPORT.

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THE proceedings of the Select Committee on the Marconi contract have recently been subject to considerable criticism, and suggestions for a speedy conclusion of its labours have been freely offered. The time has not yet arrived for an impartial judgment, and the circumstances with which it has to deal are so exceptional that in the end some justification may be found for an unusual method of procedure. But whatever opinions may be held of recent sittings, credit must be given to the Committee for a recognition, at an earlier stage, of its limitations and a desire to obtain competent assistance. At the meeting on January 13th, it reported that it was unable to deal adequately with the technical features of the contract and desired the appointment of a scientific Committee, which should report thereon. The Advisory Committee, as we recorded at the time, consisted of Lord Parker (chairman), Mr. Duddell, Dr. Glazebrook, Sir Alexander Kennedy and Mr. Swinburne, with Mr. E. H. Rayner as secretary.

The appointments were made by the Postmaster-General. The terms of reference were: to consider and report on the merits of the existing systems of long-distance wireless telegraphy, and in particular as to their capacity for continuous communication over the distances required by the Imperial chain. It will be seen that the terms of reference are somewhat narrow, and it would have been possible to comply with them strictly and submit a report which would not be of much practical value under all the circumstances. But the eminent scientific members have evidently not overlooked the fact that science is "organised common sense," and the distinguished judicial member of the Committee has apparently borne in mind that it is not possible to answer every question by a simple affirmative or negative, and be sure that justice results. The provisions of the agreement are regarded as outside the terms of reference to the Advisory Committee, but the latter safeguards its position by stating: "but nothing we have said in this report must be taken as expressing our approval of such provisions." The common sense which recognises that the Committee's duties had relation to a really practical question characterises the report as a whole. The Committee took evidence upon known systems, and advertised with a view to ascertain whether there were any new inventions or improvements, the consideration of which might be useful. But apparently there are no budding systems of a retiring nature, or if so, their inventors are still hiding their lights under bushels, for the advertisement led to no useful result. Evidence was taken from representatives of the various systems, such evidence being given in private, and treated as confidential. A brief description of the plant required in terms which even a House of Commons Committee could understand leads to the remark that "the term

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

## 1913 EDITION.

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'system of wireless telegraphy' is not really apt," because the major portion of the buildings and plant could, with minor modifications, be used equally well with any high-frequency generator or other patented device. It is pointed out that each company or firm uses apparatus protected by its own patents, and has to avoid the use of apparatus protected by patents belonging to other companies or firms. Considerable attention is given to the matter of patents, as might be expected from a Committee whose chairman has had so wide experience of patent law. Some qualification may be necessary for the statement that "the existence of a patent may seriously interfere with the normal development of an industry," but with its application to the purpose under consideration, no fault will be found, for it is pointed out that a competent engineer, if asked to erect and equip the wireless chain in the most efficient manner, might desire to combine apparatus whose combination would be difficult if not impossible because of the existence of patent rights. And then follows a statement which has been made by critics of the contract, that the Government is not fettered by considerations arising out of patent rights, but can use any patent on fair terms under the 1907 Act.

The Committee has examined the various "systems" and describes in general terms their principal features. The companies or firms controlling these "systems" were invited to give practical demonstrations. It was in regard to these practical demonstrations over the required distance that evidence was lacking from all except the Marconi Co., but whilst recording the facts, the Committee thinks it right to state that, according to the information given, it was in several cases impossible to arrange for the demonstration within the short period which could be allowed for the purpose. Moreover, the Committee records the reported achievements of each system so far as evidence was produced, and does not lose sight of the possibilities or the good features attending each. Wireless telegraphy, in its opinion, is in a condition of rapid development, and the members commit themselves to the expression of opinion that this development will, in all probability, involve the ultimate substitution of continuous oscillations for spark discharges. But, leaving description or forecast, and dealing with facts and demonstrations, the Committee report that, according to its investigation, "the Marconi system is at present the only system of which it can be said with any certainty that it is capable of fulfilling the requirements of the Imperial chain," which is the answer to the "in particular" phrase of the terms of reference. But again the Committee wisely avoids the possibly misleading effect of such an answer if unequalled, for the qualification immediately follows in the words: "but this must not be taken to imply that, in our opinion, the Marconi Co. must necessarily be employed as contractors for all the work required for the Imperial chain."

The confidence which was felt in the *personnel* of the Committee on its appointment will only be strengthened by its report, the trend of which may be said to confirm the official view as to the superior facilities possessed by the Marconi Co. for carrying out the contract, but so far from being so impressed with that superiority as to make onerous terms with a company perhaps unduly confident of its superior position, the Committee thinks that in some respects it might "be better for the Government themselves to undertake the construction and equipment of the necessary stations, acting for that purpose under the best technical and scientific advice which can be obtained, and employing the most suitable contractors for the various portions of the work or plant." At the same time, recognition is given to the fact—or as the Committee expresses it, "it may be said, and no doubt the fact"—that the Marconi Co. alone has had

the practical experience in putting down stations, organising traffic and staff, and in coping with the difficulties that arise in a new industry, "and the value of such experience may well outweigh other considerations if rapid installation and immediate and trustworthy communication is desired." The value to be attached to such experience is of the essence of the controversy on the contract. That such exceptional experience at the moment should be paid for by a royalty upon the gross receipts for a long term of years gave rise to one of the foundation criticisms. The official evidence before the Select Committee indicated that the agreement contained ample provision for the termination of the royalty period. On the other hand, the omission of any reference to the possible earlier termination of the royalty in the circular to the shareholders was justified by the managing director, who held the view that in practice the royalties would continue. The Select Committee will probably be saved a great deal of trouble in determining this part of the contract by the report of the Advisory Committee. After recounting various features of wireless systems which are under development, or in a transition stage, the Committee expresses the opinion that it is "undesirable that in constructing and equipping the stations of the Imperial chain, the Post Office should be pledged to the continued use of any apparatus now used in any so-called system, or be subject to any penalty by way of continued royalties or otherwise for the disuse of any apparatus which may be installed in the first instance." It considers it imperative in any contract that may be entered into that complete liberty of action in this respect should be reserved. All the stations should be constructed with a view to possible and probably rapid developments of the art, and two should be used at once as experimental stations, in which suggested improvements may be thoroughly tested. Not content with suggesting that stations should be available for testing, the Committee goes further and dwells on the necessity of the department of the Government working the industry being willing to make such tests. There follows a paragraph which in character with the general tone of the report prevents any misunderstanding of a previous statement. "We have already referred," it says, "to the possibility that the existence of patents may fetter the normal development of an industry. A Government monopoly may stop its growth altogether, and is almost sure to do so unless the Government department which works the industry is ready to welcome and test any new invention and improvement, to adopt and use it if the test be satisfactory, and to pay for it on fair terms if adopted." On a subject so controversial as the Marconi contract, it is not impossible to conceive that some may regard such an *obiter dictum* as outside the terms of reference to the Committee. We should not be disposed to argue that point, but we should say that it is due to the practical common sense of the Advisory Committee that we have a report (appropriately dated from the Royal Courts of Justice) that will be of real assistance in determining the practical solution of a question which involves the progress of science as well as of public and private rights.

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#### The Coming Position in Turkey.

NATURALLY enough, the trade of Turkey has been greatly interfered with for some time past, and exports from the United Kingdom during 1912 were lower than in either of the two preceding years. Our imports from Turkey, on the other hand, were the highest on record since 1897, the chief increases being in barley and raisins. In the annual report of the British Chamber of Commerce of Turkey there are given numerous detailed figures which are likely to be of interest to anybody who wants accurately to gauge the position of affairs. The Chamber says that without making rash prophecies regarding the future of the country and the territories likely soon to become part of the Balkan States, both belligerents "may yet surprise the world with their powers of recuperation." It is noteworthy that during the war there have been few cases of

suspension of payment in Turkey, and financial houses have experienced little loss. "The Government has kept its financial obligations with scrupulous exactitude, and has never for a moment broken faith with the creditors of the State." We reprint from the report the appeal of the Chamber to British manufacturers and traders to assist in securing a greater British hold on the market:—

It would please us to see our countrymen look this way and take a part in the developments that must take place as soon as peace is restored. Turkey, as well as the Balkan States, are bound to undertake public works of all kinds in order to promote the well-being and the security of these territories, sadly lacking in the elementary necessities of modern civilisation. We hope that Great Britain will not lag behind or fail to profit by the opportunities which will present themselves to capitalists and industrialists.

Earlier in the same report there is a warning to "home firms" not to be content with representation by "undesirable agents." The Chamber has itself in cases recommended important firms to make changes, having found that though their goods are appreciated on the market, they are doing unsatisfactory business "through incompetent or unscrupulous agents." Unfortunately, the Chamber has occasionally been appealed to respecting such matters when it has been too late, serious mischief having been done. We congratulate the Chamber on the growth of its membership (from 303 to 356) during 1912, following upon an advance from 244 to 303 in the previous year. Further comment upon some of the effects of the disturbed state of the country was made last week in the report of the Constantinople Telephone Co., the closing sentences of which show that the company is already taking appropriate measures for securing other concessions for establishing telephonic communication elsewhere in the Ottoman Empire. It is almost superfluous to suggest the wisdom of taking equally prompt and far-seeing action respecting other kinds of electrical and engineering undertakings and work in the same country.

#### Constantinople Railways.

It is of interest, in connection with the above comments, to note that a company has now been formed in Constantinople

under the title of the Société Ottomane des Chemins de Fer Métropolitain de Constantinople for the purpose of working the concession granted to the group headed by the Deutsche Bank for the construction and operation of an underground network of railways in the Turkish capital. The ordinary share capital amounts to £1,400,000 divided into 70,000 £20 shares, all of which have been subscribed and a first instalment of 10 per cent. has already been paid. As the undertaking is expected to involve an expenditure of £2,800,000, it may be assumed that the difference between this amount and that of the ordinary capital will be raised by the issue of bonds. The directors include representatives of the German Orient Bank, the Imperial Ottoman Bank, the Hungarian General Credit Bank, the Société Centrale pour l'Industrie Electrique de Paris, the Société Financière de Transports of Brussels, the Electric Light and Power Investment Co. of Berlin, &c. In addition to the main line, the concession places upon the holders the obligation to construct three branch lines, and the former has to be completed within 4½ years. The company will have to pay to the city authorities a sum of £806 per annum per mile of railway in operation and a further sum is payable for the expenses of the Imperial commissariat. The concession is for a period of years extending to 1993, but the Government reserves the right of acquiring the undertaking at any time after the expiration of 30 years.

Apart from this enterprise, it may be remembered that a concession has also been granted to the firm of Lenz & Co., of Berlin, in association with the A.E.G. for the construction of the so-called Bosphorus electric railway. As the two railways would compete with each other over a short distance, negotiations are in progress with a view to bringing about a mutual understanding so as to obviate any rivalry.

#### "Local Representation Necessary."

READERS who, either as a matter of general interest or in search of business opportunities, make a study of the mass of contract information that we put before them in the course of a year will have observed somewhat

frequently how they are debarred from tendering unless they qualify by "local representation." From the point of view of the country calling for the work, the limitation thus imposed upon outsiders may be perfectly reasonable, and it is useless girding at it. We have got to fall in with it whether we like it or not, or else lose the chance of doing business with Government Departments and public undertakings in certain countries. The stipulation is imposed by Scandinavian authorities and by Spanish, but, as though with a desire to prevent a desirable tenderer from dismissing the matter precipitately, there is a hurriedly added clause indicating that such local representation need not be personal, but may be through a native agent.

There are often business possibilities justifying the appointment of such agents, where a branch would not appear to be warranted. But it is not only European countries that impose such limitations as we have indicated above. Our own Colonies are increasingly impressing upon us the need for efficient representation "on the spot," and in some cases they actually insist upon it. The reasonableness of being right there to secure business has been realised by a number of our British electrical firms, but it may be that those who have failed to adopt the advice when it has been given by Consuls, trade experts, and by our humble selves, may find it easier to repent in presence of Colonial and foreign compulsion.

The *British and South African Export Gazette* has something to say on the matter, basing its observations upon the announcement by the Durban municipality expressly stipulating for local representation by tenderers for electric meter-testing equipment. Our contemporary points out that there is no lack of choice among the many South African firms of high repute, and a suitable qualifying arrangement might be made with one of these in the absence of ability to have one's own branch. We have many times regretted the shortness of time allowed for firms to tender for Colonial contracts, and we believe that there has been some improvement, but as time goes on will it be reasonable to expect public authorities to inconvenience themselves by allowing longer than is actually necessary? The demand for attendance on the spot must, it seems to us, increase rather than decrease, and we have got to see that our representation is up to such a standard of efficiency that it will make the clinching of bargains possible without reference home, and in face of foreign competitive methods. But we have said this *ad nauseam*—yet we must say it again.

#### Consulting Engineers in Germany.

THE position of consulting engineers in Germany cannot be a very happy one, if credence is to be attached to a statement made in the Prussian Diet in the course of the proceedings on April 19th, in connection with the second reading of a Government Bill to authorise the conversion to electric traction of the Berlin City and Circle railways. As is known, the Bill had previously occupied the attention of a commission, whose proceedings were private, although an official report in a brief form was issued at the termination of each day's sitting, summarising the general course of the deliberations. The commission called for and heard expert evidence on the proposals for electrification of the railways in question, but the names of the witnesses have not been disclosed. The reason, according to the statements made in the Prussian Diet by Herr von Pappenheim, is quite simple, although showing a surprising state of affairs. When the experts were examined by the commission, and were asked to intimate their opinions, they almost invariably expressed the wish that the attitude they assumed should not be allowed to be made public, and that their names should also be withheld, as they feared that they would have to suffer injury in the further progress of their science and profession from those at the back of the Government scheme. Commenting on this statement, a Berlin newspaper remarks that affairs have thus so far advanced in the electrical industry that experts outside of the large undertakings apprehend personal disadvantages if they express opinions which differ from the business interests of these undertakings!

## NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

The Calgary Power Co. is developing another water-power on the Bow River at Kananaskis Falls; it is intended that this shall be run in parallel with the existing plant at Horseshoe Falls. The output of the new plant will be about 12,000 H.P., under a 70-ft. head, as there will be two 6,000-H.P. turbines coupled to two 5,100-K.V.A. 12,000-volt three-phase generators.

The town of Kamloops, B.C., has decided to spend £50,000 on a hydro-electric plant, and £13,000 in improving and extending the electric lighting system.

The Industrial Commissioner of Ottawa has just issued a map showing, among other things, the water-powers within a radius of 60 miles of the city; these are estimated to be capable of developing a minimum (at low water) of 2,300,000 H.P., and it is stated that 150,000 H.P. is at present developed.

The Toronto newspapers have lately been full of discussion of the question as to whether the city should buy the Toronto Street Railway Co. and the Toronto Electric Light Co., both of which are owned by the Mackenzie & Mann interests. A short length of municipally owned tramway has already been in operation for a few months, and other sections now under construction will be ready before long.

The idea of purchasing the Street Railway Co.'s equipment is with a view to the unification of the city's transport facilities, which, owing to the rapid growth of Toronto, fall far short of providing an efficient service for the thousands of persons wishing to use the trams; this results in the cars being dangerously overcrowded to an extent which would not be tolerated for a moment at home.

The Ontario legislature passed a Bill a few days ago, empowering the Hydro-Electric Power Commission to investigate and report upon the cost of constructing and operating electric railways in any locality where power is supplied by the Commission.

Municipal corporations may be authorised to enter into an agreement with the Commission (1) for the construction, equipment and operation of an electric railway, to be operated by power supplied by the Commission; (2) for its construction by the Commission, and for its operation by the municipality; (3) for its construction and operation by the corporation or corporations, and in either case for the supply of electric power by the Commission, which body will control rates, character of service, equipment, and location of lines. The whole burden of cost will fall on the municipalities interested.

It will be remembered that some weeks ago these "Notes" contained the information that the representatives of a number of towns had met together and passed a resolution calling upon the Hydro-Electric Power Commission to investigate and report upon the subject of electric railways for the Province. The foregoing is the outcome of that resolution. There can be no question that such light radial lines as are contemplated would be a very great boon if they could be made a commercial success. The small towns and villages desire to have better communication with the big cities, both for pleasure and profit; the big cities, especially Toronto, are greatly in need of such communication, in order that the produce of farmers and market gardeners may be more expeditiously and cheaply brought thereto. Owing to bad roads, at certain seasons of the year it is practically impossible for many farmers and others to get their produce into the large markets, while, on the other hand, prices in those markets are excessive, owing to the shortage thus caused. The radial railways would benefit the whole community.

## CORRESPONDENCE.

Letters received by us after 6 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

## Prospects in Electrical Engineering.

In reference to Mr. Alderton's reply to my letter of the 11th ult., kindly allow me to state that the same is a mean, cowardly, and illogical attack. Mean because it is all assumption without any reasonable ground, cowardly because my letter does not allude to any personal grievances in particular, and illogical because in the lines to which he refers I deal with two classes of individuals and obviously cannot be likened unto both, and, again, because in his argument he assumes his premise, then takes it for granted and draws his conclusion, which is absurd.

In regard to my lack of ability to discriminate between appointments having probabilities and those having possibilities, I suggest this is merely "bluff," but, in any case, although his advertisement is made use of as a typical example, my remarks are applicable in numerous other instances.

If Mr. Alderton will only take the trouble to read intelligently my second letter in this week's issue of the REVIEW on the above subject, especially the last paragraph, he will observe that I am not the type of engineer he, for the sake of argument, assumes me to be.

A. C. Black,

Hon. Sec., A.E.S.E. (Liverpool District).

Bootle, May 5th, 1913.

## Long-Scale Instruments.

Referring to Mr. Davies's letter which appeared in your issue on April 18th, I am sorry he did not confine himself to history. He writes, however, in what he believes to be the cause of justice, and then proceeds to discredit my patents.

Where the inferred injustice lies, it is somewhat difficult to see, and also why he is interested in taking up the cudgels on behalf of the other firms who, he states, are "manufacturing these instruments," as they have the same channels open to them as my firm for making known their goods.

But who are these others whose cause Mr. Davies champions? Readers will acknowledge that until my company introduced long-scale instruments for direct current they were comparatively unknown.

As for himself, Mr. Davies has no cause to feel aggrieved, since he has had 20 years' start in which to develop his instrument, and with all the knowledge at his disposal, it is surprising that his instrument is not now the most popular instead of being of mere historic interest.

It is also interesting to note that Mr. Davies did not deem it worth while to continue his patent for more than six years. The Thompson patent which he quotes was also allowed to expire in nine years; therefore, had these patents been all that could be desired, it is strange it was left to me to produce the first commercial and practical instrument.

Mr. Davies, in his letter, refers to his statement in the *Philosophical Magazine* for August, 1899, that he had "arranged for the active use of even three sides of the coil," but he omitted to mention that in the same article he stated "but it has the rather serious disadvantage of being complex in design and—I am afraid—difficult to build."

I am more than surprised that Mr. Davies, with all his experience, should fall into such a blunder as to look upon the gap in my instrument as a constructional necessity. Furthermore, it is to be regretted that he did not choose from amongst my patent drawings a more representative sketch of my instrument, especially as he appeals to engineers to observe the gap, which he did not reproduce in his illustration.

As for the attack on my patent claims, what I claim and what I do not claim are open for anyone to read who cares to consult the patent specifications, so I do not propose to

**Strike.**—A Leicester newspaper says that the strike of electricians there for higher wages is causing little inconvenience to the trade, as sufficient men are at work to keep things going. It is said that only 28 employes are out. Another paper said last week that five local firms and 70 men were affected, and that firms outside the E.C.A. had agreed to the advance from 8½d. to 9d. per hour.

discuss the "dignity of the chimneys" here; there are other places where they can be argued to greater advantage.

In conclusion, perhaps I may be pardoned for adding that several eminent engineers and instrument makers who have seen my instrument, have been sportsmen enough to admit that I have succeeded where others, including themselves, have failed.

The Record Electrical Co., Ltd.,  
J. WESTMORELAND RECORD.

London, S.W., May 3rd, 1913.

#### State Charges in Textile Mills.

I should be much obliged if any reader could give me some information regarding a method of neutralising electric charges which are formed on silk or woollen materials during the process of manufacture. I believe apparatus has been brought out for dealing with this trouble in paper mills. Names of firms manufacturing apparatus for this purpose would also be esteemed.

Statie.

#### Omnibus Lighting.

I am operating some direct-current petrol-electric motor-omnibuses of the Tilling-Stevens type, in which the dynamo varies from a minimum of 15 v. to a maximum of 350 v. I should like, if possible, to be able to get the lighting on the vehicles from the dynamo, rather than have to put in a small one of the usual car-lighting type.

I shall be glad to learn if any of your readers know of a system that is adapted for this purpose. Of course, I do not expect the lighting to be done without a small storage battery, which would have to be connected in some way with the main supply.

Enquirer.

#### The "Point Five" Meeting (M.E.A. Convention Week), June 17th.

I have been asked to make it quite clear as to the persons entitled to attend the above meeting. On behalf of the Association, I would like to say that it was the wish of our members at the Bradford meeting that any persons interested in pushing the use of electricity for domestic purposes would be welcomed, whether technical men or laymen. Manufacturers will be specially welcome.

In order that the Committee may make arrangements for the place of meeting, it is necessary that all who propose to attend should let me know not later than May 22nd.

A. Hugh Seabrook,

Hon. Secretary.

London, W., May 2nd, 1913.

#### Report of Royal Commission on University Education.

One would have thought that engineering was a sufficiently important subject to have a faculty all to itself, for even music has a separate faculty. At present engineering is a sort of excrescence of Science. The Commissioners propose that it should be mixed up with something else, and the compound called "Technology," so that if this should ever come to pass some of our distinguished engineers will be able to state that they have the D.Ts. (i.e., that they each possess the degree of Doctor of Technology)!!! "which," as Euclid would have said, "is absurd," and being absurd, it cannot be. Therefore let us have a separate faculty for the important subject of engineering, and let the degrees be B.E. and D.E. (Bachelor and Doctor of Engineering), which would be understood by the man in the street.

A. S. E. Ackermann, B.Sc. (Engineering).\*

#### IMPERIAL WIRELESS SYSTEM: REPORT OF THE ADVISORY COMMITTEE

THE Committee appointed by the Postmaster-General consisted of:—The Right Hon. the Lord Parker of Waddington (chairman); W. Duddell, Esq., F.R.S.; Dr. R. T. Glazebrook, C.B., F.R.S.; Sir Alexander B. W. Kennedy, F.R.S.; and J. Swinburne, Esq., F.R.S., with E. H. Rayner, Esq. (secretary).

The Report, which is dated April 30th, 1913, is abstracted below:—

Immediately after our appointment we took measures to ascertain what systems of wireless telegraphy there were in existence, and by whom such systems were controlled. These systems appear to be the following:—(1) The Marconi, controlled by the Marconi's Wireless Telegraph Co., Ltd.; (2) The Telefunken, controlled in this country by Messrs. Siemens Bros.; (3) The Poulsen, controlled in this country by the Universal Radio Syndicate; (4) The Goldschmidt, controlled by the Anglo-French Wireless Co.; and (5) The Galletti, controlled by the Galletti's Wireless Telegraph and Telephone Co.

It appears, however, that the Admiralty, while in the main making use for communication between His Majesty's ships and shore stations and between ship and ship, of apparatus similar to that employed by the Marconi Co., claim nevertheless to have introduced important improvements. These improvements may be of some materiality; for the Admiralty desire that each station in the proposed chain shall be capable of communicating with His Majesty's ships. It should be considered, therefore, whether any system adopted by the Post Office for the purposes of the Imperial chain ought not to be capable of being worked in conjunction with the Admiralty appliances, especially as to the wave-lengths to be employed.

We have heard evidence on 11 days. We have also personally visited and inspected the several stations and works mentioned in the Second Schedule to this Report.

The term "System of Wireless Telegraphy" is not really apt. Each company or firm engaged in working a wireless station uses apparatus protected by its own patents and has to avoid the use of apparatus and devices protected by the patents belonging to other companies or firms. The main differences in the apparatus and devices at present in use centre in the high-frequency generator; but there are other apparatus or devices protected by patents, such as special aeriæ, different types of automatic high-speed transmitters and of receivers and recorders. Any company or firm which makes use of apparatus or devices which others are precluded from using because of the existence of some patent may claim to have its own system of wireless telegraphy, but the term "system" is misleading, inasmuch as by far the major portion of the buildings and plant could with minor modifications be used equally well with any other frequency generator or other patented device.

The existence of a patent may seriously interfere with the normal development of an industry, for it tends to prevent the general use of the means best adapted for securing the end in view. It may well be that a competent engineer, if asked to erect and equip in the most efficient manner a chain of wireless stations such as the Post Office contemplates, would desire to combine apparatus, the combination of which is difficult if not impossible because of the existence of patent rights. In this connection we desire to lay stress on the fact that the Government is not fettered by considerations arising out of patent rights, but can use any patent on fair terms under Sec. 29 of the Patents and Designs Act, 1907.

Subject to the above criticism on the use of the word "system," the existing systems of wireless telegraphy may be divided into two classes according to the type of high-frequency generator used. In the first class, the production of high-frequency currents depends on spark discharges giving groups of oscillations and therefore intermittent trains of ether waves. In the second class, the generator produces oscillations which for practical purposes may be treated as continuous, and therefore as giving continuous ether waves.

To the first class belong the Marconi and Telefunken systems, and to the second class the Poulsen, the Goldschmidt and possibly the Galletti systems.

The Poulsen high-frequency generator is a modification or development of the singing arc fed by direct current.

The Goldschmidt high-frequency generator is a dynamo, giving an alternating current of a fundamental frequency of the order of 10,000 periods per second. The frequency is increased by the use of suitably tuned oscillation circuits, each successive circuit adding the fundamental frequency of the machine.

The Galletti generator involves a series of spark gaps arranged to operate in a cycle, so that the discharge of each causes, and is immediately followed by, the discharge of the next in the series, the sequence of discharges being so rapid that the resulting oscillations may be viewed as practically continuous.

Though at present making use of generators depending on spark discharges producing groups of oscillations, both the Marconi Co. and the Telefunken Co. are developing and experimenting with generators of their own, producing continuous oscillations. The Marconi continuous high-frequency generator consists essentially of a rapidly rotating contact-maker in a direct-current circuit, with special dispositions of other circuits to give continuous oscillations in the aerial. The Telefunken continuous high-frequency generator consists of an alternator constructed to give as high a fundamental frequency as may be convenient in the first instance, the frequency being doubled or quadrupled by a polarised transformer method. In making use hereafter of the term Marconi system or Telefunken system, we do not include either of these generators.

\* Note our present clumsy degree! The abbreviation (save the mark!) is official.

In order to test the efficiency of the various systems to which we have referred for the purposes of the Imperial chain, we invited the companies or firms by which these systems are controlled to give us practical demonstrations thereof, if possible on a commercial scale, and if possible over distances of 2,000 miles and upwards. Except in the case of the Marconi system we did not, however, obtain any demonstrations on a commercial scale, or any demonstration over a distance of even 1,000 miles. It is right, however, to state that, according to the information given to us, it was in several cases impossible for the companies concerned to arrange for the demonstration as desired within the short period which we could allow for the purpose.

In order that we might test the Marconi plant at Clifden, the Postmaster-General permitted us to avail ourselves of the services of a small staff of skilled operators, who stayed there for a complete week, keeping continuous watch on the actual commercial working between Clifden and Glace Bay, and reporting to us very fully. These reports, for which the Committee acknowledge their indebtedness to Mr. S. E. J. Burrow and his assistants, contain full and valuable evidence as to the commercial working of the plant now in use.

We then went to Clifden, and the Marconi Co. put the station at our disposal. Through the courtesy of the Canadian Government, we were represented at Glace Bay by Mr. C. P. Edwards, general superintendent of the wireless service of the Canadian Government, who had the assistance of one of his operating staff. Mr. Edwards was provided with a number of sealed messages by our secretary, and he was instructed to open and superintend the transmission of these when and as requested by the Committee at Clifden, and to take charge of similar messages sent from Clifden to Glace Bay, and to send them by post to the secretary. Mr. Edwards made reports and comments from time to time during our visit, and dispatched a detailed account to us later.

The Marconi Co. use at their Clifden station a high-frequency generator, in which condensers charged from the high-tension batteries are discharged by projections which are fixed on a rapidly rotating wheel, and which pass close to metal disks on each side of it. Each discharge produces a group of high-frequency oscillations in a primary circuit, according to the company's usual practice. We observe that, for the purposes of the Imperial chain, they proposed to charge the condensers from an alternator through a high-tension transformer, as is their practice elsewhere, including the long-distance station at Coltano. This method is, in our opinion, preferable.

At Clifden the Marconi Co. use their directive aerial; and they have a second separate station for receiving from Glace Bay without being disturbed by the simultaneous sending at Clifden. They demonstrated duplex working while we were at Clifden and Mr. Edwards was at Glace Bay, all interference of the outward waves being eliminated, though the strength of the received signals was somewhat reduced.

The Marconi Co. is, we are satisfied, working on a commercial scale between Clifden and Glace Bay, a distance of about 2,300 miles, though at present the number of messages transmitted either way is not so great as to require duplex working or high-speed transmission. We were, however, present when messages were transmitted automatically at the rate of 60 words (of five letters) a minute, and we see no reason why this rate should not be considerably increased if it becomes necessary. The communication is practically continuous, though there are, no doubt, periods when the signals become very weak, and even occasional periods when no signals can get through. Periods of this nature are due to natural conditions, and will be incident to the working of any system. During such periods communication can, in our opinion, be ensured only by the use of great power in the aerial. We understand that for this reason, and having regard to the increased power required for high-speed transmission, the Marconi Co. proposed to employ for the Imperial stations practically double the power now used at Clifden. Even so we think there may be periods when communication is impracticable, especially in tropical regions where atmospheric disturbances may be expected to cause more difficulty than over the Atlantic.

With regard to the Telefunken system, which, like the Marconi, is largely used, its practicability on a commercial scale for distances of 2,000 miles has not yet been proved. Experiments are now being made between Nanan and Togo, a distance of 4,000 miles, and the results indicate that communication over this distance is already possible at night.

With regard to the Poulsen system, we are satisfied that it is practicable for short distances. The Poulsen arc has been tried between San Francisco and Honolulu, a distance of about 2,100 miles, but as to its practicability over this distance we have no evidence except that which was in the possession of the Post Office long before our appointment. The results obtained do not appear to have been very satisfactory. In our opinion the power used was insufficient. No one tendered any evidence on behalf of the company which is working between San Francisco and Honolulu, and the firm controlling the system in this country was apparently in ignorance of how it is now working in America. We have recently been informed of important experiments between Arlington and the U.S.S. ship *Salem* and between Arlington and Gibraltar, using both the arc and spark transmission; but full details are not yet before us. We conclude that if the Poulsen system is to be so developed as to be practicable for commercial purposes over distances of 2,000 miles or upwards, the arc will have to be constructed so as to supply the aerial with higher power, or use will have to be made of a more sensitive receiver.

Similarly, with regard to the Goldschmidt system, it is no doubt successful over short distances, and the only thing required to make it practicable over long distances is a machine of the necessary

power. When the Goldschmidt station near Hanover and the corresponding station on the other side of the Atlantic are complete and in working order, we expect that communication between them will be established by the use, either alone or in conjunction with improved receiving apparatus, of the Goldschmidt machine which we inspected at the station near Hanover, and which was admirable both in design and workmanship.

Though continuous waves may be somewhat more efficient than intermittent trains of waves, and though the strength of the received signals may probably be increased by the use of improved receiving apparatus, we are of opinion that having regard to the experience of the Marconi Co., and in view of the demand likely to arise for high-speed transmission, it would be desirable in the first instance to insist on high powers for the Imperial chain whatever system be adopted. At present, with the exception of the Goldschmidt machine at the station near Hanover, we have seen no continuous high-frequency generator capable of putting into the aerial as much power as is put in by the Marconi Co. at Clifden for their trans-Atlantic service. We may add that both the Poulsen arc and the Goldschmidt machine are admirably adapted for high-speed transmission. Though we have not seen transmission by either at a higher speed than in the case of the Poulsen arc 70, and in the case of the Goldschmidt machine 60 words a minute, we have no doubt that these speeds could be increased. We have had no evidence as to the practicability of the Galletti system even over short distances.

We report, therefore, that according to our investigation the Marconi system is at present the only system of which it can be said with any certainty that it is capable of fulfilling the requirements of the Imperial chain, but this must not be taken to imply that, in our opinion, the Marconi Co. must necessarily be employed as contractors for all the work required for the Imperial chain. Indeed, in some respects it might, we think, be better for the Government themselves to undertake the construction and equipment of the necessary stations, acting for that purpose under the best technical and scientific advice which can be obtained, and employing the most suitable contractors for the various portions of the work or plant. On the other hand, it may be said, and is no doubt the fact, that at the present moment the Marconi Co. alone has had practical experience of the sort of long-distance work required, including experience in putting down stations, in organising the traffic and staff, and in coping with the difficulties that arise in a new industry, and the value of such experience and organisation may well outweigh other considerations, if rapid installation and immediate and trustworthy communication be desired.

Further, in our opinion wireless telegraphy is in a condition of rapid development, and this development will in all probability involve the ultimate substitution of high-frequency generators producing continuous oscillations, for high-frequency generators dependent upon spark discharges which produce groups of oscillations. Continuous oscillations should allow of more accurate tuning and greater selectivity, and may be better adapted for use in conjunction with improved receiving apparatus. The need of high-frequency generators producing continuous oscillations has long been felt by telegraph engineers, and has led to the various devices for the generation of continuous high-frequency oscillations to which we have already referred.

The only continuous high-frequency generator we have yet seen tried with success over long distances is the Marconi continuous high-frequency machine to which we have already referred. For the purpose of witnessing trans-Atlantic experiments with this machine we paid a second visit to Clifden and experiments were made with it in our presence. Using it Mr. Marconi, on the 26th and 27th of April, 1913, sent from Clifden to Glace Bay messages prepared by us for the purpose, such messages being at our request at once repeated from Glace Bay by means of the company's ordinary plant and correctly received at Clifden. The power put into the aerial by this machine for the purpose of the experiments was not sufficient for commercial purposes, but there seems no reason why higher power should not be obtained.

These experiments, in our opinion, warrant the belief that all or any of the devices for the generation of continuous waves to which we have referred may, at no distant date, be shown to be capable of successful use for the purpose of long-distance wireless telegraphy. Many engineering firms are also engaged in designing high-frequency alternators, and it seems probable that various other devices suitable for long-distance wireless telegraphy may shortly be available. Again, there is some evidence that the design of the aerial is in a transition stage. At present there are engineering difficulties in building perfectly satisfactory aeriels for the longer waves which appear to be most appropriate to long-distance telegraphy. Aeriels, especially high aeriels, are frequently blown down or damaged by wind.

The directive aerial used in the Marconi system has the advantage of not requiring very great height and of giving preference in the desired direction. Its use in connection with the separate receiving station comparatively close to the transmitting aerial makes duplex working practicable. We see no reason why this form of aerial should not be capable of use with any form of high-frequency generator. Moreover, the development of the aerial may facilitate the use of still longer waves for long-distance work, and this may profoundly affect the problem of the high-frequency generator, by rendering possible the employment of simple alternators for the production of the frequency required, high though it must still be.

Receiving plant may take many forms. Thus the first receiver may be a crystal contact or some discharge valve on the lines of the Fleming valve, and this may work any one of various kinds of relay; and the record may be made by a Morse inker, by photo-

graphy, by a phonograph, by simple telephone or otherwise. There is a wide field here for experiment and development.

Having regard to these facts, it is, in our opinion, undesirable that in constructing and equipping the stations of the Imperial chain the Post Office should be pledged to the continued use of any apparatus now used in any so-called system, or be subject to any penalty by way of continued royalties or otherwise for the disease of any apparatus which may be installed in the first instance. It is, we consider, imperative that in any contract which may be entered into, the Post Office should reserve complete liberty of action in this respect. Further, the stations should be constructed and equipped with a view to the possible and probably rapid development of the art, and we think it would be wise that at any rate two of the stations should be used at once not only for commercial purposes, but as experimental stations in which the various high-frequency generators hereinbefore referred to, and also any suggested improvement in any part of the apparatus, should as far as possible be thoroughly tested. This would involve the employment of a highly-trained staff with an engineer of special knowledge and of high standing at their head, but the information thus obtained would be invaluable for the construction and equipment or the improvement in the design of the stations.

Even when all the stations are constructed, equipped and in working order, we do not think it would be wise to cease using some of the stations for experimental purposes. We have already referred to the possibility that the existence of patents may fetter the normal development of an industry. A Government monopoly may stop its growth altogether, and is almost sure to do so unless the Government department which works the industry is ready to welcome and test any new invention or improvement, to adopt and use it if the test be satisfactory, and to pay for it on fair terms if it be adopted. For the purpose of testing, examining and, if necessary, further developing any new invention or suggested improvement in wireless telegraphy, a trained staff with an engineer of special knowledge and standing at its head will be necessary. Under the guidance of such a staff and engineer we see no reason why the Post Office wireless stations should not be ultimately equipped with apparatus far more efficient than that now used in any so-called system, more especially as the Post Office will be able to combine, in spite of existing patent rights, apparatus or devices which, because of the existence of such rights, cannot now be combined by anyone else.

We desire to add that the provisions of the agreement, now the subject of inquiry by a Select Committee of the House of Commons, are not, in our opinion, within the terms of our reference; but nothing we have said in this report must be taken as expressing our approval of such provisions.

#### SCHEDULE I.

*Part I.—Names of Witnesses heard on behalf of the Companies or Firms interested.*

Dr. R. Goldschmidt (Goldschmidt).  
Dr. J. Erskine Murray (Goldschmidt and Poulsen).  
Mr. Rappis (Galletti).  
Mr. G. Marconi (Marconi).  
Mr. Hird (Telefunken).  
Prof. Pedersen (Poulsen).  
Mr. Campbell Swinton (Poulsen).  
Prof. Silvanus Thompson, F.R.S. (Poulsen).

*Part II.—Names of Witnesses invited by the Committee to give evidence.*

Vice-Admiral Sir Henry B. Jackson.	Commander Lorrig, R.N.
Commander W. R. W. Kettlewell, R.N.	Mr. H. A. Madge.
Lieut. D. W. Roe R.N.	Mr. J. E. Taylor.
Lieut. J. A. Slee, R.N.	Sir Oliver Lodge.

#### SCHEDULE II.—Stations and Works Visited.

Admiralty Station, Whitehall.  
Admiralty High-Power Station, Hersen  
H.M.S. *Vernon*.  
Goldschmidt Station, Slough.  
Marconi Station, Clifden, Ireland.  
Messrs. Bergmann's Works, Berlin.  
Messrs. Lorenz's Works, Berlin.  
Telefunken Station, Nauen.  
Poulsen Works, Copenhagen.  
Poulsen Wireless Station, Lyngby.  
Goldschmidt Station, Neustadt, Hanover  
Post Office Station, Cullercoats.

Mr. H. E. Duke, K.C., and Mr. Lalley represented the plaintiffs, and Mr. L. Sanderson, K.C., and Mr. McCardie represented the defendants.

Mr. DUKE stated that at the commencement of 1911 the plaintiffs established in Paris a separate office, and appointed as manager there Mr. A. C. Lochenies. Towards the close of 1911, having regard to large contracts the plaintiffs undertook, Mr. Keen, the plaintiffs' manager in Europe, considered it prudent to obtain a fidelity guarantee bond for Mr. Lochenies. In a communication to the defendants, they applied for a £1,000 bond. The defendants on March 5th wrote that the application for a bond for the £1,000 had been accepted by them at a premium of £6 5s., and that on the plaintiffs advising them that the rate of premium was accepted, the bond would be prepared and forwarded. Mr. Keen had occasion to go to America on a short visit, and the plaintiffs' London accountant asked the defendants in a letter to permit the question to remain open pending Mr. Keen's return. On April 18th that gentleman returned to London, and on that day his representative paid the premium and received the bond, which was dated March 8th. At the time the premium was paid (said counsel) there was a suspicion that Mr. Lochenies had left Paris. Mr. Keen went to Paris, and found that Mr. Lochenies had disappeared with the proceeds of a draft for a considerable sum. Mr. Keen wrote to the defendants, who replied alleging that they had been imposed upon, and were under no liability. Counsel proceeded to argue that the bond was issued on March 8th, and that, therefore, the defendants were liable in regard to it.

Mr. SANDERSON, for the defendants, contended that the risk covered by the policy did not commence to run until the premium was paid, and that, as Mr. Lochenies had disappeared with money belonging to the plaintiffs before the payment was made, the defendants were not liable.

At the close of the evidence and legal arguments, Mr. DUKE incidentally expressed regret that his learned friend on the other side should have thought fit to criticise the attitude of Mr. Keen.

His LORDSHIP (emphatically): I may say that there is not the slightest reflection on Mr. Keen, in my opinion.

After an adjournment his LORDSHIP held that the plaintiffs had made out their case, and granted the declaration asked for, with costs.

#### DISTRICT IRON AND STEEL CO., LTD., v. ARMORCUT MANUFACTURING CO., LTD.

In the King's Bench Division on Saturday, May 3rd, Mr. Justice Channell had before him an action brought by the District Iron and Steel Co., Ltd., of Smethwick, Birmingham, against the Armorduct Manufacturing Co., Ltd., whose works are at Witton, near Birmingham. The plaintiffs claimed the balance of account due in respect of a class of steel known as "Strip" supplied to the defendants, and the Armorduct Co., in addition to asserting their right to a cash discount of 2½ per cent., counterclaimed a rebate with reference to anterior transactions relating to close-joint iron and steel tubes. In the latter connection, reference was made to a circular sent out in March, 1907, informing buyers of such tubes that they would be paid a deferred rebate in respect of orders given to firms who had signed the circular. Such payment was to be conditional upon the purchasers confining their orders for the tubes to members of the Association that was formed, and to their being in no way interested in the manufacture of the tubes otherwise than as proprietors, partners, directors or shareholders in one or more of the firms and companies in question. It was stated, in evidence, that the defendants, who manufacture electrical appliances, bought the "Strip" steel for the purpose of manufacturing these tubes, and his Lordship, holding that this was in violation of one of the terms of the circular, gave judgment in favour of the plaintiffs on both claim and counterclaim, with costs.

#### OSRAM LAMP WORKS CO., LTD., v. THE ELECTRICAL MANUFACTURING CO.

In the Chancery Division on Friday, May 2nd, before Mr. Justice Eve, this motion was again mentioned by Mr. Tomlin for the defendants. Counsel stated that he had agreed with Mr. Gray for the plaintiff company, that subject to his Lordships' sanction, the matter should stand over generally.

His LORDSHIP: Very well.

#### STRETFORD U.D.C. v. GORTON, LTD.

In our issue of December 20th, 1912, under the heading "Feeder Pillars Again," we recorded a breakdown in connection with "Stretford electric supply system. This occurrence had its sequel in the Manchester Assize Courts on May 1st, when the Stretford U.D.C. claimed damages in respect of injuries to property (a feeder pillar damaged to the extent of £122), by a runaway horse belonging to Messrs. John Gorton, Ltd., carriers, defendants in the action. For the plaintiffs it was contended that the driver of the vehicle should not have removed the bit from the horse's mouth, as thereby control of the animal was lost. For the defence it was shown that it was the proper thing to remove the bit from the horse to drink. Veterinary surgeons were called by both sides on this point, and ultimately the jury gave a verdict for the defendants.

## LEGAL.

#### ALLIS CHALMERS CO. v. THE FIDELITY AND DEPOSIT CO., OF MARYLAND.

In the King's Bench Division, Mr. Justice Phillimore, on May 1st, concluded the hearing of this action, brought by plaintiffs, manufacturers of electrical machinery, and carrying on business in the United States, London, Paris and elsewhere, against the defendant company, of Old Broad Street, E.C., the plaintiffs seeking a declaration that a fidelity guarantee bond for £1,000 was valid. Liability was repudiated by the defendants in regard to the bond.

## BUSINESS NOTES.

**Patent Notices.**—Patent No. 9,145, granted in 1911 to Chas. Rudolph for "Improvements in unions or couplings with bayonet joints," has been revoked.

**Book Notices.**—"The National Form of Building Contract." By W. Valentine Ball and W. H. Hope. 1913. London: *The Local Government Journal*. Price 6s.

"Introductory Electricity and Magnetism." By Carl W. Hansel. 1913. London: W. Heinemann. Price 2s. 6d. net.

"Proceedings of the Physical Society of London." Vol. XXV, Part 3. April 15th, 1913. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"Proceedings of the American Society of Civil Engineers." Vol. XXXIX, No. 4. April, 1913. New York: The Society.

"The School of Mines Quarterly." Vol. XXXIV, No. 3. April, 1913. New York: Columbia University. Price 50 cents.

"The Physical Review." Vol. I, No. 4. April, 1913. Lancaster, Pa.: The American Physical Society.

"Transactions of the Illuminating Engineering Society." Vol. VIII, No. 3. March, 1913. New York: The Society. Price 75 cents.

"Bulletin Mensuel Société Belge d'Electriciens." Vol. XXX, March, 1913. Brussels: E. Brylant. Price 1 fr. 75 cents.

"La Télégraphie sans fil, la Télémechanique et la Téléphonie sans fil à la portée de tout le monde." By E. Monier. 1913. Paris: H. Dunod & E. Pinat. Price 2 fr. 50 cents.

"Life Test and Economical Study of Incandescent Lamps." By T. Hirobe and R. Mitsuda. January, 1913. Tokio, Japan: Electro-Technical Laboratory.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, Nos. 7 and 8. April 15th and 30th, 1913. Milan: Stucchi, Ceretti and C. Price L. 1.50 each.

"Boletín de la Sociedad de Fomento Fabril." Vol. XXX, No. 3. March 1st, 1913. Santiago, Chile. The Society.

"The Railway and Travel Monthly for May is a special Argentine number. It contains a number of illustrated articles on the Central Argentine Railway, and on some of our great British railways, a number of the pictures being excellently produced in colour.

**Bankruptcy Proceedings.**—CHAS. MUSKER, electrical, &c., engineer, 1, Northumberland Avenue, W.C.—An application for an order of discharge was made on May 2nd to Mr. Registrar Brougham at the London Bankruptcy Court. Mr. W. P. Bowyer, Official Receiver, reported that the applicant failed in September, 1912. Proofs of debt amounting to £6,364 had been tendered by creditors; the assets, valued by the bankrupt at £450, had realised £31, and a further £100 was likely to be received. In 1889 the bankrupt and a brother commenced business in partnership as C. & A. Musker, electrical and hydraulic engineers, at Bootle and sold the undertaking in 1895 to a limited company, of which they became managing directors. In 1901, in order that further capital might be raised, a new company, entitled C. & A. Musker (1901), Ltd., was formed, which took over the business, acquired further machinery and erected new buildings at Tuebrook, Liverpool, the applicant and his brother continuing to act as managing directors of the concern. In June, 1909, a Receiver for the debenture-holders was appointed, by whom the bankrupt was employed until September, 1911, when the works were closed. He attributed his insolvency to the failure of the last-named company, to the depreciation of his share interest therein, and to his household and personal expenses having exceeded his income. As offences the Official Receiver reported (1) insufficiency of assets to equal in value 10s. in the £ on the amount of the unsecured liabilities; and (2) contributing to the bankruptcy by unjustifiable extravagance in living. On those grounds the learned Registrar imposed a further suspension of two years. Order entered accordingly.

CECIL WRAY, electrical and mechanical engineer, Bradford.—May 21st is the last day for the receipt of proofs for dividend. Trustee: Mr. W. Durrance, 12, Duke Street, Bradford.

C. S. NORTHCOLE, electrical engineer, Streatham.—May 23rd is the last day for the receipt of proofs for dividend. Trustee: E. W. J. Savill, 132, York Road, Westminster Bridge Road, S.E.

**French Wire Lamps.**—The Société Française d'Incandescence par le Gaz, of Paris, states that the company derived advantage from the working of its new electric lamp "O. R.," for the first time during 1912. This lamp is provided with a pressed filament, which is claimed to possess the advantage of a longer life than lamps having drawn-wire filaments, although the latter types are cheaper.

**Electric Clocks.**—With reference to a notice on electric clocks at the Ghent Exhibition, the MAGNETA TIME CO., LTD., of Chiswick, write:—"We wish to point out that your reference to this matter under "Business Notes," in your issue of the 25th ult., is liable to misconception. The chief postal buildings of London are equipped with the Magneta system, the dispatch of home and foreign mails depending thereon. We enclose a complete list of these installations, and in order that there may be no misapprehension, the following will convey a correct idea of the magnitude of this work. Taking a 12-in. dial as one unit, the aggregate of units for Government Magneta installations has reached 2,600 (two thousand six hundred), and, in view of the history of electric clocks, it may not be out of place to mention that although the first of these installations has now been at work some eight years,

the running of this mass of Magneta apparatus has not cost the Post Office one penny for maintenance, or charges of any kind, up to this date. We felt these remarks were strongly called for, as the note might be read as the appropriation by others of the prestige which solely belongs to the Magneta system."

The list enclosed with the letter mentions the new G.P.O. (King Edward Building), London, and 15 other very important post offices and public works.

**Holland.**—The Dutch Customs authorities have lately given a decision to the effect that commutator brushes and brush-holders, armatures and pole cases for dynamos and electric motors, imported separately, "are to be classified as parts of factory machines" and admitted free of import duty.

**Water Turbine Contracts.**—MESSRS. BOVING & CO., LTD., report having received the following orders for water turbines, pipe lines and pumps during the past month:—

Mount Lyell Mining and Railway Co.—4 Impulse wheels of 2,000 h.p. and three of 180, under a head of 1,000 ft., through the General Electric Co., of New York. Also, direct from the company, two pipe-lines of 750 and 550 mm. diameter and 2,900 ft. long.

Sagami Hydro-Electric Co., Japan.—3 Francis turbines of 3,750 h.p. and one of 150 h.p. under a head of 41 metres.

Porco Tin Mines.—1 Impulse turbine of 150 h.p. under 210 metres head, and a pipe-line 1,190 metres in length, 15 in., 12 in. and 10 in. diameter.

Compañia Ingenieria Exportadora, Mexico City.—1 Francis turbine of 75 h.p., Borough of Napier, N.Z.—1 Victoria turbo-pump 415 g.p.m. 825 ft. head, and one 830 g.p.m. and 170 ft. head, coupled to Lancashire Dynamo motors.

Also repeat orders for a Victoria mining pump from Messrs. Kilburn Brown to deliver 750 g.p.m. against 573 ft. head, and from the Great Western Colliery to deliver 417 g.p.m. against 745 ft. head.

**A Modern Aladdin.**—MR. H. W. LEONARD, of the General Electric Co., Ltd., Publicity Department, in the character of "the modern Aladdin with the wonderful (Ooran) lamp" secured first prize at a fancy dress carnival at Birmingham, on the 26th ult.

**Austria.**—The Elektrotechnische Verein Brunn is the name of a new association, which has just been formed at Brunn, Bohemia.

**Electric and Copper Works in Chile.**—It is stated that the Siemens-Schuckert Works have secured an order of the value of £500,000 in connection with a scheme for the mining of copper ore in Chile. It appears that the New York metal firm of Guggenheim have acquired copper mines in the Chilean Cordilleras, and propose to work them. As a scarcity of water exists in this mountainous district, it is intended to employ electric power, which is to be transmitted from the coast. For this purpose a steam power station is projected in one of the coastal towns; the capacity is to be 60,000 h.p., and oil fuel is to be used for firing the boilers, in conjunction with turbo-generators. The power is to be conveyed to the mines at a pressure of 100,000 volts by means of overhead conductors, the distance being about 124 miles, and it is to be used in connection with the working and smelting of the ore and the production of electrolytic copper. The installation of the long-distance transmission line will be undertaken by the firm of Guggenheim, who are large producers of copper, whilst the transformers and distributing network, &c., at the mines will form the subject of future contracts. It is said that the Siemens-Schuckert Works have obtained the order for the generating station and plant in competition with the General Electric Co., the Westinghouse Co. and the A.E.G.

**Catalogues and Lists.**—MESSRS. SCHOEN BROS., 29 and 30, Cock Lane, Snow Hill, London, E.C.—New four-page leaflet, giving illustrations, brief particulars and prices of a variety of apparatus for wireless telegraphy for experimental and demonstration purposes, which they hold in stock.

MESSRS. T. HARDING CHURTON & CO., LTD., Atlas Works, Water Lane, Leeds.—New catalogue (No. 30) (20 pp.), containing detailed description with illustrations, of polyphase induction motors, starters and controllers for same, with tabulated data and prices. Representative characteristic curves appear of 15-H.P. three-phase and 50-H.P. two-phase motors, showing high efficiency maintained over a long range of load, and a high power factor. Single-phase induction motors are also described and priced. Messrs. Harding Churton report that their works have for some considerable time been exceedingly busy, working continuously day and night.

MR. HARRY MOSS, 116, Horton Grange Road, Bradford.—Leaflet showing a patent electric window heater.

MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, London, W.C.—Leaflet illustrating and pricing (their inspection electric hand lamps for motor-cars.

MESSRS. W. T. HENLEY'S TELEGRAPH WORKS, CO., LTD., Blomfield Street, London Wall, London, E.C.—A new telephone cable catalogue of nearly 140 pages has been issued. It is divided into three sections as follows:—(1) Underground telephone and telegraph cable; (2) aerial telephone and telegraph cable; (3) miscellaneous cables, accessories, and subaqueous cables. In view of the company's long and varied experience of the manufacture of such cables, the publication, with its specifications, tests, illustrations and general information, naturally possesses considerable interest for telephone engineers. Full specification and details are given of all the various types of cable used, which include—in addition to the usual lead-sheathed single, twin, multiple twin and quad, type, dry core telephone cable and screened telegraph cables—various types of rubber insulated cables and wires used for both indoor and outdoor work, also flameproof switchboard cables and wires, together with tests and notes describing the purposes for which each type of cable is designed. Information is given with regard to the important question of jointing, and prices of all necessary jointing materials are included. Particulars

of various types of subaqueous cables have been included, and the question of loading cables is dealt with; we understand that the tests shown in the catalogue are put forward as being consistent with an economical and practical cable. Lower capacity tests can be given, but such would necessitate an increase in diameter, and a consequent increase in cost. For convenient reference, class numbers and code-words are given for all types. Owing to the firm's large foreign business in telephone cables, they have found it necessary to give dimensions in both the English and metric systems, and for the convenience of foreign clients have included a table of money conversions.

**MESSRS. DANIEL ADAMSON & Co.,** Dukinfield.—Illustrated descriptive circulars of their patent Adamson-Davies tubular extension for Lancashire or Cornish boilers. Particulars of tests are tabulated.

**BRITISH ECONOMICAL LAMP CO., LTD.,** 9, Old Bailey, London, E.C.—Two illustrated and priced leaflets give particulars of the "Totolite" crystal glass reflector fittings—concentrating, expansive, intensive and extensive types; also of Belco arc fittings for high C.P. lamps, for inside and outside lighting.

**MESSRS. O. ELLEFSEN & Co.,** 26A, Silver Street, Bedford.—Pamphlet (12 pages) describing and illustrating Ellefsen's new patent low-water alarm and feed regulator for steam boilers.

**THE STERLING TELEPHONE AND ELECTRIC CO., LTD.,** 200, Upper Thames Street, London, E.C.—Publication No. 203 gives prices of, and illustrated information regarding, "Primax" automatic interphones.

**MESSRS. DAVID ROWELL & Co.,** 33, Old Queen Street, Westminster, London, S.W.—12-page pamphlet giving an illustrated description of the Barrol system of ventilation for schools and churches.

**Dissolutions and Liquidations.**—**MARSH, SON & Co., LTD.,** 167 and 169, Wardour Street, Oxford Street, London, W.—A circular has been issued by the managing director to the effect that for some time past the business has been carried on at a loss, and the company is being wound up voluntarily. Mr. Marsh adds that he is the sole debenture-holder and hold debentures for £9,200, which are a first charge over all the assets of the company. The assets in question, when realised, will not be sufficient to pay off all these debentures in full. He is very desirous that all the creditors of the company should be paid, and he does not therefore propose to take advantage of his position as debenture-holder, but intends to apply the moneys received by him in respect of his debentures in payment of the debts of the company. The liquidator, Mr. R. W. Brown, who is well acquainted with the business, will realise the assets to the best advantage, and Mr. Marsh says that he hopes that the amount realised will be sufficient to enable him to pay all the creditors in full. "If, for any reason, another liquidator should be appointed by the creditors, I must hold myself at liberty to reconsider the course which at present I propose to adopt." A meeting of creditors is to be held on May 15th at the Holborn Restaurant.

**CARNEY & PEARN, LTD.**—This company is winding up voluntarily with Mr. B. H. Brook Eldridge, 52, Brown Street, Manchester, as liquidator.

**WALBURN & MILLS,** electricians and motor engineers, 92, Wharf Street, Sowerby Bridge.—Messrs. E. Mills and J. B. Walburn have dissolved partnership. Mr. Walburn will attend to debts.

**INGHAM, BARRIE & Co.,** consulting and contracting engineers, Highbury Chambers, Newport.—Messrs. O. Ingham and J. S. Barrie have dissolved partnership. Mr. Barrie will attend to debts, &c.

**LANE & Co.,** builders and electrical engineers, 1, Gage Street, Bloomsbury, W.C.—Messrs. E. Lane and A. Purrier have dissolved partnership. Mr. Lane will attend to debts.

**Trade Announcements.**—**MESSRS. DORMAN & SMITH,** switchgear and fittings manufacturers, of Ordsal Electrical Works, Manchester, have made arrangements to be represented in Scotland by Mr. David Alexander, of 43, Mains Street, Waterloo Street, Glasgow, at which address samples of their fittings and switchgear, more especially such apparatus as is used in ships and collieries, may be inspected. Telephones: Central 4394, Argyle 587; Telegrams: "Ohmic, Glasgow."

**MESSRS. BERRY, SKINNER & Co.** announce that their agency, which has until recently been in the hands of Mr. David Alexander, of 43, Mains Street, Waterloo Street, Glasgow, has now been transferred to Mr. J. Hally Craig, of 45, Hope Street, Glasgow, to whom all local inquiries should be directed.

**THE EASTERN ELECTRIC AND TRADING Co.,** of Karachi, intend to stock large quantities of electrical accessories, as electric supply (D.C. 220 volts) will soon be available there. Fans, metal-filament lamps of all candle-powers (no carbon lamps will be used, and drawn-wire lamps are preferred), fittings, wires and cables, and accessories of all kinds will be required, and manufacturers are invited to send samples.

**MESSRS. ELECTRICAL INSTALLATIONS, LTD.,** have taken additional offices at 28, Martin's Lane, adjoining their existing premises, 27, Martin's Lane, Cannon Street, E.C., owing to growth of business.

**THE BRITISH THOMSON-HOUSTON Co., LTD.,** announce that the address of their Middlesbrough office was altered from Wednesday, 7th inst., from Maritime Buildings to Prudential Chambers, Albert Road, Middlesbrough. The telephone number remains unaltered—(No. 814).

**MESSRS. FRIEND, WILTON & Co.** have removed from 17, Quay Street, Cardiff, to 8, Westgate Street, Cardiff.

**Private Arrangements.**—**GEORGE ASHFORD** (trading as Whitcombe & Co.), electrical engineer, Newhall Hill, Birmingham.—The creditors interested herein were called together last

week when a statement of affairs was presented showing liabilities of £647, all of which was due to unsecured creditors. There was a fully-secured creditor for £99, who held securities valued at £100. The assets were returned at £261. It was stated that the debtor started trading at his present address in September, 1911, with a capital of about £80, his own savings. Shortly afterwards he was joined by another man who brought no capital into the concern. Last August the partner retired, and another man then put into the business £185 in cash and a debenture for £100 in the New York Telephone Co. The debenture was said to be worth its full face value, and was held by the bank, who were returned as fully-secured creditors. The present position was attributed to losses on contracts, and it was stated that a considerable loss had been made in connection with a picture palace. In that connection a debt of £50 was due to the debtor. The debtor was also said to be interested in a patent unpuncturable tire, which it was believed would be a success. He was in negotiation with one of the large tire companies for the sale of the patent, providing a 500-mile trial run was first made on it. A deed of assignment had already been executed, and after a short discussion it was decided to confirm the deed, and to adjourn the meeting.

## LIGHTING and POWER NOTES.

**Accrington.**—The Electricity Sub-Committee has been deputed to deal with an application from Alliance Mill, Baxenden, for a supply of energy for power purposes, and has also been asked to deal with the question of opening an electricity showroom in some other situation, in lieu of the present showroom.

**Barrow-in-Furness.**—At the T.C. meeting on Monday, recommendations of the electrical engineer were approved providing for the whole of the arc lamps in Bridge Road being replaced by clusters of four 100-watt metal-filament lamps, and those on Walney Bridge being replaced by 100-watt metal-filament lamps, the carcasses of the arc lamps on the bridge being adapted to take these lamps. It was reported in regard to the electricity works extensions that the contractors had delivered and practically completed the erection of the water-tube boiler and chain-grate mechanical stoker ordered in December last. It was agreed to approve the installation of cleaning apparatus by the British Vulcan Soot Cleaner Co., Ltd., Edinburgh, at a cost of about £80. During this week a series of demonstrations of electric cooking by means of "Tricity" cookers are being given in the Technical Schools, under the auspices of the Barrow Corporation.

**Basingstoke.**—The T.C. has been informed that its application for a prov. order for electric supply has been granted by the B. of T.

**Bedworth.**—The question of having the parish publicly lighted by electricity has been discussed by the Parish Council, which has asked the Leicestershire and Warwickshire Electric Power Co. if it will tender for the lighting in competition with the gas company.

**Birmingham.**—Elsewhere in this issue we give some details of the proposed new power station at Nechells, and electrical extensions in the city. The Finance Committee has reported on the proposals, and offers no objections on financial grounds. It, however, draws attention to the fact that sums of £5,380 for substations, and £46,546 for mains had been expended prior to the approval of the Council being given to the scheme, and regards this as undesirable practice. The Committee also appears to view with concern the effect of the last revision of charges, and points out that the erection of these new works will involve the necessity for regular, systematic and adequate contributions being made in every succeeding year to provide for the contingency of obsolescence. It may be mentioned that the electricity department has a reserve fund of £80,458, and a renewals fund of some £32,000.

**Blackburn.**—The Electricity Committee has adopted the report of the electrical engineer on the scheme for the erection of new electricity works; the Gas Committee offers land at Greenbank as a site for the new station, subject to suitable terms being arranged.

**Blackpool.**—The Corporation electricity department for the past year had a net surplus of £13,179, compared with £6,240 in the previous year. The income was £40,333, against £35,454 in 1912, and £3,633 more than the estimate. The working expenses amounted to £20,928, against £16,347. The reserve fund now stands at £9,508. The aggregate of the works output for the past 12 months was 4,109,983 units—an increase of 544,229. Of the increase, 333,138 was due to private lighting, showing that the public are adopting electric lighting more generally. There were 239 new consumers during the year.

**Bognor.**—The U.D.C. has asked the Gas Co. to submit a scheme of electric lighting for the sea front in substitution for the present gas lighting.

**Bridlington.**—It is estimated that the net profits on the electricity undertaking for the year ended March 31st, 1913, will amount to £1,376.

The Electricity Committee has decided to apply to the L.G.B. for sanction to borrow £3,000, £1,500 being in respect of mains and £1,500 in respect of services.

**Bradford.**—The Corporation Electricity Committee has recommended the extension of mains from the Dudley Hill transforming chamber along Tong Street to Montserrat Mills, at a cost of £2,191, and a similar extension from Victoria Street to Lumb Lane Mills, at a cost of £520.

The engineer has been directed to proceed with the work of changing the system of supply in the Manchester Road district, south of Bowling Old Lane, from direct to alternating current.

**Brighton.**—With a view to increasing the capacity and improving the efficiency of the Southwick generating plant, the T.C. has had under consideration a proposal by Mr. Christie, the borough electrical engineer, to replace one of the original turbine plants by a Richardson-Westgarth turbine driving a 3,000-kw. Siemens alternator, speed 3,000 R.P.M. With condensing plant the cost is estimated at some £7,600. Alterations to pipework, foundations, switchgear, &c., will cost £900. The displaced plant will, it is proposed, be sold, and the cost of the above work be met out of revenue and reserve.

**Chester.**—The Corporation has adopted the proposed battery scheme, to cost £11,550, reported on by the city engineer Mr. S. E. Britton, and recently described in these notes.

**Chester-le-Street.**—The L.G.B. has sanctioned an expenditure of £410 by the Guardians in carrying out the scheme for lighting the workhouse, &c., by electricity.

**Clones.**—The Urban Council has discussed the terms under which Mr. Chas. Ferguson is to be permitted to carry out an electric lighting scheme in the town. The Council will have the option of purchasing the works after 10 years.

**Continental Notes.**—ITALY.—La Società per Imprese Elettriche, of Rome, has secured a contract from the Officine Elettro-Chimiche Dottori Rossi, of Legnano, for the establishment of a plant near Rome, for the electric production of nitric acid from the atmosphere. The plant to be at first put down will be of 5,000 kw., provision for doubling it at a later date being made.

**Coventry.**—The Electric Light Committee has passed the accounts for the year ending March 31st last, showing an available balance of £16,294. It was decided to recommend the City Council to apply £4,500 to the relief of rates and £11,000 in payment of new machinery, &c. (in lieu of raising a loan), and to carry forward the balance of £194. The Committee will also recommend an increase of the salary of Mr. G. Tough, electrical engineer and manager, from £550 to £650 per annum; also that the flat-rate charge of ½d. per unit for current for lighting purposes be reduced to 3½d.

**Delabole (Cornwall).**—At the annual meeting of the Parish of St. Teath it was decided to light Delabole by electricity. At a public meeting of the electors, Mr. R. Pearce, who was in the chair, reviewed the position, after which it was decided to obtain the necessary powers.

**Derby.**—The T.C. has applied to the L.G.B. for a loan of £11,950; for mains £7,500, services £700, motors £3,000, and transformers and switchgear £750.

On May 2nd, a L.G.B. inquiry was held into the application of the T.C. for a loan of £13,500, needed principally for additional generating plant. There was no opposition.

**Dundalk.**—Last week a L.G.B. inquiry was held into an application by the Council for a loan of £5,000 for extensions of the electric lighting scheme in the town. From the evidence it appeared that the Council had already obtained a loan for electric lighting of £20,000. Owing to the increasing demand for electricity £5,000 more was needed. The amount received for energy sold during the year was £1,729, showing a net profit of £600. The inspector stated that he was glad to know that this much-debated scheme had been so successful.

**Eccles.**—The Public Lighting and Electricity Supply Committee has made a recommendation that Devonshire Road be lighted by electricity.

**Edinburgh.**—Treasurer MacLeod, in submitting the draft provisional estimates for the year from May 15th, 1913, to May 15th, 1914, said, with regard to the estimates by the Electric Lighting Committee, the estimated surplus was only £220. The policy of the Committee was to frame its estimates so as to come out practically square at the end of the year. The estimated revenue was £142,660, which was counterbalanced by expenditure of £80,265 and interest and sinking fund contributions of £62,175. Under this head was noted the great increase in the coal bill, which was estimated at £30,840, as against the actual in 1911-12 of £20,041. The revenue for the same year was £131,678, so that while the revenue had only increased 8 per cent, the coal bill had gone up 50 per cent in the same period, without any increased charge to the consumer. The capital expenditure for the coming year includes an item of £11,360 for extension of electric light works. Dealing with the rates and the likelihood of an increase, Mr. MacLeod said he was confidently looking forward to a surplus from the electric light account, which might be applied to reduce the amount required from the rates. Councillor McMichael, in the discussion which followed, said, in his opinion, the Council had a right to expect very substantial relief from the electric light undertaking. Mr. Stevenson, replying, considered it complimentary to the success of the cooling towers when they found that, although their coal bill alone had increased £8,000, the cost to the consumer remained unaltered.

**Ellesmere Port and Whitby.**—The B. of T. has granted a prov. order for electric light to the U.D.C.

**Falkirk.**—An interesting function took place last week when an addition to the generating station was formally inaugurated. Space has been provided for additional turbine plant of 2,700 h.p. Up till 1911 the supply was entirely on the low-pressure direct-current system. In 1910-11, in order to meet the power requirements of the large industrial concerns of Falkirk, the plant was extended, and the extra 112 alternating current three-phase system adopted for the supply of the burgh. The 1910-11 extension consisted of a steam turbo-generator of 670 h.p., a new boiler, and about ¼ miles of mains. Owing to the rapidity with which the demand for power purposes grew, a further 670-h.p. turbine was installed for the winter of 1912-13. Transformer sub-stations are in operation at Falkirk Ironworks, Etna Foundry, Crown Brass Works, Sunnyside Foundry, Camelon Main Street, and Union Road; and Cross's Chemical Works, Camelon. During the last two years nearly 1,000 h.p. of electric motors has been connected to the Corporation system. The Falkirk Iron Co. has nearly 500 h.p. of motors being supplied from the Corporation mains, and the demand for electric power from this consumer alone is already more than equal to the demand for electric lighting purposes from the whole of Falkirk.

**Gargrave (Yorks).**—A proposal is on foot for lighting this village, in the Craven district of Yorkshire, by electricity. The supply station, it is proposed, will be at the High Mill, owned by Mr. Joseph Mason. Messrs. Crompton & Co., Ltd., are to carry out the work of installation if the proposed scheme is successfully launched.

**Harwich.**—Last week Dr. C. H. Liebbrand addressed a meeting of the ratepayers on the subject of electricity supply for Harwich and district, explaining his scheme for centralising electric supply at the seaside resorts of Lowestoft, Clacton, Walton and Felixtowe.

**Henley.**—The Reading Electric Supply Co. having applied to the R.D.C. for consent to supply current to premises at Sunning and Shiplake, the Council has decided that "under present conditions" permission cannot be given in respect of Shiplake, and with regard to Sunning a decision has been deferred, the Council intimating that if the company desired to supply electricity in districts outside its area it should proceed by prov. order.

**Hereford.**—The L.G.B. has sanctioned the conversion of the pumping plant at the waterworks from steam to electricity.

**Hull.**—The T.C., on May 1st, decided, by 21 votes to 18, not to purchase the prov. order for electric supply obtained by Hessele U.D.C., for £462.

**Keighley.**—A L.G.B. inquiry was held last week into the application of the Corporation for powers to borrow £7,000 for purposes of the electricity undertaking. The electrical engineer (Mr. Harry Webber) said the money was required for the purchase of a new turbo-alternator; the contract had been placed provisionally. The estimated profit on the year's working was about £1,000, there having been a large increase in sales, chiefly in respect of power. The outstanding borough loans, it was stated, now amount to £100,640, and the department had received rate aid to the extent of £12,130. The new turbine would cost £5,827, and other requirements would bring the amount to £7,000. The inspector suggested that the application should be increased by £200, as if an outstanding debt on economiser tubes were deducted, the total amount at present asked for, would be insufficient.

**Kendal.**—The T.C. has applied to the B. of T. for permission to erect overhead wires in various parts of the district for the supply of current at a pressure of 220 volts.

**Leyburn.**—The local gas company is putting down electric plant at its works to supply in the locality, and has applied to the Council for permission to use overhead wires.

**Liverpool.**—Sanction has been received from the L.G.B. to the borrowing of £40,000 for the provision of mains.

**London.**—HAMSTEAD.—A very careful series of tests carried out by Mr. H. H. Conzen, with the object of improving the electric street lighting in the Hampstead district, has resulted in the Council deciding to adopt similar fittings to those designed and erected by Mr. Haydn Harrison in the borough of St. Marylebone and elsewhere. In certain important streets new posts are to be erected at a distance of 30 yards apart, the height of the light source being increased so as to produce a satisfactory minimum horizontal illumination, as described in the draft Standard Street Lighting Specification, which has lately been the subject of a paper read by Mr. A. P. Trotter. Mr. Harrison has been instructed to proceed with the work immediately, so that the illumination of the Hampstead streets will be much improved before the autumn.

HACKNEY.—The L.C.C. has sanctioned the borrowing of £53,100 in connection with the extension of the undertaking. Sites in Lauriston Road and Dalston Lane are to be purchased for the erection of sub-stations.

MARYLEBONE.—The L.C.C. has sanctioned the borrowing of £42,500 for the electricity undertaking. This is for the provision of two 3,000-kw. turbo-alternators with condensing plant; four 1,000-kw. converters; switchgear and feeder cables. The plant capacity at the B.C.'s station next winter will be 17,400 kw., and the maximum load is expected to reach 10,300 kw., giving a

reserve of 7,100 kW., apart from battery plant, which represents some 1,500 kW. The Finance Committee (L.C.C.) has been advised that this margin is not excessive. The loan periods sanctioned are 15 years for the turbine plant and switchgear, and 25 years for mains.

**BERMONDSEY.**—A loan of £2,035 is to be taken up from the L.C.C. in connection with the undertaking.

**Lytham.**—The draft of the Lytham Electric Lighting Order has been received by the Council, and contains a special clause protecting the Blackpool, St. Anne's and Lytham Tramways Co. against having to take a supply of current from Lytham during the existence of the company's agreement with St. Anne's Council. This agreement lapses in June, 1917. The other clauses are of usual nature.

**Manchester.**—The scheme for improving the lighting of the central streets of the city was to come before the City Council on Wednesday. The capital cost spread over three years will be £15,000 for electricity and £18,000 for gas.

**New Zealand.**—The contract for the erection of the power house at Lake Coleridge has been let to Messrs. Taylor Bros. and Mooreland, of Christchurch, the price being £15,636.

**Northwood and Ruislip.**—The B. of T. has granted a prov. order for electric lighting to the Northwood Electric Light and Power Co., Ltd., for supplying current to certain parishes in the area of the Watford and Rickmansworth R.D.Cs. The B. of T. dispensed with the consent of the Watford R.D.C. to the company's application.

**Nottingham.**—There is a gross profit of £39,319 on the working of the electricity department during the year ended March 31st last. After allowing for repayment of loans, interest on consolidated stock, sinking fund, &c., there remains a net profit of £10,890, of which £8,000 is to be appropriated in aid of the general district rate, and £2,890 transferred to the reserve fund. The amount realised during the year from the sale of current amounted to £93,579; from rent of meters, £1,931; and from public lighting, £732. \* The number of units generated totalled 13,599,812, and the quantity sold was 12,602,306, as against 13,563,732 and 12,577,326 in 1911-12. The engineer, in his report on the year's working, states that extensions of mains amounting to 1'32 miles have been made during the year, and the total length of distributing mains at March 31st was 63'05 miles. There has been an increase of 234 in the number of applications for a supply of electricity, the consumers at the end of the year, 4,415, showing largest increase since 1906. The adaptability and convenience of electric motors is shown by another large increase in their number. The 191 additional motors aggregating 480 H.P., which have been connected to the mains, bring the totals to 1,540 motors and 5,690 H.P. During the 12 months 3,909,847 units were sold for lighting, 2,931,363 for power, and 5,761,096 for traction. The units used for lighting show an increase for the first time since 1908, when metallic-filament lamps began to be used; 23'65 per cent. of the units used for private lighting were at the flat rate of 3½d. per unit, which has been in operation nine months; 60'51 per cent. of the units for private lighting charged on the maximum demand system were at the reduced rate of 1½d. per unit. There has been an increase of 1s. 9d. per ton in the cost of coal, and the total additional cost for the eight months the increase has been in operation, is £3,099. It is estimated that the consumers who have adopted the flat rate have benefited to the extent of £2,395.

**Nuneaton.**—The Trades Council has passed and forwarded to the T.C. a resolution urging the Corporation "to make electricity a more utilitarian product for lighting, cooking, heating, &c.," in order that it may replace gas in the homes of working men.

**Port Glasgow.**—The B. of T. has granted the Electric Lighting Order promoted by Port Glasgow T.C., in favour of Greenock Corporation entering the burgh to supply the ship-builders and others with electricity.

**Rishton.**—The D.C. has agreed to the Accrington Electricity Committee supplying electricity at Rishton Paper Mills, subject to the supply being discontinued at a time to be agreed upon. The Accrington Electricity Committee has accepted these conditions, subject to the insertion of a clause fixing the minimum period at seven years.

**Salford.**—On May 1st there was held a L.G.B. inquiry into the application of the Corporation for sanction to borrow £35,900 for the purposes of the electricity undertaking. The town clerk said that £25,000 out of the £35,000 was required to cover the anticipated expenditure during the next few years on mains and service cables. Mr. H. Hawkins (electrical engineer) said an arrangement had been made to take a bulk supply from the Lancs. Electric Power Co., and in connection with this the laying of mains would cost not less than £8,000 during the first 12 months. In addition to that, the ordinary anticipated expenditure on continuous-current mains would be at the rate of about £4,000 per annum. During the second year there would have to be a further outlay in connection with the provision of extra-H.T. three-phase mains, which would cost something like £6,000. There would also be an expenditure of about £4,000 for the ordinary continuous-current mains during the second year. The total expenditure for three years would be about £25,000. In answer to the Inspector, Mr. Hawkins said the generating station capacity was 9,250 kW., and the maximum demand was just under 9,000 kW. There was no opposition to the application.

**Sevenoaks.**—The Sevenoaks Electricity Co. has, owing to a difficulty arising, asked the U.D.C. to consent to the withdrawal of the purchase clause in the agreement with respect to the E.L. scheme. The Council has decided not to dispense with a purchase clause, and has submitted a draft clause to the B. of T., with a view to it being inserted in the proposed prov. order.

**Shipley.**—A L.G.B. inquiry was held on the 30th ult. into the application of the Council for powers to borrow £5,700 for electrical plant. It was explained that the requirements were for cable-laying and providing equipment for supply of H.T. current. The Council was unable to meet demands by means of the existing plant. Complaints had been made by consumers that satisfaction was not being given, and owing to agreements made by the Council with textile and other manufacturers, and for other reasons, the Council felt obliged to proceed with the works without waiting for the sanction of the L.G.B., and the work was now practically completed. No opposition was offered to the application.

At the last meeting of the Electricity Committee it was reported that there were at the present time 701 lighting consumers on the Council's mains. An application had been received asking terms for the supply of electricity temporarily for power purposes at Lower Holme Mills.

**South Africa.**—A CAPE TOWN HYDRO-ELECTRIC PROPOSAL.—For some time the question of augmenting the water supply in the Cape Peninsula has been under consideration, there being apparently a barely sufficient supply of that necessary commodity available at the present time. In this connection a correspondent sends us some particulars of a tender which has been submitted to the Mayor and Councillors of the Peninsula municipalities by Messrs. A. and C. Struben for the supply not only of water but also of electricity, the water being obtained from the Steenbras River, 35 miles from Cape Town. The total cost of the scheme is £520,000, of which water supply accounts for £270,000, and electrical supply for £250,000. The tender provides for the supply of 5,000,000 gallons of water per day and 12,000,000 kw.-hours of electricity per annum to Cape Town, and by the diversion of adjoining waters these quantities could be doubled. Thus the scheme proposes to dam the Steenbras River, and so form an artificial lake several miles in length at an elevation of 1,115 ft. above sea level. The dam would contain 3,000 million gallons of water, taking a depth of 75 ft. From the reservoir a 2,540-ft. tunnel passes under a hill to two 33-in. diameter steel pressure mains leading to a preliminary hydro-electric generating plant, situated 280 ft. above sea level, and designed to use 5,000,000 of the total of 15,000,000 million gallons of water delivered daily, while the remainder would be used in a second power station, 50 ft. above sea level. The tail water from the first scheme would be purified and delivered to the Council's waterworks, while the lower station would discharge into the sea, unless the water were required for agricultural purposes. The upper station is proposed to contain 1,400 kw. and the lower one 6,400 kw. of plant; both stations would supply through the lower one, where the current would be stepped up to 40,000 volts pressure for transmission over duplicate three-phase overhead mains a distance of 35 miles to a receiving station in Cape Town. The estimates of working cost are of considerable interest, as the total annual charges, including interest at 4 per cent., and depreciation at half that rate, amount to £47,310, whereas the revenue derived from the sale of water at 6d. per 1,000 gallons, and of electricity (12,000,000 units) at ½d. per unit, totals £52,375. These prices are for water and electricity delivered. Last year the Cape Town Corporation generated 4,000,000 units in its own plant, requiring over 9,000 tons of coal, or an average coal cost of 6d per unit, so that the scheme which, of course, looks towards the industrial developments of the future and the electrification of local railways, appears to be of considerable interest.

**Stalybridge.**—The Council is installing four 3,000-kw. Curtis-Rateau turbo-alternators at its power station, which will then have plant installed of 19,000-kw. capacity.

**Stroud.**—Some years ago a private company proposed an electric lighting scheme for Stroud and district, and the U.D.C. obtained a prov. order for its own protection. The order was renewed year after year, and eventually allowed to lapse, this transaction costing the ratepayers £500, and proving a bar to progress. Now another private company is in the field, with a scheme for electric supply for the town of Stroud and district, and both the U.D.C. and the R.D.C. have consented to waive any objection they might have to the proposal on certain conditions, which have been agreed to, but the B. of T. has objected to the conditions which the promoters of the scheme have entered into with the R.D.C., and states that the order must either be given up so far as the latter is concerned or else the Council must withdraw its conditions. This means that the R.D.C. will be struck out from the Electric Light Order, which will be confined to the area of the Urban Council. The latter authority has obtained the insertion of a clause in the prov. order providing for option of purchase in 21 years, it being understood that with the granting of powers the promoters would forthwith proceed to carry the same into effect. It is not anticipated that the R.D.C. will agree to withdraw its conditions, and the clerk is in correspondence with the B. of T. on the subject.

**Tyneside.**—Efforts have recently been made to exploit the pit heaps on the sites of disused collieries near Coxhoe, as much good coal is known to exist in them. The rubbish from South Kelloe heap is being loaded into trucks and hauled to the Carville power station, where some 400 or 500 tons are being sent each week. The waste is also being used for firing at local brickworks, and its use will eventually clear large areas of land at present disused.

**U.S.A.**—According to the *Wall Street Journal*, Los Angeles is the most highly-developed electrical city in the world. It is said that 98 per cent. of all habitable dwellings are wired for electric supply, and that there is a meter for every 43 inhabitants.

**Watford.**—At the last meeting of the B. of C. it was stated that the installation of electric light at the workhouse had resulted in £74 being saved in one quarter, compared with the previous cost of gas.

**West Bromwich.**—According to reports issued on the 2nd inst., the sales of electric energy during the year ended March 31st amounted to £17,618, which is an increase of £1,121 upon last year. For private lighting there is an increase of £136, and for motive power an increase of £1,100, but for traction there is a decrease of £115.

**West Ham.**—The Corporation Electricity Supply Department has arranged for electric cooking demonstrations and lectures to be given by Mr. F. S. Grogan at the Town Hall, Stratford, from May 19th to 22nd, at 3.30 p.m. and 7 p.m. each day.

**Worthing.**—Acting on the report from the electrical engineer, Mr. G. Porter, the Electricity Committee of the T.C. has decided that provision should be made as soon as possible for additional plant and buildings to meet the increasing demand upon the machinery, and authority has been given for the preparation of the necessary plans and estimates, with a view to the Committee reporting to the Council at an early date.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—The "Pay-as-you-enter" system of cars has been adopted by the Corporation on the Woodside section. The T.C. contracted for 10 cars, which have been constructed by a local firm at a cost of between £800 and £900 each. At the inauguration ceremony, Mr. R. Stuart Pilcher, the manager, was heartily congratulated on his enterprise in introducing the cars. The innovation, which appeared to work quite smoothly, created great interest.

**Accrington.**—The year's working of the Corporation tramways undertaking shows the total receipts to have been £27,822, an increase of £1,601. The total working expenses were £15,455, or £340 less than last year. The balance to net revenue account was £12,367, as compared with £10,426 in the previous year, an increase of £1,941. The gross profit was £4,553, and the net profits £1,194.

**Belfast.**—At the monthly meeting of the Corporation last week, the minutes of the Tramway and Electricity Committee contained Mr. Mance's annual statement on the tramways. Alderman Finnigan said that it was thought that there would have been a larger revenue, but, on the whole, it was a satisfactory one. The forecast of profits was £260,000, but expenses had gone up, and instead of amounting to £135,000, they were £143,000. The nominal net profit was £16,000. There was an increase of £2,500 in sundry wages, and the late wet summer lost them £5,000. Recently a lot of the old cars had been converted into up-to-date cars.

**Bingley.**—Last week, a L.G.B. inquiry was held into an application by the Council, for powers to borrow £19,930 for street and highway improvements in connection with the scheme for the extension of tramways from the present Nab Wood terminus of the Bradford system, for which the Bingley Council has obtained powers. There was no opposition.

**Blackpool.**—The tram-fares question has been settled for another year: there was an agitation for 1d. fares on the Promenade, and Mr. Chas. Furness, the manager, pointed out that during 21 weeks last year, the tramway systems of Blackpool and Bournemouth each carried about 7½ million passengers; at Bournemouth, where there were 1d. stages, the receipts were £45,840, while at Blackpool, principally through the 2d. minimum on the Promenade, the receipts were £54,794. Mr. Furness pointed out that the difference of £8,954 in favour of Blackpool made all the difference between profit and loss, and enabled them to face the loss of £10,000 incurred in maintaining the tramway service during the winter, for whilst the average weekly winter receipts in Bournemouth were £1,600, they were only £600 at Blackpool. He estimated that the adoption of 1d. stages during the season would mean a loss of from £7,000 to £10,000. It was stated that as from 80 per cent. to 90 per cent of the tramway receipts were contributed by visitors during the summer, it would be folly to make any change which would result in adding to the ratepayers' burdens. Therefore no change was made.

**Bolton.**—The revenue account and balance-sheet of the tramways undertaking for the year ended March 31st, 1913, has just been presented to the Tramways Committee by the borough treasurer. The Committee approved the accounts, and resolved to transfer £13,500 towards the relief of the rates, as compared with £10,500 last year. The reserve fund now stands at £55,901.

**Bury.**—Mr. W. Clough, the general manager of the tramway undertaking, in his annual report, states that the gross traffic receipts amounted to £67,525, as compared with £66,074

for the previous year, an increase of £1,451. The figures for the year 1911-12 were, at the time, regarded as the maximum because several exceptional factors had contributed to the result. To have exceeded the result of that record year was extremely satisfactory. The gross receipts were allocated as follows:—Bury sections, £14,167; Radcliffe sections, £13,892; Heywood sections, £7,226; and Salford sections, £2,239. There was a net surplus on the Bury sections of £9,572, to which had to be added the net surplus of £1,252 from the Radcliffe tramways, making a total net surplus of £10,824. Of this amount, £6,252 had been contributed to the borough rates, £3,572 carried to reserve and depreciation fund, and £1,000 used to commence an insurance fund against third-party claims.

**Continental Notes.**—**RUSSIA.**—La Societé des Tramways de Kischinev has taken over the municipal tramway system in the town of Kischinev, and, under a 45 years' concession, is converting the same to electric traction, as well as constructing several new lines. It is expected that the work of conversion will be completed by October next. The necessary electrical energy will be supplied from the municipal electric power station.

**Dewsbury.**—The Batley Corporation having intimated its inability to undertake the construction of a line of tramway in Dewsbury Gate Road, the Dewsbury Electricity and Tramways Committee has decided to notify the intention of the Corporation with respect to a physical junction between the Shaw Cross and Westborough tramways to the Yorkshire (Woolden District) Tramways Co. and the National Electric Construction Co., and inquire if, under the circumstances, they are prepared to submit to the Committee amended proposals for dealing with the matter.

**Doncaster.**—The R.D.C. has decided to support the Mexborough and Swinton Railless Tramways Bill, which has met with strenuous opposition on the part of many of the smaller townships of South Yorkshire. The support has been given on an undertaking that clauses will be inserted for the protection of the Doncaster Council.

**Jarrow-on-Tyne.**—A letter from the Jarrow and District Electric Traction Co., stating that the directors are being pressed to provide improved travelling facilities between Jarrow and South Shields, has been received and considered by the Corporation Tramways Committee of South Shields. The company expresses the opinion that the time is opportune for the renewal of through running over the Shields tramways, and asks whether the Corporation is prepared to discuss the matter. The Committee has decided that the Corporation is not prepared, in view of its previous experience, to discuss the question of running powers.

**Keighley.**—At a meeting of the T.C. last week, the chairman of the Tramways Committee moved that, instead of continuing to insure the motor-omnibuses against damage and the Corporation against third-party risks, £200 per annum should be set aside and paid into the existing tramway insurance fund. Outside insurance, he said, had cost £365 in two years, and only £62 had been received on account of claims. The local tramways insurance fund had been formed through the laying aside of 1s. 6d. per 100 miles run, and the fund now stood at £965. The motion was adopted.

The Corporation has received official sanction to the running of a service of railless cars from Ingrow for the next three months.

**Liverpool-Ormskirk Electric Railway.**—May 1st marked the inauguration of a full electric train service between Liverpool and Ormskirk, made possible by the completion of the electrification extension from Town Green to Ormskirk. The provision of the new storage battery station at the latter town enables practically a half-hourly service to be maintained, and only through steam-trains to and from the north will run on this portion of the line in future. It is expected that the quickened service will prove beneficial to the Ormskirk district as a residential centre.

**London.**—I.C.C.—The Highways Committee, in view of the alterations to be made at the Greenwich generating station and the shortage of plant, has made arrangements with the London Electric Supply Corporation to purchase up to 2,000 kw. at £3 per kw.-year, and 3d. per unit, for a period of not less than nine months. This represents a charge of £13,750 as compared with £11,870 if obtained from the Council's own plant.

**Manchester.**—A report has been prepared by a Special Sub-Committee of the Corporation Tramways Committee upon the question of the congestion of tramway traffic. Attention has been concentrated solely upon what may be described as the passenger transportation problem—how best to meet the demands of the travelling public between the central parts of the city and the various suburban districts. The report states that the problem is of so important a character, affecting so vitally not only the future of the tramway undertaking, but that of the city generally, that the Sub-Committee suggested that full information should be obtained from all available sources. The Sub-Committee deemed it necessary that the general manager and the permanent-way engineer should be instructed to visit other cities, both in this country and abroad, and the Tramways Committee adopted a recommendation in this sense, but the City Council subsequently referred the matter back for further consideration. The Sub-Committee was more than ever convinced, after further consideration, that the procedure originally suggested was absolutely necessary, and it again recommends that the two officers named be instructed to visit the following cities at as early a date as possible, and that they be

directed carefully to study the various methods of passenger transportation adopted:—London, Glasgow, Paris, Berlin, Hamburg, Vienna, New York, Boston, Chicago, Philadelphia and Toronto. The Sub-Committee points out that delay is serious, because the traffic demands are so great that the Tramways Committee is forced to provide new rolling stock, and the outcome of the proposed inquiry may be that some modification in the existing types of rolling stock may be suggested.

In regard to the allocation of £100,000 to the relief of the rates from the Corporation tramways undertaking, the Finance Committee of the Corporation has pointed out to the Tramways Committee that, on the basis of 5 per cent. on capital expenditure, the tramways department should contribute £103,117 in rate relief. The Tramways Committee is protesting against the contribution of any greater sum than the £100,000 shown in the annual estimates, declaring that the effect of such a policy will be to cripple the development of the undertaking, and to prevent the granting of further improved facilities to the travelling public.

**Newcastle-on-Tyne.**—At a conference of the Institution of Municipal and County Engineers, Mr. J. McKellar, of Newcastle, contributed a paper on the tramway extensions of the city. He mentioned that there were about 60 miles single track, and they had cost about one and a quarter millions. With the exception of the first 20 miles, which were constructed under contract, all the work had been carried out departmentally. The present trolley system came into operation in December, 1901, and almost all the original rails and other material were still in use, evidence of the quality of the work. The only renewals carried out so far were about 500 yards on each side of two very steep gradients (worn out owing to the action of the magnetic brakes) and three of the original junctions. During the present year it was proposed to relate about two miles of route and seven junctions.

**Nottingham.**—The tramways undertaking shows a net profit of £24,775 for the last year, which is to be apportioned as follows: In aid of general district rate, £19,000; to reserve and renewals fund, £4,775; to reserve for removal of centre poles suspense account, £1,000. Traffic receipts during the 12 months amounted to £164,755, while advertisements brought in £2,200. Energy for power and lighting accounted for £30,005 of the total expenditure, which amounted to £108,273.

**Swansea.**—A deputation representing the Corporation, which has been to Halifax, Leeds and other places with the object of inspecting the working of tramways on steep gradients in order to decide on the best means of traction up Mount Pleasant, Swansea, has returned, and its members express themselves satisfied that a system of ordinary electric traction with overhead wires, recommended by Mr. Sellon, the Corporation's consulting engineer, will meet every requirement of efficiency and safety. There is a likelihood that the adoption of a central rail may be recommended as an additional precaution.

## TELEGRAPH and TELEPHONE NOTES.

### An International Wireless Telegraph Company.

An interesting development in international co-operation is afforded *Télégraphie sans Fil*, with a share capital of £90,000, divided into by the formation in Brussels of the *Société Internationale de 4,500 shares of £20 each*. The principal interests in the company are represented by Marconi's Wireless Telegraph Co. with 1,500 shares, the *Gesellschaft für Drahtlose Telegraphie*, of Berlin, with 1,500 shares and the *Banque d'Outremeur*, of Brussels, with 800 shares.

**Australia.**—The Postmaster-General has stated that for three consecutive nights the operator on Macquarie Island, in the vicinity of the Antarctic Circle, has been able to maintain regular communication with the wireless stations at Port Moresby and Thursday Island—a distance of considerably over 2,000 miles.

**Blind Telephone Operators.**—In the United States trials have been made with blind girls as telephone operators, with remarkable success. It is stated that they carry out their duties more accurately than girls who are in possession of sight.

**Crete.**—It is proposed to enlarge the telegraph and telephone networks in the island of Crete at a cost of 105,000 fr. The orders for the material and instruments will be placed by the Greek Government.

**Imperial Wireless System.**—On Wednesday last week, Mr. F. Straker, assistant general manager of the London and South-Western Bank, was examined by the Select Committee on the Marconi contract regarding the statement of Mr. Powell, that a large syndicate had been operating in Marconi shares, which he denied *in toto*. Mr. Godfrey Isaacs banked with them, and opened a special account in connection with the American shares. There was no request for small notes. The total amount credited to the special account was about £150,000; £53,000 was withdrawn by Mr. Isaacs and paid to Marconi's Wireless Telegraph Co., the balance being cabled to New York in payment for the shares.

Mr. H. T. Campbell, broker to the Marconi Co., was recalled, and gave evidence regarding the dealings in shares. Mr. Godfrey Isaacs afterwards explained the transfer of moneys from his bank account to that of the company.

After the close of the public sitting the Committee considered the desirability of presenting a special interim report on the questions affecting Ministers and others, and came to the conclusion that the time available before the rising of the House was not sufficient to enable it to do so. It was resolved that the evidence in regard to this part of the inquiry be concluded before the Whitehall recess, and that at the first meeting after the recess the Committee should proceed forthwith to the preparation of an interim report.

In the House of Commons the Prime Minister refused facilities to discuss a motion that the Committee be instructed to report on or before June 2nd.

On Monday Sir Albert Spicer, assisted by Mr. G. W. Knox examined the pass-books of Mr. Lloyd George and Sir Rufus Isaacs. The report of the Technical Committee appears elsewhere in this issue.

The Select Committee refused an application submitted by Mr. Maxse for a further hearing. A further sitting was held on Wednesday, when Mr. Marconi gave evidence.

**India.**—An automatic telephone system, which was recently inspected by numerous officials of the Government of India at Delhi, is to be introduced at Simla next cold weather.—*Indian Engineering*.

**L.C.C.**—The Post Office has given notice that the charges made to the Council under agreement with the National Telephone Co., for the services of the telephone operators at the private exchanges at the county hall and the education offices, have been revised. Under the existing arrangement the cost of the services of the operators, for which a charge of £598 a year is to be made in future, amounts to £401 a year, so that the increased cost to the Council will amount to £197 a year.

**London Fire Alarms.**—London is to be provided with a more modern system of fire alarms than those now in use, which are reported to be not of the best type. An officer of the fire brigade is to visit America for the purpose of inspecting and reporting upon the systems of fire alarms in use in the large cities.—*Daily Telegraph*.

**Poulsen System of Wireless Telegraphy.**—It is announced that the Canadian Government has introduced a Bill to ratify an agreement between the Dominion and the Universal Radio Syndicate for the establishment of wireless communication between Canada and England, on the Poulsen system. The company claims to be able to transmit at the rate of 80 words a minute, and to work day and night over a distance of 2,000 miles. The British station will be at Ballybunnion, Co. Kerry, and it is said that the system will be in operation in August next. Code messages will be taken at 8d. a word, ordinary messages at 4d., and Press messages at 2d. Code messages will not be given priority over private ones.

**The Telegraph Service.**—The Controller of the Central Telegraph Office has addressed a letter to the staff, stating that the service is in a state of transition, and urging the members to revise their methods and accelerate their procedure, in view of the growing competition of the telephone.

**Telephonic Communication Between Vienna and Dalmatia.**—About a year ago it was decided to establish telephonic communication between Vienna and Dalmatia, and the line—now completed—passes through Istria and over a number of islands in the Adriatic to the Dalmatian coast. The total distance from Vienna to Zara (Dalmatia) is about 510 miles. The overhead lines are of 5-mm. bronze wire, and the total length of the submarine sections of the line is 37 miles. The Krarup (distributed loading) construction was adopted in preference to the Pupin system of loading, owing to the numerous changes from submarine to overhead construction; the submarine cables were supplied by the *Norddeutsche Seekabelwerke* (Nordenham), whose tender was the lowest received. The cables contain four cores, each comprising a round central copper conductor surrounded by three strip conductors (total section 55 sq. mm.), overwound with three layers of 0.2 mm. soft iron wire, and covered with a special gutta-percha mixture to 8.4 mm. diameter. The conductors are stranded in pairs, which are then also stranded together. A brass tape covering is provided as protection against the teredo, while the armour consists of 24 galvanised iron wires of 5.7 mm. diameter on the deep sea, and of 27 1.1-mm. wires on the coastal sections of the cable. No cable ship being available, the cargo steamer *Peru* was adapted to the work of laying the cable, which was effected without mishap, though the sirocco raged during part of the laying period.

On the completion of the line, it was found that communication between its ends was very satisfactory despite the considerable leakage from the overhead lines, which leakage was particularly severe on the islands owing to the collection of thick salt deposits on the insulators and posts. The two pairs of conductors in the submarine cables were free from mutual induction, so that no cross-talk was experienced. Before laying the submarine cable the two pairs of cores were placed in series for experimental purposes, and it was found that satisfactory communication could be effected through the 75 miles effective length of submarine cable thus obtained and 395 miles of landline. Recently satisfactory speech transmission has been secured between Vienna and Sarajevo (875 miles), although the overhead lines in Bosnia are only 3 or 4 mm. in diameter.—*E.T.Z.*

**Wireless Station Burned.**—The wireless station at Cape Race was destroyed by fire on Monday.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—VICTORIA.—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

May 16th.—One 15-ton overhead travelling crane, for the Melbourne City Council. See "Official Notices" May 2nd.

June 2nd.—20,000-volt H.T. switchgear and L.T. switchgear and accessories, for the Melbourne Suburban Railways. See "Official Notices" May 2nd.

June 11th.—Switchgear and instruments, for the Melbourne City Council. See "Official Notices" April 25th.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

TASMANIA.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" to-day.

QUEENSLAND.—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" April 11th.

August 27th.—Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

WESTERN AUSTRALIA.—May 28th. Condensing plant, pump and piping, for a Government power station at Perth. See "Official Notices" to-day.

July 9th and 30th and August 6th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

SOUTH AUSTRALIA.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

**Barnes.**—May 19th. Feeder and distributor cables, for the U.D.C. See "Official Notices" April 25th.

**Belfast.**—May 19th. Circulating-water pump, for the Corporation Tramways and Electricity Committee. See "Official Notices" April 25th.

**Belgium.**—May 16th. The Direction des Ponts et Chaussées in Brussels (52, Boulevard du Regent) is inviting tenders for an installation of electric lighting in the Public Park at Laeken. Particulars may be obtained from the Engineer, 15, Rue des Augustins, Brussels.

**Birkenhead.**—May 19th. Corporation Electricity Department; tenders for washed slack or washed small coal, for 12 months, commencing July 1st, 1913. Electrical engineer, Mr. W. Wyld, Craven Street.

**Bootle.**—May 13th. Boiler and pipe coverings for Marsh Lane electricity works. Borough Electrical Engineer's Office, Pine Grove.

**Bradford.**—May 15th. The Education Committee invites tenders for electrical work and fittings at the Belle Vue Boys' Secondary School and the School for Deaf and Cripple Children, Lister Lane. Tenders to the Director of Education, Town Hall.

**Bulgaria.**—May 21st. The District Administration of Finance in Sofia is inviting tenders for a double electrically-operated winding cage with all accessories, for the State Collieries at Pernik.

**Derby.**—May 23rd. One 750-kw. motor-alternator, for the Corporation. See "Official Notices" to-day.

**Germany.**—May 21st. The Prussian State Railway authorities at Königsberg are inviting tenders for two 30-cwt. electrically-operated coal-loading cranes.

**Glasgow.**—May 26th. Two steam turbo-alternators, with condensing plant (5,000 kw. and 2,000 kw. respectively), for the Corporation Tramways Department. See "Official Notices" April 25th.

**Grimsby.**—Pipework, extension of Klein cooling towers, conduits, seven-way D.P. distribution board and motor-driven rotary air and water extraction pumps and circulating pump, for the Corporation. See "Official Notices" May 2nd.

**Leeds.**—May 19th. Economiser chamber at the generating station, Whitehall Road; extension of engine room flooring at generating station, Whitehall Road. Specifications, &c., from 1, Whitehall Road, Mr. C. N. Hefford, engineer.

**London.**—May 9th. Electrical installation at Wilton Road Central Elementary School, Hackney. See "Official Notices" April 25th.

May 13th.—One 20-ton overhead hand crane, for the Shoreditch sub-station. See "Official Notices" April 25th.

L.C.C.—May 28th. Electrical installations at Lewisham Bridge and Fairfield Road (Bow) elementary schools. See "Official Notices" to-day.

Applications are invited from persons and firms wishing to be included among those from whom the Council invites tenders for the supply of stores and the execution of general maintenance contracts. See "Official Notices" to-day.

MILE END.—Two 30-kw. and one 15-kw. compound engines and dynamos, for the Guardians (from municipal authorities only). See "Official Notices" to-day.

**Malta.**—May 22nd. Arc lamp carbons. Receiver-General and Director of Contracts, Valletta. Forms, &c., from Crown Agents for the Colonies, Whitehall Gardens, S.W.

**Manchester.**—May 13th. Electric light installation at Withington Workhouse. Specification and particulars obtainable from Mr. F. H. Overmann, architect, 49, King Street, Manchester.

**Mexborough.**—May 30th. Lancashire boiler, for the U.D.C. electricity department. See "Official Notices" April 25th.

**New Zealand.**—CHRISTCHURCH.—May 22nd. City Council. Two 500-kw. converters and switchboard panels. Tenders, c.i.f. Lyttelton, to office of High Commissioner for N.Z., 13, Victoria Street, S.W. Specification, &c., at Board of Trade C.I. Department in London.

**Norway.**—May 14th. Norwegian State Telegraph Department. Copper wire, insulators and soldering tin. Local representation. Copies of the specifications may be seen at the C.I. Branch of the Board of Trade, London.

**Peterborough.**—The Council is about to invite tenders for two steam boilers and a steam turbine and generator.

**Paris.**—May 13th. Tenders are invited for the electrical high-tension equipment to be established at the sub-station at Meudon-val-Flenny. Particulars, Bureaux du Service Electrique (2-m. Division), 43, Rue de Rome, Paris.

May 17th. Supply of 200,000 liquid pile elements, in four lots. Particulars, Direction de l'Exploitation Téléphonique, 103, Rue de Grenelle, Paris.

**Plymouth.**—May 13th. Steam coal (8,500 tons), for the Corporation Electricity Department; Mr. E. G. Okell, Borough Electrical Engineer, Prince Rock (returnable deposit of £1).

**Rathmines and Rathgar.**—May 19th. Electrically-driven jet condensing plant, for the U.D.C. See "Official Notices" May 2nd.

**Rochdale.**—May 14th. Electrically-driven induced-draught plant, for the Corporation electricity department. See "Official Notices" April 25th.

May 21st.—Boiler feed pumps, for the Corporation Electricity Committee. See "Official Notices" May 2nd.

**Salford.**—May 19th. Tenders invited for 10 car bodies and 10 Brill trucks. Tramways General Manager, 32, Blackfriars Street, Salford.

**South Africa.**—STELLENBOSCH (CAPE PROVINCE).—June 4th. The Municipality is requiring tenders for buildings, generating plant, cables, public lighting, meters, &c., in connection with the electric lighting scheme. Specifications from Prof. Bohle, South African College, Cape Town.

**Spain.**—May 23rd. The municipal authorities of Montilla (province of Cordoba) are inviting tenders for the concession for the electric lighting of the town during a period of 20 years.

**Walthamstow.**—May 28th. Natural draught cooling tower, for the U.D.C. Electricity Department. See "Official Notices" May 2nd.

**Warrington.**—May 13th. Traction battery and reversible booster, for the Corporation. See "Official Notices" April 25th.

May 13th.—Feeder pillars and high and low-tension cables, for the Corporation. See "Official Notices" May 2nd.

### CLOSED.

**Australia.**—SYDNEY.—The *Australian Mining Standard* records the acceptance of the following tenders by the Municipal Council:—

Feeder Cables.—B.I. & Helsby Cables Ltd., £276; Noyes Bros., £3,353; Henley's Telegraph Works Ltd., £4,018.  
Underground Cables.—B.I. & Helsby Cables Ltd., £11,721, and the following as per schedule tendered: Siemens Bros., Western Electric Co., Henley's Telegraph Works, Noyes Bros.  
Motors.—British Westinghouse Electric Co., Gardner, Waern & Co., Union Electric Co., Australian General Electric Co., Australian Metal Co., Siemens Bros., all as per schedule tendered.

The same contemporary records the following results:—

P.M.G.'s Department, Adelaide:—

82 tons H.D. copper wire, 106 tons galvanised iron wire.—R. Johnson, Clapham & Morris, Ltd.

P.M.G.'s Department, Melbourne:—

Bells, induction coils and fuses, I.R., G.P. & T. Works Co. 38 miles paper-insulated cable, Australian Metal Co. Bells, fuses, telephone apparatus, switchboards, &c., J. Bartram & Son, Pty., Ltd.

P.M.G.'s Department, Perth:—

About 9 miles lead-covered, paper-insulated telephone cable (£8,899), Imperial Electrical Engineering Co., Perth. Telegraph cable (£1,165 ft.), B.I. & Helsby Cables, Ltd.

According to *Tenders*, the Home Affairs Department has ordered the steel frame for power generating station, Federal capital site, at £6,345, from Messrs. Johns & Waygood, Ltd., Melbourne, and one Green's patent economiser, for Federal capital, at £1,292, from Babcock & Wilcox, Ltd.

**Barrow.**—The Council, on Monday, decided to relieve Messrs. Ship Carbons, Ltd. from their contract for supplying yellow-flame carbons, and agreed that the tender of Messrs. Engineering and Arc Lamps, Ltd., be accepted. In regard to the supply of copper wire and carbon-filament lamps, it was decided to inform Messrs. Thos. Bolton & Sons, Ltd., and the Radium Electric Co. that the Electricity Committee regret that they cannot make any alteration in their tenders, and that they be requested to supply such goods as may be ordered in accordance with their tenders.

**Belfast.**—The Corporation, last week, accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £2,805, for an additional boiler, superheater, mechanical stoker and pipework for the electricity works.

**Belgium.**—The municipal authorities of Scherbeck, Brussels, last week opened tenders for the supply and installation of 11 transformer boxes in connection with the electric lighting undertaking. Six concerns—four Belgian, one French and one German—competed for the contract, the lowest tender being that of the Société A.E.G. Union Electrique, of Brussels.

**Bexhill-on-Sea.**—The T.C. has sealed an agreement with the Tudor Accumulator Co., for the maintenance of the batteries for 10 years.

**Blyth.**—The tender of Messrs. Resive & Co., of Brignouse, has been accepted for the E.L. installation at the new Government buildings at Blyth.

**Bolton.**—The Corporation Tramways Committee has accepted the tender of Messrs. Milnes, Voss & Co. for ten additional top covers for double-deck cars.

The Electricity Committee has accepted the following tenders:—  
W. Gornall.—Reservoir construction in connection with the new generating station.  
Bertram Thomas.—Sub-station equipment.  
S. Talbot & Sons.—Two chimney stacks.  
B.I. & Helsby Cables, Ltd.—Wires and cables.  
F. & J. Webster.—Castings.

**Bradford.**—The Corporation Electricity Committee has accepted the tender of Messrs. Ferranti, Ltd., to supply E.H.T. switchgear required for the transformer chamber at Montserrat Mills, for £215. The Committee has authorised an alteration in the supply in the Manchester Road district, south of Bowling Old Lane, from direct current to alternating current, involving the provision of new cables, relaying of single-core cables, &c., at a cost of £450.

The following tenders have also been accepted:—  
Bertram Thomas.—Three-phase A.C. and D.C. switchgear required for new sub-stations at Thornbury and Odsal, £2,075.  
Underfeed Stoker Co., Ltd.—Two Underfeed stokers for boilers at Valley Road Works, £75.  
Babcock & Wilcox, Ltd.—Two chain-grate stokers for boilers, £800.  
Taylor Bros., Ltd.—50 nickel-chrome-steel traminer axles, £4 5s. 9d. each.

**Bridlington.**—The Electricity Committee has placed an order with the Brimsdown Lamp Works, Ltd., for lamps for a year, at prices quoted.

**Bristol.**—The Electrical Committee reported to the Council, on Tuesday, that it had entered into the following contracts for 1913-14:—

W. Lucy & Co., Ltd., fuse boxes .. .. .	£104
Sykes & Suggen, Ltd., joint and junction boxes .. .. .	480
Oliver Arc Lamp, Ltd., yellow flame arc lamp carbons .. .. .	801
Sloan Electrical Co., Ltd., open-type arc lamp carbons .. .. .	371
Ferranti, Ltd., D.C. meters .. .. .	368
British Westinghouse Co., Ltd., A.C. meters .. .. .	1,069

**Brighton.**—The T.C. has accepted the following tenders:—

R. Richardson, Westgarth & Co., Ltd., turbine (3,000 r.p.m.) coupled to a Siemens 3,000-kw. alternator, complete with waterspray filter, air pump, and augmentor condenser with 200 sq. ft. of cooling surface, £7,251.  
Greenwood & Batley, Ltd., for a De Laval motor-driven turbine pump, with switchgear, at £276.

**Broadstairs and St. Peter's.**—The U.D.C. has referred the following tenders for the installation of electric fire alarms to a Committee for consideration:—

Stuart & Moore.—Without telephones, £190 10s., and £12 per annum for maintenance; with complete telephone apparatus £213, (and maintenance £14 a year.  
Siemens Bros.—£139, exclusive of fixing and wiring.  
Walter Electrical Manufacturing Co., Ltd.—£223 complete.  
Mr. G. Longfield.—£158, exclusive of wiring and maintenance.

**Buenos Ayres.**—Two engines of 240 B.H.P. each for the Provincial Electric Lighting Co., of Buenos Ayres, have been ordered from Messrs. Hick-Diesel Oil Engines, Ltd.

**China.**—The *Indian and Eastern Engineer* states that there has recently been formed in the little city of Fatshan, near Canton, a company to undertake the supply of electric lighting and power. A British firm, the General Electric Co. of China, Ltd., has secured the principal contract in connection with the installation. The generating plant which the G.E. Co. is to supply will consist of three three-phase high-tension A.C. generators with an overload capacity of about 200 kw., driven by crude-oil Bolinders engines. The plant, which will go from Witton, will arrive in July and should be ready for starting by the end of the year. "Much difficulty has been encountered in the choice of a suitable site for the power station. Fatshan lies very low, and to avoid the possibility of occasional flooding, it has been found necessary to raise the ground on which the building is to be erected some 5 ft."

**Coventry.**—The Corporation has accepted the tender of the Brush Electrical Engineering Co. for five double-deck tramcars with four-wheeled trucks.

**Dewsbury.**—The Electricity and Tramways Committee has accepted the tender of the Union Cable Co., of Dagen Deck, for 1 mile of electric cable.

**Doncaster.**—The Electricity Committee recommends the acceptance of the following tenders for six new cars—The United Electric Car Co., Ltd., for car bodies, with top covers, at £456 each. The Pockham Truck Co. for pendulum trucks, at £90 each and Dick, Kerr & Co. for electrical equipments, at £24 each.

**Dukinfield.**—Messrs. C. Benyon & Co., a local firm, have received the contract for installing electric light at the Primitive Methodist New Sunday School, Foundry Street.

**Eccles.**—The Electricity Supply Committee has accepted the tender of Messrs. F. Danks, Ltd., Oldbury, for a Lancashire boiler for the electricity works for the sum of £410.

**Germany.**—Messrs. Nagel & Kamp, of Hamburg, have secured a contract from the Finance Deputation, of Hamburg, for the supply and erection of four electric cranes, at a cost of £4,015.

**Glasgow.**—The Clyde Navigation Trustees have agreed to accept the following tenders for the material required for the erection of 10 electric capstans at Renfrew:—

Motors.—Laurence Scott & Co., Ltd., at £360.  
Iron castings.—Fullerton, Hodgart & Barclay, Ltd., at £208.  
Steel castings.—Carnlyne Steel Castings Co., at £116.  
Controllers and resistances.—British Westinghouse Co., Ltd., at £262.

**Holland.**—Messrs. Cassirer & Co., of Charlottenburg, Germany, have secured a contract from the Provincial Administration authorities at Groningen for the supply of 68½ miles of electric cables, for the round sum of £24,000.

**Keighley.**—The Electricity Committee has accepted the tender of Messrs. Hird Bros. & Co., at £139, for work in constructing a concrete foundation for a new 2,000-kw. turbo-alternator.

**Liverpool.**—The T.C. has accepted the following tenders for supplies to the Electricity and Tramway Departments:—

Joshua Thomson-Houston Co., Ltd.—Two 6,000-kw. turbo-alternators.  
Joshua Henshaw & Sons.—Alterations at the Lister Drive electric power station.  
Pearson Huggins & Co., Ltd.—1,000 pairs of drivers' and conductors' winter trousseaux.  
British Westinghouse Electric and Manufacturing Co., Ltd.—Three sets of rotary converters and accessories.

**London.**—L.C.C.—The following were the tenders received during the election interval and the Easter recess for the electric lighting of the Avery Hill Training College Hostels:—

H. J. Cash & Co., Ltd. .. .. .	£1,180
Pinching & Walton .. .. .	1,159
Tredegar & Co. .. .. .	1,209
Williams & Bach .. .. .	1,240
G. B. Taylor & Co. .. .. .	1,306
W. C. Tackley & Co., Ltd. .. .. .	1,426
G. Weston & Sons, Ltd. .. .. .	1,463
Malcolm & Allen, Ltd. .. .. .	1,617
(Architect's estimate, £1,068.)	

The Fire Brigade Committee is accepting the tender of the "Cedes" Electric Traction, Ltd., for a petrol-electric motor chassis required for converting a horse-drawn turntable long ladder into a petrol-electric motor appliance, at £850. The company will sub-let the motor engine to the Aster Engineering Co., Ltd.

The following tenders were received by the Highways Committee for two 8,000-kw. turbo-generators and auxiliaries, required for the Greenwich generating station:—

Name.	Maker of generator.	Amount of tender.
Escher, Wyss & Co., Zurich .. .. .	Siemens .. .. .	£48,012
British Westinghouse Electric, &c., Co., Ltd. .. .. .	British Westinghouse, &c., Co. .. .. .	50,682
Willars & Robinson, Ltd. and Red. .. .. .	Siemens .. .. .	50,560
Richardsons, Westgarth & Co., Ltd. .. .. .	Brown, Boveri .. .. .	51,610
Fraser & Chalmers, Ltd., Erith .. .. .	Brown, Boveri .. .. .	52,989
Willars & Robinson, Ltd. and Red. .. .. .	General Electric .. .. .	53,710
Willars & Robinson, Ltd. and Red. .. .. .	Dick, Kerr .. .. .	53,730
Fraser & Chalmers, Ltd. .. .. .	Siemens .. .. .	64,380
Richardsons, Westgarth & Co., Ltd. .. .. .	Siemens .. .. .	64,261
Jas. Howden & Co., Ltd. .. .. .	Siemens .. .. .	55,342
Richardsons, Westgarth & Co., Ltd. .. .. .	General Electric .. .. .	58,269
Fraser & Chalmers, Ltd. .. .. .	General Electric .. .. .	58,269
Brush Electrical Engineering Co., Ltd. .. .. .	Brush .. .. .	60,600
C. A. Parsons & Co. .. .. .	C. A. Parsons .. .. .	64,830
British Thomson-Houston Co., Ltd. .. .. .	British Thomson-Houston .. .. .	70,224
Belless & Morcom, Ltd. .. .. .	Siemens .. .. .	70,770

The Committee reports upon these offers as follows:—"The above prices are subject to an increase or decrease resulting from a bonus or penalty on steam consumption, such bonus or penalty being at the rate of £500 per tenth of a pound of steam less or more than 12.75 lb. per kw.-hour at full load. The estimate of the chief officer of tramways was £62,500. Having regard to the very great importance of obtaining the best possible type of plant for the generating station, the chief officer of tramways consulted an expert as to which of the tenders would be most satisfactory from the Council's point of view. Sir Alexander Kennedy was asked to advise on the matter, and he has carefully examined each of the tenders received. As the result, Sir Alexander Kennedy, after discussing the matter with the chief officer of tramways, has advised that the second lowest tender, that of the British Westinghouse Co., amounting to £50,532, should be accepted. One of the most important considerations involved in coming to a decision as to the tender to be accepted is that of steam economy, and the figure submitted by the British Westinghouse Co. is 12.44 lb. of steam per kw.-hour at full load, which, we are advised, is satisfactory. The corresponding figure offered by Messrs. Escher, Wyss & Co. is 12.82 lb. per kw.-hour, subject to an allowance of 3 per cent. either more or less. On the assumption that both sets of figures were obtained in actual operation, the extra steam required by the two Escher, Wyss turbines would represent an additional expenditure for coal of about £1,500 a year at present prices. We accordingly propose that the

tender of the British Westinghouse Co. should be accepted. An additional provisional sum of £4,000 for transformers will be included in the contract. The company stipulates that certain modifications shall be made in the clause usually inserted in the Council's contracts as regards the submission to arbitration of any disputes arising thereunder. We are of opinion that the clause, as amended, is substantially in agreement with the standard clause in the Council's usual form of contract."

It is proposed that the tenders for additional water condensing pipes, &c., be opened during the Whitsuntide recess, and that the chairman or vice-chairman have authority to accept the lowest satisfactory one.

The tender of Messrs. A. Ransome & Co., Ltd., for a pedestal type rounding machine for the third section of the central car repair depot, at £66, is recommended for acceptance.

**WATER BOARD.**—The following tenders have been accepted by the Metropolitan Water Board:—

General Electric Co., Ltd.—Various electric fittings for Hampton Station, £41; ditto, for Surbiton Station, £44; one power panel and fittings, £39. Simplex Conduits, Ltd.—Tube ends, switchboxes, lampholders, &c.

**MARYLEBONE.**—The tender of Messrs. Parsons has been accepted by the B.C., at £230, for a new spindle for a turbine at the generating station. The tender of Messrs. Blackmore & Co. has also been accepted for the supply to the Electricity Department of 120 tons of Badesley beans at 15s. 11d. per ton.

**ASYLUMS BOARD.**—The Metropolitan Asylums Board has accepted the tender of Mr. H. J. Godfrey, at £322 10s., for wiring certain portions of the Grove Hospital.

**HAMMERSMITH.**—The Electricity Committee proposes to enter into a contract with the Main Colliery Co., of Neath, for free burning coal, similar to that supplied under the existing contract, for one year, at 17s. 6d. per ton. This is 10d. per ton advance.

**SHOREDITCH.**—The Lighting Committee report that during the annual overhaul of engines at Whiston Street, while No. 2 Wallsend engine was dismantled they received an offer from Messrs. Allen and Simmonds, Ltd., of Reading, to bore out the valve chambers and provide a full set of eight valves for £299, also making and fitting a 2½-in. diameter self-contained Bull piston ring, fitted with Allen "patent" frictionless rings and springs complete for H.P. cylinder, and a 5½-in. ditto for L.P. cylinder, also boring out L.P. cylinder of above engine, for £156. Messrs. Allen & Simmonds, Ltd., guaranteed to reduce the steam consumption to 19½ lb., which was equal to an efficiency of nearly 10 per cent. better than when the engine was new, and the improvements effected will be sufficient to return the whole cost within a few months. The Committee, therefore, ordered the work to be put in hand.

**G.P.O.**—The G.P.O. contract with the General Electric Co., Ltd., for the supply of Osram lamps has been extended for a further period of six months.

**LEWISHAM.**—The B. of G. on Monday again considered the tenders for the electric installation at the workhouse. The Works Committee reported that a letter was written to Messrs. Tredegar inquiring if they were willing to execute the work for £668, the amount quoted in their tender. In reply, Messrs. Tredegar referred to the Guardians' proposal to accept their tender for part of the work only, but their estimate was based on the assumption that they should receive the order for both the infirmary and the workhouse. If, as they understood, the Guardians proposed to accept only one part of the estimate, viz., the workhouse, they would require an increase of 5 per cent. on the price originally quoted to cover the increased cost of supervision and establishment charges. This would make their tender £701. The Works' Committee reported that they were of opinion that as Messrs. Tredegar were not willing to adhere to their original tender, and now increased their price after publication of the amounts of the tenders submitted to the board, the tender of Messrs. Haycraft & Son, Ltd., Brockley, be accepted for £759. Mr. W. Ross submitted that the board ought to accept the lowest price, that of Messrs. Tredegar. Mr. A. O. Weeks pointed out that if the tenders for the two institutions were added together Messrs. Tredegar were not the lowest. Mr. H. M. Clemow inquired why they should spend £59 of the ratepayers' money in this way. A proposal to accept Messrs. Tredegar's revised tender was defeated, and the board, by 18 votes to 9, accepted the tender of Messrs. Haycraft.

**FULHAM.**—The B.C. has accepted the offer of Messrs. Phillips and Co., Ltd., for the supply of 1,450 tons of Kirkby nutty black steam coal, at 13s. per ton.

**Leyton.**—The U.D.C. has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., at £780, for the supply of a spare lighting armature, and at £795 for a spare traction generator armature. The tender of the General Cable Manufacturing Co. has also been accepted, at £456, for one mile of 2 sq. in., half-mile of 0.25 sq. in., and half-mile of 0.125 sq. in. cable. Other tenders were received from the following:—

Union Cable Co., Ltd.	£144
R. R. Todd	451
Electrical Engineering and Equipment Co.	451
Standard Cable Co., Ltd.	467
Pirelli, Ltd.	477
Johnson & Phillips, Ltd.	498
General Electric Co., Ltd.	501
E.I. and Helsby	501
Siemens Bros. & Co., Ltd.	504
Glover & Co., Ltd.	505
Callender's Cable Co., Ltd.	507
W. T. Henley's Telegraph Works Co.	516

**Luton.**—The tender of Mr. A. J. Pitkin, Luton, has been accepted for the electric light installation at new club premises being erected in Dunstable Road.

**Peterborough.**—The T.C. has accepted a tender by W. T. Henley's Telegraph Works Co., Ltd., for cable for Westgate, at £567.

**River Plate.**—The Minister of Public Works has accepted the tender of the Sociedad Gasmotoren Fabrik Deutz for the electric light installation in the Reformatoren at Marcos Paz, at \$19,702.

Messrs. Siemens Bros. have obtained the contract for all the switchgear at the power house that the Western Railway Co. are building in Dock Sud in connection with the electrification of their suburban lines.—*Review of the River Plate.*

**Salford.**—The following tenders have been accepted by the T.C.:—

British Westinghouse Electric Co., Ltd.—Extra-high-tension three-phase switchgear with control board, £1,765.  
 General Electric Co., Ltd.—Two Aron meters.  
 Siemens Bros. Dynamo Works, Ltd.—Two induction meters.  
 British Electric Transformer Co., Ltd.—Three compensator transformers, £299.

The following tenders have also been accepted for annual supplies to the Electricity Department:—

W. T. Glover & Co., Ltd.—1-R. cables, £150; multiple core cables, £300.  
 Wm. Geipel & Co., Ltd.—India-rubber cables, £200; twin flexible cable and plain white tape.  
 John Bassett.—Tin and lead, £150.  
 Albion Clay Co., Ltd.—Stoneware conduits and pipes, cable protectors, &c., £70.  
 W. H. Kays, Ltd.—Bitumen, £240.  
 W. T. Henley's Telegraph Works Co., Ltd.—Rubber strip, £72.  
 Bell's United Asbestos (Northern Agency).—Asbestos packing, millboard, &c., £40.  
 Grove Asbestos Works Co., Ltd.—Rubber insertion, &c.  
 L. Andrew & Co.—Flake graphite, mica, rubber gloves, rubber caps, £24.  
 T. Hart.—Cotton driving rope, £46.  
 J. Cookson, Ltd.—Tarred twi, c.  
 Bell Bros.—Crank chamber oil, £333.  
 M. Wells & Co.—Turbine oil and charcoal refined cylinder oil, £110.  
 Stern Sommerschlag Oil Co., Ltd.—Black oil, £20.  
 Baxendale & Co.—Wrought-iron tubes and fittings, £60.  
 F. A. Ellis.—Fire bricks, fire clay, &c., £22; cement, £52.  
 North British Rubber Co., Ltd.—Rubber overshoe.  
 Lancaster & Tonga.—Brass, &c., fittings.  
 Brunner, Mond & Co., Ltd.—Soda ash, £44.  
 Hall & Pickles.—Iron and steel bars, plates, &c., £16.  
 W. Higgins & Son.—Chamber bricks, 4s.

**Sheffield.**—The Corporation has accepted the tender of the Brush Electrical Engineering Co., for 25 double-deck tramcars with top covers and four-wheeled trucks.

**Swindon.**—The Wilts. C.C. has accepted the tender of Messrs. Lott & Son for installing the electric light at the police buildings at Swindon, at £149.

**Winchester.**—The City Council has accepted a tender by Messrs. A. Reyrolle & Co., Ltd., for a new switchboard for the electricity works, for £824.

FORTHCOMING EVENTS.

- Boyal Institution.**—Saturday, May 10th. At 3 p.m. Lecture on "Humphrey Internal-combustion Pump," by Mr. H. A. Humphrey. (Lecture I.)  
 Saturday, May 17th. At 3 p.m. Lecture on "Humphrey Internal combustion Pumps," by Mr. H. A. Humphrey. (Lecture II.)
- Institution of Electrical Engineers (Yorkshire Section).**—Wednesday, May 14th. Meeting at 7 p.m. At the University, Leeds.
- Association of Electrical Station Engineers (Manchester Section).**—Thursday, May 15th. At 7 p.m. At the Crown Hotel, Manchester. Paper on "The Status of Electrical Station Engineers and the Need of an Association," by Mr. J. W. Thomas.
- Salford Technical and Engineering Association.**—Thursday, May 15th. Whit-week tour in Wales.
- Physical Society.**—Friday, May 16th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Experiments to Detect β-rays from Radium A," by Drs. W. Makower and S. Russ.
- Junior Institution of Engineers.**—Friday, May 16th. At 89, Victoria Street, S.W. Discussion on "Electrical Propulsion of Ships," introduced by Mr. W. P. Durnall.

**The B.A. Meeting.**—Sir Oliver Lodge, the president of this year's meeting at Birmingham, will deliver his address on the evening of Wednesday, September 10th, in the Central Hall, Corporation Street. One of the evening discourses will be delivered on Friday, September 12th, by Sir H. H. Cunynghame, on "Explosions in Mines and the Means of Preventing Them." The Town Hall will be the Reception Room, and the various section rooms will be in the surrounding buildings. On the Saturday there will be many excursions, places to be visited including Stratford-upon-Avon, Warwick Castle, Stoneleigh Abbey, Kenilworth Castle, Bromsgrove, Hartlebury Castle, Tewkesbury, Worcester, the Forest of Arden, Malvern, &c. The honorary secretaries (the Council House, Birmingham) will issue a list of hotels and lodgings in due course.  
 Newcastle proposes to invite the Association to meet there in 1916.

**THE ELECTRICAL ENGINEERS  
(LONDON DIVISION)**

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

- Monday, May 12th.—Headquarters will be closed.
- Tuesday, May 13th.—Headquarters will be closed.
- Wednesday, May 14th.—All Companies. Annual course of musketry at Purfleet rifle ranges. Railway tickets will be sent to those notifying headquarters of their intention to attend.
- Thursday, May 15th.—"G" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 6th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.
- Friday, May 16th.—"D" Company. Ditto.
- Saturday, May 17th.—Annual musketry as for Wednesday, May 14th. Headquarters will be opened for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.  
For Officer commanding L.E.E.

**NOTES.**

**Wanted—Six Hundred Pounds.**—Our readers are already aware that at the annual festival dinner Mr. E. G. Byng offered to give £100 to the funds of the Electrical Trades Benevolent Institution if nine other firms or gentlemen would do the same within three months from April 16th. The £100 which Mr. Sutton had already given was to be counted as one of the nine; Mr. H. Hirst, through Mr. Sutton, promised a like amount; and Mr. Garcke's promise brings the total up to £400 out of the required £1,000.

It has been thought that some of our generously disposed readers would be willing to follow the splendid example set by these gentlemen and ensure that the conditional offers are fulfilled by making or influencing six other offers. We hope that in later issues it will be possible for us to fill names into the six spaces now standing vacant below:—

1	Mr. E. G. Byng	...	...	...	...	...	...	...	...	£100
2	Mr. G. Sutton	...	...	...	...	...	...	...	...	£100
3	Mr. H. Hirst	...	...	...	...	...	...	...	...	£100
4	Mr. E. Garcke	...	...	...	...	...	...	...	...	£100
5	*	...	...	...	...	...	...	...	...	
6	*	...	...	...	...	...	...	...	...	
7	*	...	...	...	...	...	...	...	...	
8	*	...	...	...	...	...	...	...	...	
9	*	...	...	...	...	...	...	...	...	
10	*	...	...	...	...	...	...	...	...	

**Electricity from the Air.**—A Manchester paper announces that Councillor J. W. Cook, who has just returned from a tour in America, has acquired some of the patent rights in a marvellous invention, which he came across in the course of his travels. The inventor collects electricity from the air, after the style of Benjamin Franklin, but with an apparatus which is obviously a vast improvement on the primitive kite, for it consists of the following parts:—

"The electrical absorbers or accumulators, which are composed of zinc plates and magnetised steel, or may be composed of peculiarly treated and magnetised steel only; the compound-rectifying exciter transformers; the automatic governor, circuit breaker, or lightning arrester; and the tower. The switchboard ammeter, voltmeter, switch and insulations complete the list of parts.

"The wiring of the machine is not unlike that of any electrical machine except that no copper wire is used until the point is reached where the electric energy is ready to be delivered for use. The compound-rectifying exciter transformers perform the function of preparing the ambient elemental electric forces, after being gathered by the accumulator for use. These compound-rectifying exciter transformers are susceptible of being adapted to the varying requirements found to exist under various climatic conditions, so as to increase the voltage and lower the amperage, or increase the amperage and lower the voltage as desired. The real secret and technical points of this part of the invention, as well as the accumulators, will be given to the world at large as soon as the last applications for foreign patents have been accepted."

It is clear that we have here a discovery of fundamental importance, destined to revolutionise the electrical industry. That theory has not been neglected is evident from the following statement:—

"The success of this invention, like that of all dynamos, depends upon the natural law that electricity produces magnetism, and magnetism produces electricity. The inventor, however, claims to have made a new application of this natural law, which will completely revolutionise electric science and necessitate a re-writing of electrical text-books."

It is quite usual for inventors of revolutionary devices to upset the text-books; epoch-making discoveries of this kind are almost necessarily contrary to the laws assumed by ordinary scientists to

be universally true, such as gravitation and the conservation of energy, but considerations such as this cannot be allowed to hamper progress.

"The inventor authorises a statement that his machine produces a continuous direct current, and is protected against surplus charges such as lightning, by a circuit-breaker or lightning arrester which safely delivers surplus charges of electricity to the earth; that he has proved that electricity and lightning are one and the same thing, as believed to be the case by Benjamin Franklin, that lightning has been tamed and made to serve man."

Franklin is to be congratulated upon the vindication of his pet theory, which at least survives the wreck of the text-books; and we pay respectful homage to Councillor Cook, our coming multi-millionaire, who will in the future control the shafts of Jupiter Tonans and create a corner in domesticated lightning.

**Point Five Publicity.**—The accompanying illustration shows the poster which has been got out by the "Point Fives," as mentioned in our last issue, in the absence of a suitable design from



what they call the "moribund" Electric Publicity Committee. Simplicity is the key-note of the design, which clearly implies that the lady of the house is doing the cooking herself.

**Concert.**—The annual prize distribution of the Devon (Fortress) R.E. Electric Light Companies was held in connection with a smoking concert at Mutley Barracks, Plymouth. Colour-Sergeant-Major Pearks presided, and was supported by the commanding officer (Major W. E. P. Bastard) and other officers. "The Officer Commanding and Officers" was given by Sergeant Rowe. Major Bastard, replying, remarked that they had heard so much about the Territorial Force recently, that some of them had begun to wonder where they were, and if they were anywhere at all. There had, however, been a lot of exaggerated statements made, and he doubted whether the force was in such a parlous state as some would have them believe. They were up to strength, if not over, in the Works Companies, which did not accept any but exceptional men and those particularly wanted. He wished the Electric Light Companies were up to strength. They had had a nasty knock in not being able to take men from the dockyard. A delightful musical programme was enjoyed.

**Cold Light.**—Some time ago we commented on an invention of Prof. C. F. Dussaud, which was shown before the French Academy of Science, under the ægis of Prof. Branly. Last week the working of the system, which is called "Cold Light," was demonstrated at the offices of Messrs. Louis Schloss & Co., London, in its application to cinematographs, projection lanterns, lighthouses, and other lighting uses. The fundamental idea is rest; the inventor claims that by running metallic-filament lamps at an excessive voltage, say, 100 per cent. above normal, for very short intervals he is able to secure an extremely high efficiency, and a powerful light from a small lamp, without causing the bulb to grow hot and without destroying the filament. This is effected either by interrupting the current flowing to a single lamp or group of stationary lamps, or by fixing several lamps on a revolving disk with a contact-maker which causes each lamp to light in succession whilst passing a fixed point. In the latter case, the lamps appeared as a ring of light, thus proving that the filaments had not time to grow cold between-times. In the case of the cinematograph, a single lamp is used, which is alternately lighted and extinguished, and the film is moved during the extinction, so that the revolving shutter ordinarily used to cut off the light of the arc lamp while the film is moved is dispensed with.

In the case of the projection lantern, three lamps are mounted on a revolving frame: one lamp is lighted for the exposure of a view, and may remain alight, we were told, for as much as 1 or 2 min. On changing the view, the operator also changes the lamp by rotating

the frame, and thus each lamp will burn (at excess voltage) for one minute out of three, or two out of six.

The life of a lamp thus used is said to be about four hours in the aggregate, which, of course, corresponds to a continuous display of pictures lasting 12 hours. A lamp taking 25 watts under these conditions was shown to be as effective as an arc lamp taking 10 amperes at 100 volts, of which perhaps 500 watts was expended in the arc.

When the system is used for lighthouse, with revolving beams, a large lamp is used, with a revolving screen, and during part of the revolution the lamp is extinguished, giving the bulb a chance to cool. It is claimed that, thanks to the coolness of the source of light, small lenses can be used close to the lamp, thus effecting a very great economy in cost. A lamp intermittently lighted about 50 times a second, while fed with current at 100 per cent. above normal voltage, and fixed in a suitable reflector, gives a splendid light. We understand that the system is being adopted by numerous theatres and restaurants in France, and by the French Government.

The demonstration was mainly qualitative, and not quantitative, and we are not in a position to give reliable data as to the efficiencies, temperatures, &c. We formed the opinion, however, that the essence of the matter was the use of an excessive voltage, and that interruption of the current was of little consequence. Lamps thus over-run can be kept cool in various ways. Of course, the efficiency of any incandescent lamp when heavily over-run is extremely high, and while the life under such conditions must necessarily be brief, there is certainly a valuable lesson to be derived from these experiments. It is this: It may be a highly economical plan to use metallic-filament lamps for cinematographs, projection lanterns, searchlights, photographic projectors, and all such purposes for which long-continued illumination is not necessary; to run them at an excessive voltage and corresponding candle-power, and replace them when burnt out—instead of using arc lamps.

The fact that an intermittency so high as 50 per second is used in some cases, equal in effect to an alternating current at 25 cycles per second, shows that the intermittency has no material importance; and this is emphasised by the fact that sometimes the rate of intermittency is only once in three minutes. Hence the over-voltage is the only essential feature of the "system."

**Electrical Workers' Wages.**—A letter has been forwarded to the Bolton Electricity Committee by the secretary of the Electrical Trades Union making application on behalf of members in the employ of the department for an advance of 1d. an hour on the present rate of wages. The fittings superintendent was requested to obtain further information and report to the next monthly meeting of the Committee.

**Appointment Vacant.**—Engineering representative for power business, for the Sales Department of the Bristol Corporation (£160). See our advertisement pages in this issue.

**Fatalities.**—NEWCASTLE-ON-TYNE.—An inquiry was opened on 3rd inst. at Newcastle Royal Infirmary, before Deputy-Coroner R. E. B. Lisle, into the circumstances attending the death of Frederick Dennis Hasdell, 32, an electrician, employed by the Newcastle-on-Tyne Electric Supply Co., who lodged at Whickham, and died on 2nd inst. Mr. Hasdell was in charge of the Newcastle Co.'s sub-station at Blaydon Haughs, and it is understood that he and a man named Robert Winde were engaged in testing the low-tension switchboard, when suddenly there was what was described as "an explosion." The place was filled with smoke, and Mr. Hasdell and Winde were both burned. The former, indeed, rushed out with his clothes on fire. Help was speedily obtained, and the injured men were attended by Dr. McAleenan. Mr. Hasdell was found to have received extensive burns about the face and body, and he was conveyed by Dr. McAleenan and a constable to Newcastle Infirmary in a motor-car, but he died within a few hours. Winde was burned about the arms and hands. Owing to the accident, some of the local works were temporarily stopped. At the inquiry the Deputy-Coroner said that the only witness who could give evidence as to the accident was at present injured himself, and it would be some time before he would be sufficiently recovered to attend—probably three weeks before the man got the bandages off—so he proposed to adjourn the inquiry for six weeks, to June 15th.

TULLAMORE.—An inquest was held on April 30th, into the death of Laurence Carroll, employed by Mr. Norman Robinson, Dublin, in putting up electric lighting wires at Dew Park residence, Tullamore. Deceased fell from the top of a telephone pole.

JARROW.—On May 1st, an inquest was held concerning the death of a labourer, Thomas Tinley, 46. According to the evidence, he was assisting to lay an electric cable across some posts and three chimneys at Palmer's rolling mills, when he fell 34 ft. from the top of a pole and was killed. George Sanderson, electrician, said that he thought Tinley's feet slipped while he was lifting the cable into position. It was impossible for him to get a shock. George Furlong, a labourer, stated that if deceased lifted the cable over the insulator it would go over the arm and drag him over if he retained his hold. The pole was 14 in. out of line, and in such circumstances they generally used a piece of rope to prevent the cable going over the arm. Deceased did not use the rope. A verdict of "Accidental death" was returned.

LONDON.—An inquest was held on 2nd inst. into the death of Edward J. Peake, 31, a painter employed by a firm of contractors, who was killed by coming into contact with a live wire on the L.B. & S.C. Railway, at Queen's Road Station, Camberwell. He was on a plank, a few feet above the overhead wire, painting a signal bridge. The foreman denied that he told the men to paint

the bridge in the afternoon; he meant them to paint the signal posts, and not the bridge, as that should have been dealt with when the current was off. The medical evidence showed that the man's left leg was partly charred, and that the current had entered there. Death was due to shock following the burns; both arms were burnt. He was surprised that the man had not been killed outright with a 6,500-volt shock. Peake died the day after the accident. The jury, in returning a verdict of "Accidental death," added a rider that there had been negligence on the part of the man's employers in not supervising the work in a proper manner. The deceased left a widow and six children, all under 7 years of age.

**Football.**—The Bertram Thomas Employés' Football Club has just finished a very successful season, and has had a most auspicious wind-up by an extraordinary run of successes in "The Ecclesboro' Workshop Competition." Over 60 workman teams entered this competition, including the following engineers and electrical engineers. Messrs. Bertram Thomas's employés met the following teams, which they succeeded in defeating as shown:—

1st Round.	Schemp's Employés	Won	1-0
2nd	Elkanah Armitage Employés	Drawn	0-0
2nd "replayed	"	Won	1-0
3rd	British Westinghouse C.E. Dept.	"	1-0
4th	Mandleburgs Rubber Works	"	1-0
Semi-Final	Nasmith Wilsons' Employés	"	1-0
Final	S. Kershaw & Sons	Drawn	0-0

The final tie took place on Wednesday evening, the 30th ult. and, we are informed, was an extraordinary match in all respects. The result, after full time was played, being a draw with no score, an extra 15 minutes was played, with the same result, then a further extra 10 minutes was played, with still the same result; and a further five minutes was played without any score taking place. Darkness had then set in, so that it was impossible to play any longer, and as this was the last day of the football season it is impossible for the match to be replayed; so the two clubs have agreed to be joint holders of the cup for the next four months, and to play off for the right of holding the cup and taking the first medals in September next.

A special word of praise is due to the players of Messrs. Bertram Thomas's E.F.C. for their long-sustained effort throughout competition, and for their most excellent defence in keeping 11 opponents out throughout the seven matches which they played, particularly when it is mentioned that they knocked out the last year's holders, Messrs. Nasmith Wilsons, and the Westinghouse team, who are also past holders of the trophy. The committee and secretary of the above club have worked untiringly during the season.

The St. Helens Cable and Rubber Co.'s Rugby football team won the Warrington workshops' challenge cup on Saturday last. The opposing side in the final round was Pearson & Knowles Ironworks, but we are credibly informed that as the St. Helens backs "were principally from the C.T.S. cable department, they were well able to withstand the mettlesome onslaught of their opponents." Thirty clubs competed, and the odds were 3 to 1 against St. Helens in both the semi and the final ties. The event was celebrated by a dinner and a music-hall show for the victorious team, who also won gold watches presented by the Warrington Football Club.

**Imperial College of Science and Technology.**—The fifth annual report of the Imperial College for the year ended August 31st, 1912, was issued recently. The total number of students under instruction during the year was 928, as compared with 887 in the previous year. Of this number 779 were full-time and 149 part-time students.

**The Wireless Telegraph Report.**—A correspondent writes as follows:—The report called for by the Postmaster-General on the merits of long-distance wireless telegraphy has been presented to Parliament by the Committee. There is no cause to question the ability of those appointed to consider this subject from a technical point of view, but the report perhaps would have been more useful if a telegraph man—and there exist such as know telegraphy in all its branches, commercially and technically—had formed part of the Committee, and clause 17 of the report, given here, might then have contained more commercial details:—  
"Clause 17. The Marconi Co. is, we are satisfied, working on a commercial scale between Clifden and Glace Bay, a distance of about 2,300 miles, though at present the number of messages transmitted either way is not so great as to require duplex working or high-speed transmission. We were, however, present when messages were transmitted automatically at the rate of 60 words (of five letters) a minute, and we see no reason why this rate should not be considerably increased if it becomes necessary. The communication is practically continuous, though there are no doubt, periods when the signals become very weak, and even occasional periods when no signals can get through. Periods of this nature are due to natural conditions, and will be incidental to the working of any system. During such periods communication can, in our opinion, be ensured only by the use of great power in the aerial. We understand that for this reason, and having regard to the increased power required for high-speed transmission, the Marconi Co. proposed to employ for the Imperial stations practically double the power now used at Clifden. Even so, we think there may be periods when communication is impracticable, especially in tropical regions where atmospheric disturbances may be expected to cause more difficulty than over the Atlantic."

It does not seem quite plain what is meant by "working on a commercial scale," and we think, says the writer, that when the cost of wireless installations is separated from the manufacture a

the expenditure on maintenance and working and capital charges is placed against the receipts, it will be found there is a considerable deficit in many, if not nearly all, wireless installations, and therefore, what we require set out, if we are to understand the actual facts, as to working on a "commercial scale," is the above information in plain figures and not general terms.

With regard to the communication being "practically continuous." To enable this to be understood in anything less than the general terms used, there would, we think, have to be a trial extending over a whole year and during the various seasons, and a daily record would have to be made.

It is well known that any speed can be sent, and, at times, received, but this is not telegraphy.

**Lightning Storm.**—Considerable damage was done last week by a violent storm which raged in various parts of the country. At Hull a man was blinded by a flash of lightning. Telephone services were disorganised, and buildings seriously damaged, by lightning, but the accompanying floods caused by the deluge of rain gave rise to the worst consequences.

**Victorian Railway Electrification.**—The *Australian Mining Standard* gives the following latest information regarding the above scheme, and the contracts in connection therewith:

"The following contracts have been let by the Victorian Government for the manufacture and supply of plant and rolling stock in connection with the intended electrification of the suburban railways:—(a) Steel work for power station buildings and sheeting of roof, also complete equipment for one boiler house, Messrs. Babcock & Wilcox, £258,220; (b) turbo-alternators and transformers, four 10,000-kw. sets, Messrs. C. A. Parsons & Co., £122,235; (c) sub-station equipment—this is a schedule of rates contract, and the Commissioners undertake to order from contractors, Siemens Dynamo Works, Ltd., within one year, plant to the extent of 60,000 kw., at an estimated cost of £168,000; (d) electrical equipment for cars, 400 each for motor and trailer coaches, the General Electric Co., of New York, £678,180. The Commissioners also hold options, operative for two years, under these contracts, for the second boiler house, two additional generating sets, 15,000 kw. of sub-station plant, and car equipment for 100 motor and 50 trailer coaches, which form the balance of the scheme as provided for in the report submitted by Mr. Merz. As it is imperative that foundations, conduits, &c., shall be ready before the end of this year, Mr. Merz is pushing on with the preparation of plans, and he has informed the Railway Commissioners that he hopes to be able to despatch them during May. After that, the plans for other branches of the work will be pushed on with, and further details are now being prepared by the departmental officers to enable Mr. Merz to carry the work through as expeditiously as possible. It is expected that the power station will be practically complete by the end of next year; and that the first line to be converted, that between Sandringham and Broadmeadows, will be electrically operated by May or June, 1915."

**Institution and Lecture Notes.**—ASSOCIATION OF MINING ELECTRICAL ENGINEERS (WEST OF SCOTLAND BRANCH).—At a joint general meeting of this branch and the Scottish Branch of the National Association of Colliery Managers in Glasgow on Saturday last, Mr. W. H. Telfer, general manager of Neilsons and Clyde Coal Co., read a paper on "Power Transmission in Mines." Mr. Telfer considered that fairly large collieries or groups of collieries requiring generating plant of 400 kw. and upwards, ought to have their own plant.

**ROYAL INSTITUTION.**—In a lecture on "Polarised Light" recently, Dr. T. M. Lowry pointed out the exceptional merits of the mercury arc as the source of light in optical investigations, the pure yellow, green, and violet rays being particularly prominent in its spectrum.

**IRON AND STEEL INSTITUTE.**—At the annual general meeting of the Institute last week, the Council reported that 108 new members were elected during the year 1912, and that the total membership at the end of the year was 2,119. The total receipts for the year were £6,483, and the expenditure £5,793, leaving a balance of £690. The invested funds of the Institute amounted to £13,213. The Carnegie Gold Medal was awarded to Dr. J. Newton Friend, Worcester, for his research work on the corrosion of iron and steel. A Carnegie scholarship award of £100 was made to Mr. W. H. Patterson (Birkenhead), to enable him to continue his investigations on the constitution and combustion of fuels. The Bessemer Medal was awarded to Mr. Adolphe Greiner, general director of the steel works of Messrs. John Cockerill, Seraing, Belgium, who was responsible for the introduction into Belgian iron and steel practice of the basic processes, and had been to the front in the utilisation of blast furnace and coke oven gas.

The annual dinner of the Institute was held on Thursday evening at the Hotel Cecil, Mr. Arthur Cooper, president, occupying the chair. About 450 persons were present.

**SOCIETY OF ENGINEERS (INCORPORATED).**—At a meeting of the Society on May 5th, a paper on "Tidal Waters as a Source of Power" was read by Mr. C. A. Battiscombe, the object of the paper being to draw attention generally to the commercial possibilities of hydro-electric installations in the British Isles, more particularly with regard to the use of the tides. The author points out that the head of water available for actuating turbines cannot exceed one-third of the range of minimum tides. The form of installation required for a continuous output of power is then discussed. An outline is given of the arrangements proposed for the constant maintenance of a working head, by means of a chamber for the turbines, connected by valves to the tidal way and to three reservoirs in which the tidal water may be impounded, with a description of the

proposal of sequence of flow between the tidal way and the reservoirs. It is claimed that the utilisation of the tides for power purposes presents few engineering difficulties as far as principles are concerned, but that the real difficulty lies in the question of cost, and therefore in the choice of the site and in the design of the structural details. It is submitted that not only can the tides be utilised as a constant source of power, but that, taken in conjunction with the power that could be derived from fresh-water rivers, their utilisation would be a great gain to the commercial and industrial interests of the United Kingdom.

The Society held a Bohemian Concert at the Holborn Restaurant on May 3rd, when a varied musical programme, arranged by Mr. Charles Capper, was listened to with much pleasure by the large audience of members of the Society and their friends.

**INSTITUTE OF METALS.**—The annual autumn meeting of the Institute of Metals will this year take place in connection with the Ghent International Exhibition, the dates fixed being August 28th, 29th and 30th. Among many important papers to be communicated will be the report of the Corrosion Committee. Gentlemen desirous of attending the Ghent meeting should send in their forms of application for membership to the Secretary of the Institute, Caxton House, Westminster, S.W., not later than July 31st.

**INSTITUTION OF CIVIL ENGINEERS.**—At the annual general meeting, held on April 29th, the result of the ballot for the election of officers was declared as follows: President, Mr. Anthony George Lytler, M.Eng. (London); Vice-Presidents, Mr. B. H. Blyth, M.A. (Edinburgh); Mr. J. Strain (Glasgow); Mr. G. R. Jebb (Birmingham); Mr. A. Ross (London). Amongst the other Members of Council are Mr. J. A. F. Aspinall, M.Eng.; Col. R. E. B. Crompton, C.B.; Mr. Basil Mott (London); Mr. Dugald Clerk, F.R.S.; and Mr. Edward Hopkinson, M.A., D.Sc.

**INSTITUTION OF CIVIL ENGINEERS (STUDENTS).** The thirty-eighth annual dinner took place at the Trocadero Restaurant on Wednesday, last week. Mr. R. Elliott-Cooper (President of the Institution of Civil Engineers) presiding.

**INSTITUTION OF ELECTRICAL ENGINEERS.**—The following are the names of the authors, and titles, of the papers which will be discussed at the joint meeting to be held in Paris, with the Société Internationale des Electriciens, from May 21st to 24th.—"High-Tension Continuous-Current Traction," by M. Gratzmuller; "Single-Phase Traction," by M. Latour; "The Electrification Schemes of the Chemin de Fer du Midi," by M. Julian; "The Electrification of the Paris Suburban Lines of the State Railway," by A. N. Mazen; "Railway Electrification Problems in the United States," by H. Parodi; "Petrol-Electric Motor-Trains," by J. B. Damoiseau; "Long-Distance Transmission of Electric Energy (Continuous-Current)," by J. S. Highfield; "Long-Distance Transmission of Electric Energy (Three-Phase Current)," by H. Leblanc; "Automatic Telephony: Application of Mechanical Devices to the Assistance of Manual Operating in Telephone Exchanges," by W. Slingo.

**I.E.E.—MANCHESTER SECTION.**—The report of the Committee shows that the number of members at the close of the session was 812, an increase of 27 over the figures of last year. For the session 1913-14, the chairman will be Prof. E. W. Marchant; vice-chairmen, Dr. E. Rosenberg and Mr. P. P. Wheelwright; ordinary members of Committee, Messrs. C. C. Atchison, C. J. Beaver, K. M. Faye-Hansen, H. J. Hawkins, E. L. Hill, E. M. Hollingsworth, G. Layton, A. E. KeKenzie, B. Thomas, Prof. Miles Walker, B. Welbourn, F. H. Whysall; past chairmen, Messrs. J. S. Peck, Wm. Cramp, and A. A. Day; hon. secretary and treasurer, Mr. Julius Frith, The Homestead, Victoria Park, Manchester; assistant secretary and treasurer, Mr. A. L. Green, 8, Westminster Avenue, Manly Park, Manchester. The report of the Students' Section, which numbers 197 members, shows an average attendance at meetings of 42. Mr. H. A. Carney is vice-chairman, and Mr. A. T. Robertson hon. secretary.

**ROYAL INSTITUTION.**—The annual meeting was held on May 1st, Sir James Crichton-Browne, treasurer and vice-president, in the chair. The annual report of the Committee of Visitors for the year 1912, testified to the continued prosperity and efficient management of the Institution. Thirty-nine new members were elected in 1912. The Duke of Northumberland is president for the ensuing year; secretary, Mr. Alexander Siemens; and the managers include Sir William Crookes and Mr. A. A. Campbell Swinton. Among the visitors are Mr. Dugald Clerk, Mr. R. Kaye Gray, Mr. H. R. Kempe, Mr. C. E. S. Phillips, and Dr. W. N. Shaw.

**Wages During Sickness.**—A vigorous conflict is proceeding between the Leeds and Bradford Chambers of Trade and the National Shop Assistants' Union in regard to the Chambers' proposal that assistants shall sign a printed agreement relieving the employer of the newly discovered Common Law liability to pay full wages during absence through sickness. Negotiations have been fruitless. The Chambers insist on maintaining their position and the Shop Assistants' Union have sent special agents into these districts to persuade assistants to join the Union. These agents are addressing public meetings on the question wherever they can get the opportunity, and are threatening to compile and publish a black list of tradesmen who insist on the signing of the agreement.

**London Chamber of Commerce.**—The annual meeting of the Chamber was held on April 24th. The annual report, in dealing with the Electrical Trades Section, states that at the first meeting of this Section attention was given to the important municipal trading test of "The Sheffield Corporation versus Davidson," in which an injunction was obtained restraining the Sheffield Corporation from carrying on the business of supplying electric light fittings and electric bells in competition with other contractors in the city. The Sheffield Corporation afterwards

sought Parliamentary powers to carry on the business of making electric fittings and wiring premises. The Section approved of the objections of the Electrical Contractors' Association to this interference with legitimate private enterprise, and supported the opposition in Parliament. A circular letter was issued to interested members asking for financial support to the Parliamentary opposition, and a sum of 50 guineas was obtained, partly from the funds of the Municipal Trading Committee and partly from other subscribers.

Dealing with the International Congress on the application of electricity held at Turin in 1911, the report states that Mr. Leon Gaster, who had been appointed as the Section's representative, reported fully as to the proceedings, and that a resolution had been adopted urging the appointment of an International Commission to consider all methods of lighting and technical problems connected therewith.

The Section endorsed the action taken by the Institution of Electrical Engineers, in opposition to the proposed removal of certain exemptions granted to the electrical industry under Sections 54, 55 and 56 of the Factory and Workshop Act, 1911, on the grounds that such exemptions were necessary owing to the circumstances of the employment and the requirements of the public, and authorised the chairman to take all necessary steps in support of the Section's views. The views of the industry were, to some extent, covered in the report of the Committee which, though recommending the withdrawal of the exemption, suggested that the case of electrical stations might be met by a special provision allowing the employment of boys of 16 years between 6 a.m. and 12 midnight for a specified period. Other matters mentioned in the report were the Second Census of Production and the Light Railways Bill.

**Fire Prevention.**—The British Fire Prevention Committee's Testing Station, near Regent's Park, which has been recently extended and altered, was reopened on Wednesday, when high-temperature fire tests with fire-resisting glazing (Luxfer electro glazing), and with fire-resisting party wall doors (Chubb's reinforced concrete doors), were carried out.

**Birmingham Electric Club.**—At a meeting of the Club, on Saturday, two interesting papers were read, one by Mr. Fennel, on "Purchased *versus* Home Generated Power," and the other by Mr. F. W. Foster, on "Direct *versus* Alternating Current for General Works Power."

**A Dead-Short Romance.**—She was a sweet 17 (S.W.G.), single as yet. In feature amperious, in form she was flexible. Her dress, taped and braided, was a double cotton-covered overall. Such was the alluring specification of Miss Milly Meter.

He was middle aged—35/40—and, temporarily stranded far from ohm by a volt-face of fortune, had become a conductor. Never a great feeder, a continuous diet of currents had made him more wary than ever. But still he did his jute-y; he was essentially a V.I.R.—good Latin for a Man.

They met. She tendered a copper (100 per cent. M.S.) for her fare. He, in a state of high tension, dropped it. Both went to earth to recover it. Their heads made contact, and their hands. She responded to his ami-cable pressure, without resistance; was she not his twin soul?

The rest was easy. Over a three-cores lunch compounded of ezo-kerit and gutta-percha, he proposed; and she, after a show of refusal, did the usual coy consent trick. Their lips short-circuited. (That's the bit u men—you sentimental men—were waiting for, Watt!) A short en-gauge-ment, and they were married, spliced, joint in holy matrimony; and lead thereafter a life of bliss. You see 'em, eh?—H. R. T.

**The Neon Lamp.**—In a paper read before the Société Internationale des Electriciens, an account is given of an experimental research upon the neon lamp with other "luminescent" lamps, and the curious fact is brought out that the candle-power of this lamp cannot be determined. The difficulty arises from the red colour of the neon light, that being a colour for which the sensibility of different observers' eyes varies enormously; the candle-power measurements ranged between values in the ratio of no less than 1 to 3, and there was no particular value round which the observations were grouped. On the other hand, all the observers were agreed on the increase of visual acuity with high intensities of illumination with neon light; and as regards fatigue of the eye, the neon tube was the best of all the light sources tested.

**A Large American Sign.**—A mammoth electric sign has been erected on the roof of the Majestic Building in Milwaukee, Wis. The sign will consist of the single word "Gimbels," to advertise the department store of that name. The sign is 150 ft. long and 54 ft. high; each letter is 34 ft. high. The total weight is about 16 tons. 10,000 ft. of copper wire were used in wiring the letters. The total candle-power installed is about 32,000, and the cost of operation is estimated at \$10,000 annually.—*Elec. World.*

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—The Hammersmith Electricity Committee having considered applications for additional increases in salaries from a number of officers in the electricity

department, recommends that the maximum of Mr. H. R. WATTS, meter assistant, be increased to £175 per annum, to be reached by two annual increments of £12 10s. each; that the maximum of Mr. T. A. TAYLOR, mains superintendent, be increased to £175, to be reached by two annual increments of £12 10s. each; that Mr. T. H. MEACOCK, wages clerk (Class 5), be promoted to Class 4 at a salary of £100, rising by £5 to £130 per annum; and that no action be taken on the other applications.

The Islington B.C. last Friday appointed Mr. W. E. BRADSHAW, of the Charing Cross, West End and City Electric Supply Co., Ltd., to the position of mains superintendent, recently rendered vacant by the resignation of Mr. T. A. G. MARGARY.

The Dublin Corporation had before it on Monday a recommendation of the Electric Supply Committee, that the salaries of the City electrical engineer, Mr. MARK RIDDLE, be increased from £750 by annual increments of £50 to £1,000; that of Mr. L. J. KETTLE, deputy electrical engineer, from £400, by annual increments of £50, to £600; and that of Mr. GILBERT ARCHER, chief distribution engineer, from £350, by £25 per annum to a maximum of £450 a year.

It is stated that the appointment that is being taken up by Mr. H. H. COZENS, late of Hampstead, is that of general manager of the Toronto electric system, under the Toronto Electric Commissioners.

Mr. J. H. KIRK, shift engineer at the West Bromwich Corporation Electricity Works, is leaving in order to take up a similar position in the Chiswick power station of the London United Tramways. On behalf of the staff at West Bromwich he has been presented with a suitably inscribed silver cigarette case.

Mr. W. H. WOODS, on leaving the Weardale power station, was presented by the staff of the Cleveland and Durham Electric Power, Ltd., with a non-magnetic centre second stop watch and a fountain pen. Mrs. Woods was presented with a gold brooch.

Mr. T. W. MACKAY, late shift engineer with the Cleveland and Durham Electric Power, Ltd., has been appointed to a staff position with the Hong-Kong Electric Lighting Co.

The Colne T.C. has decided to increase the salary of the electrical engineer, from £300 to £325 per annum.

**Tramway Officials.**—At a meeting of Southport Tramways Committee on May 1st, Mr. B. ANDREWS, formerly manager of Southend Corporation Tramways, and manager to the Malta Tramways Co. for three years, but latterly engaged with a firm of engineers in Otley, was appointed manager of the Southport Tramways at £200 per annum. There were 106 applicants, and Mr. Andrews was chosen from five selected candidates.

Mr. EDGAR HARRY COCKSHOTT, formerly chief engineer of the London United Tramways Co., Ltd., has been appointed to the position of assistant engineer to the London Underground Electric Railways Co., Ltd.

**General.**—Mr. E. GARCKE was, on Monday, elected a member of the Royal Institution.

Mr. ALFRED W. BEUTTELL has removed to 203, Victoria Street, London, S.W.

Mr. GEORGE C. HAMILTON, of Knutsford, a member of the firm of Messrs. Drake & Gorham, has been adopted as the Unionist candidate for the by-election in the Altrincham division, caused by the resignation of Mr. J. R. Keby-Fletcher, M.P.

Mr. ANDREW WILKINSON has just taken up the position of works manager to the Anti-Attrition Metal Co., Ltd., Glengall Works, London, S.E. Mr. Wilkinson for the past five years has been in the service of the London County Council as works superintendent of their tramway repair depôts.

The staff of Messrs. Crompton & Co., Ltd., at the Arc Works, Chelmsford, has presented a cabin trunk, a Gladstone bag, and an inscribed silver cigarette case, to Mr. A. DOWSETT, who, after 13 years' service on the staff, is leaving to take up an appointment on an Atlantic liner.

*Indian Engineering* states that Mr. J. H. CARDEW, electrical engineer, Oudh and Rohilkhand Railway, is permanently transferred to the North-Western Railway as electrical engineer of that line. He will have charge of the electrical department of the Oudh and Rohilkhand Railway, in addition to his own duties, until further orders.

The Right Hon. LORD CASTLETOWN, of Upper Ossory, K.P., C.M.G., Chancellor of the Royal University of Ireland, has been appointed chairman of the Governors of Faraday House Electrical Training College, in succession to the late Earl of Crawford, K.T., F.R.S.

**Wills.**—Mr. JAMES TANGYE, one of the founders of Tangyes, Ltd., left £13,161.

Mr. HENRY DRAKE, chairman of Callender's Cable and Construction Co., and of the Anchor Cable Co., Ltd., left £69,634.

Mr. WILLIAM BULLOUGH, of Messrs. Howard & Bullough, Ltd., Accrington, left £187,835 gross, and net personally £185,652.

Mr. GEO. MATTHEY, F.R.S., of Johnson, Matthey & Co., Ltd., left £305,252 gross, and net personally £301,067.

**Obituary.**—We tender our deep sympathy to Dr. J. T. Bottomley, LL.D., F.R.S., upon the death of his wife—daughter of the late Chas. R. Blandy, Esq., of Madeira—which occurred on Tuesday last, after a few days' illness.

## THE BROMPTON AND KENSINGTON ELECTRIC RESTAURANT.

ONE more proof that electric cooking in this country has at last been roused from its coma, and is henceforth to be regarded as a serious commercial proposition, is to be found



THE BROMPTON AND KENSINGTON CO.'S ELECTRIC RESTAURANT IN EARL'S COURT ROAD, S.W.

in the admirable equipment of the premises in Earl's Court Road (a few doors from the District Railway Station), which the Brompton and Kensington Accessories Co. has, during the past few months, converted into a fine electric restaurant, the main hall of which is illustrated here with the mezzanine or gallery room in the background.

No pains have been spared to make the premises worthy of their high destiny, and the architects, decorators, and furnishers, are to be complimented upon their intimate acquaintance with, and realisation of, the conditions and surroundings best securing the comfort and convenience of tired and hungry humanity. In addition to the main hall and mezzanine, there is provided a snug tea room and a telephone cabinet. Adjacent to the dining hall there is an inquiry office and a sale room, so that those who have consumed food of one description or another—varying from the portly steak to the daintiest of tea cakes—in full sight of some of the gleaming "armour plated" ranges which

have cooked their viands, and which are still cooking—as the red signal lamps and nothing else testifies—these persons may at once take the first steps towards becoming "consumers" in the best sense of the word, and realising in their own homes those advantages of which they have lately had tangible proof.

On April 30th we were guests of the chairman and directors of the company on the occasion of an inaugural banquet comprising nine excellent courses. Every dish was cooked exclusively by electric heat, and by the time these lines are published, the restaurant will be opened to the public, and, the refrigerating plant being completed, "electric ices" will be added to the menu.

Among the guests participating in what was a no less historical than enjoyable ceremony, were Messrs. A. B. Anderson, H. H. Berry, S. Beeton, R. A. Chattock, J. Christie, F. A. Cortez Leigh, J. C. L. Coward, K.C., W. F. Davies, R. S. Downe, J. S. Highfield and A. H. Scabrook. At the conclusion of a meal, during which, to judge from the snatches of conversation which reached us, golden opinions were formed which will lead to very brisk cooking business in the near future, the toast of "The King" was received with enthusiasm, and Mr. Coward rose to propose "Success to the New Enterprise." The speaker recalled those occasions on which he had been compelled by professional engagements to criticise the policies and methods of the company in whose house he now found himself a guest. Under these circumstances, he was pleased to find that his beer had not been poisoned! On one occasion when he had promoted an electric tramway Bill, Lord Ravensworth had stigmatised as preposterous and intolerable the suggestion to have two naked conductors alongside the track. As development had been wide and rapid since those days, so he felt sure it would be henceforth from the epoch marking function at which they were present that night. In replying to this toast, Mr. H. R. Beeton (chairman of the Brompton and Kensington



THE MAIN RESTAURANT, SHOWING GRILL AND MEZZANINE.

Electricity Supply and Accessories Companies), remarked that 25 years ago he had made so many statements and

prophecies (in connection with the inauguration of the Brompton and Kensington electricity supply), which time had proved incorrect that he proposed to be extremely reticent on this occasion. One of the extraordinary statements to which he had lent his name in the past was that electric lamps gave no heat. Gas had been routed from the lighting field, but was at present entrenched in the field of cooking. During recent years the cost of electrical energy had been reduced 75 per cent., and in the near future electric cooking would far exceed electric lighting in importance as a central station load. The reliability of electrical apparatus had been proved beyond doubt, and the persistent ingenuity of gas-cooker designers had paved the way for rapid developments in electrical apparatus. He regarded the present restaurant undertaking as a sober, serious business proposition, and when the L.C.C. entered into its inheritance he believed that the Brompton and Kensington Accessories Co. would be in a position to continue its business independently, thus ensuring continued prosperity to the shareholders.

A short but excellent musical programme followed, and the guests were then free to wander where they would from the luxurious public rooms to the gleaming kitchens on the first and ground floors and to the hot water pit, the refrigerator

main kitchen, which is part of the restaurant (being situated on the first floor and approached through a plate-glass door), the ordinary visitor will be welcomed at all times, and will thus be able to appreciate the convenience and extreme cleanliness appertaining to an electric service.

Another feature of the restaurant is a supply of current on every table, and visitors may, if they wish, carry out small cooking operations with toasters, chafing dishes, &c.

Each table is provided with one or more bell pushes, by which a signal lamp corresponding with the table is lighted up in the service room, and remains lighted until the particular table is attended to.

The electrical equipment has been supplied by various manufacturers to the design and specification of the Accessories Co., and is based on experience gained at the "Queen's Head" Electric Restaurant, Earl's Court, last summer, and the results obtained on the company's own and consumers' premises during the past three years,

which have enabled them to produce apparatus which is suitable for the purpose in view, and able to stand up to its work under everyday conditions.

In the main kitchen is provided one large cooking suite having a loading of 70 kW., controlled by 58 switches; there are nine ovens in the lower part, of various sizes and loadings for different cooking operations. At the extreme right,



ELECTRIC COOKING RANGE.



THE ELECTRIC KITCHEN.



THE TEA ROOM.

THE BROMPTON AND KENSINGTON CO.'S ELECTRIC RESTAURANT.

room and the transformer chamber in the basement. The neat black and bright metal work and the spotless paint and woodwork lent to the strictly utilitarian parts of the premises a distinctly naval atmosphere.

The restaurant has a seating capacity of from 90 to 95 persons. The lighting, cooking, bread baking, ventilating, heating of the building, water heating, refrigerating, cleaning, signalling and time service are all accomplished electrically. In the

there are two steamers for vegetables, fish, puddings, &c., and immediately adjoining, ovens for baking all varieties of bread and rolls required in the restaurant. At the left hand side there is a large fish fryer, adjoining which is a grill and toaster. On the main hob are fitted 12 boiling plates of various sizes and loadings. Running along the top of the suite are switch indicator lamps, and immediately underneath are hot cupboard for silver.

The other equipment in the main kitchen comprises an electrically-heated coffee roaster, electrically-driven meat chopper and coffee grinder, bain marie, fish kettle, stock pot, egg boilers, &c.

The hot water in the kitchen and scullery on this floor is supplied by a "Cooper" water heater.



FIG. 1. THE MEZZANINE, B. AND K. ELECTRIC RESTAURANT.

In the main restaurant is fitted a large double grill, together with a carving table and hot cupboards, and hot plates are fitted throughout the establishment, so that hot dishes may be served hot, and not warm.

One of the basements is fitted as a messroom, where the restaurant staff, numbering about 18, will have their meals served and cooked. The installation here will be shown under ordinary working conditions to visitors. There is also on the first floor a small model kitchen fitted with the usual pattern of domestic stove.

Another basement contains refrigerating plant for supplying the cold chamber and making ice, and a 100-gallon "Cooper" heater supplying hot water for general purposes.

The ventilating arrangements comprise duct-work by means of which the air is drawn in from outside—cooled in

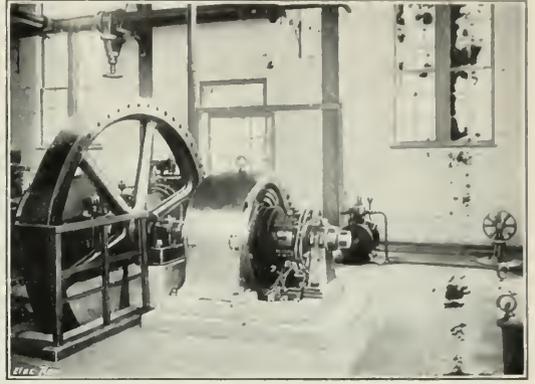


FIG. 2. 25-KW. EXCITER SET, FUSAN ELECTRICITY WORKS (see page 772)

summer and warmed in winter—and delivered to the restaurant through gratings, being afterwards exhausted by means of fans situated on the roof of the building.

The arrangements for metering all the circuits through the building are very complete and will enable accurate data to be obtained.

The illumination of the various apartments has been carefully studied, and in addition to the ordinary pendants and table lighting, some concealed lighting has been introduced. The company has, moreover, imported from New York a couple of typical "White Way" lamp columns, each carrying five globes, for exterior pavement illumination, as shown in one of our views.

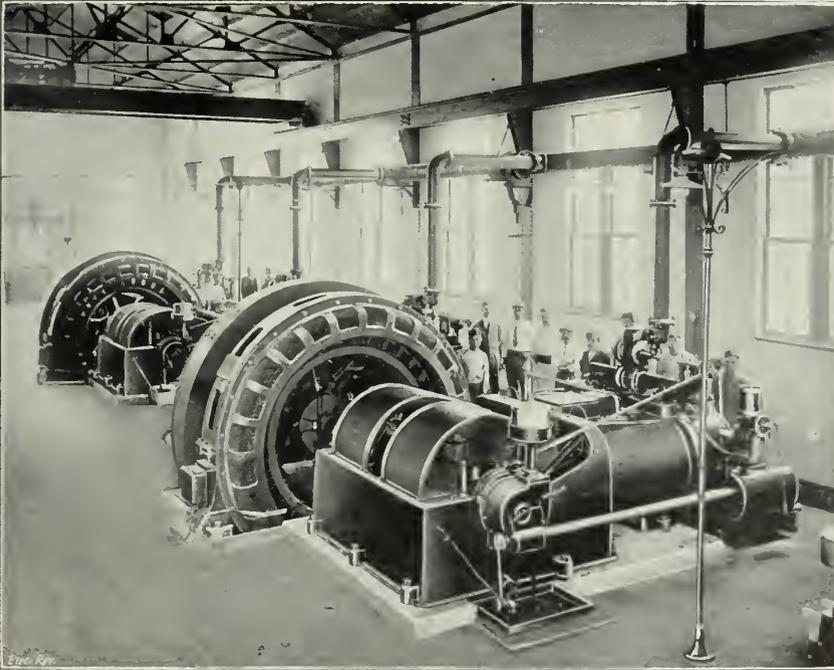
With a view to carrying out its restaurant scheme, the company's premises in Earl's Court Road have been quadrupled in size.

The adjacent basements have also been acquired, and recently the company purchased the premises of the Earl's Court Motor Garage Co.,

which adjoin and run parallel at the back, comprising over 5,000 sq. ft. superficial area.

These premises will be used as a depot and workshops for the cooking and heating business in the company's area, for development work generally, and the charging of electric vehicles.

In conclusion, we are indebted to Mr. R. S. Downe, the



VIEW IN THE GENERATING STATION, FUSAN ELECTRICITY WORKS, SHOWING ALTERNATORS (see page 772).

In the servery at the back of the main restaurant are the electrically-heated urns for the purpose of supplying tea, coffee, &c.

The loading of the whole electrical equipment is approximately 140 kW., and this is supplied from two sub-stations on the premises, each containing two 50-kw. transformers, which also feed into the adjoining network.

company's general manager, for his courtesy in giving us the fullest information; we may add that his own and his company's extensive knowledge of electrical cooking requirements is at the fullest disposal of any who may be interested in the matter.

### NEW ELECTRICITY WORKS AT FUSAN, KOREA.

By J. DOUGLAS COLLIER.

THE port of Fusan, situated at the S.E. corner of Korea, is becoming important in view of its position relative to Japan,

electricity plant with entirely new machinery, and a description of the latter may be of interest, as the new generators are gas-engine driven for parallel operation.

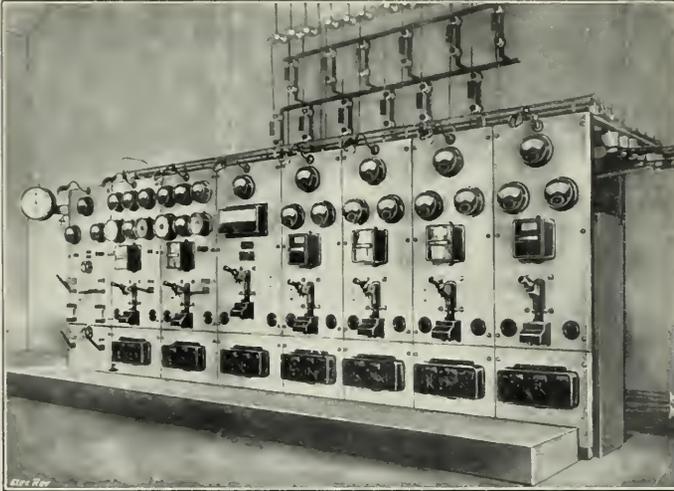
The two main sets have a capacity of 300 kW. each, at 3,500 volts, three-phase, 50 cycles, speed 188 R.P.M., and consist of four-cylinder premier gas engines with direct-coupled Bruce Peebles alternators, the rotors of which are directly mounted on the engine fly-wheels placed between the cylinders, which are in pairs. The cranks are arranged to obtain an impulse every half revolution.

Starting is effected by compressed air, working on two cylinders, and a compressor, belt driven from a 2-B.H.P. vertical gas engine, has been installed for this purpose.

There are two separately driven exciters, one of 25-kw. capacity coupled direct to a single-cylinder gas engine running at 220 R.P.M., and the other, a motor-generator, having an output of 23 kW., driven by a three-phase, 3,500-volt, 50-cycle, 750 R.P.M. squirrel-cage induction motor, supplied from the main sets. The exciters are flat compound wound for 125 volts; the capacity of either machine is sufficient to excite three 300-kw. units, allowance being made for the installation of an additional set in the future.

The switchboard, which has been manufactured by Messrs. Ferranti, Ltd., is of white Silician marble, and comprises two generator panels, one exciter panel and one A.C. motor panel, also four three-phase feeder panels.

In addition to the usual instruments, each A.C. panel is fitted with a Ferranti three-phase adjustable overload time-limit relay to work the tripping gear of the oil switches, which are operated from the exciter circuit. All the H.T. switches are fitted with red and green signal lights; the synchronising gear is of the usual synchroscope type; a three-phase static-type ground detector with water resistance cut-outs is installed in accordance with official regula-

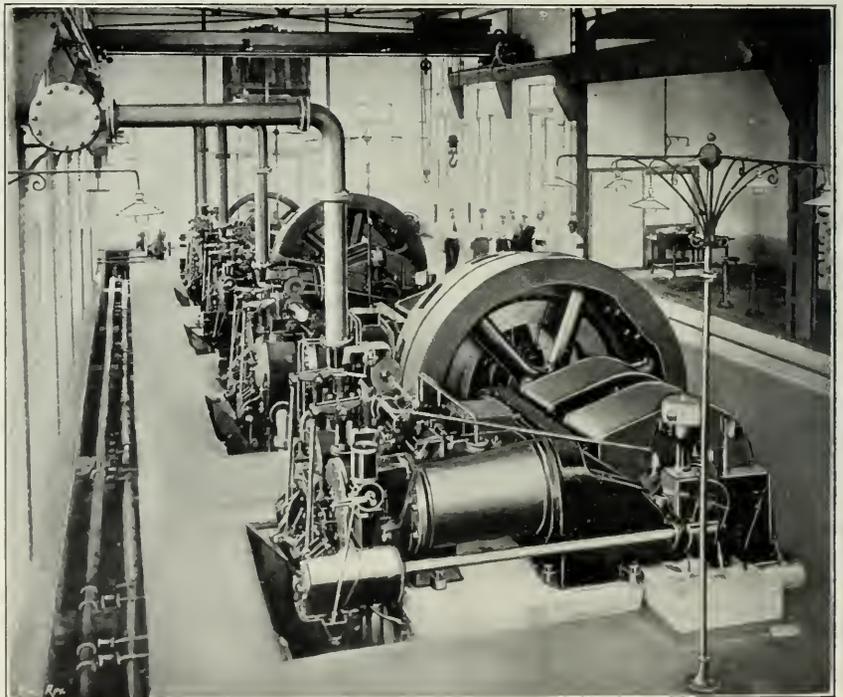


THE MAIN SWITCHBOARD, FUSAN ELECTRICITY WORKS.

and recently has become the terminus of the alternative route between Japan and Europe by the Trans-Siberian Railway, the other route being *via* Vladivostok. The population numbers about 55,000, of whom 25,000 are Japanese and the remainder Koreans.

The original electric lighting plant was installed about ten years ago: it consisted of four direct-current generators belt-driven from steam engines, having a total capacity of 180 kW., all of American make.

Following the annexation of Korea by Japan in August, 1910, a Japanese company, known as the Kankoku Gas and Electric Co., was formed to buy out the old electric light company. This company has recently installed a combined gas and



FOUR-CYLINDER GAS ENGINES, FUSAN ELECTRICITY WORKS.

tions. Spark-gap type lightning arresters, with choking coils, are provided for each feeder, all these being mounted on a separate framework on the wall at the back of the switchboard.

The engine circulating water is supplied by a two Peebles-Gwynne centrifugal pumps driven from the excitors.

As regards crane equipment, the engine room is provided with a 10-ton hand-operated crane by Messrs. Higginbottom and Mannock.

The distribution is carried out by means of overhead lines with weather-proof covering, carried on wooden poles. Single-phase oil-cooled pole-type transformers are used, having a ratio of 3,500/110 volts, the latter being the usual voltage of supply for lighting and small motors in this part of the world.

For the present, the engines are being run on gas having a calorific value of about 600 u.t.u.c. net per cubic foot, supplied from the town's gas plant; but as the ordinary lighting and heating load on the latter increases, it is intended to install a producer gas plant for the engines at a later date, and provision as regards piping and valves has been made accordingly.

The machines described operate in parallel successfully, and the load may be regulated on either generator to a nicety.

The plant has been installed and installed by the contractors, Messrs. L. J. Healing & Co., London and Yokohama, in accordance with the specification of Mr. I. Naito, engineer, Tokyo Gas Co., who has acted as consulting engineer to the Kankoku Gas and Electric Co.

## NEW COMPANIES REGISTERED.

**Thompson Bros. (Blackburn), Ltd. (128,198).**—This company was registered on April 7th, with a capital of £3,000 in £1 shares, to take over the business of motor and electrical engineers, motor-car dealers and agents, &c., carried on by Walter and William Thompson as "Thompson Bros." at Preston New Road, Blackburn. The subscribers (with one share each) are:—Walter Thompson, Norwood, Somerset Avenue, Wiltshire, electrical and motor engineer; Wm. Thompson, 50, Carnarvon Road, Blackburn, motor engineer. Private company. The number of directors is not to be less than two or more than five; the first are Walter Thompson and Wm. Thompson; qualification, £100. Solicitor, J. Taylor, 41, Ainsworth Street, Blackburn. Registered office, 15, Preston New Road, Blackburn.

**Simms Motor Units, Ltd. (128,437).**—This company was registered on April 18th, with a capital of £20,000 in £1 shares, to carry on the business of manufacturers and proprietors of and dealers in magnetos, magneto parts and accessories, motor-car motor and other carriages, boats, flying machines, cycles, &c., and to adopt an agreement with F. R. Simms. The subscribers (with one share each) are:—H. Dock, 14, Regent Street, S.W., clerk; J. A. Maynard, 14, Regent Street, S.W., clerk; A. Cleave, 59, Cambridge Road, Anerley, S.E., clerk; J. H. Jones, 37, St. Stevens Terrace, South Lambeth, S.W., clerk; H. G. Hancock, 28, Olive Street, Romford, clerk; R. Pudgen, 96, Mildenhall Road, Clapton, E.C., clerk; E. Percy, 14, Regent Street, S.W., clerk. Minimum cash subscription 25 per cent. of the shares offered to the public. The number of directors is not to be less than two or more than five; the first are F. R. Simms, W. M. Rolph, and R. Scruby; remuneration, £50 each per annum and a percentage of the profits. Registered by John B. and F. Purchase, 14, Regent Street, S.W.

**Models, Ltd. (128,331).**—This company was registered on April 14th, with a capital of £10,000 in 400 preference shares of 25 each, and 8,000 ordinary shares of £1 each, to carry on the business of manufacturers of mechanical and constructional models, including locomotives, railways, steam and small internal combustion engines, aeroplanes, &c., and to adopt an agreement with the Models Development Syndicate, Ltd. The subscribers (with one share each) are:—A. F. Brough, 66, Mildred Avenue, Watford, draughtsman; J. Crussell, 60, Leavensden Road, Watford, apprentice; W. Cox, 85, Fleet Street, E.C., printers' manager; R. Reis, 169, Fordwych Road, Cricklewood, secretary; E. M. Sutcliffe, "Escudene," Cavendish Road, Sutton, Surrey, traveller; Evelyn B. Evans, 57, Bartholomew Road, Camden Road, N.W., clerk; H. E. Ryman, 42, Springfield Road, Walthamstow, mechanic. Minimum cash subscription, £1,000. The number of directors is not to be less than three or more than nine; the first are K. Cochrane-Holroyd, A. W. Bond and F. Tibby; qualification (except first directors), £150; remuneration (except managing director), not less than £25 or more than £75 each per annum. Registered by R. Reis, 169, Fordwych Road, Cricklewood, N.W.

**Lodge Fume Deposit Co., Ltd. (128,743).**—This company was registered on May 2nd, with a capital of £9,000 in £1 shares, to carry on the business of manufacturers of and dealers in certain appliances used in connection with an invention for the production of continuous high potential electrical discharges applicable for the deposition of dust, fume, smoke, fog and mist and for other purposes, with the exception of such purposes as these for which the Agricultural Electric Discharge Co., Ltd., is licensed. The subscribers (with one share each) are:—F. H. Bretherton, Belgrave House, Gloucester, solicitor; G. Newman, Sutton House, Howard Street, Gloucester, corn merchant; W. F. Newman, 85, Park End Road, Gloucester, Private company. The number of directors is not to be less than two or more than seven; the first are Lionel Lodge and Noel Lodge, both of Marleton, Birmingham, and W. F. Newman, 85, Park End Road, Gloucester; qualification 500 shares; remuneration as fixed by the company; solicitors, Champney, Fream & Corke, Gloucester. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

**Reflecting Glass Letter Co., Ltd. (128,751).**—This company was registered on May 2nd, with a capital of £5,000 in £1 shares, to carry on the business of glass workers, sign manufacturers, electricians, &c., and to adopt an agreement with A. Stubbs and C. Persson. The subscribers (with one share each) are:—M. Selby, 46, Tudor Road, Hackney, N.E., clerk; N. C. Meredith, 69, Tasman Road, Clapham, S.W., clerk. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first; remuneration, £25 each per annum (£25 extra for chairman). Registered office, 6, Eldon Street, E.C.

**Stolz Electrophone Co. (1913), Ltd. (128,419).**—Registered April 17th, by Owen, Jones & Co., 4890, Chancery Lane, W.C. Capital £10,000 in £1 shares. Objects: To carry on the business of manufacturers, repairers and letters to and dealers in electrophones, aids to the deaf, and aural instruments generally, and to adopt an agreement with the Stolz Electrophone Co. (London), Ltd. The signatories (with one share each) are:—A. Hawdon, York Hill, Loughborough, Essex, clerk; C. Boyle, 76, Bissell Road, Bradford, clerk; Miss A. G. Jones, South Norwood Hill, S.E.; Miss G. H. Mead, Mayfield, Chappin Road, Wembley; L. M. Godfrey, 1, Herford Road, East Finchley, E. clerk; Miss W. B. Malvern, 11, Cumberland Road, Acton, W.; W. J. Kaley, 74, Mashro Road, West Kensington, W., secretary. Minimum cash subscription, 20,000 ordinary shares. The first directors (to be not less than three or more than seven) are Mr. John E. Thrill, K. (chairman), 62, Leigham Court Road, Brixham; Lord Broadhead, Wyecombe Lodge, Bechill-on-Roa, E. Clarke, 7, Westbourne Street, Lancaster Gate, W.; and J. Holt, 85, Fleet Street, E.C.; qualification, £100; remuneration, £20 each per annum (chairman, £25 lbs. extra). Registered office, 85, Fleet Street, E.C.

**Redglo, Ltd. (128,550).** This company was registered on April 21st, with a capital of £1,000 in £1 shares, to acquire from H. B. Martin certain patent rights for improvements in electrical heating and radiating apparatus; also to take over the business of a mechanical and electrical engineer carried on by him at 314, Great Ancoats Street, Manchester. The subscribers (with one share each) are:—H. B. Martin, 314, Great Ancoats Street, Manchester, electrical engineer; L. S. Taylor, 610, Royal Liver Building, Liverpool, consulting engineer; P. Hutchinson, 610, Royal Liver Building, Liverpool, consulting engineer. Private company. The first directors are H. B. Martin, L. S. Taylor and P. Hutchinson. Solicitor, O. Harley, 1, Water Street, Liverpool. Registered by T. T. Hull & Son, 22, Chancery Lane, W.C.

**E. Beekwith & Co., Ltd. (128,509).**—This company was registered on April 23rd, with a capital of £500 in 25 shares, to carry on the business of electrical engineers and contractors, founders, mechanical, steam, gas, petrol, motor and sanitary engineers, manufacturers of agricultural implements, &c., and to adopt an agreement with H. E. Beekwith, F. T. Porter and W. H. Bugden. The subscribers (with one share each) are:—H. E. Beekwith, 45, Luton Road, Barking, electrical engineer; F. T. Porter, 158, Ripple Road, Barking, electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. E. Beekwith and F. T. Porter; qualification, £50; remuneration as fixed by the company. Registered office, 3, Chester Terrace, Longbridge Road, Barking.

**Preston Portable Battery and Lamp, Ltd. (128,626).**—This company was registered on April 28th, with a capital of £2,000 in £1 shares, to adopt an agreement with J. E. Preston for the acquisition of an invention for improvements in galvanic batteries. The subscribers (with one share each) are:—A. C. Warwick, 68, Denman Road, Peckham, S.E., law clerk; W. Sullivan, 43, Dunmow Road South, Leyton, N.E., law clerk. Private company. The number of directors is not to be less than two or more than five; the first are W. E. Morum (chairman), J. E. Preston, H. Vielleville, and A. W. Pask. Registered by H. Dade & Co., 14, Queen Victoria Street, E.C.

**New English Glass Manufacturers, Ltd. (128,746).**—This company was registered on May 2nd, with a capital of £12,000 in £1 shares, to carry on the business of glass manufacturers and workers, mirror manufacturers, bottle makers, makers of electrical appliances, &c. The subscribers (with one share each) are:—A. F. Prince, 190, High Street, Dudley, licensing officer; S. Pearson, 6, Charles Street, West Bromwich, bottle manufacturer. Private company. The number of directors is not to be less than two or more than six; the first are to be appointed by the subscribers; qualification, £100; remuneration as fixed by the company. Solicitor, J. D. Harward, Stourbridge. Registered by Waterlow Bros. and Layton, Ltd., Birch Lane, E.C.

**Structural Patents, Ltd. (128,754).**—This company was registered on May 2nd, with a capital of £10,000 in £1 shares (5,000 pref.), to carry on the business of electric, mechanical, constructional, marine and general engineers, shipbuilders and repairers, founders, &c., and to acquire the rights under Patent No. 8,327, of 1904, granted to J. Lillibrook. The subscribers (with one share each) are:—T. E. Samuels, 23, Bramston Road, Harlesden, N.W., clerk; D. Macaulay, 3, Lambert House, Fortess Road, N.W., secretary. Private company. Table "A" mainly applies. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

**CORRECTION.**—In our issue of April 25th, page 691, the name of a new company was incorrectly given as *Electric Cookers, Ltd.* It should have read *Cyclictric Cookers, Ltd.*

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**General Electric Tramways Co., Ltd.**—A memorandum of satisfaction of debentures, dated June 30th, 1896, securing £15,000, has been filed. Statement under Sec. 12 of 1907 Act, old charges outstanding on July 1st, 1908; now first registered:—4 per cent. first mortgage debentures, dated June 30th, 1896, securing £15,000.

Particulars of £15,000 debentures, created February 12th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908: the amount of the present issue being £10,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Fraser & Chalmers, Ltd.**—Particulars of £100,000 debentures, created February 6th, and secured by trust deed dated March 14th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908: the amount of the present issue being £50,000. Property charged: The company's undertaking and property, present and future, including uncalled capital and certain freehold and leasehold lands at Erith. Trustees: Exploration Co., Ltd., 11, Cornhill, E.C.

**Egerton & Co., Ltd.**—Capital, £2,000 in £1 shares. Return dated February 19th, 1913, 1,511 shares taken up. £1,511 paid. Mortgages and charges: Nil.

**Borland, Hagedorn & Co., Ltd.**—Particulars of £120 debentures created March 1st, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Reform Lighting Co., Ltd.**—Debenture dated March 26th, 1903, to secure £2,750 charged on the company's undertaking and property, present and future, including uncalled capital. Holders: J. T. Zimmermann and Mrs. C. A. Zimmermann, St. Moritz, Villiers Avenue, Sarbiton.

**Cambridge Electric Tramways Syndicate, Ltd.**—Capital, £5,000 in £10 shares; return dated March 6th, 1913, 107 shares taken up: 29 Os. 4d. per share called up on 90 shares, £10 on 10 shares, and nothing on seven shares, £911 13s. 1d. paid. Mortgages and charges: Nil.

**United Sherardizing, Ltd.**—Charge created by Receiver, on company's property, present and future (in priority to debentures), dated May 15th, 1913, to secure not more than £150. Holder: W. J. Halsey, 23, Queen Anne's Gate, Westminster, S.W.

**Banbury and District Electric Supply Co., Ltd.**—Particulars of debentures for an amount not exceeding half the issued capital of the company, created December 2nd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £1,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.  
A memorandum of satisfaction in full on March 26th, 1913, of debentures, dated December 30th, 1910, securing £1,600, has been filed.

**City of Buenos Ayres Tramways Co. (1904) Ltd.** (S2,214).—Capital £1,240,000 in 45 shares. Return dated February 27th, 1913; all shares taken up; £1,240,000 paid. Mortgages and charges: £174,000.

**South London Electric Supply Corporation, Ltd.**—Issue on April 1st, 1913, of £1,400 debentures, part of a series of which particulars have already been filed.

**Paignton Electric Light and Power Co., Ltd.**—Issue on April 7th, 1913, of £500 debentures, part of a series of which particulars have already been filed.

**Pearson & Cox, Ltd.**—Particulars of £750 debentures, created February 11th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £175. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Northampton Electric Light and Power Co., Ltd.**—Issue on March 28th of £6,515, and on April 1st, 1913, of £100 debentures, parts of a series of which particulars have already been filed.

**Electrical Power Storage Co., Ltd.**—Issue on April 10th, 1913, of £5,000 debentures, part of a series of which particulars have already been filed.

**Brown & Parsons, Ltd.**—Particulars of £1,000 debentures, created March 14th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £625. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**British Mica Co., Ltd.** (72,187).—Capital, £5,000 in £1 shares (2,000 pref.) Return dated March 17th, 1913; 2,006 ord. and 629 pref. shares taken up; £1 per share called up on 629 pref.; £629 paid; £2,000 considered as paid on 2,000 ord. shares. Mortgages and charges: Nil.

**Bastian Meter Co., Ltd.** (53,304).—Capital, £20,235 10s., in 9,000 preference shares of £1, and 68,942 ordinary shares of 6s. each. Return dated March 6th, 1913, 2,011 preference and 39,672 ordinary shares taken up, 5s. per share called up on 4,272 ordinary and £1 on 2,011 preference shares, £3,062 10s. paid, including £310s. paid on forfeited shares, £3,850 considered as paid on 35,400 ordinary shares. Mortgages and charges: £2,450.

**Bastian & Partners, Ltd.** (77,601).—Capital, £2,500 in £1 shares. Return dated December 31st, 1912, all shares taken up, £907 paid, £1,593 considered as paid. Mortgages and charges: £3,325.

**Cambridge Electric Supply Co., Ltd.** (31,457).—Capital, £10,000 in £10 shares. Return dated March 11th, 1913, 3,428 shares taken up, £9 per share called up, £24,807 paid. A list of allotments filed March 27th shows a further 363 shares allotted for cash at £1 premium. Mortgages and charges: £30,000 first debentures, also one debenture, with the Capital and Counties Bank, Ltd., to cover £15,000.

**Switchgear & Cowans, Ltd.**—Particulars of £3,000 "B" debentures, created December 11th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £250. Property charged: The company's property, present and future, including uncalled capital. No trustees.

**Rawlings Bros., Ltd.**—Issue on April 11th, 1913, of £1,437 debentures, part of a series of which particulars have already been filed.

**Mexican Fuel and Power Co., Ltd.**—Issue on April 8th, 1913, of £850 debentures, part of a series of which particulars have already been filed.

**I. Frankenburg & Sons, Ltd.** (67,889).—Capital, £250,000 in 10,000 shares (12,500 pref.). Return dated February 7th, 1913; 11,323 ord. and 10,010 pref. shares taken up; £10 per share called up on 1,823 ord. and 10 pref.; £18,830 paid; £95,000 considered as paid on 9,500 ord. and £100,000 on 10,000 pref. Mortgages and charges: £15,000.

**Key Engineering Co., Ltd.** (76,459).—Capital £5,000 in £1 shares (7 defd.). Return dated November 7th, 1912 (filed April 10th, 1913; 4,070 ord. and 7 defd. shares taken up; £4,077 paid. Mortgages and charges: £3,500.

**Electric Wiring and Fittings Co., Ltd.** (29,676).—Capital, £5,000 in £1 shares; return dated February 24th, 1913; 1,382 shares taken up. £1,375 paid, leaving £7 in arrears. Mortgages and charges: Nil.

**Hove Electric Lighting Co., Ltd.** (36,942).—Capital, £100,000 in 25 shares (6,000 pref.); return dated April 2nd, 1913, all shares taken up; £100,000 paid. Mortgages and charges: £44,600.

**Hart Accumulator Co., Ltd.** (60,059).—Capital, £110,000 in £1 shares (20,000 pref.). Return dated April 2nd, 1913; 87,060 ord. and 7,059 pref. shares taken up; £1 per share called up on 31,352 ord. and 7,059 pref. shares; £38,411 paid; £55,708 considered as paid on 55,708 ord. shares. Mortgages and charges: Nil.

**Electrical and Industrial Investment Co., Ltd.**—Acknowledgement of indebtedness, dated April 18th, 1913 (given under trust deed dated August 12th, 1912), to secure £80,000 debenture stock, ranking *pari passu* with £100,000 debenture stock issued under trust deed, charged on company's undertaking and property, present and future. Trustees: Electric and General Investment Co., Ltd., 1-2, Great Winchester Street, E.C.

**X. L. Electric Co., Ltd.**—Debenture, dated April 1st, 1913, to secure £303, charged on company's undertaking and property, included uncalled or unpaid capital. Holder: Capt. C. Wesner, Ewell Castle, Ewell, Surrey.

**Ackroyd & Best, Ltd.**—Issue on March 20th, 1913, of £100 debentures, part of a series of which particulars have already been filed.

**Imperial Light, Ltd.**—Issue on April 12th, 1913, of £1,000 debentures, part of a series of which particulars have already been filed.

**Electromobile Co., Ltd.**—Issue on April 23rd, 1913, of £459 debentures, part of a series of which particulars have already been filed.

## CITY NOTES.

## Rangoon Electric Tramway and Supply Co., Ltd.

The directors' report that the amount of debenture stock available for future issue is £28,342. During the year to December 31st the company's cars travelled 1,462,285 miles, against 1,447,118 miles in 1911, an increase of 15,167 miles, and carried 10,633,328 passengers, against 9,569,922, an increase of 1,063,406; the receipts were Rs. 890,340, as compared with Rs. 842,033, an increase of Rs. 48,306, or 5.73 per cent. In the private lighting and power department the gross receipts for current supplied of all descriptions amounted to Rs. 4,80,232, as compared with Rs. 3,89,710 in 1911, an increase of 23.23 per cent.; the working expenses were 45.10 per cent. of the receipts, as against 46.13 per cent. for the previous year. The gross receipts of the house wiring and supply department amounted to Rs. 1,64,571, against Rs. 1,78,671 in 1911; although a slight decrease is shown in the total takings, the profit was Rs. 2,846 in excess of 1911, due to an improved system of working in this department and the increase in the demand for electrical articles of daily utility. The report, as given in the *Financier*, says that the general improvement thus shown is due, first, to the cessation of the economic disturbances that were severely felt in Burma during 1911, and, secondly, to a healthy expansion observable in the company's operations. The gross profits were £50,793. Interest on debenture stock absorbed £8,950; provision for redemption of debenture stock, £5,481; depreciation on meters, uniforms, &c., in Rangoon, £973; transfer to reserve for renewals, £12,500; transfer to special reserve account for cables, &c., £3,000; fees for directors, managing director and trustees, and expenses in London, £2,218; leaving £23,872, plus amount brought forward, £728, making £24,601. Deduct preference dividend to December 31st, 1912, £15,000; leaving available for dividend on ordinary shares, £9,601. The directors recommend a dividend on the ordinary shares of 5 per cent., for the year, free of income-tax, absorbing £8,850, and carrying forward £751.

## Willans &amp; Robinson, Ltd. and Reduced.

MR. J. C. PEACHE (chairman) presided on Tuesday, at the Cannon Street Hotel, E.C., over the ordinary general meeting of this company.

In moving the adoption of the report (see page 735), the CHAIRMAN said they met that day under the revised articles of association. Since the original interests of the shareholders were now represented by the "B" preference stock, the result of the half-year's working was of interest to them chiefly in regard to its bearing on the ability of the company to meet the dividend obligations on that stock. The result for the half-year was a small profit of £154, not in itself a subject for congratulation, but it was an encouraging indication for the future. This improvement was in the main due to the increased business obtained towards the end of 1911 and during the year 1912, thus keeping the shops more fully employed than had been the case for some time past, and making possible an increased output in the half-year now being considered, with the accompanying marked improvement in the accounts which that half-year showed. In regard to the future, the progress made since January 1st pointed to a continuation and extension of this improvement. A further satisfactory volume of orders had been obtained, and the output of the works continued to be good. The Diesel engine business was extending in a most satisfactory manner, and this extension had been especially marked since the opening of the present year. It was too early to speak of the effect of reconstruction on the actual work of the business, for until the confirmation of the Court was obtained last month, no step could be taken in bringing the new connection into operation, and beyond the taking up of the agreed proportion of ordinary share capital, the incoming parties had not as yet been in a position to actively foster the business, although small orders had already been received from that source. The reconstruction had, however, indirectly been of material benefit to the company. As an example, he might mention that two important contracts running into some £50,000 had recently been obtained, the orders being placed with the company, subject to the reconstruction scheme passing the Court. That was to say, had the reconstruction scheme failed to go through the company would have lost these two important contracts. This fact emphasised the urgent need there was of the reconstruction. There was every indication that the dividend requirements of the "B" stock would be met as they fell due, and, indeed, the directors had reason to believe that the obligations on the "B" stock would be more than covered—a matter of especial interest to the shareholders in that the "B" stock was also entitled to one-tenth of surplus profits. In the circular accompanying the report and accounts, the directors had called the shareholders' attention to the issue of £80,000 "A" preference capital, with its attendant right to acquire ordinary shares. This "A" stock was offered, in the first instance, to W. & R. shareholders, and the offer was an advantageous one. The issue ranked next to the debenture issues, and a reserve fund equal to one year's dividend on both the "A" and "B" stock had to be created and maintained before the ordinary shares received more than a nominal dividend; also the total of the "A" capital being limited to £30,000, there should be no difficulty in meeting the dividend requirements. He should remind them that this issue of "A" capital carried with it the right to take up 20 per cent. of the 1s.

ordinary shares. These ordinary shares were entitled to all surplus profits after the dividends on the two preference stocks had been met. W. & L. shareholders thus had the opportunity of securing an interest in the prosperity which there was every reason to hope would fall to the lot of the company in the future. The present meeting—though held under the revised articles—must be looked upon as a transition meeting, since it dealt with a period coming under the previous constitution. Meetings in the future would be held annually instead of half-yearly, and the next meeting, which would be held in the spring of 1914, would deal with the first complete year's accounts of the reconstituted company.

Mr. F. R. DAVENPORT (managing director), in seconding the motion, said he would like to endorse what Mr. Peache had said regarding the improvement shown in the last half-year. The additional work produced and invoiced in that period was the fruit of orders secured in the previous six or 12 months. Most of these orders, he need hardly say, were obtained with no little difficulty in view of their weak position, but the pursuit of these in the face of such difficulty was now bringing its reward. The contracts and orders more recently secured were of an improved character, and he had every reason for thinking that the current year's output would be a good one, and would yield a return on the reduced capital, which would be satisfactory. Steam turbine plants for the production of power on a large scale would remain the company's principal product, but the Diesel oil-engine trade was steadily increasing, and the policy of releasing themselves from the position of manufacturing a limited number of engines for another party to sell, which they would recollect prevailed for some time, had proved itself to be a good one. Contracting direct with the customer as they did now, they were establishing an excellent record for reliable and accurate work, so essential in Diesel business, which could not fail to be an advantage in the future. At present they confined themselves to the land issues of the engine, but were ready, if conditions warranted it, to start the building of certain marine types, for which, in years to come, there would be a great demand. Apart from these two most staple lines of production, they were extending the range of their manufactures and looked forward to including in that range business due to the "interests which animate the reconstruction scheme." In conclusion, he would remind them that the greatest asset they possessed to-day was the renewed confidence on the part not only of those they sold to, but also of those they bought for, without which no business could succeed; and it followed from the scheme of capital arrangement which the shareholders recently agreed to. He very much hoped that the present shareholders would avail themselves of the opportunity of taking up a portion of the new capital, so as to share in the improved outlook for the future.

The report was adopted without discussion, and the auditors having been re-elected, the proceedings terminated.

### National Telephone Co. (in Liquidation).

A GENERAL meeting of the members of the above company was held on May 1st at Hamilton House, Temple Avenue, E.C., Mr. George Franklin (the liquidator) presiding.

The CHAIRMAN said it appeared to him that the usual practice of calling shareholders together and merely telling them what had been done would not be sufficient in a company of the size and importance of that, and, therefore, they had circulated the report and accounts. Dealing with the first complete year of the liquidation from January 26th, 1912, to January 25th, 1913, the principal items were the receipt of the three millions in cash on account of the purchase money and four millions in Exchequer bonds, which only realised £3,718,419. Their interest from the Postmaster-General's investments realised an amount of £575,808. The receipts from those amounts enabled them to discharge the entire amount of the debenture stock, the three kinds of preference shares and the preferred stock. It also enabled them to pay the premium of 5 per cent. on the preferred stock, and there had been arbitration and liquidation expenses amounting to £113,000. On January 25th last £8,709 of dividends remained uncollected by the owners, and he was sorry to say that £5,500 still remained uncollected. Coming to the realisation account, the total assets were £17,421,393. They had to deduct from that the reserve funds which the company had provided amounting to £4,645,944, and there were special reserves and other provisions which the company had made, but which were not required, which amounted to another £305,131, so that they had a total of £4,951,075 of reserves to deduct from the total assets. That left them with £12,470,318, as against the amount of the award by the Railway and Canal Commission of £12,515,264. If they added to the amount of the award the sum realised from investments, sundry debtors, and cash in hand, they were able to carry forward a balance of £674,755. To that should be added certain receipts by way of interest from the Postmaster-General, both interest paid and interest which they hoped was still to be paid, and the estimated value of other assets not yet recovered, making up a total of £990,539. From that they proposed to take off arbitration and liquidation expenses paid amounting to £71,600, and the estimated balance of disbursement by the Postmaster-General on behalf of the company up to January 25th last, estimated at £30,000, making a total of £101,600. Then came the premium of 5 per cent. on the re-payment of the preferred stock, £111,250; and interest on debentures, £6,638. The loss on the realisation of the Exchequer bonds amounted to £281,580, and the further estimated loss on bonds yet to be realised amounted to £350,000, giving a total of £631,580. The estimated surplus available, subject, of course to the liquidator succeeding in

the appeal of which notice had been given by the Postmaster-General, was £137,470. Referring to the loss on the Exchequer bonds, he said that by the purchase agreement of 1905 the Postmaster-General had the option of paying three-fourths of the purchase-money awarded by the arbitrators in the form of what were called terminable annuities. The annuities were exchanged into Exchequer bonds because they believed they were a more marketable form of security than the annuities would have been, and the present position was entirely due to the fall in the value of Government securities since the date of the purchase agreement. In 1905 the highest price of Consols was 90½ and the lowest 86½ to-day the price of Consols was 71½. The Postmaster-General had been constantly urged that he ought not to exercise his option under the agreement because of this injustice to the company. They contended that the award meant value and, in the second place, it was contrary to the intention of the agreement when made, because, if Government securities, instead of diminishing so rapidly in value as they had done, had risen in value, they felt sure that the Postmaster-General would certainly not have exercised his option, and given them those Exchequer bonds. With the Postmaster-General it had been a case of "heads I win and tails you lose." However, the Postmaster-General had insisted on the exercise of his option, but he had consented in response to representations to the issue of those Exchequer bonds which were a more marketable form of security. He might tell them that nearly 17 per cent. of the award was swallowed up by that loss. He had heard comments as to the discrepancy between the large sum which the company claimed, and the amount which was awarded. If they took the total plant value comprised in what were known as headings 1 and 4 of the company's claim, they had an estimated sum of about £11,300,000, against the amount awarded by the Court for plant value, £10,239,345. If they took the overhead charges—and it was there where the company had greatly suffered—the claim amounted to £8,964,851, whereas the sum awarded was £3,335,974. As to depreciation, the company allowed £2,633,245 on their total claim, and the Court awarded a depreciation of £3,115,523 upon the amount awarded. They had a total claim of £20,924,700, and the total amount awarded by the Court was £12,515,264. The company's claim was equal to £37 5s. 6d. per station, including land and buildings, and the amount awarded was £22 5s. 11d. per station. In the House of Commons the Postmaster-General congratulated Parliament that the arbitration was over, but he had evidently forgotten that he himself had given notice of an appeal on certain points. After 31 years of existence a great business, with a gross income of nearly £4,000,000 a year, had passed over to the State. The shareholders, during the company's life, had never received more, and had often received less, than 6 per cent. per annum, and in the end, so far as they could see it now, the capital only might possibly be all that would be repaid to the shareholders. It was not an encouragement to invest in enterprises where the State had the right to purchase. He was quite sure that the company and its officers had no occasion for reproach. At the outset, the State insisted that the telephone was a telegraph, of which it had a monopoly. The State having granted a licence, and the company having provided the capital and ventured upon the enterprise, it had been subjected to the monstrous injustice of competition, the payment of an exorbitant royalty, and the refusal of proper privileges wherewith to carry on its business, which was the business of the public. The history of the company was of one continuous struggle against iniquitous restrictions, taxation, oppression and difficulties. The chairman, in concluding, said that there was no resolution to propose to the meeting, but he would be pleased to answer any questions.

In replying to shareholders, the CHAIRMAN said that, with reference to a distribution on the deferred shares, that depended upon the result of the appeal of which the Postmaster-General had given notice. When that was decided, they could proceed to make up the accounts.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in—

Letters Patent Insurance Co., Ltd.—22,148 ordinary shares of 1s. each, full paid (Nos. 1 to 19,548 and 294,549 to 297,148).  
London and Suburban Traction Co., Ltd.—1,411,409 ordinary shares of 11 each, fully paid (Nos. 1 to 1,411,409); 1,018,178 5 per cent. cumulative preference shares of 11 each, fully paid (Nos. 1 to 1,018,178); and £144,441 43 per cent. first mortgage debenture stock.

And to allow the following securities to be quoted in the Official List:—

Central London Railway.—£1,423,839 guaranteed assented ordinary stock, £469,976 guaranteed assented preferred stock, and £909,499 guaranteed assented deferred stock, in lieu of similar amounts of ordinary, preferred and deferred stock.

Pennsylvania Water and Power Co.—\$8,495,000 capital stock in shares of \$100 each.

**Craigpark Electric Cable Co., Ltd.**—The accounts for the year ended March, 1912, show a net profit of £7,437, plus £191 brought forward, making £7,628. The directors recommend that there be placed to depreciation off buildings and machinery, £1,800; dividend on 47,500 6 per cent. preference shares, £2,850; dividend on 37,500 ordinary shares, at 5 per cent., for the year, £1,875; balance of cost of new issue of preference shares, £183; balance to be carried forward (subject to payment of directors' fees for the past year), £920. The directors report the continued steady expansion of the company's business. All departments are fully employed, and the number and value of orders in hand are satisfactory. The stocks have been carefully gone over by the managing director, and are certified by him as being correct.

The meeting is called for May 12th at Glasgow

### Chiswick Electricity Supply Corporation, Ltd.

THE directors' report for the year ended December, 1912, says that the returns from the undertakings owned by the Corporation at Chiswick and Aberystwyth show good progress, and the increase in the number of consumers added during the year is satisfactory. During the year £2,634 has been expended on capital account for machinery, mains, services, &c. £615 has been written off for depreciation, and it is proposed to place a further £535 to depreciation reserve fund account, making a total contribution for the year, £1,150.

At December.	Number of consumers.	Revenue.	Profits.	Total liabilities on share and loan account.
1909	1,875	£15,129	£7,592	
1910	2,081	£15,504	£7,534	
1911	2,297	£16,338	£7,863	£142,500
1912	2,418	£18,322	£7,902	

The profits for the year, after paying sinking fund premium and trustees' fees, were £7,903. Out of this, interest on first mortgage debenture stock, amounting to £3,600, has been paid, leaving a balance of £4,303 to the credit of the net revenue account. The increase in the revenue for the year is £1,984. As influencing the profits, the account for repairs has been rather heavy, owing to an accident to one of the engines at Chiswick, while depreciation has been written off amounting to nearly twice as much as in the previous year. At Chiswick the cost of coal per unit has been higher than in the previous year, for the reasons that the price of coal was greater, and was very high during the strike, and that at the higher output a larger proportion of the units has to be generated non-condensing. As the result of experience with the Diesel engine at Aberystwyth, the directors have for the extensions required at Chiswick placed a contract for the supply and fixing of a similar type of engine, from the use of which considerable economy in fuel is expected to result. The results of the year's working will enable a dividend of 6 per cent. for the year to be paid. This dividend the directors propose to pay to the West London and Provincial Electric Supply Co., Ltd. Sir T. Brook-Hitching, who has occupied the position of chairman since the formation of the company, has resigned that position on account of ill-health, but he has consented to remain a director. Mr. Harry Kahn was elected chairman.

### United River Plate Telephone Co., Ltd.

THE annual meeting took place in London on April 29th, Mr. Geo. Franklin presiding. The chairman referred with very deep regret to the death of Sir Irving Courtenay, who was their chairman for over 26 years. The board had nominated him (Mr. Franklin) to fill the office. He hoped in that position, with the continued confidence of his colleagues on the board, and of the shareholders, to be able to do something to keep the company no less prosperous in the future than in the past. It was with regret also that he announced the death of Mr. C. H. Menzies, of the Local Committee out in Buenos Ayres. Regarding the company, he was very much impressed with the extraordinary growth of its business, and of the prospects before it at the present time. The truth was that they had outgrown the habiliments of their youth. Their articles of association were insufficient, likewise their capital plant and machinery. They had outgrown everything. The telephonic business in Buenos Ayres had increased so rapidly that they had been forced on several occasions to enlarge their plant. The accounts, as arranged at the last annual meeting, were made up to December 31st, instead of March 31st, which meant they only applied for a period of nine months. The revenue for that period from subscriptions had amounted to £400,068, as against £351,744, in the proportionate period of the previous year, which meant an increase of £48,324. The expenses in River Plate and in London amounted to £281,465, as compared with £244,038 for the same period of the previous year, or an increase of £37,427, but there was an increased profit for the period of £10,897. The increase in expenses was largely due to the enhanced cost of living in Argentina, consequent upon which wages and salaries had had to be increased. They had also incurred extra expense by placing the wires underground and by substituting one type of plant for another. During the period under review, the capital account had been increased by the amount of last year's issue of shares (40,000 shares), and the reserve for renewal of plant had been increased by £99,750, notwithstanding the writing off of special charges for replacement of the type of plant he had mentioned, and capital expenditure during the period had been increased by £270,767, of which £250,325 was in respect of plant, and £20,442 on account of real estate and buildings. There was an increase of the stock of meters of £38,000, due to the general expansion of the business, and to the difficulty of getting telephone material quickly from the manufacturers, whereas the frequent delays in the Argentine Custom house made it necessary to keep larger stocks against emergencies. A dividend at the rate of 8 per cent. per annum was again recommended. £30,000 had been added to the reserve fund account, which would make that fund total £237,792. It was also decided to put £2,000 to the staff provident fund. It was also anticipated during the present year to extend the scope and usefulness of that fund. He would like to mention that just recently a serious fire was started in one of their principal exchanges, but was quickly extinguished by the chief engineer, who was somewhat badly burned. It showed that the company was possessed of a right loyal staff, who did not at any time shrink from their duty. That being the case, he thought they ought to do as much for the Staff Provident Fund as possible. Since 1903 the Argentine had

steadily progressed. In that year the imports amounted to £26,000,000, but last year they reached £73,000,000, and the exports had increased to even a greater extent. He mentioned those facts as the prosperity of the company was locked up in the prosperity of the country. With the right kind of emigrant, the Republic ought to keep on advancing on the road of progress; 10 years ago their plant and real estate figured in their balance-sheet at about £450,000, but now it stood at something like £2,000,000. He would like to mention, however, that their exchanges were just about reaching their full limit or capacity. Any further progress would have to be accompanied by an increase in their plant. One thing, however, which affected them somewhat was the shortage of operators, in spite of the fact that they had a school attached to the works where they trained young people to become operators, eventually drafting them into the company's exchanges. Another thing which seriously hampered them was the fact that the Government out there would only grant fresh options on the understanding that those options reverted to the possession of the Government with all appurtenances, after 30 years' use, without any payment to the company whatever. They trusted, however, to get a modification of that decree, otherwise the company would be mulcted in some very heavy losses in a few years' time. This year the board had decided to ask the shareholders for a small premium of 10s. per share, which sum would be transferred to the reserve fund for the purpose of increasing the future earning power of the company. He hoped the shareholders would agree to that proposition. It would leave a fair margin of profit for them. It brought a sum of £27,000 to their reserve, which would be invested in land and buildings and plant. That would render their financial position very strong in spite of all the difficulties which he had enumerated. A new issue of 54,000 ordinary shares would be forthwith made to the ordinary shareholders at the price of £5 10s. per share.

MR. KEITH seconded the adoption of the report.

MR. T. CRAWLEY said he noticed in the papers the other day that the municipal authorities were inviting tenders for the construction of telephone tubes underground and underground tunnels for other purposes. He wanted to know if that would affect the future of the company. He should also like to know whether the company's service compared favourably with the London Telephone Service.

The CHAIRMAN said that the authorities had been inviting those tenders for many years, and if nothing else came of it, as in the past, they had nothing to fear. On the other hand, if more underground tunnels were constructed, the company would not be slow to take advantage of them.

Replying to MR. LOWE, the CHAIRMAN said he did not think they had much to fear in the way of competition from other companies, if they kept up their progressive methods.

MR. LONG, chairman of the Monte Video Telephone Co., said he had the pleasure some time ago of staying in Buenos Ayres, and during that stay made an inspection of the company's exchanges, works and other buildings. He also had many occasions to use the service, and he had to say he found it most satisfactory. He could not help being struck with the methodical way in which things were managed, and the shareholders had every cause to congratulate themselves.

A vote of thanks to the staff was carried with acclamation.

MR. PARKER, the manager in Buenos Ayres, in thanking the meeting for the vote, said it was reported in the papers recently that a severe storm had destroyed a large number of the telephone apparatus, but he would like to say it was not their company which was affected, as most of their cables were underground.

A vote thanks to the chairman, proposed by MR. KINGSBURY, concluded the business of the meeting.

**Singapore Electric Tramways, Ltd.**—The directors' report for the year ended December 31st, 1912, states that in October, 1912, the capital was reduced to £100,000 by reducing the nominal value of each share from 20s. to 5s. The accounts (says the *Financial News*) show an excess of revenue over expenditure of £34,439, the profit for the year, after charging debenture interest, depreciation, and royalty paid, being £5,358. Compared with the year 1911, tramway revenue shows an increase of £1,446. The lighting and power receipts continue to improve, being 17 per cent. higher than in 1911, and 59 per cent. higher than in 1910. The ratio of total expenses to total receipts in Singapore for the year is 52'66 per cent., or, taking only tramway working and tramway receipts, 57'25 per cent. The directors report that, after lengthy negotiations with the Municipal Commissioners of Singapore, the company has been able to secure an extension of the arrangement under which it supplies current for lighting and power purposes. A reduced scale of charges has been agreed upon, and it has been decided that the residential district of Tanjong shall be added to the present area now served by the Municipality. The contract is to be extended for 10 years from the date electric current is supplied to this new area.

**R. S. Stokvis & Zonen, Ltd.**—The directors propose to pay a dividend of 15 per cent. on the ordinary shares for 1912, to transfer to special reserve fund £13,531 and £17,045; managing directors' commission, £7,416. There will be carried forward £22,071.

**Prospectus.**—*Consolidated Gas, Electric Light and Power Co. of Baltimore.*—The list was to close on Wednesday in an issue of £700,000 5 per cent. consolidated mortgage debenture stock at 96.

### Oriental Telephone and Electric Co., Ltd.

THE annual meeting was held on April 30th, at the Great Eastern Hotel, E.C., Mr. B. St. John Ackers presiding.

The CHAIRMAN, in proposing the adoption of the report, said the directors were pleased to be able to report another prosperous year and a satisfactory increase in the business of the company. They had given their unremitting attention to that business for many years past and watched its progress closely, so that they considered themselves on this occasion in a position to recommend a higher dividend, making 10 per cent. for the year. The board had of course always felt that, with the yearly improving position of the company, the shareholders were fairly entitled to receive from time to time, as far as prudent, the benefit of increased profits; but, as he pointed out in a previous address, the directors, before giving effect to any desire they might entertain to distribute part of such increased profits among the shareholders, must be reasonably satisfied that there would be no going back. Acting on that principle, they had gradually accumulated considerable funds which were available at very short notice. They had in addition recently increased the company's holding of Consols to £20,000, and increased also the amount of their stores for sale purposes, besides spending a large amount on profitable new construction, whilst the company's investments in the affiliated companies, which were all in a highly prosperous condition, were, as they knew, very valuable. The revenues from their own exchanges, as well as those from the affiliated companies, had, during the last five years, not only maintained the increases shown annually, but had each year exhibited an increase over the previous year, and there was every evidence of these conditions continuing on their present moderate but very steady scale, so that the directors had come to this decision with every confidence in the future. It would be noticed that they had written down the total capital expenditure very considerably—below, in fact, the value placed upon their numerous installations by their different managers—and having regard to those installations being kept up in the highest state of efficiency, there would really be very little further to write off for some years to come. That condition of efficiency applied equally to their affiliated companies, so that the directors had felt justified in revising at the same time the very low valuation they placed upon their investments in these companies many years ago, and they would accordingly find their value increased in the balance-sheet to what was still a very low figure. As regarded the company's house property, he need hardly say that every care was taken to maintain this also in thorough repair and in the best possible condition. He took that opportunity again to refer to the ability and zeal with which the staff at home and abroad had worked to bring about the results which they showed, and for this the thanks of the shareholders and the board were justly due. The directors had decided the question of dealing with the pension fund by commencing investing the allotted sums in the names of two of their body to hold in trust on behalf of the company for the purpose of applying the interest to the payment of certain pensions to duly qualified members of the staff whenever the necessity for such pensions should arise. They had recommended £2,000 for this fund for the past year, raising it to £5,000, and they proposed to add substantial amounts every year.

MR. THOMAS LOYD seconded the motion, which was adopted.

### Anglo-American Telegraph Co., Ltd.

THE ordinary general meeting of this company was held on April 29th, at Winchester House, E.C.

MR. F. A. BEVAN, who presided, said that they received a fixed amount annually for the use of their cables from the Western Union Telegraph Co. They had, therefore, no questions to deal with as regards increase or decrease, and he had not to tell them anything about the management or expenses of the company. That was all carried on by the Western Union Co., who did not furnish them with any figures at all, but were very prompt in paying the annual rent of £262,500. The credit side of the accounts showed as regards the renewal fund that they had come to an arrangement with the Western Union Co. whereby the cost of new cables was borne by the Anglo Co., but all renewals and repairs to those cables were met by the Western Union. On that account the Western Union Co. were creditors to the extent of about £20,000, which would have to be taken from the company's renewal fund. The Western Union, however, were bound to keep all their cables in good repair during the term of the lease. In the revenue account the shareholders would notice that a sum of £1,621 appeared in the form of bank interest. That arose by reason of the deferred shareholders only receiving their dividend at the end of the year. The Western Union Co. paid to them the full quarter's dividend, which they could not distribute to the deferred shareholders until the end of the year. Therefore, a certain amount of interest accrued in respect of that sum, with which he hoped in course of time the company would pay a bonus to the deferred shareholders. Since they made the arrangement with the Western Union, and during the past year especially, efforts had been made by the Press, aided by the Postmaster-General, to reduce the rates of telegraphic messages chiefly by a ring system. What the result would have been he did not pretend to know, but although there might have been an increase in the number of messages, at the same time a loss might have been made. It, therefore, seemed to him that the directors were wise, and the shareholders also, in agreeing to the arrangement with the Western Union. It was much more easy for the Western Union

to bear any loss in that direction which might have accrued owing to a reduction of tariffs. Another thing they had to consider was whether an amalgamation of the deferred and preferred stock would be beneficial to the company. The directors were favourably disposed to amalgamating, but he understood several of the large preferred shareholders were opposed to the scheme. There was an argument on both sides. It would, however, be undoubtedly an advantage for them to have only one class of stock to deal with. He could not help noticing at that meeting that several familiar faces were gone. Sir Charles Burt, who was one of their most valuable directors, had passed away, and Sir Gerald Fitzgerald also. He should also like to mention that Mr. Carson had retired from the position of manager. That was a fact to be deplored. That gentleman had thrown his whole heart into the work, and had always given them of his best. Mr. Wells, who was secretary for a great many years, had also retired, likewise their old friend, Mr. Smith (the accountant). The old people passed away, but still the company went on as successfully as ever, and he trusted that when they had passed away the old Anglo-American would still be flourishing, occupying the proud position of being the first company to carry messages under the sea.

MR. BENSON seconded, and the motion was carried.

At the extraordinary general meeting held afterwards, the CHAIRMAN proposed a resolution adopting new articles of association. He said that the old articles were prepared many years ago, and were some of the first made under the Companies' Act. They were now quite obsolete, and the new conditions in connection with the arrangement with the Western Union made it imperative that certain alterations should be carried out.

The motion was carried.

**Anglo-Portuguese Telephone Co., Ltd.**—The accounts for the year 1912 record a healthy state of affairs. Contrasting the profit and loss account with that of 1911, the income for the year at £62,919 marks an increase of £5,874, but the operating and other expenses at £37,723 are £6,205 higher. Notwithstanding this factor, the directors are in a position to recommend a final distribution at the rate of 5 per cent. per annum, making 8 per cent. for the year, which was the rate for 1911, and which enables them to carry forward £5,609, which is slightly in excess of the sum brought into the account from 1911. A satisfactory feature of the accounts is the gradual increase in the amount of subscriptions received or charged in advance, less royalty and rents paid in advance, which appears as a liability in the balance-sheet at £25,859, and which, of course, represents the proportion of subscriptions unearned at the close of the financial year. If the present rate of increase both as regards the revenue and the reserves be maintained, the position is distinctly encouraging. The reserves total £75,000, which includes £12,500 appropriated from the year's accounts.

**West London and Provincial Electric Supply Co., Ltd.**—The directors' report for the year ended December, 1912, says that the company derives its revenue from the dividends on the shares of the Chiswick Electricity Supply Corporation, Ltd., which it owns, from the fees charged for managing the affairs of that Corporation, and from commission for acting as engineers in respect of additions to the Corporation's plant and machinery. The report of that company appears elsewhere. The 6 per cent. on shares in that company will be received in due course by this company, whose accounts show a balance to the credit of the profit and loss account of £3,485. The directors propose to pay a dividend on the cumulative preference shares at the rate of 6 per cent. per annum for 1912, and to pay interest at the rate of 4½ per cent. per annum on the funding certificates for the year ending 1911, carrying the balance forward. Sir T. Brooke-Hitching, who has occupied the position of chairman since the formation of the company, has resigned that position on account of ill-health. He has consented to remain a director. Mr. Harry Kahn was elected chairman.

**Alderley and Wilmslow Electric Supply, Ltd.**—The directors report for the year ended December 31st, 1912, that the total lamp connections have increased from an equivalent of 22,866 to 24,898 8-c.p. lamps. The result of the year's working shows a profit of £2,846, which, with £184 brought forward, makes £3,031, and after paying £1,766 interest on debentures and loans, there remains a balance of £1,245, of which the directors recommend that £800 should be put to reserve fund, and the balance, £445, carried forward.

**Vera Cruz Electric Light, Power and Traction, Ltd.**—The directors report that the net profits in Mexico for the year 1912 amount to £31,785, an increase of £3,901. After providing for London office expenses and bond and other interests, there remains a balance of profit of £16,744, plus £1,514 brought forward, making £18,259. From this there is transferred to depreciation and general reserve account £5,000; dividend on the share capital for 1912 at the rate of 2½ per cent., £8,750; carry forward, £4,509. The contract with the Pnaba Tramway, Light and Power Co. for the supply of power, referred to last year, has been settled on satisfactory terms, and it is anticipated that power will be available before the end of 1913.

**Kent Electric Power Co.**—Notice appeared in the *London Gazette* on May 2nd of the company's intended application to Parliament this session for powers to rearrange the capital, convert shares, repeal or amend certain Acts, and other matters.

### Colombo Electric Tramways and Lighting Co., Ltd.

THE eleventh annual meeting of the above company was held on Wednesday at the offices, St. Benet's Place. The meeting was private. The report for the year ended December, 1912, which was adopted, stated that there was a total net profit in Ceylon for the year, after deducting all current expenses, amounting to £38,041. During the year 2,456,290 units were generated, as against 2,368,032 for the previous year, the cost per unit being slightly less. The tramways receipts show a further marked improvement. The total number of passengers carried amounted to 9,884,969, as against 9,114,633 for the previous year. The lighting branch of the company's business continues to show satisfactory progress. In consequence of the steady growth of the lighting branch, and also extension to the tramway track, orders have been placed for additional machinery and rolling stock. The appeal to the Supreme Court respecting the ferry service has not yet been decided. The total available profit, after providing for debenture interest and all expenses, and including the balance brought forward, amounts to £36,506. Out of this the directors have transferred £15,000 to general reserve and renewal fund, which had been dealt with by writing off £1,000 from the track renewal account, and £4,000 from the mains and plant account, leaving the general reserve and renewal fund at £35,000. The directors recommended a dividend of 10 per cent. on the share capital, free of income-tax, amounting to £13,084, leaving £8,422 to carry forward. The directors placed on record their appreciation of the work of the staff.

### British Westinghouse Electric and Manufacturing Co., Ltd.

THE thirteenth annual meeting was held on Monday at Hamilton House, Victoria Embankment, E.C., Mr. J. Annan Bryce, M.P., presiding.

The CHAIRMAN, in proposing the adoption of the report (see *ELEC. REV.*, p. 732), said that dealing first with the debit side of the balance-sheet, the capital authorised and issued remained as before. The item, 6 per cent. prior lien debentures, was reduced by £6,300 in respect of 63 debentures drawn on December 13th, 1912, for repayment on January 1st, 1913, in accordance with the provisions of the trust deed, making in all £28,800 redeemed to date out of the profits of the company; 4 per cent. mortgage debenture stock remained as before, viz., £1,241,353. Prior lien redemption account represented the liability for the repayment of 63 debentures on January 1st of this year, plus a small balance carried forward to this year's account. Interest accrued to date on prior lien debentures and 4 per cent. mortgage debenture stock included three months' interest to December 31st, 1912, on the former and six months' interest on the latter, both of which had since been paid. Sundry creditors and credit balances, £199,387, including £49,431 reserve against maintenance on uncompleted contracts, stood at practically the same figure as last year, which was satisfactory having regard to the increased business. Advantage had been taken wherever possible by using their cash resources to obtain special cash discounts for payments before due dates. The reserve for employers' liability had been increased to £10,000, at which figure the board proposed to maintain it in the meantime. He might repeat what he said last year, that, owing to the care exercised in their shops, they had hitherto been singularly free from accidents of a serious nature. Turning to the credit side of the balance-sheet, the item "patents and goodwill" remained as before. Some of their patents had lapsed and some had been abandoned, but new patents had been acquired, the expenses connected with which had been defrayed out of revenue. For the sake of simplification they had this year, with the approval of the auditors, amalgamated the two items of works, machinery, plant, &c., starting with £1,672,677, the total of the two items shown in the 1911 balance sheet. The reserves of £51,912 which appeared in last year's accounts and which were the accumulation of several years, had been appropriated to various items comprised in the total sum mentioned of £1,672,677, and the amount put to depreciation in the present accounts, viz., £49,750 represented the amount written off for this year only, as previously there had been charged to revenue account a large sum for upkeep and maintenance of buildings and plant. Stock and material on hand, &c., £641,985, compared with £622,264, showing a slight increase over last year due to the expansion of business. Completed work on contracts, £249,310, compared with £292,024, showing a difference of £42,714. The smaller amount outstanding was satisfactory. In regard to the Underground Electric Railways Co. of London arbitration account, £95,681, the decrease of £23,916 was approximately accounted for by the result of the appeal to the House of Lords, under which the Railway Co. returned to them the amount of the original award, thus leaving them in the same position as before the award was given. The amount outstanding was still considerable, the exact value of which, to them, must depend upon the result of the further reference to the arbitrator. Sundry debtors—less reserve, £237,193, was some £56,000 odd in excess of last year owing to the increase of the business. Ample reserve was made for bad and doubtful debts which, considering the volume of business, constituted but a very small percentage. Shares and debentures in other companies were slightly less than last year owing to certain depreciations having been made with regard to some of the minor items. Bills receivable, cash at bankers and on loan amounting altogether to £115,677, compared with £61,711 last year, showing an increase of £53,959. This increase was partly due to better terms of payment and the careful attention paid to collections. Coming to the profit and loss account, the trading profits of 1911

amounted to £126,144, as compared with £112,539 in 1910. In 1912 they amounted to £157,871, or an increase of £45,332 over 1910, and £31,727 over 1911. This result was encouraging. The prospects for the current year were so far promising. Orders received this year were in advance of those booked up to the same time in 1912. The first three items on the debit side were the same as last year. Expenses on surplus land and buildings had been reduced from £4,254 to £3,033. This reduction was mainly due to the fact that they were now fully occupying the steel foundry building for the manufacture of other products. Amount written off works, machinery, plant, &c., £43,450, was £12,582 more than was devoted to this purpose last year. The net profit for the year, £41,074, showed an increase over the same item last year of £20,366, and compared as follows with recent preceding years:—December 31st, 1908, loss £6,521; December 31st, 1909, loss £799; December 31st, 1910, profit £12,437; December 31st, 1911, profit £20,708. There had thus been a continued steady improvement. Towards the close of his remarks last year, he alluded to the effects of the coal strike. Owing to this strike, their output was very considerably hampered. Their own supply of coals was adequate, but many of their suppliers were not in the same position, and it was really not until towards the end of the year that they returned to normal conditions of output. But for the strike and the additional cost of production caused by insurance payments and rise in wages, their results would have been considerably better. Although with this year's profit, and the amount brought forward, there was now available £66,899, the directors did not propose to recommend any distribution. In the first place they did not yet know what the loss would be in respect of the item "Underground Electric Railways Co. of London." Secondly, they did not consider that even with the reduction of capital effected in 1907, the assets had been written down to an amount adequate in the case of an undertaking such as theirs. While, therefore, they were undoubtedly in a better position than last year owing to the success of their appeal to the House of Lords, the board was still of the opinion that it would be wise to reduce the capital. As he said last year, the interests of the preference shareholders would not suffer in any way by such reduction.

MR. E. A. GOULDING, M.P., seconded the motion. He said it was clear from the lucid statement of the chairman that the company was in an improved position, and they had to recollect that it was under the chairmanship of Mr. Bryce that that had been brought about. The shareholders had been very patient, and he believed, if they exercised that patience a little longer, they would be rewarded in the success of the company. He saw a bright future before it, for all the difficulties had been faced and met instead of being covered up.

Replying to a shareholder, the CHAIRMAN said he did not think Mr. Lyttleton, the arbitrator, had yet fixed a date when he would deal with their claim against the Underground Railways Co. They would have to wait the result of that award before they proceeded to do anything further in the way of cutting down the preference shares. He would remind the holders of those shares that it really did not matter what their nominal value was. The question was—what was the value of the shares in the market, and what dividends would be paid on them? If the nominal amount was reduced it would become much more easy to declare what appeared to be a reasonable dividend.

MR. BIRKS said that as one who had attended every meeting of the company, he rather expected that the chairman would have spoken in a more cheerful tone as to the future. If there was to be any further reduction in the capital he thought it ought to be made in the ordinary shares. He would like to know what was likely to influence the policy of the board in regard to the reserve funds.

The CHAIRMAN said he did not see how it was going to hurt the preference shareholders if their shares were further cut down, so long as they received their interest. It did not matter to them whether the ordinary shares were similarly dealt with. Those shares belonged almost entirely to the American company, which also held a majority of the debentures and the preference shares, so it would be necessary to get their consent before they could do anything. They must remember that the American company came to their assistance and subscribed very large sums to pull the company through its troubles, and therefore they deserved consideration.

MR. BULL asked whether there was any chance of a working combine between the different electrical companies in this country. He said he knew of another large company which was doing as much business as it possibly could, but yet could not pay a dividend on its ordinary stock.

The CHAIRMAN said it was very difficult to say whether there was any possibility of bringing about any general arrangement between the various electrical firms in the country. They had tried for years to avoid cutting prices, but it was a very difficult thing to bring about a general arrangement of that kind.

The report was adopted.

**City of Buenos Ayres Tramways Co. (1904), Ltd.**—The directors have declared a dividend of 1s. 3d. per share, less income-tax, for the quarter ended March 31st.

**Tramways and General Works Co., Ltd.**—A dividend of 16½ per cent. (1s. per share), free of income-tax, has been declared for the year to March 31st.

**Chloride Electrical Storage Co., Ltd.**—The directors have declared a dividend of 10 per cent., free of tax, on the ordinary shares for the year. £8,407 is carried forward.—*Financier*.

### La Plata Electric Tramway Co., Ltd.

Mr. W. F. HAMILTON (chairman) presided on April 20th at Winchester House, E.C., over the fourth annual general meeting.

In moving the adoption of the report, he said the board regretted that the result of the working of the tramways for 1912 was so disappointing, although the total receipts on revenue account amounted to £53,179, being an increase of £3,126 as compared with the receipts of the previous year. The expenditure increased from £35,580 to £43,397, leaving a balance only of £9,782. The board had decided to write off out of this sum the whole of the defalcations account, and the expenses in connection therewith, and to recommend the payment of four months' dividend on the preference shares, covering the period from July 1st to October 31st, 1911, and to carry forward £598, to next year. As the 170,000 preference shares issued to the public were not fully paid up until August 1st, 1911, the dividend was 1'65d. per share. The decrease in their profits was large, but it was almost entirely due to causes of an exceptional nature, some of which could not happen again. During the whole year the weather at La Plata was very bad and deprived them of traffic which, in the normal course of things, would pass over their tramways, and there was a loss of £1,385 on their horse tramway to Ensenada. In addition to these causes, alterations were made in their routes as further portions of tramline were electrified, which entailed the running of much unprofitable mileage, and the great delay in the completion of the Ensenada section necessitated the payment of interest during a considerable part of the year on unproductive capital. All works of construction by their contractors were now entirely finished. Two short extensions to the Digne remained to be carried out, but they had till June, 1914, to do this in, and the work would be done in the most economical manner under the supervision of the manager. One of the first improvements effected by their new manager, Mr. Valentine Brown, after his arrival at La Plata, was to take advantage of the opening of the Ensenada section, to so modify the service of the tramways as to secure the best results, both for the company and the public. He had also completely reorganised the La Plata office, and the board were pleased to inform the shareholders that in Mr. Brown they had a very capable and experienced manager. The board were of opinion, judging by the reports they had received from the manager, and the result of the first quarter of the year, that the profits of the working would probably not be less than £20,000. Several shareholders had written to the company with regard to the other system of electric tramways in La Plata, but this other system did not compete with their own so far as regarded the Ensenada section and the Tolosa section—which were both very profitable—and also the Los Hornos and Cemetery sections, whilst in La Plata itself their lines ran in opposite directions. When he was at La Plata recently it was agreed between himself and the proprietors of the other tramways, that in making extensions competing lines should, as far as possible, be avoided. Their relations with the Government and the municipal authorities continued to be excellent. The present position of the action against their late local auditor was that appearance in the action had been entered on behalf of two of the defendants. The delay in the proceedings had been entirely due to the fact that the remaining defendant was travelling in South America, and it had been difficult to effect service of the writ upon him for that reason. The company had passed through troublesome times, and they had had many difficulties to contend with, but the prospects were favourable; and with the growth of La Plata and Ensenada, which was bound to continue, they might reasonably look forward year by year to increased profits.

Mr. W. T. WESTERN seconded the motion.

Answering Mr. VAN RAALTE, the CHAIRMAN said he had gone very carefully into the question of the working expenses per car-mile, and they were not extravagant, but, of course, with an increase of receipts, the working expenses would diminish proportionately.

The report was adopted.

### Lisbon Electric Tramways, Ltd.

The directors report a net profit of £102,745 for 1912, plus £4,466 brought forward, making £107,212. From this £35,000 has been placed to depreciation reserve, and £5,000 to the credit of exchange reserve account. Out of the available balance of £67,212 the usual preference dividend, amounting to £25,533, has been paid. On November 1st the directors paid on the ordinary share capital an interim dividend of 3 per cent. net, amounting to £19,029, and now recommend the payment of a final dividend at the same rate, making 6 per cent. net for the year 1912. £3,637 has been carried forward. The operations during the year were again affected by strikes. On May 29th a strike occurred amongst the tramway employes, owing to the men insisting on the reinstatement of certain of their number who had been discharged for insubordination. This strike lasted until June 24th, when the bulk of the cars were again in operation. The damage to the plant was trifling. Since that date the service has been continued without interruption. It is estimated that the total stoppage of the tramway during the strike resulted in a loss of about £20,000 in traffic receipts, but, owing to the satisfactory traffic during the remainder of the year, this loss has been mostly made up, and the net decrease on the year, compared with the previous year, amounts to £7,060. The exchange ruling during the year has been less favourable than in the previous year, the average rate being 18½d.

as against 49'11d. After prolonged negotiations with the municipality of Lisbon, a contract was eventually agreed upon with that body, and finally signed in January last, for the reconstruction and electrification of the lines of the Nova Companhia dos Arsenhores Mechanicos de Lisbon, in which system this company has a considerable interest.

**Brisbane Electric Tramways Investment Co., Ltd.**—The directors announce that the revenue account for 1912, including £6,574 brought forward, shows an available balance of £82,006, which, says the *Financier*, the directors have dealt with as follows:—Debtenture stock interest, £19,068; preference dividend, £17,656; an interim dividend of 1s. per share on the ordinary shares, £18,000. Out of the remaining balance of £27,281 the directors recommend that £5,500 be added to the reserve fund, bringing it up to £10,000; that a balance dividend of 4s. per share, free of income-tax, be paid on the ordinary shares (making a total dividend for the year of 8 per cent.), and that £3,781 be carried forward. After the above appropriation the renewal and other reserve funds of both companies will amount to £113,000, with an aggregate of balances carried forward of £8,909.

### STOCKS AND SHARES.

Tuesday Evening.

By another of those violent *coltes-face* to which the Stock Exchange is becoming accustomed, markets swung round completely this week, on the news that King Nicholas had consented to evacuate Scutari. The Stock Exchange humorists at once declared that he had closed his "bear" of Canadas and Rio Tintos, regardless of the consequences of so obvious a slander. This little joke, however, was one outcome of the much happier frame of mind that prevailed all round the markets, and the "bear" points were forgotten as prices rushed up generally.

The Electricity sections took the alteration in sentiment with the same quiet philosophy that they displayed through the previous slump. Changes on the week are mostly in the upward direction, so far as those securities are concerned in which there is any sort of speculative account, while the possibility of money growing easier, if the situation in Central Europe is really better, holds out hope to the investment markets.

On May 1st a number of stocks and shares quoted in the Stock Exchange daily Official List were removed from its pages in consequence of their having been no bargain recorded in them for a period of 16 months. Amongst those which were deleted in this way were several which appear week by week in our lists, such, for instance, as Dublin United Tramways Preference and Newcastle-on-Tyne Electric Preference. The paucity of general interest is our excuse also in removing them from their accustomed places. It will not be difficult to fill up the gaps with some of the other stocks and shares constantly added to the lists of those connected with the electrical industry.

English electric supply issues present their usual quota of something less than half-a-dozen changes on the week. Charing Cross and City Preference eased off to 4, but South Londons are up 1, and Edmondson's 6 per cent. non-cumulative Preference have again come into demand, showing a rise of  $\frac{3}{8}$  at 2 $\frac{3}{4}$ , while the Ordinary at 10s. are likewise better. South Metropolitan 4½ per cent. Debtenture stock gained 2 points at 99, and the improvements recorded last week have been maintained.

Members of the Stock Exchange were amongst the audience at the demonstration given last week of the Cold Light, invented by Prof. C. F. Dussaud. Full particulars appeared in some of the papers, and the Stock Exchange men agreed that it was extremely interesting, likely also to exert a far-reaching influence over the electricity supply industry when the Cold Light developments have been carried further into commercial use. At the present time, they are not regarded as of sufficient immediate consequence to have much effect upon quotations for the supply companies' shares.

The Home Railway market was one of the principal gainers by the improved political news. Prices shot up in very vivacious fashion, assisted by the announcement that the scale of charges, both for passengers and goods, was to be increased in many directions. Of the Tube stocks, Metropolitan jumped 1½ and Districts 1 to 52½ and 39½ respectively, but the prices of both had been acutely depressed just previously. The only change in City and South London stocks was a point rise in the 5 per cent. Preference of 1903, and Central Londons did not move. Important improvements are already being made on the systems of both these last-named lines, accelerated services being one of the principal achievements of the new control. Great Northern and City Preferred fell 1s. 8d. to 2½; but East Londons were a better market, moving up to 9½. Underground Electric shilling shares eased off nominally, though, as a matter of fact, the actual price remains about 11s. 9d., while the £10 Ordinary rose 1s. 8d. The 6 per cent. First Income Debtenture stock shows a loss of a point at 110. In the British Electric Traction group a fall of ½ in the 5 per cent. Perpetual Debtenture lowered the price to 90, and the Preferred at 84½ is a point down. Bath Tramways Debtenture continues to dwindle.

The Telegraph market is firm on the whole, although there are one or two falls. Direct Spanish Preference rose 1/4, "China" shares 1/2, and Commercial Cable Debenture 1/4. West India and Panama shares, on the other hand, fell to 2 1/2 upon the appearance of the report, which, after all, must be regarded somewhat in the nature of an interim one, inasmuch as the company is not expected to benefit largely until the Panama Canal is open. The dividend for the year remains at 1 1/2 per cent., and the price, after being dull, as just mentioned, braced up to 2 1/2 later on. Reuters new shares hardened to 11, and Anglo-Portuguese Telephone Debenture stock rose 1 1/2 to 102 upon the publication of a report that was read as being very satisfactory.

The features of the week, however, have been Marconi shares and National Telephone Deferred stock. Marconis put on good fractions, both as regards the Ordinary and Preference, thanks to the appearance of the report of the Technical Committee, which is looked upon as evidence that the Marconi Company possesses the best wireless system now in existence. Prices of shares in the subsidiary companies hardened with those of the parent, Canadians being particularly active at 16s. 9d., after dipping to 14s. 10d. On Tuesday, however, the market became duller again. National Telephone Deferred rose to 21 upon further consideration of the figures to which reference was made here last week. Speculation in the stock revived languidly, but amongst actual holders there is profound discontent at the way in which they have been paid off through the operation of the Post Office purchase. If the Postmaster-General happened to be the Member of Parliament for stockholders in the National Telephone Company, we venture to think that his seat at the present time would not be one of the most secure to be found in the constituencies.

News from Mexico continues to be read with a certain nervousness, but the falls in the prices of Mexican securities have been stayed. Mexico Light and Power Preference is a point down, but this stock was unaffected in the slump last week. The Common shares are 1 higher. Mexico Trams Common shares and the First Mortgage bonds are both lower. Monterey Fives fell a point. Other issues connected with this group show a firmer tendency. Brazilian Traction at 9 1/2 is unchanged. The market went dull on expectation of a 10-million-dollar issue of Preferred shares. Rio Tramway bonds lost their trifling improvement of last week. Toronto Power Debenture hardened to par middle, and Electric Light of Cochabamba bonds have also improved. Vera Cruz Debenture stock was unaffected by the issue of a report this week which showed the company to be making good progress. The Anglo-Argentine Tramway division is steady. Calcutta Trams are 1 higher. The Baltimore Gas and Electric Debenture prospectus, particulars of which were given here last week, duly appeared on Monday; it must be said that the stock looks a cheap and good investment.

In the Manufacturing division, Callenders and Henleys are both better, but beyond these movements there is little to chronicle. Edison & Swan First Debenture eased off to 62. The rubber share market participated in the better tone shown by the Stock Exchange as a whole on Monday, and prices revived to some extent. With one exception, shares in the copper mining concerns went up gaily, and the prophets are as confident as ever that the metal itself will further improve.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, May 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric .. .. per cwt.	5/-	..
a	" Nitric .. .. ..	22/-	..
a	" Oxalic .. .. .. per lb.	2 1/2d.	..
a	" Sulphuric .. .. .. per cwt.	5/6	..
a	Ammoniac Sal .. .. ..	42/-	..
a	Ammonia, Muriate (large crystal) per ton	229 10	..
a	Bleaching powder .. .. ..	46 5	..
a	Bisulphide of Carbon .. .. ..	4 18	..
a	Borax .. .. ..	£17 10	..
a	Copper Sulphate .. .. ..	£23 5	..
a	Lead, Nitrate .. .. ..	£27	..
a	" White Sugar .. .. ..	£25 5	..
a	Peroxide .. .. ..	£39	..
c	Methylated Spirit .. .. .. per gal.	2/6	..
a	Potassium, Bichromate, in casks .. per lb.	8 1/2d.	..
a	Polash, Caustic (88/90 %) .. .. per ton	£22 10	..
a	" Chlorate .. .. .. per lb.	9 1/2d.	..
a	" Perchlorate .. .. ..	4 1/2d.	..
a	Potassium, Cyanide (98/100 %) .. .. (for mining purposes only)	7 1/2d.	..
a	Shellac .. .. .. per cwt.	£0/-	..
a	Sulphate of Magnesia .. .. .. per ton	£4 10	..
a	Sulphur, Sublimed Flowers .. .. ..	£6 10	..
a	" Recovered .. .. ..	£5 10	..
a	" Lump .. .. ..	£5	..
a	Soda, Caustic (white 70/72 %) .. ..	£10 5	..
a	" Chlorate .. .. .. per lb.	8 1/2d.	..
a	" Crystals .. .. .. per ton	£8 5	..
a	Sodium Bichromate, casks .. .. ..	8d.	..
METALS, &c.			
b	Aluminium Ingots, in ton lots .. .. per ton	£95	..
b	" Wire, in ton lots .. .. .. (1 to 14 K.W.G.)	£112	..
b	" Sheet, in ton lots .. .. ..	£156	46 inc.
b	Babbitt's metal ingots .. .. ..	£50 to £221	..
c	Brass (rolled metal 2" to 12" basis) .. per lb.	8 1/2d.	..
c	" Tube (braced) .. .. ..	10 1/2d.	..
c	" (solid drawn) .. .. ..	9d.	..
c	" Wire, basis .. .. ..	8 1/2d.	..
c	Copper Tubes (braced) .. .. ..	10 1/2d.	..
c	" (solid drawn) .. .. ..	9 1/2d.	..
g	" Bars (best selected) .. .. per ton	£85	..
g	" Sheet .. .. ..	£85	..
g	" Rod .. .. ..	£85	..
d	(Electrolytic) Bars .. .. ..	£72 10	..
d	" Sheets .. .. ..	£89 10	..
d	" Rods .. .. ..	£77 10	..
d	" H.C. Wire .. .. .. per lb.	9 1/2d.	..
f	Ebonite Rod .. .. ..	4/6	..
f	" Sheet .. .. ..	4/-	..
g	German Silver Wire .. .. ..	1/10	..
h	Gutta-percha, fine .. .. ..	7/- to 8/-	..
h	India-rubber, Para fine .. .. ..	3/6d	1d. inc.
l	Iron Pig (Cleveland warrants) .. .. per ton	67/9	7 1/2 dec.
l	" Wire, galv. No. 8, P.O. qual. .. ..	£14	..
g	Lead, English Pig .. .. ..	£17 10	..
m	Manganese Wire No. 28 .. .. .. per bot.	6/8	..
g	Mercury .. .. ..	£7 10	..
c	Mica (in original cases) small .. .. per lb.	6d. to 8s.	..
c	" " " medium .. .. ..	8/6 to 6/-	..
c	" " " large .. .. ..	7/6 to 11/-	..
o	Nickel, sheet, wire, &c. .. .. ..	3/6 to 4/6 nom.	..
p	Phosphor Bronze, plain castings .. ..	1/1 to 1/8d	..
p	" " rolled bars & rods .. .. ..	1/2d to 1/2	..
p	" " rolled strip & sheet .. .. ..	1/2d to 1/5d	..
o	Platinum .. .. .. per oz.	185/-	..
d	Silicium Bronze Wire .. .. .. per lb.	11d.	..
r	Steel, Mangn. in bars .. .. .. per ton	£35	..
g	Tin, Block (English) .. .. ..	£282 to £283	inc.
o	" Wire, Nos. 1 to 16 .. .. .. per lb.	2/9	2d. inc.
p	White Anti-friction Metals .. .. .. per ton	£30 to £228	..
k	Zinc, 8h* (Vielite Montagne band.) ..	£29	..

Quotations supplied by—

- a G. Boor & Co.
- b The British Aluminium Co., Ltd.
- c Thos. Bolton & Sons, Ltd.
- d Frederick Smith & Co.
- e F. Wiggins & Sons
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- h Edward Tilt & Co.
- i Bolling & Lowe.
- k Morris Asby, Ltd.
- l Richard Johnson & Nephew, Ltd.
- m W. T. Glover & Co., Ltd.
- n P. Ormiston & Sons
- o Johnson, Matthey & Co., Ltd.
- p R. W. F. Dennis & Co.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Bath .. .. .	May 3	8,158	- 859	18	13,259	+ 291	..	..
Blackpool-Plectw'd .. .. .	" 3	1,580	- 615	17	6,989	+ 201	8	..
Bristol .. .. .	" 2	28,514	+ 2,619	..	122,057	+ 11,572	30 5	..
Brit. Elec. Trac. Co. April 25	24,373	- 618	..	368,060	+ 21,834	..	..	
Clintham and Dist. .. .. .	" 21	3,331	- 291	16	18,518	+ 256	14 98	..
Cork .. .. .	May 1	1,920	- 168	17	7,794	- 189	9 49	..
Dublin .. .. .	" 2	23,468	- 518	..	97,077	+ 1,775	54 25	..
Hastings .. .. .	" 1	3,431	- 865	..	..	- 644	19 3	..
Lancashire United April 30	5,618	- 1	17	23,781	+ 2,274	33	..	
Llandudno-Col. Bay .. .. .	" 25	817	- 124	21	9,717	+ 417	6 5	..
London United .. .. .	" 23	22,570	- 4 5	..	80,510	- 3,635	..	..
Tyneside .. .. .	" 30	1,858	- 275	18	8,207	- 497	11	..
Anglo-Argentine .. .. .	" 21	30,576	+ 24,927	..	918,255	+ 71,850	..	..
Auckland .. .. .	" 11	20,216	+ 2,744	..	109,111	+ 27,367	24 1	8
Bombay (B.E.T.) .. .. .	Feb. 27	12,066	+ 437	9	26,511	+ 629	..	..
Brisbane .. .. .	March	26,970	+ 7,550	13	71,010	+ 81,486	..	..
Brit. Columbia Rly. .. .. .	" ..	..	..	..	..	..	..	..
Calcutta .. .. .	May 3	17,034	+ 1,615	..	..	+ 2,906	..	..
Cape Electric T. Ry. .. .. .	" ..	..	..	..	..	..	..	..
Kalgoorlie, W.A. .. .. .	Mar. 6	2,862	..	13	8,210	..	20 5	..
Lisbon .. .. .	" ..	..	..	..	..	..	..	..
Madrass .. .. .	April 30	3,621	+ 170	..	14,181	+ 1,114	14 7	2
Montevideo .. .. .	April	39,087	+ 2,053	26	150,62	+ 11,160	..	..
Can. London Rly. .. .. .	May 3	20,473	+ 4,923	18	95 5	10,53	6 78	4
City & S. Lon. Rly. .. .. .	" 3	11 5	0	424	63,781	- 4,148	7 26	..
Dublin-Lucan Rly. .. .. .	" 2	593	- 26	18	2,103	+ 89	7	..
G.N. and City Rly. .. .. .	April 26	5 3	6	374	25,386	- 3,278	8 5	..
L'pool Overh'd Rly. .. .. .	" 27	6 5	- 139	18	24 8	+ 1 54	6 6	..
London Elec. Ry. Co. .. .. .	May 3	54,175	+ 4,340	18	261,775	+ 1,10	21 25	..
Mercy Railway .. .. .	" 8	8,788	- 657	18	4,514	+ 2,671	4 6	..
Metropolitan Rly. .. .. .	April 27	61,888	- 2,107	17	277 2	3 65	25 75	..
Met. District Rly. .. .. .	May 3	52,491	+ 3,297	18	297,133	+ 11,482	25	..

\* Compared with the corresponding period of 1912. Includes horse, steam and other receipts.

**Ernest F. Moy, Ltd.**—The directors report that during the year ended December 31st, 1912, a profit of £677 was earned, which, together with £262 brought forward, makes £939 to be dealt with. The directors propose a 6 per cent. dividend on the ordinary shares (less income-tax) £480; 6 per cent. dividend on the preference shares (less income-tax) £85; income-tax on profit, £39; balance to be carried forward, £335.

**Calcutta Electric Supply Corporation, Ltd.**—The directors have decided to recommend a final dividend on the ordinary shares at the rate of 10 per cent. per annum for the six months ended December 31st last, making 8 1/2 per cent. for the year. Such dividend will be payable on 16th inst.

**Eastern Telegraph Co., Ltd.**—The directors recommend the payment of a final dividend of £1 5s. per cent. and a bonus of £2 per cent., both free of income-tax, making, with previous payments on account, a total distribution of 7 per cent. on the ordinary stock for the year ended December 31st, 1912.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations May 6th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations May 6th.	Rise or Fall	Present Yield p.c.
Bournemouth & Poole, Ord. ..	10	1911. 6 1/2	9 1/2 - 10 1/4	..	5 18 6	Kensington & Knightsbridge, Ord	5	3 8 1/2	7 1/2 - 7 1/2	- 1/4	5 14 8
Do. 4 1/2 % Pref. ....	10	4 1/2	8 1/2 - 9 1/4	..	4 14 0	Do. 4 % Deb. ....	Stock	4	4 90 - 98	..	4 6 0
Do. Second 6 % Pref. ....	10	6	10 - 10 1/4	..	6 11 8	Kent Elec. Power, 4 1/2 % Deb. ..	Stock	4 1/2	78 - 80	..	6 12 6
Do. 4 1/2 % Deb. Stock ..	Stock	4 1/2	96 - 98	..	4 11 10	London Electric, Ord. ....	8	2 1/2	1 1/2 - 1 1/2	..	4 0 0
Brompton & Kensington, Ord. ....	10	10	8 1/2 - 9 1/8	..	6 6 8	Do. 6 % Pref. ....	5	6	4 1/2 - 5 1/4	..	6 17 1
Do. 7 % Cum. Pref. ....	5	7	7 1/2 - 8 1/4	..	8 18 10	Do. 4 % First Mort. Deb. ....	Stock	4	4 91 - 94	..	4 6 1
Central Electric Supply, 4 % Guar. Deb. )	100	4	4 95 - 98	..	4 1 8	Metropolitan ..	6	4	4 1 8 1/2 - 8 1/2	..	5 6 8
Charing Cross, West End & City	5	6	6 1/4 - 6 1/2	..	5 0 0	Do. 4 1/2 % Cum. Pref. ....	6	4 1/2	4 1/2 - 4 1/2	..	4 17 4
Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	4 1/2 - 4 1/2	..	4 17 4	Do. 4 1/2 % First Mort. Deb. ....	Stock	4 1/2	98 - 101	+ 1	4 9 3
Do. "City Undertaking" ..	5	4 1/2	4 1/2 - 4 1/2	- 1/8	4 10 7	Do. 8 1/2 % Mort. Deb. ....	Stock	8 1/2	8 1/2 - 8 1/2	..	4 2 4
Do. Do. 4 % Deb. ....	100	4	4 9 1 1/4 - 9 1/4	..	4 6 7	Midland Electric Corporation )	100	4 1/2	4 99 - 102	..	4 8
Cbelesen, Ord. ....	5	5	4 1/2 - 5	..	5 0 0	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	5	5 9 1/2 - 10 1/4	..	4 19 8
Do. 4 1/2 % Deb. ....	Stock	4 1/2	96 - 99	..	4 10 1 1/2	Notting Hill, 6 % Non-Cum. Pref.)	10	6	6 9 1/2 - 10 1/2	..	5 11 7
City of London, Ord. ....	10	8	9 1/2 - 10 1/4	..	5 6 8	Oxford ..	5	7 1/2	6 1/2 - 7 1/2	..	5 13 0
Do. 6 % Cum. Pref. ....	10	6	6 12 - 13	..	4 10 7	St. James' and Pall Mall, Ord.	6	10	10 1 1/2 - 9	..	5 11 1
Do. 6 % Deb. ....	Stock	6	116 - 120	..	4 8 4	Do. 7 % Pref. ....	5	7	7 6 1/2 - 7 1/2	..	4 16 7
Do. 4 1/2 % Second Deb. ....	100	4 1/2	100 - 102	..	4 8 8	Do. 8 1/2 % Deb. ....	100	8 1/2	8 1/2 - 8 1/2	..	4 0 0
County of London, Ord. ....	10	6	6 10 1/2 - 11	..	5 9 1	South London, Ord. ....	4	6	6 2 1/2 - 3 1/2	+ 1/4	7 7 8
Do. 6 % Pref. ....	10	6	6 11 1/2 - 12 1/2	..	4 19 0	Do. 6 % First Mort. Deb. ....	100	6	6 1 1/2 - 1 1/2	..	5 0 0
Do. 4 1/2 % Deb. ....	Stock	4 1/2	104 - 106	..	4 5 0	South Metropolitan, 7 1/2 % Pref. ....	1	7	7 1 1/2 - 1 1/2	..	5 17 1 1/2
Do. 4 1/2 % Second Deb. ....	Stock	4 1/2	97 - 100 x d	..	4 10 0	Do. 4 1/2 % First Deb. Stock ..	100	4 1/2	4 1/2 66 - 9 1/2	+ 2	4 10 6
Edmundson's, Ord. ....	43	Nil	8 - 8	+ 1/8	Nil	Urban, Ord. ....	43	Nil	8 - 8	..	..
Do. 6 % Cum. Pref. ....	5	Nil	4 1/2 - 4 1/2	..	..	Do. 5 % Cum. Pref. ....	5	2	2 1/2 - 2 1/2	..	..
Do. 6 % Non-Cum. Pref. ....	5	..	11 1/2 - 2 1/2	..	..	Do. 4 1/2 % First Mort. Deb. ....	100	4 1/2	4 1/2 83 - 86	..	6 2 8
Do. 4 1/2 % First Mort. Deb. ....	100	4 1/2	4 1/2 81 - 81	..	6 7 2	Do. 6 % Cum. Pref. ....	5	6	6 1 1/2 - 1 1/2	..	6 11 1
Folkestone ..	5	6	6 4 1/2 - 5	..	6 0 0	Do. 4 1/2 % First Mort. Deb. ....	100	4 1/2	4 1/2 83 - 86	..	6 2 8
Do. 6 % Cum. Pref. ....	5	6	6 4 1/2 - 5	..	6 0 0	Westminster, Ord. ....	5	10	10 8 1/2 - 9	..	5 11 1
Do. 4 1/2 % First Deb. ....	100	4 1/2	4 1/2 90 - 92	..	4 17 10	Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	4 1/2 6 - 6 1/2	..	4 8 9
Hove ..	5	9	9 1/2 - 7 1/2	..	5 16 2						

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ....	6	6	6 - 6 1/2	..	6 14 8	Monterey Rly. Light & Power, 5 % 1st Mort. Deb. )	100	6	6 81 - 81	- 1	6 19 1	
Calcutta, Ord. ....	5	5 1/2	5 1/2 - 5 1/2	..	6 19 4	Montreal, Lt., El. and Power ..	\$100	8	9 1/2 229 - 234 x d	..	9 17 0	
Do. 5 % Pref. ....	5	5	5 4 1/2 - 5 1/2	..	4 17 7	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$600	5	5 15 - 25	..	..	
Calgary Power, 1st Mort. Bds.	100	6	6 93 - 95	..	5 6 8	River Plate, Ord. ....	Stock	10	..	217 - 227	..	4 8 0
Canadian Gen. El. Com. ....	\$100	7	7 116 - 119	..	5 17 8	Do. 6 % Non-Cum. Pref. ....	Do.	6	6 105 - 110	..	6 9 1	
Do. 7 % Pref. ....	\$100	7	7 120 - 125	..	5 12 0	Do. 5 % Deb. Stock ..	Do.	5	5 100 - 102	..	4 18 0	
Cordoba Lt., Power and T., Ord.	1	8	8 1 1/2 - 1 1/2	..	5 14 3	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb. )	100	4 1/2	4 1/2 100 - 102	..	4 8 3	
Do. 5 % Deb. ....	100	5	5 94 - 96	..	5 4 2	Shawinigan Water, Capital ..	\$100	6	6 18 1/2 - 14 1/2	..	9 10 2	
Elec. Lt. and P. of Cochabamba, 4 % Bonds	100	6	6 98 1/2 - 9 1/2	..	6 6 0	Do. 5 % Con. 1st Mort. Bonds	\$600	5	5 107 - 109	..	4 11 9	
Elec. Supply Victoria, 6 % 1st Mort. Deb. )	100	5	5 90 - 93	..	5 7 6	Do. 4 1/2 % Per. Deb. ....	Stock	4 1/2	4 1/2 10 1/2 - 10 1/2	..	4 7 0	
Elec. Dev. Ontario, 5 % 1st Mort. Deb. )	\$600	5	5 95 - 97	..	5 3 1	Toronto Power, 4 1/2 % Deb. ....	Do.	4 1/2	4 1/2 99 - 101	+ 1/4	4 9 0	
Kalgoolie Elec. P. and L., Ord.	10 1/2	Nil	.. - ..	..	Nil	Versa Cruz Lt., P. and T., 6 % 1st Mort. Deb. )	100	5	5 91 - 94	..	6 6 5	
Do. 6 % Pref. ....	1	6	6 1 1/2 - 1 1/2 x d	..	8 6 8	Victoria Falls Power, Pref. ....	1	11 1/2	11 1/2 1 1/2 - 1 1/2	..	..	
Kaministiquia Power, 6 % G. Bs. Madras, Ord. ....	\$500	5	5 100 - 102	..	4 18 0	West Kootenay Power and Lt., 1st Mort. 6 % Gold )	100	6	6 106 - 108	..	5 11 1	
Melbourne, 5 % 1st Mort. Deb.	100	5	5 102 - 106	..	4 15 2							
Mexican El. Lt., 5 % 1st M. Bds.	5	6	6 81 - 84	..	6 19 1							
Mexican Lt. & Power, Common	\$100	5	5 4 1/2 - 5	+ 1	5 2 7							
Do. 7 % Cum. Pref. ....	\$100	7	7 101 - 103 x d	+ 1	6 16 0							
Do. 5 % 1st Mort. Gold Bds.	..	6	6 91 1/2 - 9 1/2	..	6 7 0							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ..	10	4	4 1/2 6 1/2 - 7 1/2	..	6 2 0	Monte Video Telephone, Ord. ..	1	8	6 1/2 1 - 1 1/2 x d	..	5 6 8
Do. 6 % Deb. Red. ....	Stock	5	5 97 - 99	..	6 1 0	Do. 5 % Pref. ....	1	5	5 97 1/2 - 98 1/2 x d	..	5 14 3
American Telep. & Teleg., Cap.	\$100	8	8 133 - 134	..	5 19 6	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2 97 1/2 - 98 1/2	+ 1/4	4 11 2
Do. Collat. Trust ..	\$1000	4	4 92 - 94	..	4 5 1	Oriental Telep. and Elec. ....	1	8	8 1 1/2 - 1 1/2	..	4 2 6
Anglo-American Telegraph ..	Stock	8	8 6 1/4 - 6 1/4 x d	- 1/4	4 10 3	Do. 6 % Cum. Pref. ....	1	6	6 1 1/2 - 1 1/2	..	4 16 0
Do. 6 % Pref. ....	Do.	6	6 110 1/2 - 112 1/2 x d	..	5 7 8	Do. 4 % Red. Deb. ....	Stock	4	4 88 - 90	..	4 8 1 1/2
Do. Def. ....	Do.	80 1/2	80 1/2 2 1/2 - 2 1/2	- 1/8	6 2 6	Pacific and European Tel., 4 % Guar. Deb. )	Do.	4	4 97 1/2 - 99 1/2	..	4 0 6
Anglo-Portuguese Tel., 5 % Mort. Deb. )	100	6	6 101 - 103	+ 1 1/2	4 17 1	Renter's ..	10	10	10 1 1/2 - 1 1/2	..	8 12 0
Chili Telephone ..	5	7	7 7 1/4 - 7 1/4	..	5 1 1	Do. New Shares ..	10	..	.. 10 1/2 - 11 1/2	+ 1/4	.. 4 16 6
Commercial Cable, Brit., 4 % Deb.	Stock	4	4 84 - 86	+ 1/4	4 13 0	Submarine Cables Trust	Cert.	6	6 124 - 127	..	.. 4 14 6
Cuba Telegraph ..	10	8	8 84 - 84	..	6 6 4	Telephone Co. of Egypt, 4 1/2 % Deb. Red. )	Stock	4 1/2	4 1/2 96 1/2 - 98 1/2	..	.. 4 11 5
Do. 10 % Pref. ....	10	10	10 16 - 17	..	6 17 8	United River Plate Telephone	6	8	8 7 1/2 - 7 1/2	- 1/4	.. 5 4 1
Direct Spanish Telegraph, Ord.	5	4	4 8 1/2 - 8 1/2	..	6 6 8	Do. 5 % Cum. Pref. ....	5	5	5 6 1/2 - 6 1/2	..	.. 4 9 0
Do. 10 % Cum. Pref. ....	6	10	10 6 1/2 - 7	+ 1/2	6 18 0	West Coast of America ..	2 1/2	2 1/2	2 1/2 1 1/2 - 1 1/2	..	.. 4 8 4
Direct United States Cable ..	10	5	5 6 1/2 - 7	..	5 14 4	Do. 4 % Deb. 1 to 500 guar. by Braz. Sub. Tel.)	100	4	4 95 - 98	..	.. 4 1 8
Direct W. India Cable, 4 1/2 % Reg. Deb. )	100	4 1/2	4 1/2 99 - 101	..	4 9 0	West India and Panama Telog.	10	1 1/2	1 1/2 2 1/2 - 3 1/2	- 1/4	.. 4 1 8
Eastern Telegraph, Ord. Stock	Stock	7	7 13 1/2 - 13 1/2	..	5 1 6	Do. 6 % Cum. 1st Pref. ....	10	6	6 10 1/2 - 10 1/2	..	.. 6 11 7
Do. 8 1/2 % Pref. Stock ..	Do.	8 1/2	8 1/2 7 1/4 - 7 1/4	..	4 8 1	Do. 6 % Cum. 2nd Pref. ....	10	6	6 9 1/2 - 10	..	.. 6 0 0
Do. 4 % Mort. Deb. ....	Do.	4	4 94 - 96	..	4 8 4	Do. 5 % Deb. ....	100	5	5 101 - 103	..	.. 4 17 1
Eastern Extension ..	10	7	7 13 1/2 - 13 1/2	+ 1/4	5 2 7	Western Telegraph, Ltd. ....	10	7	7 18 - 19 1/2	..	.. 6 3 8
Do. 4 % Deb. ....	Stock	4	4 95 - 97	..	4 2 6	Do. 4 % Deb. ....	Stock	4	4 95 - 97	..	.. 4 6
East and S. Africa Tel., 4 % Mh. Dh. Mauritius Sub.)	25	4	4 98 - 100 x d	..	4 0 0	Western Union 4 1/2 % Pdg. Bonds	\$1000	4 1/2	4 1/2 96 - 99	..	.. 4 11 0
Globe Telegraph and Trust ..	10	6	6 10 1/2 - 11 1/2	..	5 6 8						
Do. 5 % Pref. ....	10	6	6 12 1/2 - 13 1/2	..	4 11 4						
Great Northern Telegraph ..	10	18	18 30 1/2 - 32 1/2	..	6 8 1						
Indo-European Telegraph ..	25	13	13 1 1/2 - 1 1/2	..	6 6 7						
Mackay Companies Common ..	100	5	5 6 1/2 - 6 1/2	..	5 16 3						
Do. 4 % Cum. Pref. ....	\$100	4	4 69 - 72	..	5 11 1						
Marconi's Wireless Telegraph	1	20	.. - ..	+ 1/4	4 9 0						
Do. 7 % Cum. Partic. Pref.	1	17	.. - ..	+ 1/4	4 7 9						

\*Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ Bs. in Funded Dividend Cere.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railway and tramway companies in the home market. Columns include Name, Stock or Share, Dividends for (1911, 1912), Closing Quotations (May 6th), Rise + or Fall, Present Yield p.c., and £ s. d. prices.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railway and tramway companies in colonial and foreign markets. Columns include Name, Stock or Share, Dividends for (1911, 1912), Closing Quotations (May 6th), Rise + or Fall, Present Yield p.c., and £ s. d. prices.

MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Share, Dividends for (1911, 1912), Closing Quotations (May 6th), Rise + or Fall, Present Yield p.c., and £ s. d. prices.

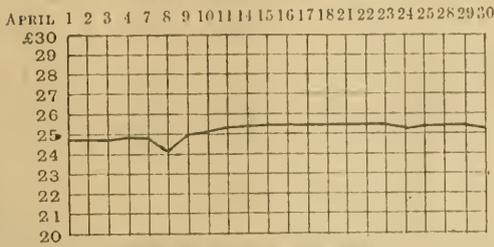
Unless otherwise stated, all shares are fully paid, † Interim dividend, ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

Bank rate of Discount 4 1/2 per Cent., April 17th, 1913.

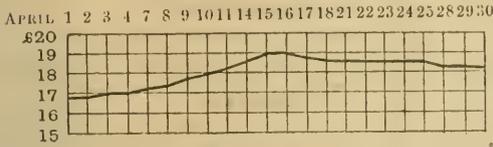
**METAL MARKET.**

**Fluctuations in April.**

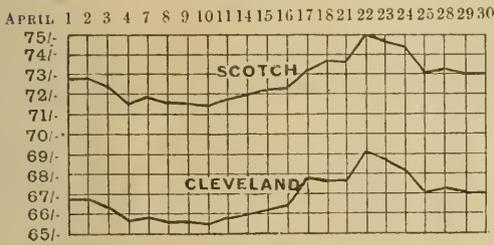
**SPELTER (G.O.B's.).**



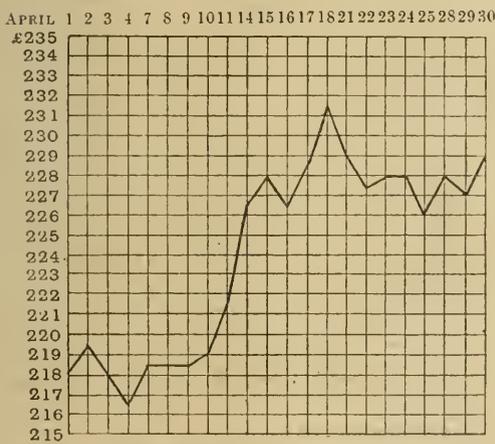
**LEAD (ENGLISH).**



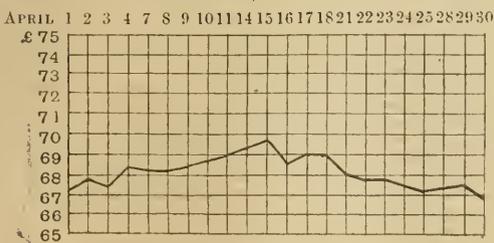
**IRON.**



**TIN.**



**COPPER (G.M.B's.).**



**TRADE STATISTICS OF SOUTH AFRICA.**

THE following statement, showing the imports of electrical and similar goods into the Union of South Africa during the year 1912, has been taken from the recently issued official trade statistics. The figures for 1911 are added for purposes of comparison, and notes of any increases or decreases are given.

	1911.	1912.	Inc. or dec.
	£	£	£
<b>Detonators.—</b>			
From Great Britain ...	23,000	30,000	+ 7,000
" Germany ...	9,000	11,000	+ 2,000
Total ...	32,000	41,000	+ 9,000
<b>Fuse.—</b>			
From Great Britain ...	75,000	79,000	+ 4,000
" Germany ...	37,000	46,000	+ 9,000
" Other countries ...	2,000	1,000	- 1,000
Total ...	114,000	126,000	+ 12,000
<b>Asbestos manufactures.—</b>			
From Great Britain ...	500	3,000	+ 2,500
" Other countries ...	1,700	2,000	+ 300
Total ...	2,200	5,000	+ 2,800
<b>Brass manufactures.—</b>			
From Great Britain ...	24,000	37,000	+ 13,000
" Germany ...	1,000	2,000	+ 1,000
" Other countries ...	2,000	2,000	—
Total ...	27,000	41,000	+ 14,000
<b>Copper, plate and sheet.—</b>			
From Great Britain ...	4,000	4,000	—
<b>Copper manufactures.—</b>			
From Great Britain ...	2,000	4,000	+ 2,000
" Other countries ...	1,000	1,000	—
Total ...	3,000	5,000	+ 2,000
<b>Electrical cable and wire.—</b>			
From Great Britain ...	152,000	142,000	- 10,000
" Germany ...	62,000	30,000	- 32,000
" Other countries ...	13,000	4,000	- 9,000
Total ...	227,000	176,000	- 51,000
<b>Electrical fittings, including posts.—</b>			
From Great Britain ...	139,000	170,000	+ 31,000
" Germany ...	92,000	87,000	- 5,000
" Holland ...	1,000	1,000	—
" United States ...	19,000	23,000	+ 4,000
" Other countries ...	9,000	8,000	- 1,000
Total ...	260,000	289,000	+ 29,000
<b>India-rubber of all kinds.—</b>			
From Great Britain ...	31,000	33,000	+ 2,000
" Germany ...	5,000	2,000	- 3,000
" United States ...	5,000	7,000	+ 2,000
Total ...	41,000	42,000	+ 1,000
<b>Lamps and lampware.—</b>			
From Great Britain ...	19,000	19,000	—
" Germany ...	18,000	16,000	- 2,000
" United States ...	10,000	11,000	+ 1,000
" Other countries ...	1,000	1,000	—
Total ...	48,000	47,000	- 1,000
<b>Machine bands and belting.—</b>			
From Great Britain ...	114,000	102,000	- 12,000
" United States ...	37,000	29,000	- 8,000
" Other countries ...	2,000	2,000	—
Total ...	153,000	133,000	- 20,000
<b>Electrical machinery.—</b>			
From Great Britain ...	170,000	140,000	- 30,000
" Germany ...	318,000	238,000	- 80,000
" United States ...	39,000	50,000	+ 11,000
" Other countries ...	1,000	7,000	+ 6,000
Total ...	528,000	435,000	- 93,000
<b>Cranes, elevators and lifts.—</b>			
From Great Britain ...	30,000	33,000	+ 3,000
" United States ...	3,000	4,000	+ 1,000
" Other countries ...	—	2,000	+ 2,000
Total ...	33,000	39,000	+ 6,000

**Cirencester.**—The U.D.C. has decided to install an electrical recorder at the waterworks pumping station, at a cost, including poles and wires, of £157.

Mining machinery.—	1911. £	1912. £	Inc. or dec. £
From Great Britain ...	605,000	483,000	— 122,000
„ Germany ...	116,000	72,000	— 44,000
„ United States ...	145,000	128,000	— 17,000
„ Other countries ...	11,000	7,000	— 4,000
Total ...	877,000	690,000	— 187,000

Machinery not specially mentioned (other than agricultural, manufacturing, &c.)—	1911. £	1912. £	Inc. or dec. £
From Great Britain ...	410,000	359,000	— 51,000
„ Germany ...	22,000	38,000	+ 16,000
„ United States ...	46,000	45,000	— 1,000
„ Other countries ...	10,000	12,000	+ 2,000
Total ...	488,000	454,000	— 34,000

Railway rails.—	1911. £	1912. £	Inc. or dec. £
From Great Britain ...	6,000	13,000	+ 7,000
„ Belgium ...	10,000	4,000	— 6,000
„ Germany ...	60,000	51,000	— 9,000
„ United States ...	2,000	3,000	+ 1,000
Total ...	78,000	71,000	— 7,000

Telegraph and telephone material—	1911. £	1912. £	Inc. or dec. £
From Great Britain ...	5,000	9,000	+ 4,000
„ Germany ...	1,000	1,000	—
„ Sweden ...	8,000	4,000	— 4,000
„ United States ...	—	1,000	+ 1,000
„ Other countries ...	2,000	2,000	—
Total ...	16,000	17,000	+ 1,000

Tramway rails.—	1911. £	1912. £	Inc. or dec. £
From Great Britain ...	5,000	1,000	— 4,000
„ Germany ...	4,000	7,000	+ 3,000
„ United States ...	8,000	3,000	— 5,000
Total ...	17,000	11,000	— 6,000

Tramway rolling-stock.—	1911. £	1912. £	Inc. or dec. £
From Great Britain ...	3,000	4,000	+ 1,000
„ United States ...	1,000	2,000	+ 1,000
Total ...	4,000	6,000	+ 2,000

Other tramway materials.—	1911. £	1912. £	Inc. or dec. £
From Great Britain ...	8,000	9,000	+ 1,000
„ Germany ...	1,000	1,000	—
„ United States ...	4,000	1,000	— 3,000
Total ...	13,000	11,000	— 2,000

In addition to the above the following were imported as "Government Stores":—

Brassware.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	5,000	4,000	— 1,000

Copper, plate and sheet.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	15,000	19,000	+ 4,000

Electrical cable and wire.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	65,000	57,000	— 8,000
„ Germany ...	1,000	2,000	+ 1,000
Total ...	66,000	59,000	— 7,000

Electric fittings.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	15,000	14,000	— 1,000
„ Germany ...	—	1,000	+ 1,000
Total ...	15,000	15,000	—

India-rubber.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	9,000	5,000	— 4,000

Lampware.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	2,000	2,000	—

Cranes and elevators.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	28,000	1,000	— 27,000

Electrical machinery.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	14,000	22,000	+ 8,000

Other machinery.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	52,000	58,000	+ 6,000
„ Other countries ...	3,000	4,000	+ 1,000
Total ...	55,000	62,000	+ 7,000

Railway rails.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	39,000	319,000	+ 280,000
„ Germany ...	25,000	53,000	+ 28,000
„ United States ...	—	44,000	+ 44,000
„ Belgium ...	6,000	34,000	+ 28,000
Total ...	70,000	450,000	+ 380,000

Telegraph and telephone material.—	1911. £	1912. £	Inc. or dec. £
From United Kingdom ...	63,000	88,000	+ 25,000
„ Sweden ...	17,000	32,000	+ 15,000
Total ...	80,000	120,000	+ 40,000

## PROCEEDINGS OF INSTITUTIONS.

### On Phase-Advancing.

By DR. GISBERT KAPP, Past President I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, April 24th, 1913; also at Birmingham and Newcastle.)

If the current sent out from a power house has a lagging component, this may be compensated and the power factor brought to unity by connecting to the circuit some apparatus taking a leading current. A well-known form of such apparatus is an over-excited synchronous motor, and it has also been suggested to use an electrostatic condenser for this purpose. Whichever apparatus is used, the improvement takes place from the generator up to the point of attachment, but not beyond. The apparatus must therefore not be installed in the power house, for there it would only relieve the generators of wattless current, and not the line. Apart from this imperfection it can easily be shown that this method is wasteful both in capital outlay and in running cost.

To compensate for a power factor of 0.8 by a rotary condenser, the cost of the electrical plant will be increased by 60 per cent. over a generator designed large enough for this power factor—and the cost of the steam plant and the expenses for power will both be increased by about 4 per cent. Obviously it is a wrong policy to install the phase advancer side by side with the generator.

The same reasoning applies to an electrostatic condenser. The losses would probably be a little smaller, but to save 20 per cent. of generator volt-amperes we should have to put in 75 per cent. of condenser volt-amperes, obviously the reverse of a commercial proposition. We may thus dismiss at once the idea of installing any kind of phase-advancing apparatus in the power house, and turn to the only practical plan of putting such apparatus at the end of the line or on the customer's premises.

Here we may distinguish two cases. First the reduction of the phase angle of the installation as a whole without any change in the power factors of individual motors or other consuming devices; and secondly, the increase of the power factor of individual motors. The former plan is too expensive for general adoption and can only be justified if the cost of the line has a preponderating influence. It is the only possible method where the consuming devices are squirrel-cage motors, arc lamps, induction furnaces, and similar appliances; and then it becomes a question whether it will be more profitable to put in a phase advancer or to lay an additional line and install additional generators if the plant must be extended.

If the phase advancer is a synchronous motor it requires an exciter, starter and synchroniser. The cost of such a machine with its adjuncts would hardly be less than £2 per K.V.A. capacity, and every additional kilowatt set free for sale is obtained at a capital outlay of from £7 to £10. The financial position is not improved by replacing the dynamic machine by an electrostatic condenser. In the discussion on Prof. Miles Walker's recent paper, Mr. A. W. Ashton quoted £28 per K.V.A. as the cost of condensers, and this was afterwards corrected to £19 for a frequency of 50. For power transmission a lower frequency is desirable, and then the cost of condensers is proportionately increased. The static condenser can therefore in point of cost hardly compete with the dynamic condenser.

In the case of phase advancement applied to individual motors, as the dynamic condenser is not only used as a phase advancer but is also doing useful work as a motor, its cost must not be entirely debited to advancing the phase.

Phase-advancing by an idle running motor may or may not be a commercial proposition; phase-advancing by a loaded motor certainly is, especially for the power company, since their share of the cost can only amount to a part of what it would be if they had to do the phase-advancing by an idle-running motor on their own account, instead of getting a customer to help them. At the same time, they get the full benefit of a smaller phase angle over the whole system, which enables them to sell more power without having to lay down additional plant.

The over-excited synchronous motor has constancy of speed and a high overload capacity, which distinguish it favourably from the ordinary induction motor; but it is also distinguished unfavourably from the induction motor by the necessity of starting appliances being provided, including a synchroniser.

Some types of synchronous motors have been developed which do not require synchronising, and in which the starting appliance is

fairly simple. Of these types two may be mentioned: one has been perfected by the Lancashire Dynamo and Motor Co., and the other by the late Mr. Danielsen, of Vesteras, Sweden.

The Lancashire Dynamo and Motor Co.'s arrangement is shown in fig. 1. The outer circle represents a three-phase stator, and the inner circle a wound rotor. This rotor may be excited from a small dynamo *e*, and then it becomes the continuous-current field magnet of a synchronous motor, the stator being the armature. At starting, however, the rotor is not excited, but its winding is closed over the

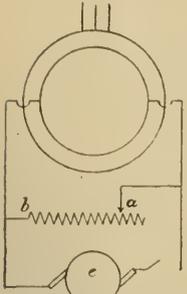


FIG. 1.

resistance shown, and then the rotor winding acts as the secondary circuit of an induction motor. The machine is started in the usual way by gradually reducing the resistance until the contact *a* has advanced to *b* and the whole of the starting resistance is short-circuited. The machine then works like an ordinary induction motor. If now the resistance is again inserted, and, at the same time, the exciting circuit of *e* is closed, the rotor becomes a continuous-current magnet and jumps into step. By the time the contact *a* has been completely withdrawn from the starting resistance the rotor is over-excited, and the machine, whilst giving power mechanically, acts as a phase advancer.

In the Danielsen arrangement (fig. 2) the three lines, *a*, *b*, *c*, represent the phases of the rotor of an induction motor. Phase *a* is shown by a thicker line to indicate that it has twice the copper section of the other two phases; *s* is the starter, and the contacts corresponding to the phases *b* and *c* are permanently connected. The contact corresponding to *a* is connected to the joined contacts over a small continuous-current series exciting dynamo *e* mounted on the motor shaft. During the starting period the connections to the dynamo are short-circuited, and the brushes are placed on the axis of the field so that the machine cannot excite.

The motor is started as an induction motor in the usual way, and when up to speed, *i.e.*, when the whole of the starting resistance is short-circuited, the exciting dynamo is inserted by opening the switch above mentioned. It will then be traversed by the rotor current, which has the very low frequency of the slip. Hence the self-induction of the exciter does not interfere with the working of the machine as an induction motor.

If now the brushes are shifted into their working position the machine begins to excite not only itself, but also the rotor of the motor, transforming it into a continuous-current magnet. The current enters at phase *a* and passes out by the other two phases in parallel. This is the reason why the copper section of phase *a* is twice that of the other phases. The machine jumps into step and becomes a synchronous motor. The excitation is adjusted by shifting the brushes on the exciter.

A machine intended to act purely as a phase advancer is 24.5 per cent. larger than a machine intended to act purely as a motor and taking the same current.

If the machine is to act both as a phase advancer and as a motor, in an example given the cost of the motor is £120, of which £70 must be debited to it in respect of its being a motor and £50 in respect of its being a phase advancer. If this cost were borne by the power company it would mean that by the expenditure of £50 it purchases a market for an additional 25 KW. of saleable power. This is at the rate of £2 per KW. If, on the other hand, the customer is to pay the £2 per KW., he will expect a recompense in the shape of a lower tariff or a discount on the general tariff. This discount need not be large. Phase-advancing by a loaded synchronous motor thus becomes a commercial proposition.

It is possible to obtain phase advancement by injecting a leading E.M.F. into the secondary of an induction motor. This must necessarily react on the primary and thus reduce the original lag in it; and if carried beyond the requirements of the individual motor it may even produce a leading component of the current taken by the motor and so improve the power factor of the system as a whole.

A small natural slip is of far greater importance than a large natural power factor. If, then, an engineer is called upon to design a motor to work with a phase advancer, he should aim at a small natural slip, even at the cost of a somewhat reduced natural power factor; he will thereby get a cheaper motor and also a cheaper phase advancer, so that the cost of the set capable of giving unity power factor need not be greater than the cost of a motor designed to work alone. But in the latter case the power factor cannot be much over 0.9; so that the unity power factor is practically obtained without extra expenditure.

This theoretical conclusion is borne out in practice. In my laboratory at the Birmingham University is a Brown-Boveri induction motor of 25 H.P. fitted with a Scherbius phase advancer. At full load the set has unity power factor, and its efficiency is 88 per cent. The synchronous speed is 1,000 R.P.M., and the weight is 800 lb. The figures, 1,000 revolutions, 25 H.P., and 800 lb., agree fairly well with good English practice for induction motors having at full load a power factor of 0.9, so that in the case here cited the improvement of power factor is indeed obtained without any increase in material.

The Scherbius phase advancer, as well as that which Prof Miles Walker has recently brought to the notice of this Institution, belongs to what may be called the rotational type, because the leading E.M.F. is produced by the rotation of an armature in a magnetic field. There is, however, another principle which can be applied to phase advancement, *viz.* the free oscillation of an armature in a continuous-current field. To distinguish such a machine from the rotational type I call it a vibrator.

M. Leblanc was the first engineer to call attention to both the rotational and the vibrating principles of phase advancement, and he has patented an apparatus under the name "recuperator," in which the vibrating principle is used to produce phase advancement. The "recuperator" consists of a copper disk swinging within an angular unipolar field. The current flows through the disk radially between a rubbing contact at the centre and a mercury-trough contact at the circumference. To keep the field from oscillating, a second and fixed disk is placed parallel to the oscillating disk within the polar cavity, and so connected that the current flows through the two disks in opposite directions.

When the author designed his vibrator he was not aware of M. Leblanc's recuperator, but he willingly acknowledged M. Leblanc's priority in having been the first to draw attention to the fact that phase advancement may be produced by making use of the physical principle that a leading E.M.F. is generated in an alternating-current conductor allowed to swing freely in a continuous-current field.

Any continuous-current armature if traversed by an alternating current of low frequency will tend to vibrate, but with a machine of the usual proportions this tendency is too weak to be practically utilised. In order to get a serviceable phase advancer the armature must be bipolar, of small diameter and great length, the air-gap must be as small as mechanically possible, and the saturation of

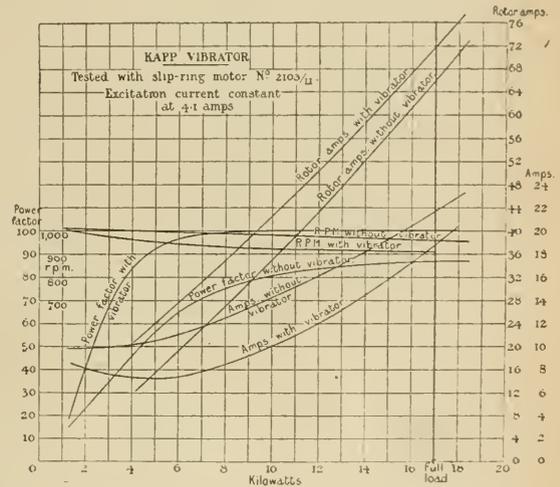


FIG. 3.

teeth and core must be very high, not only because a strong field is desirable, but also to avoid unbalanced magnetic attraction, which, with a small air-gap, would be unavoidable if the teeth were only moderately saturated. The leading E.M.F. injected by the vibrator is given by the formula—

$$e_0 = \frac{0.1}{m} \left( \frac{\phi}{\tau} \right)^2 \frac{1}{\omega}$$

where *m* = the mass of the armature in units of 9.81 kilograms reduced to its circumference,  $\phi$  = the continuous-current field in megalines,  $\tau$  = distance from wire to wire on the armature,  $\omega$  =  $2\pi f$ , the angular speed corresponding to the slip frequency *f*, and *i* the current in amperes.

This formula may with sufficient approximation be also written thus—

$$e_0 = 0.1 \frac{(\phi z)^2}{G D^3} \frac{1}{\omega}$$

where *z* = the number of active conductors, and  $G D^3$  = the fly-wheel effect of the armature in kilogram-cm.<sup>2</sup>.

The output of each vibrator armature in volt-amperes is *e*, *i*, and this is given by—

$$V A = 3.8 (\phi \Delta)^2 / G \omega$$

where  $\Delta$  is the current density in effective amperes per centimetre of armature circumference.

It will be seen that the magnitude of the injected E.M.F. is pro-

portional to the ratio of current and slip frequency. Since this ratio decreases only slightly as the load decreases, the injected E.M.F. does not fall off proportionately with the load, but at a much lower rate, with the result that the effect of the phase advancer is relatively greater at low loads, and this is just what is wanted.

It is especially at low loads where there is greatest need for improving the power factor. This effect will be seen in fig. 3, which represents test results obtained with a vibrator made by the Sandycroft Foundry Co. (I am indebted to Mr. Hunt for these curves.) At one-quarter load the power factor is already 0.87, and at half-load it is unity, maintaining this value up to full-load and beyond.

Fig. 3 gives also the primary and secondary currents and the speed, both with and without the vibrator. It will be noticed that the effect of the vibrator is to decrease the primary current considerably and to increase the secondary current slightly; this means, on the whole, a smaller copper loss in the motor.

A photograph of this phase advancer is reproduced in fig. 4. The three pairs of field cores and the common yoke frame are in one casting without any joints. The only machining required is the boring of the polar cavities and the facing-up of the surfaces to

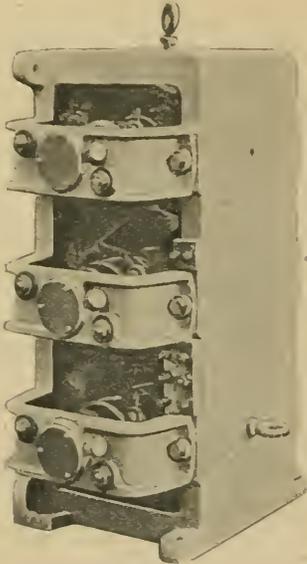


FIG. 4.

which the bearing brackets are bolted. The armature shafts are carried in ball bearings. The resistance of each armature hot is 0.048 ohm, and when the three armatures are mesh-coupled they can deal with a slip-ring current up to 120 amperes. The current in each armature is then 70 amperes, and the ohmic loss in the winding 3.35 volts, to which must be added the loss by contact resistance of the brushes. This is small, since it is possible to use copper-carbon brushes. There is no sparking. When the current has crest value the armature is at rest, and when the armature has maximum speed and the frequency of commutation has maximum value the current is zero. At intermediate points there is some reactance voltage of commutation, but this is extremely small—only a fraction of a volt. The armature is  $4\frac{1}{2}$  in. in diameter and its core  $8\frac{1}{2}$  in. long. The vibrator was tested with a 60-H.P. Hunt cascade motor having six pairs of windings. As the vibrator has only three armatures it could only deal with half the secondary circuit of the motor. The improvement in power factor was nevertheless very marked. The power factor was raised at half-load from 0.72 to 0.91, and at full load from 0.81 to 0.93.

The author is not able to give results from actual practice with a vibrator fitted to a large motor, because a small vibrator made by the Sandycroft Foundry Co. for the 60-H.P. Hunt cascade motor is as yet the only representative of this type of machine in this country. A Continental firm is making one for a 450-H.P. motor, but it has not yet been finished. The author has, however, made a design for a vibrator to be applied to the 800-H.P. motor of which particulars were given in Prof. Miles Walker's paper, and he finds that each of the three armatures would be 13 cm. in diameter and the length of core 33 cm. The armature resistance would be  $72/1,000$  ohms, and a flux  $\phi = 3.45$  megalines would be obtained with a magnetomotive force of 6,700 ampere-turns. At full load the injected E.M.F. is 23 volts. The excitation requires an expenditure of 700 watts, and the losses in the copper and iron, in brush friction, and in contact resistance, come to 1,300 watts, making a total expenditure of 2 kW. for the vibrator, against which must be set the reduction of losses in the motor due to the better power factor.

Fig. 5 gives the predetermined power-factor curve. The power factor of the 800-H.P. motor would with this vibrator be brought to unity at one-quarter load; at half load it would be 0.9 with a leading current; at full load it would be 0.95 with a leading current; and at twice full load it would again be unity. Above this output the current lags with a power factor of 0.92 at treble

load, when the limit of stability is approached. The weight of the vibrator is, as near as can be estimated, 18 cwt., and the floor space occupied is 18 in. by 3 ft., the vibrator standing 3 ft. high.

Whether a rotary or a vibrating machine be used as a phase advancer, the power to drive it is in either case very small, and will generally be more than covered by the reduced losses in the motor. The efficiency of any given motor, whether it works with or without a phase advancer, will therefore not be appreciably altered. There may, however, be a gain in the yearly energy efficiency, as the use of a phase advancer enables one to do with a smaller motor, since the overload capacity is increased. A smaller motor has smaller

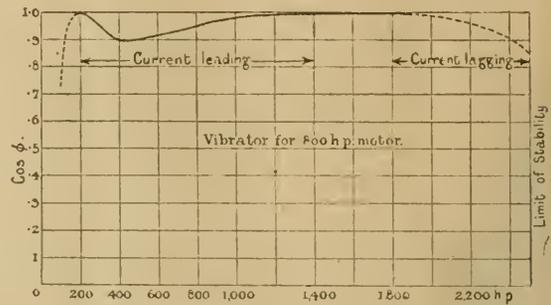


FIG. 5.

losses, and consequently the customer of a power company using his motors with a phase advancer attached will effect a certain saving in his bill for current even if the power company does not grant a special discount for his taking current at a high power factor.

Now how does the case stand with the power company? The cost for electrical energy generated and transmitted is made up of several parts, of which, however, only two need here be considered. One is the actual cost of generation, including a certain percentage of loss in transmission, and the other is independent of the amount of energy generated, but depends only on the cost of the plant which must be installed to provide the service. Part of the plant, such as the prime-movers, is only very slightly affected by the power factor; but the electrical plant, including the line and step-down transformers at the customer's end, is materially affected by it. The cost of the electrical plant is determined not by the true power, but by the output defined in volt-amperes; consequently it is only fair that a customer who takes his power adulterated by a large proportion of  $\sin \phi$  should in his payment for current recompense the company for the extra plant capacity necessary for the generation and transmission of wattless current. The customer should therefore not only pay for the true kilowatt-hours he takes but also something for the K.V.A.-hours.

This reasoning is the basis of a system of metering invented by Prof. R. Arno, of Milan. He and Signor Conti, the engineer to several Italian power companies, investigated the cost of generation and transmission as affected by power factor, and they found that the cost may with sufficient accuracy for practical work be taken as proportional to the sum of two-thirds of the watt-hours plus one-third of the volt-ampere-hours. Having settled this as a basis for charging Prof. Arno set to work to design a meter which would register according to this formula; and he has also indicated a way in which any meter may be adapted to register two-thirds of the watt-hours and one-third of the volt-ampere-hours.

In meters of the electrodynamic type where the moving system is a little armature traversed by a current in phase with the E.M.F. and the field is produced by the main current, a small lag is given to the armature current. In meters of the induction type where the moving system is a disk revolving under the combined influence of a shunt and main field, a small lag beyond  $90^\circ$  is given to the shunt field. The angle of lag in either case is so chosen that at the predominant power factor the meter registers according to Prof. Arno's formula. Thus for installations mainly supplying light the lag of the shunt current behind the E.M.F. is  $5^\circ$  in dynamometric meters and  $95^\circ$  in induction meters. The meter will then register with a negligible error at any power factor between 1 and 0.85. For installations consisting mainly of motors, the lag is  $14^\circ$  for electrodynamic and  $104^\circ$  for induction meters. The extra lag of  $14^\circ$  may be produced by a slight alteration in the compensating coil of the shunt field.

Prof. Arno states that meters so adjusted may be used in cases where the power factor varies from 0.5 to 0.9. For large consumers where great accuracy in the metering is essential, two meters side by side may be installed, one registering kilowatt-hours and the other K.V.A.-hours. The charge to be made to the consumer can then be calculated on the two-thirds and one-third basis, or on any other basis which may more nearly fit the special conditions of the power company's plant.

It is of interest to inquire what saving a customer may effect in his current bill if he uses a phase advancer. Take a large customer using large and small motors with an aggregate power of 1,000 kW. and a power factor of 0.75. Since only the large motors can be fitted with phase advancers, it will scarcely be possible to raise the power factor to unity, but a value of 0.95 may be obtained if large motors aggregating 700 to 800 kW. are so fitted. With a load factor of 34 to 35 per cent., the yearly consumption will be 3,000,000 kW.-hours,

With 0.75 power factor, the Arno meter would register 3½ million units; but after fitting phase advancers, the meter would register only 3.053 million units. With current at 0.5d. per unit this makes a difference of about £600 in the bill for current.

This, or something approaching this figure, represents the saving to the power company, owing to their having to supply very little wattless current. If, then, this saving is divided between the company and the consumer the latter gets £300 as a return for his capital outlay on phase advancers. To provide such apparatus for motors aggregating 800 kW. would cost between £300 and £450, so that the phase advancers would prove an excellent investment for the customer, and be still more profitable to the company. The latter not only reduce their working expenses by £300 a year, but they also may increase their sale of current by taking on more consumers to the extent to which their plant has been liberated from wattless current.

### Cluses for Street Lighting Specifications.

THE CHAIRMAN (Mr. F. W. Goodenough) opened the resumed discussion on Mr. A. P. Trotter's paper before the ILLUMINATING ENGINEERING SOCIETY, on April 29th. He said that in his opinion, a specification on which street lighting tenders were to be invited should be:—(1) Framed on a basis easily comprehensible by members of local authorities; (2) Based on a standard intelligible to the average man in the street; (3) Of quite general application; (4) Not open to any interpretation which, while complying with the specification, gave absurd lighting; (5) Definite. Nothing should be left to the discretion of the contractor. It should be possible to open tenders, and at once classify their data for comparison. There should be no question as to whether arrangement A or B suggested by different contractors was the better, otherwise the whole idea of the specification was defeated; (6) The provisions for making the tests upon which the contractor was to be liable to penalty for deficient lighting should secure a reasonable accuracy of result and the method of testing should be specified closely. The speaker maintained that no average councillor could understand such a term as "0.025 minimum horizontal foot-candles," but most persons had a tolerably accurate idea as to the relative value of lamps of various candle-powers. Candle-power specification was contemplated by the present specification for 80 per cent. of the streets and roads in the country, and, in his opinion, the procedure in all cases would be to determine how many lamps, of various candle-powers, arranged at various heights and distances apart, would light adequately various classes of streets and then specify on this basis. Local authorities wished to obtain *effect*, but they must really buy the cause thereof and this should be specified. Were the candle-power of lamps and the height and distance of posts not specified, requirements (4) and (5) would probably not be satisfied. It was a mistake to ignore all but the minimum illumination; Mr. Edgcombe six years ago said that minimum illumination was a scientific criterion, but aesthetic results had also to be taken into consideration, and high average was desirable even though the lighting was not very uniform. What was wanted was a bright and pleasing street appearance; obvious facts and considerations were ignored by the "scientific" basis adopted by the specification. In support of his arguments, the speaker quoted communications received from various foreign correspondents.

He considered that no one closely acquainted with street lighting photometry would be willing to accept a margin of less than 25 per cent. to provide against errors of observation and local disturbing influences in taking low minimum illumination readings. Apart from errors of observation, there would be a possibility of over 20 per cent. discrepancy if the alternative method of computation, by adding horizontal components, were employed. Authorities must be prepared to allow a margin of 33 per cent. from the contract minimum, or contractors must provide that excess to guard against possible penalties. Quoting Dr. Louis Bell—in a street lighting contract involving £50,000 or £100,000 per annum, a difference of 2 or 3 or 5 per cent. in the measured illumination was a very serious matter, and dependence upon measurements known to vary within at least this range would simply lead to exasperating litigation. The speaker submitted that the draft specification failed in every essential point to meet the requirements of a standard specification for street lighting. To produce a specification of real practical value with a truly scientific basis, the Joint Committee should abandon the "Unit of Measurement" clause and substitute one providing for rated candle-power of lamps determined by direct readings at specified angles, in a specified direction, with a specified relationship between readings at the widest and narrowest angles; and should provide a schedule showing by what number and arrangement, height, spacing and placing of lamps of specified candle-power, the illumination of streets in various classes could be (because it had been) obtained. A practical, equitable, comprehensible and comprehensive specification would be welcomed by all suppliers as well as all users of illumination.

PROF. J. T. MORRIS explained that he had placed all his test data before the Committee, but there had been no time to check these readings, which showed the discrepancies to which reference had been made by various speakers. In order of descending illumination:—In streets having minimum horizontal illuminations of 0.030; 0.023; 0.021; and 0.017 ft.-candle; the discrepancies between the sum of calculated minimum horizontal illuminations and measured values of the actual minimum horizontal illumination were:—3 per cent.; < 1 per cent.; 9 per cent.; and 20 per cent., but the absolute discrepancies were only —0.001; < 0.001; 0.0015; 0.004 ft.-candle. The lower the illumination, the greater

the absolute discrepancy, hence the percentage discrepancy rose rapidly but, provided the horizontal illumination was not less than 0.02 ft.-candle, the difference between measured and calculated values was not greater than 0.0015 ft.-candle and improvements in photometers would probably produce yet better agreement in future. Foreign illuminating engineers of high repute seemed to be against the adoption of minimum horizontal illumination as a sole basis of specification. Could they not adopt the minimum in conjunction with either the average horizontal illumination or the mean hemispherical candle-power of the lamps used? Just as the uniformity of illumination in the L.E.E. theatre was depressing, so would be uniform minimum horizontal illumination along a street. The specification as it stood would encourage uniformly low street illumination, and some such modification as that suggested appeared desirable.

MR. J. W. BRADLEY (city engineer, Westminster, communicated). As one who had controlled street lighting specification and contract work for many years on a C.P. basis, and had had much experience in surface illumination measurements, the writer preferred candle-power as a basis of specification. The C.P. height and general polar distribution of lamps should be specified, and the engineer should reserve control over the lantern and globes, &c. The contractor had then a definite basis on which to work. Specification by minimum illumination would involve the contractor in difficult problems. It was desirable that as few lamp-posts as possible be used, considering the obstruction they offered to the public, and, in important streets, a sufficient vertical depth must be adequately illuminated. The approximate number of lamps ought to be specified, and tenders should quote a price per position for each class of lamp. The location of standards must be entirely in the hands of the engineer; there were innumerable factors governing the position in which posts should be erected, and were a contractor allowed to place lamps where he would, so long as he illuminated to a satisfactory degree a plane 3 ft. 3 in. above street level, endless disputes would be raised between ratepayers, local authorities and contractors. The writer believed he was the first to specify in a lighting contract a definite amount of measured light as a basis for tendering, and after many years' experience of public street illumination, carried out under contracts based on the measurements of direct C.P. and with the knowledge of the working of such contracts in respect of both gas and electric lighting, he could definitely state that these contracts had proved satisfactory in every way; they had lapsed, and been again re-entered upon by the previous contracting parties—a fact which testified to their fairness and ease of working. The principal points in this specification were:—5s. penalty per day per lamp of deficient C.P.: lamps to be not less than 22 ft. (large units) or 12 ft. (small units) from the ground level; each lamp to give at least 90, 180, 1,800 or 3,000 C.P. as directly measured by an approved photometer placed at ground level, the C.P. being arrived at by averaging two readings in any position with regard to the light under test (readings at 20° and 50° to horizontal); light to be steady white or yellowish-white; the design of lamp pillar, winding gear, reflectors, &c., to be approved by the city engineer; the onus of testing (for maintenance purposes) to lie with the contractor.

MR. FRANK BAILEY declared himself a strong supporter of the specification. Appendix A offered an alternative to those who disagree with a minimum horizontal illumination specification, and too little attention had been paid to this section in reading and discussing the paper. Many of the objections raised by gas engineers indicated insufficient acquaintance with the object and scope of Appendix A.

MR. E. ALLAN (Vice-President, Institution of Gas Engineers) said there could be no doubt that the minimum horizontal illumination in Bow Street (lighted by high-slung centre suspended arcs), was good, but the general lighting effect was very poor. A specification was wanted which should be suitable for all undertakings, and he suggested that some other basis of comparison than minimum horizontal illumination should be added.

MR. ROGER SMITH pointed out that there were two distinct types of specification: that adopted by architects and constructional engineers, in which every detail of the work required was fully specified, and the whole responsibility of results lay with the designing engineer—and that by which general machinery was often specified—the desired result being stated, and the means and obtaining of this result being left with the contractor. There were various types of specification between these extremes, but it seemed to him that to specify all the details of the plant and the result to be secured violated every canon on which a specification should be based. When details of equipment were specified, a certain result might be expected, but must not be specified. The Joint Committee had chosen to follow the second alternative, and trust the contractor to select the means of securing a specified result; apparently gas engineers were not prepared to place such trust in contractors. During the past seven years he had designed all his railway lighting installations on the basis of minimum horizontal illumination 4 ft. from the ground, and in future his plane of measurement would be 1 m. from the ground. Under the conditions of his work speed was all-important, and he believed that specification of minimum horizontal illumination resulted in a great saving of time. The horizontal was the only plane on which a good criterion could be obtained by a single measurement, the results of which took in those on other planes of reference by implication. If one result alone was to be specified, that must be horizontal illumination. In street lighting the contractor was justified in taking advantage of light received by reflection, and from other lamps: account could only be taken of these components by horizontal illumination measurements. A certain maximum horizontal illumination (with plus and minus limits), should be specified in addition to the minimum horizontal illumina-

nation, and some restriction should be placed on the intrinsic brilliancy of the luminous source: at present, much of the powerful lighting in London streets was positively dangerous.

Mr. COOPER said that many of the objections to the specification rested on misconceptions. Horizontal illumination could be measured accurately, and if it was adequate the illumination of other planes was in practice satisfactory; illumination limits were first reached on the horizontal plane. In his opinion, the average town councillor knew no more about candle-power than about foot-candles; actually there was no reason why he should be familiar with either. Specification by candle-power was difficult in cases where dioptric or other special globes or reflectors were used; in case of very powerful units; and in cases where a number of lamps were mounted in separate globes carried by radiating arms on one post (as in "White Way" lighting units). Minimum horizontal illumination measurements offered no real difficulties and took account of every factor concerned. Glare had not been dealt with in the specification. The lighting in a street might be raised from Class A to Class E by simply increasing the candle-power of the lamps tenfold, but then glare would probably be serious, and the specification ought to discriminate between such and legitimate practice. In his opinion, it was the illumination on the street level which was of importance; not only was this illumination higher, and hence easier to measure than that on the metre plane, but also the latter penalised lighting systems in which low posts were employed. No specification should be adopted which systematically penalised any particular lighting system without cause.

Mr. ABADY considered that the specification was wrong from end to end; that it bristled with inconsistencies, was far removed from anything likely to be of use to anybody, and was unworthy of serious discussion. The minimum horizontal illumination basis was admitted to be inapplicable to 80 per cent. of the streets in the country, and the estimation of horizontal illumination by summation of calculated components did not even approximately agree with the actual horizontal illumination. The specification of a minimum illumination connoted a search for the minimum—a tedious operation, and one leaving much to the discretion of the photometrist. Minimum illumination was not a basis of comparison and minimum horizontal illumination was the nadir of utility. To make tests 3 ft. 3 in. above ground level was not fair to lamps on low posts. Horizontal illumination, whether minimum or maximum, was useless as a basis of comparison between systems, but if it was to be considered at all, it must be that on the street surface. Lighting problems could not be dissociated from the source itself or from the surface illuminated. Everything was seen by reflected light, and the amount of the latter depended on the nature of the surface as much as on the lamps lighting it. In the cases mentioned by Mr. Cooper, in which candle-power was difficult of specification, there was no difficulty in measuring the normal illumination received in a certain direction—the conversion of this normal illumination to candle-power was a purely arithmetical operation. The speaker supported Mr. Goodenough's suggestions. Local authorities did not want to buy minimum horizontal illumination. The specification permitted 2° error in the determination of the angle of incidence of a direct ray; this might lead to 20 per cent. error in the results in certain cases. The range of illumination in the street "class" was too great; a 50 per cent. variation of illumination in one direction might leave a street in the same class, while a few per cent. change in the other direction would alter its classification.

Mr. J. S. DOW outlined the views and arguments expressed in communications received from a number of members abroad:—

Dr. L. BLOCH (Berlin) agreed with horizontal plane measurements, but preferred average to minimum illumination as a basis for specification. Were minimum illumination the sole consideration, electric lighting would be in a particularly favourable position. At least, the mean and maximum horizontal illuminations should be specified in addition to the minimum.

Dr. L. J. TERNEDEEN (Amsterdam) wrote that in addition to horizontal-plane measurements, the minimum illumination should be determined in a vertical plane perpendicular to the direction of street traffic.

Dr. H. STRACHE (Vienna) wrote that horizontal illumination alone was not a sufficient basis of specification.

Prof. S. A. RUMI approved of Mr. Trotter's suggestions; in Italy contracts usually referred to candle-power rather than to illumination.

Dr. L. BELL (Boston, U.S.A.) thought that the suggestions for the draft specification of a standard contract were sufficient to secure good results. For most purposes measurements of illumination on a vertical plane would give a better indication of the practical value of an illumination scheme than would horizontal plane measurements.

Mr. L. B. MARKS (New York) said that minimum illumination was an insufficient basis of specification. Intrinsic brightness was often a matter of prime and determining importance.

Dr. C. H. SHARP (New York) said that in streets to be illuminated brightly at all points, specification of the minimum should ensure good illumination, though it might not compare correctly with different systems. In the majority of streets, however, specification of minimum illumination or the C.P. at 10° below the horizontal furnished an insufficient criterion. The delivery of a sufficient flux of light and its proper distribution might be ensured respectively by specifying the average and minimum illumination over the area. The flux-of-light method of computing average illumination was being used very generally and offered no special experimental difficulties. The illumination measured should be that on the street surface.

Mr. P. S. MILLAR (New York) considered minimum intensity an unsatisfactory basis of rating for a street lighting system. The

real value of a scheme depended on the maximum and perhaps the average as well as the minimum illumination.

Mr. L. GASTER said that the irreconcilable opposition of the Gas Members of the Joint Committee had led to the arrangement of the present discussion, and it was and had been throughout intended that, after the discussion, the draft should be taken back into committee for amendment or amplification. He did not think it necessary to impose rigid penalty clauses; there were other means whereby the interests of the public were fully safeguarded.

In his reply, Mr. A. P. TROTTER spoke of the unique constitution of the Joint Committee. As the representatives of the several institutions were unanimous among themselves, and as voting had been by institutions, no injustice seemed to have been done. The matter to be discussed was not methods of street lighting but a means of describing it when obtained. In his opinion, the specification afforded a very practical solution to this problem. Some of the participants in the discussion must have stopped reading the paper before they arrived at the specification. In practice no survey was required to locate the point of minimum horizontal illumination; it could almost be located by eye—only a few confirmatory observations were needed. He attached the utmost importance to the agreement between the surveyors' classification and that reached by the minimum horizontal illumination measurements. The surveyors must have allowed for reflected light from house-fronts and for the value of direct ray illumination at crossings; but the fact remained, simple horizontal illumination measurements led to the same classification. Admittedly, direct ray illumination was and horizontal illumination was not of importance in street lighting; yet, so early as 1883, Sir Wm. Preece had recognised that horizontal illumination was the quantity to measure—not because it was most useful, but because it allowed of an accurate description of the lighting with minimum trouble. Even were direct-ray measurements made, it was only necessary to use a table of cosines to reduce the results to the horizontal plane for comparison. He was willing to add a direct-ray clause to the specification if it could be shown how comparisons were to be effected and how direct-ray illuminations were to be added. Direct-ray was greater than horizontal illumination and was easier to measure in this respect, but the horizontal was the only plane on which all illumination was added automatically. There seemed to be no reason why a Town Council should understand foot-candles or C.P.; all they need do was to ask for light similar to that in such and such a street. The specification was intended to sid technical men ordering and providing illumination. The approximate height and location of lamps must always be determined by the surveyor, but the details of illuminating schemes should be left to the contractor, otherwise the responsibilities of borough surveyors would be enormously enhanced, and progress in good lighting would be seriously retarded. For instance, the keen competition between gas and electricity had undoubtedly led to more rapid and extensive improvement than would otherwise have been attained in lighting. The absurdities feared by some of the gentlemen who had spoken would not be realised; for instance, the cost of abnormally tall posts would prevent their adoption. The cost of the only lighting units which could provide it would prevent dismal "flat" illumination. Mr. Harrison's table was based on a formula, and should not be used outside the limits demarcated by the horizontal lines shown in the various columns. Sec. 8 had been specially inserted to provide a safeguard in respect of "glare." By simply specifying minimum illumination, the purchaser inevitably received a bonus of light. The draft specification contained certain illumination clauses, but much of it was intended for candle-power work. Dr. Bunter had shown it to be possible to make accurate measurements of very low horizontal illumination. Only in extreme cases were candle-power measurements imperative; for the latter the specification made full provision, though it was primarily intended for those cases in which good lighting was desired. Frankly, he shirked the calculations involved by average illumination specifications. Mr. Bradley's views deserved careful consideration, but it should be remembered that a system which proved admirable in a certain district with which a surveyor had grown thoroughly familiar by long association might prove quite unsatisfactory for general use; the Committee certainly aspired to the formulation of a specification suitable for international use.

In a letter addressed to us, Mr. Kenelm Edgcombe says that as he had already spoken in the discussion on Mr. Trotter's paper when Mr. Goodenough alluded to some opinions expressed by him six years ago, he had no opportunity of replying. Mr. Goodenough appeared to think that because Mr. Edgcombe was now in favour of the proposed draft specification, he had changed the views he held in 1907. Nothing could be further from being the case. He was then, and was still, absolutely convinced that the horizontal illumination was the only satisfactory criterion of street lighting.

The point which Mr. Goodenough seemed anxious to make was that in 1907 Mr. Edgcombe held that it was the average horizontal illumination which counted, whereas, in 1913, he was found to be in agreement with a specification which took the minimum horizontal illumination as the criterion. He was still strongly of opinion that the average illumination was of importance. At the same time, he was not in favour of making a statement of either the maximum or average obligatory in a street-lighting specification, and this for the following reasons:—

1. The measurement of the average illumination over a given area is a matter involving a large amount of work—certainly much more than could possibly be devoted to it by the engineer in supervising the execution of a lighting contract.

2. To specify the maximum illumination is open to the very

serious objection that "freak" spots would have to be guarded against.

3. Most important of all, experience has shown, as is made abundantly clear by Mr. Trotter in his paper, that the minimum illumination does, under present conditions of lighting, give a criterion which is in entire accord with that made by eye by experienced judges.

With regard to Mr. Goodenough's query as to his opinion of a "dismally lighted street" as compared with a "brightly lighted one," it was entirely a question of the amount of money which the purchaser was prepared to spend, seeing that Clauses 7 and 8 of the proposed specification gave the engineer complete control in this respect.

He would like finally to bring Clauses 5 and 11, as well as those just cited, to the notice of Mr. Goodenough and the other speakers, who seemed to have derived so much exhilaration from the mental gymnastics involved in working out all the possible and impossible combinations of height, spacing and candle-power, giving the same horizontal illumination.

If the infinite number of such combinations, all giving the same result, meant anything at all, surely it was that it was better to specify the result rather than the ingredients which went to make it up, more especially since the capabilities of one of the chief ingredients, namely, the lamp, could not possibly be so well known to the purchaser as to the supplier.

### BIRMINGHAM'S PROPOSED NEW POWER STATION.

AN interesting report is that which was presented by the Birmingham Electric Supply Committee at the quarterly meeting of the City Council on Tuesday last, on the question of the proposed new power station at Nechells. From it we gather that sanction to the purchase of land and to the sum of £500,000 being raised for the scheme was given by the Council in 1911, and approved in the Corporation Act of 1912. The city is at present supplied from three generating stations:—

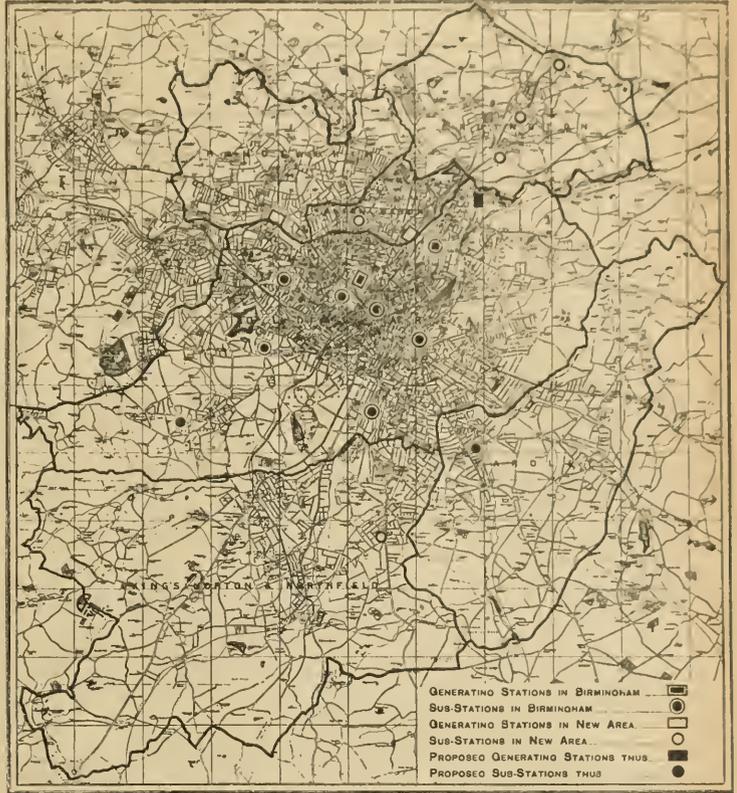
Summer Lane ...	Capacity 25,500 KW.
Water Street ...	Capacity 3,040 KW.
Chester Street, Aston Manor ...	Capacity 4,550 KW.

Total ... 33,090 KW.

The capacity of the Summer Lane Station, as originally designed, was 22,000 KW., but as advantage has been taken of the developments in generating machinery since that date, and more land has become available, the ultimate capacity of this station will be increased next year to 36,500 KW., and contracts for the final instalment of plant up to this capacity have recently been placed. Although it would be possible to substitute larger generating plant in place of that already installed in the engine house, there is no

plant are considerable; it will consequently be more economical to supply any further demand in the area served by this station from Summer Lane, or from the Nechells power house. To ensure continuity of supply in case of breakdown there should be a margin of 20 per cent. of spare plant, and it will be seen from the table on the next page that it is necessary to make further provision by the winter of 1915-16.

The Nechells power house will supply current at 5,000 volts, 25 cycles, to the whole of the area of the greater city, via Summer Lane or the sub-stations, and also direct to high-tension consumers.



THE "GREATER BIRMINGHAM" AREA, SHOWING THE EXISTING AND PROPOSED GENERATING AND SUB-STATIONS.

The ultimate capacity of the station will be 100,000 KW., the first portion being designed to accommodate plant of 25,000 KW. capacity. It is proposed to install 15,000 KW., of which two-thirds will be available by the winter of 1915-16.

A private canal basin will be provided, only a portion of which will be first constructed. A railway siding will also be built, and this will be employed for conveying material and machinery to the site, and for subsequently dealing with a portion of the coal and ash traffic.

The main coal store will be in the open on the wharf, and there will also be an auxiliary coal store on a piece of vacant land adjoining the entrance to the site. The total capacity of these coal stores is 10,000 tons of coal. For the ultimate capacity of the station there is further space available for coal storage purposes capable of accommodating 50,000 tons.

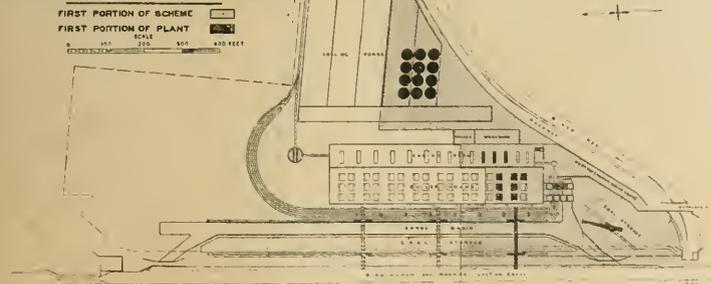
The coal will be handled by means of transporter cranes, which can be used for the double purpose of filling or emptying the stores, and for feeding the conveyors which will be used to supply the coal bunkers over the boilers. These conveyors may also be fed from railway trucks which can tip the coal direct into them.

It is proposed to install at the outset three 5,000-KW. turbines. Later on a larger type, probably of 10,000 KW., will be installed. An overhead electrically-driven crane, capable of lifting a maximum weight of 60 tons, will be provided.

In the boiler house, marine type water-tube boilers, fitted with superheaters and overhead economisers, will be erected. It is proposed to use short iron chimneys, and to control the draught by means of motor-driven fans on the Prat system. Seven boilers will form the first equipment to provide steam for the three generating sets.

For removing the ashes from the boilers it is proposed to adopt a

CITY OF BIRMINGHAM ELECTRIC SUPPLY DEPT.  
BLOCK PLAN OF SITE OF NECHELLS GENERATING STATION SHOWING IN COLOUR THE FIRST PORTION OF THE SCHEME AND THE FIRST UNITS OF PLANT.



THE PROPOSED NECHELLS POWER STATION, BIRMINGHAM.

room for the necessary corresponding increase in the boiler equipment.

While it is intended to continue to supply from the Water Street station during the winter months, any increase of the plant there is out of the question.

The Aston Manor station has reached the limit of its present capacity, and the difficulties in the way of increasing the generating

new system operated by air suction. Large totally enclosed ash receiver drums are installed, from which the air is exhausted by motor-driven exhausters. The drums are connected to pipes which run under the ashpits beneath the boilers, and a rush of air is thus continually maintained through these pipes. The ashes are dropped out of the ashpits into a small movable crusher, thence through openings into the pipes, and drawn by the rush of air into the receiver drums. The latter are emptied into barges, carts, or railway wagons. The basement of the boiler house is in this way kept quite free of all dust and from the corrosive fumes given off from the ashes when slaked.

Year.	Plant capacity of all stations in kw.	Maximum demand in kw.	Spare plant available, kw.	Percentage of plant capacity.
1909-10	20,540	15,260	5,280	25.7 %
1910-11	22,040	17,156	4,884	22.2 %
1911-12	28,590	24,081	4,509	15.7 %
1912-13	33,090	27,775	5,315	16.06 %
1913-14	39,090	†32,950	†6,140	†15.7 %
1914-15	44,090	37,450	6,640	15.06 %
1915-16	44,090	43,150	940	2.1 %
1915-16	§54,090	43,150	10,940	20.2 %

\* From 1911-12 Aston Manor is included.  
 † The figures in cols. 3, 4 and 5 are estimated for 1913-14 and onwards.  
 ‡ Without Necbells.  
 § With Necbells.

A switch house will be constructed over the entrance cartway to accommodate the whole of the switchgear required for controlling the generating plant, the out-going feeder cables and the various lighting and power circuits within the station.

on hire at date is 894, and the horse-power 5,749. The total expenditure on this account to date is £23,070.

The units sold for L.T. power for the 12 months ended March 31st, 1906, when the scheme was sanctioned, and the units sold during the 12 months ended March 31st, 1913, were as under:—

	Units.	Revenue.
Twelve months ended March 31st, 1906 ... ..	1,490,506	£10,266
Twelve months ended March 31st, 1913 ... ..	17,626,743	£70,427

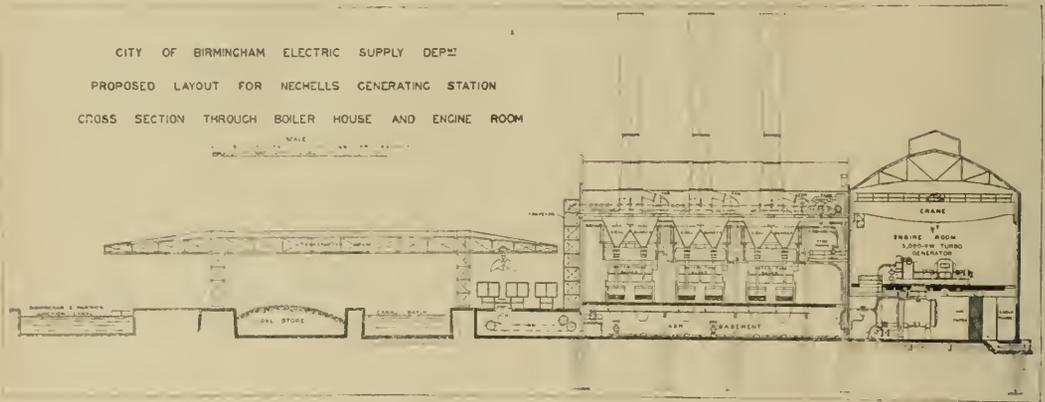
The Committee considers it desirable to continue the scheme on its present lines, and recommends the borrowing of the sum of £20,000 to cover the expenditure in excess of the original loan and prospective expenditure on the same account.

*Loan for Service Connections, Extra-High-Tension Switchgear, and Transformers on Consumers' Premises.*—In 1909, the Council sanctioned a loan of £149,350 for the general purposes of the electric supply undertaking; this included a sum of £23,000 for services, high-tension consumers' switchgear, and transformers on consumers' premises. The expenditure against this loan to date is £23,996.

The following table shows the increase in the number of consumers and in the output of electricity since the date mentioned above:—

	March 31st, 1909.	March 31st, 1913.
Number of consumers ... ..	3,903	7,435
Units sold for low-tension lighting and power ... ..	10,796,024	25,288,679
Units sold for high-tension power ... ..	1,827,794	16,908,474
Total units sold ... ..	12,623,818	42,197,153

It is proposed to borrow a further sum of £30,000 to cover excess and future expenditure under this head.



THE PROPOSED NECBELLS POWER STATION, BIRMINGHAM.

Workshops, offices and stores will also be provided adjoining the engine house.

Large cooling ponds will be arranged on the vacant land adjoining the engine house, divided up into sections, so that any section can be emptied for cleaning purposes. Over these ponds will be installed cooling towers for cooling the whole of the circulating water required in the station. It is proposed to use the effluent water from the filter beds of the Birmingham, Tame and Rea District Drainage Board for circulating in the condensers, and an ample quantity is available on the site. A first instalment of 12 cooling towers will be sufficient for the initial requirements of the station.

The Committee states that it is satisfied that at present and for some time to come, turbine plant is the best that can be adopted; this decision has been arrived at after examining proposals for gas-driven plants by home and foreign makers.

The Committee unanimously asked the Council to approve the plans and estimates presented. The latter include the following sums:—

Necbells, land and buildings ... ..	£132,500
" plant and machinery ... ..	156,000
Sub-station equipment ... ..	50,000
Underground mains ... ..	161,500
	<hr/>
	£500,000

A loan for sub-station equipments of £11,300 was sanctioned by the L.G.B. in January, 1911. This has been expended, as well as an additional £5,380 included in the sum estimated above to cover a period of five years. The last mains loan, amounting to £94,000 (in 1909), has been expended, as well as £46,546 additional, included in the amount mentioned above, which will meet the cost of trunk cables and ordinary requirements for two years.

*Loan for Provision of Motors for Hire and Hire-Purchase.*—In 1906, Council sanctioned a scheme for supplying motors upon hire and hire-purchase terms, and a loan of £20,000 was authorised. The scheme has been widely adopted; the total number of motors

### NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

#### The "Lynton" Radiator.

This radiator has been designed by Mr. Lynton of the Charing Cross and City Electricity Supply Co., especially for hiring out purposes. We understand that one of the chief difficulties of supply companies in this direction is the cost of maintenance.

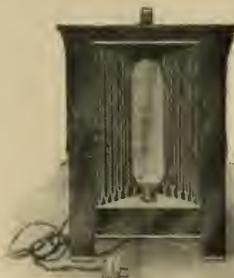


FIG. 1.—"LYNTON" RADIATOR.

This point has been carefully studied in the radiator illustrated; all repairs, should they be necessary, can be done on the spot by the company's workman, and there is no need for the radiator to be returned to the workshop.

Only one lamp is fitted in the front of the radiator, and this is claimed, by the special arrangement of the reflectors, to give almost the effect of two. MESSRS. VERITYS, LTD., of King Street, W.C., have the sole rights of manufacture of the "Lynton" radiator, and they will be pleased to forward a sample to any engineer who is interested. The heating elements at the back have a special arrangement for affixing the company's seal to prevent tampering.

### The "Tress" Illuminated Signs.

We recently visited the offices of the TRESS CO., 4, Rathbone Place, W., to examine their electrically illuminated signs, of which they make a great variety, as well as a wide range of fittings, apparatus and accessories for cinematograph theatres, photographers and other trades. In addition to illuminated letter signs, transparencies, &c., of the familiar types, the company are just introducing a novel sign, which is totally different to any that we have yet seen, and is extremely effective. The accompanying illustration shows one of these devices in the form of a double-sided hanging sign, which to all outward appearance is like others of its kind; when in operation, however, the large illuminated letters gradually diminish in size, keeping their correct proportions and constant spacing, until they finally disappear altogether; they then



FIG. 2.—"TRESS" CONTRACTING AND EXPANDING LETTER SIGN.

reappear on a diminutive scale, and gradually regain their maximum dimensions, when the cycle is repeated. The effect is exceedingly striking, and inexplicable to the uninitiated observer; it is obtained by an ingenious device on the same principle as the iris diaphragm, but it is impossible to detect the method of operation. The letters and background may be of any colours in strong contrast, and are effective by day as well as when they are illuminated. The mechanism is driven either by clockwork or by a small motor, taking a trifling amount of power. The sign has been eagerly welcomed by contractors and others. The company will retain the manufacture in their own hands, supplying only to the trade. There is, of course, no limit to the variety of patterns in which the sign can be made, including interchangeable letter signs.

Apart from signs, the Tress Co. do a very extensive business with the trade in seats, programme boards, arc lamps and rheostats of their own make, a ticket-issuing machine with an electric tell-tale, and electrical and photographic supplies in general.

### An Electric Staff-Kitchen.

Some three months ago the SIMPLEX CO. equipped, in connection with their office staff dining club in Birmingham, an electrically-operated kitchen. The time is yet early to have secured any very



FIG. 3.—SIMPLEX ELECTRIC KITCHEN.

exhaustive figures as to cost, but the experience gained is proving exceedingly useful, and clearly demonstrating that electric cooking can more than hold its own from every point of view. Some 40 meals are prepared per day, consisting of soup, at least two

kinds of joints, a choice of sweets, coffee &c., and, in addition, some 60 tons per day, many of which are of the variety known in certain localities as "high."

The records of cost so far secured may be regarded as distinctly satisfactory, in view of the fact that they include the heating of all the "washing-up" water (no small item), and that the cook has had no previous experience of the electrical method, and has yet to remember that a switch is designed for cutting off the current when it is not wanted. The average cost per person per meal has proved to be a fraction over 3d., with current at 1d. per unit.

The kitchen is being used to test articles of standard manufacture in actual practice, rather than to obtain results from the use of a large elaborate cooking range.

So far, there has been complete freedom from breakdown of the actual elements, the only mishap being a broken connection to the grill on a cast-iron oven. A view of the kitchen is given in fig. 3.

## PARLIAMENTARY.

### Rhondda Tramways (Railless Traction) Bill.

SIR IVOR HERBERT'S Select Committee of the House of Commons last week and this week considered the Bill promoted by the Rhondda Tramways Co. for power to construct about 5 miles of railless trolleys, to start from their existing tramways and go through the parish of Llantrisant. Mr. Vesey Knox, K.C., and Mr. Tyldesley Jones represented the promoters, and Mr. Hutchinson, K.C., and Mr. Rhys Williams were for the Llantrisant Rural District Council, who opposed.

MR. VESEY KNOX, K.C., in opening, stated that the tramway company had spent about £390,000 on their tramways, and in comparison with that the railless traction scheme was a very small undertaking, for it was estimated to cost only £20,000. If the powers sought were granted, it was proposed to give a half-hourly service, with a maximum fare of 5d. and a minimum fare of 1d. The roads were suitable for such a service, and would require no widening, but if the Committee came to the conclusion that the company ought to contribute to the upkeep of the roads, then he asked that such contribution should not exceed 3d. per car-mile.

MR. WATTS MORGAN, agent for the Rhondda district of miners, stated that 40 federation lodges in the district, representing 38,000 miners, had signed petitions for the Bill. At present it was impossible to get to some of the mines without going over the mountains.

A considerable amount of evidence was given regarding the effect which the construction of the proposed tramways would have in bringing about the opening up of new housing districts, the CHAIRMAN having intimated that this would be a leading factor in the settlement of the general principle of the Bill.

MR. NESBIT, manager of the Rhondda Tramways, gave evidence in favour of the proposals, and in cross-examination said that when the proper time came, the Rhondda Urban District Council would take over the undertaking in its area at a price fixed at the time the agreement was made with it, but, of course, the fixed price would not apply to the extensions.

MR. STANLEY, engineer, gave evidence on the plans and estimates and expressed the opinion that whilst an ordinary tramway would be commercially impracticable in the district, he was satisfied that the route was suitable for railless traction. The probable receipts were estimated at £5,740 and the working expenses at £3,927, leaving a profit of £1,813, out of which, however, provision would have to be made for depreciation.

MR. WALTER, engineer, also gave evidence in support of the scheme, and, replying to the CHAIRMAN, said he considered that the roads ought to be free to every class of vehicle, or, in the alternative, all should share alike with the cost of repairs. The railless trolley system had not been long enough in existence to furnish reliable data as to its effect on the roads.

The case for the promoters having closed, MR. G. MORGAN, formerly surveyor to the Llantrisant District Council, was called for the opposition, and expressed the opinion that the road proposed to be used was unsuitable on account of its surface, its gradients and its narrowness. He believed, if the system was allowed, the cost of maintaining the road would increase by £1,000 a year.

In cross-examination, witness said he did not wish to see the Bill thrown out, as it would give more facilities for transport, but he wanted reasonable protection for the local authority.

Other evidence in opposition having been heard,

MR. HUTCHINSON addressed the Committee for the Llantrisant Rural District Council, and intimated that his clients did not want the Bill thrown out. If, however, the Bill was to proceed, the promoters ought to give reasonable accommodation for the traffic, and he characterised the proposal to run six cars as ridiculous. In order to deal with the passengers 16 cars would be necessary. He contended also that the road ought to be widened at the expense of the promoters.

The Committee considered the matter in private, and the CHAIRMAN subsequently announced that they had taken into consideration the figures given in evidence, viz., £4,231, which it was calculated would provide an 18-ft. roadway and a 6-ft. footway. The Committee considered that safety would be secured by a 17-ft. roadway and a 4-ft. footway. They had come to the conclusion that the road authority must be held responsible for the adapting of the road, but they would put upon the company the liability of one-third of such capital charge, not exceeding in any case one-third of £4,000. With regard to the maintenance, they had decided

that a proportion of the annual charge should be put upon the promoters, but such a charge was not to exceed three-eighths of a penny per car-mile. Subject to agreement on these points the Committee declared the preamble proved.

**Porthcawl Gas and Electricity Bill.**—Lord Donoughmore's Committee on Unopposed Bills has passed the preamble of this Bill, which dissolves and reincorporates the company, and gives power to them to erect a generating station and supply electricity.

**Kent Electric Power Bill.**—The House of Lords has agreed to allow an additional provision to the Kent Electric Power Bill to be introduced this session.

**Brighton Corporation Bill.**—This Bill came before the Earl of Kintore's Select Committee of the House of Lords on Monday. Several matters were dealt with in the Bill, including a clause for the transfer of the powers of the Brighton, Hove and Preston General Omnibus Co. for the running of a system of railless trolley tramways between Brighton and Rottingdean. The borrowing powers sought in the Bill in regard to the railless trolley system were £19,000. There was no opposition to this part of the Bill, the preamble of which was declared proved.

**Westgate and Breighton Gas and Electricity Bill.**—The Unopposed Bills Committee of the House of Commons has passed the preamble of this Bill, which authorises an increase of capital to the extent of £45,000.

**Southport Corporation Bill.**—A Select Committee of the House of Commons, presided over by Mr. W. Middlebrook, has passed the preamble of the above Bill, which deals with a large number of matters affecting the administration of the borough, and, amongst other things, gives power to run trolley vehicles. The Committee sanctioned a loan of £3,500 for the electrical equipment of trolley vehicles, with 20 years as the period for repayment, and £2,250 for trolley vehicles, repayable in 10 years.

**Chesterfield Corporation Railless Traction Bill.**—Sir Ivor Herbert's Select Committee of the House of Commons has fixed the following periods for the repayment of loans authorised under the Bill:—Erection of car-sheds, depôts and buildings, £2,000, 25 years; overhead equipment for trolley vehicles, £33,780, 20 years; trolley vehicles, £6,400, 10 years; motor-omnibuses, £16,000, five years.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Applied expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 9,918. "Dry galvanic cells." F. WEATHERILL and C. LEE. April 21st.  
 9,921. "Electric furnace." P. EIERMANN. April 21st. (Complete).  
 9,926. "Hose coupler and electric signal." C. H. LIOHT. April 21st. (Complete).  
 9,930. "Night telephone-number indicator." K. S. HAY. April 22nd.  
 9,947. "Resistance for regulating the current in an electric circuit." M. MANSELL. April 22nd.  
 9,949. "X-ray tubes and the like, and the manufacture thereof." C. A. FRIEDRICH. April 22nd.  
 9,960. "Electrical connectors of the plug and socket type." A. P. LUNDBERG, G. C. LUNDBERG, P. A. LUNDBERG and G. FEGG. April 22nd.  
 9,963. "Earthing clips for metallic-covered electric cables." F. DE B. HART and ANCHOR CABLE CO., LTD. April 22nd.  
 9,964. "Armoured flexible electrical cable." J. BOWYER and ANCHOR CABLE CO., LTD. April 22nd.  
 9,969. "Electrical irons and the like." J. C. P. KIRKWOOD. (Divided application on 9,613, 1912, April 22nd.) April 22nd.  
 9,968. "Ampere-hour meter. ALGOMEINE ELECTRICITÄTS GES. (Convention date, April 24th, 1912, Germany.) April 22nd. (Complete).  
 9,980. "Substitution resistances for electric lamps." W. HRINGS. (Convention date, October 3rd, 1912, Germany.) April 23rd. (Complete).  
 9,984. "Electric controlling-switch gear." E. W. ADAMS. April 23rd.  
 9,975. "Machines applicable for use in taping articles such as cables." FRIED. KRUPP ART. GEB. GROSSWERK. (Convention date, April 24th, 1912, Germany.) April 23rd. (Complete).  
 9,979. "Securing electric lamps in their sockets." R. J. BOTT. April 23rd.  
 9,987. "Arrangements for automatically regulating the conditions of electric systems." H. LOGGTON. April 23rd.  
 9,990. "Enclosed electric furnace with upper charging chutes." HELFENSTEIN ELEKTRO-OFEN G.m.b.H. (Convention date, April 27th, 1912, Austria.) April 23rd. (Complete).  
 9,992. "Electric contacts and switching or contacting apparatus." Soc. ANON. DES ÉTABLISSEMENTS L. BLERIOR. (Convention date, April 24th, 1912, Belgium.) April 23rd. (Complete).  
 9,993. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) April 23rd. (Complete).  
 9,997. "Electric cable conduits." C. L. DRURY. April 24th.  
 9,994. "Electric transmission systems." W. P. THOMPSON. (Soc. Anon. des Telegraphes Edouard Bellin, France.) April 24th. (Complete).  
 9,992. "Electrical signalling." J. C. THOMPSON. April 24th.  
 9,933. "Electrical driving gear for clocks and the like." F. T. REID and C. WIENEK. April 24th.  
 9,944. "Telephonic reproducers." C. BRILLE. (Convention date, April 24th, 1912, Germany.) April 24th. (Complete).  
 9,965. "Armature windings for synchronous dynamo electric machines." BRITISH THOMPSON-HOUSTON CO., LTD., and F. P. WHITABER. April 24th.  
 9,966. "Dynamo-electric machines." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 24th.  
 9,967. "Electro-magnetic lock." H. D. E. DOWMAN. April 24th.  
 9,703. "Selective impulse transmitters." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) April 24th. (Complete).  
 9,726. "Magnetic separating machines." H. H. THOMPSON and A. E. DAVIES. April 25th.  
 9,730. "Inspection elbow and like boxes for steel conduit or tubing for electric wires and cables." J. E. H. FISHER. April 25th.  
 9,732. "Loud-speaking telephone instruments." KELVIN & JAMES WHITE, LTD., and M. B. FIELD. April 25th. (Complete).  
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 ELECTRICAL GEYSERS. C. R. BELLING. 8,682. April 12th.  
 APPARATUS FOR STARTING MULTIPLE-CYLINDER INTERNAL-COMBUSTION MOTOR BY MEANS OF MAGNETS. FIRM OF WICKERLEIN & STOCKER. 8,926. April 16th. (October 11th, 1911.)  
 DEVICE FOR INDUSTRIALLY STERILISING WATER BY MEANS OF ELECTRICAL MERCURY LAMPS GENERATING ULTRA-VIOLET AND SIMILAR RAYS. F. G. TRIQUET. 9,314. April 19th.  
 PROCESS FOR THE MANUFACTURE OF DRAWN TUNGSTEN WIRES OR THE LIKE. C. H. FISCHER. 9,361. April 20th.  
 PREPARATION OF ELECTRICITY METERS. C. J. TURBER. 13,647. June 11th.  
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 ARMATURE FOR DIRECT-CURRENT WATT-HOUR ELECTRICITY METERS. H. E. MOUL, (Korting & Mathiesen Akt.-Ges.) 27,346. November 27th.

1913

- CURRENT-RECTIFYING APPARATUS. F. CONRAD. 622. January 8th. (January 10th, 1912.)  
 SPARKING PLUGS. Siemens & Halske Akt.-Ges. 1,064. January 14th. (January 26th, 1912.)  
 TELEPHONE SYSTEMS. W. J. RICKETS. 2,357. January 29th. (Addition to No. 4,282 of 1911.)

# THE ELECTRICAL REVIEW.

VOL. LXXII.

MAY 16, 1913.

No. 1,851.

## ELECTRICAL REVIEW.

## THE GOVERNMENT AND TRADE.

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THE reader has long been familiar with criticism of the inefficiency of the British Consular service considered from the standpoint of trade, and with the demand for a Minister of Commerce. It is thought that, however admirable the Consul may be as a diplomatic official and a gentleman, he is not always a success as a representative of British manufacturers—ability, opportunity and inclination, one or all, may be lacking. The Government has been urged to spend money with a more liberal hand upon a reorganised Consular service, upon Commercial Attachés—now too few—and upon special Trade Commissioners. For what has been done in recent years by way of improvement in these directions and for the increased usefulness of the Board of Trade Commercial Intelligence Department, we must, of course, be grateful, and for the announcements of the past week we are especially so seeing that they are an indication that now that the Government has, in a sense, got other matters out of the way, it is willing to do something in response to suggestions from those responsible for the commercial affairs of the nation. Of course, we must not expect to get all that we ask for—there is to be no Minister of Commerce known as such, nor is there to be a million a year allocated for more efficient British governmental trade representation in the various quarters of the globe where it is needed. But, thanks to the sitting of a Royal Commission on the Civil Service, we are to have a Second Secretary of the Board of Trade, and thanks to the consideration of the Foreign Office, there is a prospect of closer co-operation resulting between the Commercial Attachés already in office and the Chambers of Commerce.

Sir H. Llewellyn Smith, the Permanent Secretary to the Board of Trade, in his evidence given last autumn before the Royal Commission already mentioned, expressed the view that the danger of the Board lay in its size, and he appeared to favour the appointment of a deputy or colleague to relieve the congestion in the department, preferring that course to a sub-division of the whole office. The President of the Board now announces the appointment of a Second Secretary—Mr. G. Stapylton Barnes, C.B., who is at present Comptroller-General of the Labour Department. The Labour Department of the Board is to be sub-divided, with responsible directors for Labour Exchanges and Unemployment Insurance, and for labour statistics.

It will be recalled that before ever such things as Labour Exchanges and Insurance were brought within the region of practical politics, it was strongly held in industrial and trade circles that the Board was overburdened with duties which ordinarily would hardly come under the category of trade, to the exclusion of pressing matters which were of direct trade concern. What the commercial world will, no doubt, be interested to know, is whether the present re-arrangement will merely lead to relief of the kind mentioned, or will be followed by an enlargement of interest in trade affairs, thereby in some measure satisfying the desire for a Ministry of Commerce.

The second announcement to which we allude relates to proposals which have been put before the Associated Chambers of Commerce by the Foreign Office. These pro-

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's.)

# 1913 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,**  
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posals, according to the *Times*, have for their object a closer co-operation between H.M. Commercial Attachés and the Chambers of Commerce, and Sir Edward Grey recommends them for favourable consideration.

We fear that Consular officials and manufacturers have been strangers to each other and to each other's doings far too long. The reasons may be many. Trade may be *infra dig.* to some men still, but that attitude is to-day a sheer absurdity, and should not exist; firms may have lost confidence in Consular representatives, though there again unjustifiable prejudice has not been lacking. The many other reasons need not be stated now, we believe they are familiar enough, but one thing that we must say on this point is that when, in our own experience, any desire has been shown by manufacturers to place Trade Commissioners in possession of specialised information that would assist them in watching over British Trade interests in other countries, they have not been slow to take advantage of the opportunity.

What Sir Edward Grey is now stated to believe is that better results could be obtained if our commercial attachés "were to receive some guidance from British manufacturers and merchants interested in foreign markets," and, as a first step in that direction, he suggests a standard classification of the trades and industries of this country which can be uniformly adhered to in official reports. A second suggestion is that leading questions be drawn up by experts in regard to all the principal industries in the country, especially those affected by foreign competition. It is not proposed that this classification shall extend to matters of detail, and it is thought that a certain number of the more important branches might be grouped under a few broad headings, one of which is: "Machinery.—Electrical Motors, Dynamos, &c." An official of the Board of Trade Commercial Intelligence Department has prepared a set of questions (relating to the woollen and worsted trades) as a model, and it is believed that, if similar sets could be drawn up for other leading industries, they would prove of the greatest assistance to our national representatives abroad in conducting investigations and preparing reports.

Now, if there is any trade which, from the mouths of its more militant members, has expressed itself as suffering seriously under foreign competition, it is the electrical. Therefore it will be desired that the electrical engineering industries shall co-operate in preparing information for the "guidance" of Commercial Attachés. And if there is any journal which has shown an eagerness for Consular officials to be fully and accurately informed regarding the abilities of British manufacturers, it is the ELECTRICAL REVIEW. One part of our effort in this direction has been the sending of this journal regularly to a large number of Consular offices abroad, and the conduct of a voluminous correspondence with many hundreds of them urging the interests of British electrical firms upon their attention. Between three and four years ago, in a series of articles on this and other trade questions, we went so far as to suggest that those destined to go abroad as expert trade representatives of this country should be made intimately acquainted with our great national engineering and other industries by touring among them and seeing them. We might like them to be engineers, but where that is not possible we would have men with minds trained to conduct expert observations and freely imbibe just the right kind of information relating to technical industries. Nothing in the way of official documents, statistics, records, and so forth—essential as these are for purposes of reference—could make so forceful an impression as seeing things at first hand. Of course all our Consuls could not be brought home to make provincial expeditions for their education, but in the case of new appointments and of officials visiting this country the principle might be adopted and carried out on a small scale. The idea running through this suggestion is the same as that prompting the proposal of Sir Edward Grey—the better equipment of our Consuls and others in responsible positions for the furtherance of our trade interests outside these islands.

The ELECTRICAL REVIEW, of course, heartily welcomes the new movement, and it notes that the Council of the Associated Chambers of Commerce has agreed to advise the Foreign Office on the classification and compilation of sets

of suitable questions, and to appoint committees to deal with each request as received.

We yield to none in our admiration for the activities of the Chambers of Commerce in some directions, but we may be excused if we question how far these Chambers, either through their central organisation or locally, can be fairly regarded as able to speak for the electrical and other engineering industries. There are electrical organisations which could indicate broadly and with accuracy what electrical firms want to know, and these, if so inclined, might be allowed to co-operate with the Chambers in order to ensure that this matter should be put on a proper footing for the future.

The official figures as published last week show that, compared with the month of April last year, there was an advance of

2½ millions sterling in imports and of over 10 millions sterling in exports. In the total exports the items coal and iron and steel together show an advance of more than £6,000,000. It has to be remembered that the coal strike was in progress last year, and the working days were fewer, as Easter came in April in 1912 and in March this year. The electrical and machinery figures are as follows:—

Imports.		Month of	Increase	Four	Increase
Electrical goods and apparatus, excluding machinery and insulated wire	...	April, 1913.	or decrease.	months, 1913.	or decrease.
	£	£	£	£	£
labeled wire	...	131,806	+ 12,255	506,145	- 24,667
Machinery	...	678,239	+ 96,184	2,512,131	+ 297,593
Exports.					
Electrical goods and apparatus, excluding machinery and insulated wire	...				
labeled wire	...	376,029	+ 123,490	1,916,285	+ 473,008
Machinery	...	3,344,594	+ 786,828	11,934,657	+ 1,564,421

#### The I.E.E. in Paris.

ON Tuesday next a large party of members of the Institution of Electrical Engineers, together with a considerable number of ladies, will journey to Paris, to meet their *confères* of the Société Internationale des Electriciens—a body which was founded in 1883 after the first international electrical congress, held at the Paris Exhibition of 1881, and which has since maintained its reputation as one of the most eminent societies of its kind in the world. No similar visit has taken place since the Paris Exhibition of 1900, and as vast changes and developments have taken place in the interim, in the supply of electricity to Paris and the electrification of many of the railways and other means of transit, there will be much to see and many useful lessons to be learnt from the achievements of our French friends.

Some idea of the progress that has been made in France in recent years, in connection with the electrical industries, may be gathered from the article by M. Dary, which is commenced in this issue; we print also an abstract of an article in the *Technique Moderne*, describing recent works erected by the company which has taken over the supply of Paris from its six predecessors. But it is not only in the capital that France has gone ahead; her vast natural resources in the shape of waterfalls are being rapidly developed, especially in the south-east, where they are fed by the glaciers, to which the felicitous title of "white coal" has been given. The ice, however, is better than coal in that it is perpetually renewed, and thus this source of power is inexhaustible.

As usual, a full programme has been arranged—too full, in all probability; but that is the invariable rule on these occasions, and in any event, those who prefer to do so can "skip" items. We are certain that our friends of the Société will give the visitors a thoroughly good time, and we rejoice to think that they will fraternise not merely as a matter of form, but with that cordiality which is born of a sincere and unreserved goodwill. The visit cannot fail to strengthen the bonds of friendship between the two nations, and especially between these two great engineering Institutions.

## THE ELECTRICAL INDUSTRY IN FRANCE.

BY GEORGES DARY.

THE last few years have witnessed a marked business revival in France, which has extended generally to all industries and to the electrical industry in particular. Five years ago, in a series of articles in these columns, we were under the painful necessity of drawing attention to the lack of enterprise in connection with new industries that was then prevailing in France; what may be regarded as a general condition of debility and trepidity combined with a constant feeling of hesitation, prevented even those usually associated therewith from encouraging the promotion of serious undertakings, thus greatly hindering the development of the electrical industry. We were, however, also able, in concluding the series of articles mentioned above, to foreshadow the great forward movement the industry was bound to make at an early date, thanks to the perseverance of courageous pioneers, who, in spite of systematic official obstruction, and the difficulty experienced in securing anyone to take a financial interest in the schemes proposed, valiantly continued their way towards the desired goal. To-day their victory would seem to be complete, for the proofs we are able to offer in connection with the same are both numerous and varied.

In fact, from a financial point of view, the native fears which the French investor still held with regard to industrial undertakings have disappeared, and to this exaggerated fear quite a *rolle face* has succeeded, almost without a period of transition, thus admirably demonstrating the character of the French for unreserved enthusiasm. The capitalist and the small investor have neglected Government stocks in order to buy shares or debentures in industrial undertakings, collieries, industrial financing companies, electrical undertakings, mines of all kinds, and the value of the shares is steadily advancing and with a regularly increasing market, the last batch of hesitating investors has been drawn in. On the other hand, too, and as an inevitable result, industrial undertakings which were already commencing to show renewed life, have developed an enormous activity as a consequence of the influx of capital and credit, with the result that there is just now quite a revival in industrial undertakings in France, the existing position, as compared with the past, being indeed exceptional.

From the point of view of outward appearances, the situation is extremely striking. In Paris the numerous lines of the Metropolitan, or underground railways, are approaching completion, and the number of passengers is increasing daily; then there is the extension and reconstruction of the large railway stations of Mont Parnasse and Saint Lazare; the electrification of the suburban railway lines, the increase in the number of trains, and the construction of new, better equipped, better lighted, and better heated bogie carriages. The improvement of the electrical distribution service, the reduction in the charges for energy, and the general use of metallic-filament lamps, which brought about a sudden increase in the number of consumers, have forced the electricity supply companies to greatly increase the plant at their generating stations. The Compagnie Générale des Omnibus de Paris has seen itself compelled to suddenly and totally transform itself, by getting rid of all its horse-drawn buses and replacing them, on all the different services, with speedy motor-buses. Next, there has been the introduction of thousands of motor taxi-cabs, the relatively low tariffs charged for the use of the same having brought about the disappearance from the streets of the old horse-drawn cabs which continued to make a struggle for existence. The net result of all this is that within a space of two years life generally in Paris has become much more intense, and the traffic so heavy that the latter, according to recent statistics, now exceeds that of London.

In provincial France the industrial revival is no less marked. There is the frequent formation of new undertakings which, looked at from an electrical point of view, have as their object for the most part, the exploitation and utilisation of new waterfalls in the generation of electrical energy and the distribution of the same for lighting and power purposes in neighbouring towns. Furthermore, new electric railways

are being constructed, while existing railway companies are adopting electric traction on sections of their lines. Finally, there are many huge projects which are being either considered, are being got ready for execution, or are in course of being carried through, such as tunnels through the Pyrenees, the utilisation of the water power of the Upper Rhone river with the view of supplying electrical energy to Paris, &c. From among this large number of new installations and projects, we shall select the most characteristic, the most striking from each class, from an electrical point of view, with the object of bringing home to readers the reality of the unexpected progress that has been achieved.

We shall, therefore, summarise the new electrical distribution systems in Paris, the projected utilisation of the River Rhone, the electrification of the Paris suburban railways, and the modernisation of the tramways, the new Franco-Spanish electric railway in the Western Pyrenees, and, finally, the latest examples of central stations in the Pyrenees and in South-Western France.

If we examine the actual position of the electricity supply of Paris, we find that the transitory *regime* which commenced in 1908 will come to an end at the termination of the present year. In other words, the six old concessionaires which divided Paris into as many sections, and which, in their dealings with the Paris Municipality, are represented by the Comité de l'Union des Secteurs Electriques Parisiens, will come to the end of the period of their concession on January 1st, 1914. What may be termed the definite *regime* will then commence, and will continue until June 30th, 1940; during this term of years, the work of supplying Paris with electricity will be entrusted to the Compagnie Parisienne de Distribution d'Énergie Electrique. The contract may be determined by the Paris Municipal Council on June 30th, 1924, or at the end of any subsequent two years, subject to two years' notice being given. By the agreement, the Compagnie Parisienne has to establish two generating stations to meet the demands of consumers, one in south-west Paris (Issy) and the other in north Paris (Saint Ouen). Both stations are in communication with the railway system, and are located on the banks of the River Seine. The capacity of each plant must be 25,000 kw. as a minimum. The northern station may be extended, at the wish of the Paris Municipal Council, to 50,000 kw., the Municipality also reserving the right to meet future increased demands by utilising current transmitted from hydro-electric plants at a distance, in place of extending the northern generating station. In any case, the two plants above mentioned must be ready to supply current by January 1st, 1914, the guarantee to this end deposited by the concessionaires being £80,000.

The agreement arrived at between the company and the Paris Municipality may be summarised as follows:—The transitory period from 1908 to 1913 was agreed to in order to give the new concessionary company time to re-establish the supply system, and to place its service on a satisfactory basis. The company, therefore, proceeded with the establishment of the two plants above mentioned. The northern one, at Saint Ouen, has a capacity of 75,900 kw., and the south-western one, at Issy-les-Moulineaux, a capacity of 25,000 kw., 10,000 kw. generating sets being, as far as possible, employed.

According to the agreement, the company will have a monopoly as regards lighting, but not for the supply of current for power purposes, in which department competition is very probable, as there is already a proposal to form a company, with a capital of £2,000,000, for the supply of electrical energy for power purposes, in workshops and industrial establishments, at a lower price than is charged by the Compagnie Parisienne. The suburbs of Paris would also be supplied with current for power purposes by other companies. A scheme is under consideration, too, in the Nord Department of France for the establishment of generating stations for the supply of current to a considerable area, extending right up to the gates of Paris. One of these stations will be established at Creil, another at Laon, and it is also proposed to transmit electrical energy from generating stations established directly in connection with collieries in the Nord and Pas de Calais Departments.

Returning, however, to the work which is being carried out by the Compagnie Parisienne in readiness for the supply

from January 1st next, an inspection of the plans shows that the reorganisation and extension of the system have been prepared with a view of obviating the considerable expense which would have attached to the complete unification of the system, and of avoiding the opening of trenches in all the different thoroughfares, with the object of reducing to a minimum the disturbances to the supply service and the dislocation of traffic. The programme of work, which is on the point of completion, comprises three distributing areas or zones: First, the centre zone—densely populated and with a heavy consumption of energy; supplied with continuous current on the three-wire system. Secondly, the left bank and western zone—population relatively thinly distributed and only moderate current consumption: supplied with single-phase alternating current at 3,000 volts pressure. Thirdly, the north-east, east and south-east zone—comparatively thinly populated: supplied with two-phase alternating current at a pressure of  $2 \times 110$  volts.

It may here be mentioned that the two-phase current is generated at a pressure of 12,300 volts, and that in view of the wide distribution area it was necessary to establish a number of sub-stations, or to alter those already existing.

For the first zone, supplied with continuous current, the establishment of 11 sub-stations was provided for, where the high-tension alternating current is transformed to low-tension continuous ready for direct use by consumers. The equipment at these sub-stations has been so arranged that it can, up to January 1st, 1914, be supplied with current from the existing Secteur generating stations. Six existing sub-stations have already been suitably altered to meet the new conditions—viz., the Bondy, Trudaine, Saint Roch, Mauconseil, Sévigné and Clichy-Puteaux sub-stations. The other five newly established are those known as Bergère, Pasquier, Temple, Voltaire and Saint Antoine.

The second zone, supplied with alternating current at 12,300 volts pressure, comprises four new sub-stations, where the initial voltage is reduced to 3,000, which in turn will be transformed down to 110 volts by means of transformers installed in the consumers' premises. These sub-stations, two of which—Murette and Sevres—are already completed, while two, Gobelins and Les Ternes, are nearly ready, will share the load on the phases of the primary two-phase network connecting them to the supply stations.

Finally, the third zone will comprise five coupling centres, intended to divide up the high-tension current from the generating stations between 120 transformer stations, where the voltage will be reduced to  $2 \times 110$ . The five centres are Doudeauville, Lumière, Menilmontant, Charonne and Daumesnil.

The supply mains will comprise:—(1) The primary mains connecting the generating stations with the sub-stations and coupling centres, having a length of 281 miles; (2) the feeders connecting the sub-stations with the conductors supplying the consumers, about 188 miles of which are already laid; and (3) the conductors supplying consumers' installations, and which, already in existence, have been converted to either the three or five-wire system.

As regards the tariff for electricity supply, which is on a basis of 7d. per kw.-hour for lighting and 3d. for power purposes, this is to be reduced to 3d. for lighting and 2d. for power.

The question may here be asked: Whether, with the numerous additions of electric tramways, or the new and numerous electric lines connected with the metropolitan and suburban railways, the thousands of new consumers of current for lighting and power purposes, the generating plants provided for by the agreement will be sufficient to supply Paris with electrical energy. The question may fearlessly be answered in the negative. As a matter of fact, with the Metropolitan Underground Railways complete, a supply of 100 million kw.-hours will be required: the tramways and other services will require an equal amount; the suburban railway system will need 125 million kw.-hours: for power purposes in Paris, 200 millions; for lighting in Paris, 60 millions, and for lighting in the suburbs, 100 millions, or a total of 685 million kw.-hours; that is to say, double the present consumption in Paris. It will therefore be impossible for the generating stations in the French capital to provide for this enormous consumption. Consequently recourse will have to be had to an outside

supply of electrical energy, which, generated at a distance, shall be cheap, and transmitted to Paris by overhead conductors. The utilisation of the water-power of the River Rhone is a scheme that meets the case, and which has resulted in the project of which details are appended.

The utilisation of water-power is being so much regarded as the future source of electrical energy, that for some time past the most competent authorities have been drawing up statistics with regard to the hydraulic resources possessed by France, just as a business man who is contemplating starting a new undertaking counts up his available capital. France, from this point of view, is a rich country, for, according to figures issued in 1910 by the Ministry of Agriculture, there is a total of utilisable water-power available of no less than 9,200,000 H.P., divided approximately as follows:—Northern Alps, 2,000,000 H.P.; Southern Alps, 2,600,000 H.P.; Vosges and Jura, 1,800,000 H.P.; Centre and Pyrenees, 2,800,000 H.P.

By scanning the following extract from the work recently published by M. de la Brosse as to the capacity of the hydro-electric stations that have been established in the Alps, readers of the REVIEW will be able to gather an idea of the amount of hydraulic power in France that has so far been utilised and the enormous quantity that is still available:—

<i>Rivers and Streams.</i>	H.P.
Drause ... ..	1,100
Arve ... ..	54,880
Fier ... ..	3,400
Guiers ... ..	14,760
Rhone, Yonage ... ..	22,000
Isère and tributaries ... ..	260,000
Drôme ... ..	670
Lez ... ..	90
Durance ... ..	93,000
Argens ... ..	3,800
Siagne ... ..	8,600
Loup ... ..	3,200
Var ... ..	8,350
Roya ... ..	275
Total ... ..	474,125 H.P.

The purpose for which this power is utilised is approximately as follows: Metallurgical industries, 210,000 H.P.; power and lighting distribution, 155,000 H.P.; chemical works, 60,000 H.P.; paper mills, 30,000 H.P.; traction, 10,000 H.P.; and flour mills, &c., 8,000 H.P.

As regards the project to utilise the water-power of the Upper Rhone below Geneva, which was accepted by the Government in September, 1911, this was drawn up by Messrs. Harlé, Blondel and Mahl. It is not the first scheme, nor yet the only one, as, for some years past, the subject has occupied many minds, but has long been regarded as an idealist's dream. The great progress that has been made by electrical science has, however, converted the dream into a possible reality, which, it is hoped, will shortly be put into execution.

At the present time there only exists a single very modest plant, at Bellegarde, near G'nissiat, where it is contemplated to establish the projected barrage, or dam. The Société de Bellegarde had also drawn up a similar project of transmitting electrical energy to Paris, and proposed to utilise about 270,000 H.P. We shall, however, not deal with the last-named scheme, but will occupy ourselves with the one which has been officially accepted and which has the greatest chances of success.

As it emerges from Lake Geneva, the River Rhone finds itself confined in a deep valley, into which it rushes as a veritable torrent. The flow there is considerable, the Lake serving as a reservoir, and to regulate its volume. Messrs. Harlé, Blondel and Mahl propose to establish a dam at G'nissiat, 246 ft. in height, which will convert the upper valley into a lake, having an area of, approximately, 940 acres, a length of about  $14\frac{1}{2}$  miles, and a capacity of over 1,765,500,000 cu. ft. The hydraulic power available would range between 80,000 and 350,000 H.P. The establishment of the plant would also solve the question of the navigation of the Rhone as far as Geneva, by means of a series of dams and a branch canal, which would encompass the generating station.

In order to ensure the stability of the dam, it will be necessary to go down to solid rock, which has been found at a depth of  $88\frac{1}{2}$  ft. The stream of water being  $11\frac{1}{2}$  ft. deep, the foundations will have to extend to a depth of just over 100 ft. On the other hand, the solid character of the banks will enable the ends of the dam to be strongly incorporated therewith. The generating station to be established at the foot of the dam is designed for an average capacity of 240,000 kw., divided into 24 sets of 10,000-kw. turbines. It is hoped, however, to reduce the number of sets to 16 by increasing the capacity of each to 15,000 kw. The turbines will run at 250 revolutions per minute, and will drive three-phase, 12-pole alternators giving current at 12,000 volts pressure. For transmission purposes, the voltage of the current will be raised to 120,000 in a transformer sub-station, located at a point 252 ft. above the generating station, and at a distance of about 720 ft. The continuous-current exciters (750 kw. at 160 volts) will be coupled to vertical-spindle turbines. The generating units will be divided into independent groups. All the controlling gear

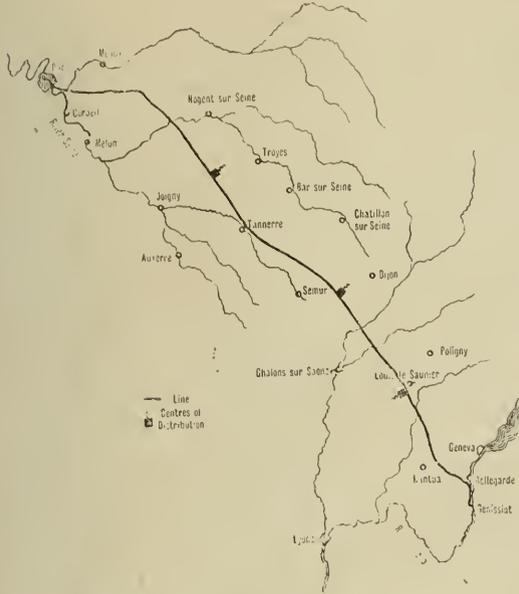


FIG. 1.—RHONE-PARIS TRANSMISSION LINE.

for the general running of the generating station will be operated from a distance. The cables leaving the alternators will be provided at their ends with oil circuit-breakers. The staff at the generating station will be able to cut off the current, but not to re-establish the circuit, this being reserved to the central establishment.

Three distinct services will be provided for—the 120,000-volt service for Paris; one of 30,000 volts for the Departments in the neighbourhood of the station; and a 12,000-volt one for electrochemical establishments.

Four lines, transmitting a total of 100,000 kw., will connect Génissiat with Paris. Each of the lines will comprise three cables. They will be divided into two groups, and, in the distance of about 220 miles, three distributing centres are provided for, as shown in the accompanying map (fig. 1)—one near Louis-le-Saulnier, the second between Semur and Dijon, and the third between Joigny and Troyes. These centres, separated by a distance of about 60 miles, will furnish a supply to well-populated industrial districts.

The transmission lines will be supported on steel columns at distances of from 492 to 656 ft. It is hoped to utilise aluminium conductors of 20 mm. diameter, and, with an initial voltage of from 100,000 to 120,000, the loss at Paris is estimated at 20 per cent. The Harlé-Blondel-Mähl scheme will cost about £4,000,000, and it is expected that it will be possible to supply energy at a reduction of 20 per cent. on the tariff established under the new 1914 régime.

(To be continued.)

## ELECTRIC LAUNDRY IRONS.

By G. H. ELLIOTT, A.M.I.E.E.

I AM greatly interested in the correspondence relating to troubles encountered with electrically heated irons in laundries and other workrooms, since I have had considerable experience with this class of apparatus.

The cord trouble, I believe, is more a matter of proper suspension than any other thing, and where what I call the "floating cord system" is adopted, as in the laundries of Messrs. John Barker (where, as stated in Mr. Carr's letter on April 25th, the irons have run for two years without trouble of any kind), of Messrs. Eastman & Son (where 300 electric irons are in use), and in many other workrooms with which I am acquainted, the trouble with the cords is negligible. This system is shown in the accompanying illustration. A little wooden ball is hung by a fine twine from the ceiling over the centre of the ironing table. The fixed wiring is taken to a ceiling rose on the wall, or on a suitable support about 4 ft. above the level of the table. The flexible cord is taken from this rose, through a hole in the ball, and drops thence to the iron. The ball should be free to swing over a distance at least equal to half the travel of the iron. Then, as the iron is moved about the table, the ball swings in unison with it, and the cord floats without strain, and will be found to have a really long life. Where the head room is limited so that the ball cannot swing freely, it is an advantage to hang the ball on a light spiral spring in order that the desired amount of motion may be given. The hole in the ball should be a snug fit on the cord, and the cord adjusted so that there is no loop or kink between it and the iron; a loop is a certain source of trouble.

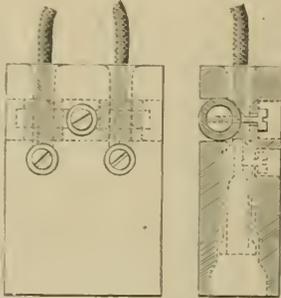
It is my experience that the cord should be as light and flexible as possible. Nothing is better than good vulcanised twin 70/40. A great fault with most electric irons is the wire cage and bush that is attached to the connector. In workrooms the cord has always to withstand a very consider-



FLEXIBLE SUSPENSION FOR LAUNDRY IRONS.

able amount of bending and straightening, and this is bound to fatigue the material after a greater or less time, even with proper suspension. Where a cage is fitted, the bending takes place at the top of the cage, especially when a bush or knob is fitted there; since the two poles are twisted closely together at this point, there is a grave risk of a "short" between the two—one cord in breaking is quite liable to fire across to the other and create serious trouble. In the connector usually fitted to the "Hot-Point" iron this shorting is avoided by keeping the two poles well apart at

the trouble point. A cord grip, consisting of a steel bar with fibrous insulating collars, is fitted near the top of the connector. The two cords coming from the sockets are passed under this bar, and are gripped between the insulating collars and the porcelain body; the braiding itself, or preferably a cotton whipping wound over the braiding, is gripped, and there is no strain on the copper. The porcelain above the cord grip has two holes or tubes formed in it, and the weakest spot on each cord is located within these tubes. Then, if the cord is allowed to remain in use so long that it wears out and breaks, any arc that may be formed occurs



DETAILS OF CORD GRIP.

inside the tube and is damped out, the two poles are kept well apart, and serious trouble is a most improbable event. "Ironical" mentioned trouble caused by poorly designed connections between the terminal pins and the elements. In the irons I am best acquainted with, these connections are made by forming a three-wire loop of the actual heavy gauge wire of the elements themselves, and securing this loop under big hexagon nuts. I understand that this arrangement is quite free from trouble.

I should greatly appreciate seeing a few more records of running cost published. Factory owners have a tendency to multiply the nominal wattage by the number of working hours per week and to declare that electric irons are ruinously expensive. The actual figures, I believe, are strongly in favour of electric irons. For instance, a report from the New York Edison Co. was published in this paper a week or two ago, giving the average consumption of irons in tailoring factories at 350 kw.-hours. This is an amount that is, I believe, much appreciated by central-station engineers, and at 1d. per unit it is quite capable of bearing comparison with gas. Should any readers of the ELECTRICAL REVIEW have similar figures, I believe that many other engineers would be pleased to see them.

### ROYAL SOCIETY CONVERSAZIONE.

ON Wednesday last week the conversazione of the Royal Society took place at Burlington House, the guests being received by the president, Sir Archibald Geikie. There was not a large proportion of electrical exhibits, partly, perhaps, because marked attention is being devoted to apparatus for use in aeronautical investigations. For instance, Mr. M. O'Gorman showed a collection of seven instruments to indicate or record the speed, path and distance traversed by aircraft, to measure the pull on a wire without disturbing it, &c., some of these being electrically operated. The Cambridge Scientific Instrument Co., Ltd., showed a yaw indicator, and the National Physical Laboratory an apparatus for the rapid determination of the lifting power of samples of hydrogen.

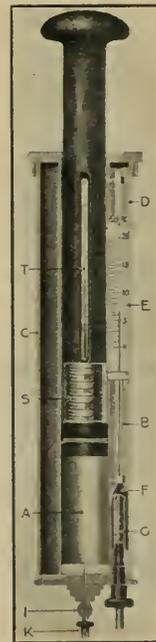
Prof. J. T. Morris exhibited a new instrument for an allied purpose—the measurement of the velocity of wind—in this case applied to the distribution of velocity round a circular rod at right angles to a current of air produced by a fan in a wooden trunk. The device consists of a Wheatstone bridge made up with alternate arms of platinum and manganin, the wires being stretched axially along the rod. At normal temperature the bridge is out of balance; a current is passed through it, and a calibrated indicator takes

the place of the usual galvanometer. The change in temperature and resistance of the platinum wires is a measure of the velocity of the air which cools them, and can be determined by the reading of a milli-voltmeter. Another method of using the instrument is to vary the current so as to bring the bridge into balance for a given velocity; the square of the watts used in the bridge wires is then nearly proportional to the velocity of the wind. With this apparatus the movement of air can be determined quite close to and all round an obstruction, and it is not necessary to find the direction of the wind before a measurement can be made—as in the case of the Pitot tube.

Mr. F. W. Jordan exhibited the sensitive convection radiometer and thermo-galvanometer, which he described before the PHYSICAL SOCIETY a few months ago;\* this instrument indicates the strength of a convection current of air in a partitioned chamber, set up by very feeble sources of heat; a deflection of 5.4 mm. is obtained on a scale 1 m. from the mirror with  $10^{-6}$  calorie per second. As shown at the Conversazione, it was measuring the heat evolved by a minute quantity of radium.

Prof. J. Norman Collie and Mr. H. S. Patterson showed experiments bearing upon their recent observation of the presence of neon and helium in hydrogen, after the passage of an electric discharge through the latter at low pressure.

A novel instrument was exhibited by the UNDERFED STOKER CO., LTD., in the shape of a pocket  $\text{CO}_2$  thermoscope, with which the percentage of carbon dioxide present in flue gases can be determined in a few seconds, and to a high degree of accuracy. The principle employed is that of absorption of the  $\text{CO}_2$  with caustic soda, the resulting chemical reaction giving rise to an evolution of heat which is proportional to the quantity of  $\text{CO}_2$ . The apparatus consists of a cylinder fitted with a piston, by means of which



SECTION OF  $\text{CO}_2$  THERMOSCOPE.

a measured quantity of gas can be drawn from the flue or chamber to be examined, two thermometers, and cartridges containing pulverised caustic soda. It is shown in section in the accompanying figure, where A is the cylinder, C an outer jacket, B the testing thermometer, and G the cartridge. An auxiliary thermometer T enables a correction to be made for the temperature of the instrument by regulating the stroke of the piston with the scale S engraved on the piston rod, so that the correct volume of gas is always drawn in.

\* ELECTRICAL REVIEW, November 15th, 1912.

To use the instrument, a sample of gas is drawn into the cylinder, and the tap *t* is closed; one of the little cartridges is pricked at each end to enable the gas to flow through it, and is attached to one end of a rubber connection, the other end *k* of which is connected to the nozzle of the tap. The cartridge is inserted into the hollow bulb *F* of the thermometer, and after adjusting the zero of the movable scale *E* to the top of the mercury column, the piston is pushed in, driving the gas through the cartridge. The percentage of CO<sub>2</sub> present is then read off directly on the scale *E*, which can be seen through a slot *D*. It will be seen that the process is extremely simple, and can be carried out by any intelligent person without skill in manipulating chemical apparatus.

The CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD., showed the "Apophorometer," an instrument designed by Prof. J. Joly, for easily obtaining sublimates at high temperatures. It consists of a thin ribbon of platinum; the substance to be tested is placed on the ribbon in the form of a pinch of powder, and the ribbon is enclosed between two watch glasses. On passing a current through the ribbon and gradually increasing its strength, the various sublimates are driven off in turn, and by noting the current in each case the temperature of the ribbon, previously calibrated, can be ascertained. By this means, the analysis of complicated minerals is greatly facilitated. Other exhibits were a barometer with a dial instead of a vernier, and an electrical device for recording the amount of opening of the stomata on a leaf.

The most interesting exhibit was that of the Sperry Gyro Compass, in which the gyroscopic element is suspended from a stranded wire, the top of which is held in a frame surrounding the sensitive element and made to follow it by a system of electrical contacts controlling a motor. The system comprises a master compass which is placed in a well-protected position in the ship, and repeater compasses which are operated by the master compass in various parts of the ship. The gyrostat is driven by three-phase currents, and takes up its definite position in about four hours from the time of starting the motor.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### The Prevention of Accidents in Electric Lifts.

I am afraid that Mr. W. S. F. Cooper's acquaintance with electric lifts is somewhat limited. If he will make inquiries he will find that combined electrical and mechanical locking gear has been successfully applied to the gates of lifts for several years past.

With an electrically-controlled lift nothing is easier than to put the electric portion of the lock on each landing gate, and frequently also on the cage gate, in series with the controller, so that current cannot be given to the motor until every gate contact has been made, or, in other words, until every gate has been closed.

Hydraulic lifts can be protected in a similar manner by arranging the electric locks in series with a solenoid rope gripper fixed on the top of the cage. Whenever the cage is at any floor, and the landing gate open, the gripper grips the rope and prevents its being operated until it is released by the closing of the gate.

Mechanical locking alone is insufficient protection, for, as a rule, it means that the cage can be moved from the landing with any gate open.

A. R. Leaver.

London, S.W., May 7th, 1913.

### The Preservation of Creosoted Poles.

I am obliged by the reply of "Communicated" to my letter, and fear I read his article, which appeared in yours of the 18th, rather hurriedly. I quite agree with this. I take it

he does not think that a normal injection of creosote into wood makes it brittle, which was all I took exception to. I have no doubt that in the case of some large users it is impossible to arrange for notching and boring before creosoting, but we find that most other large users, as electrical contractors, power companies, &c. do endeavour to plan their lines out, and have such work done, as far as possible, before creosoting.

Christopher Wade.

Hull, May 6th, 1913.

### Village Lighting.

I read with interest your note on "Village Lighting," especially as I have just successfully equipped a country residence in the Dukeries with 12-c.r. lamps fed from portable batteries. The cost (initial) is very low, and maintenance runs about 5 of a penny per hour. This may interest your correspondent.

John Morley.

Mansfield.

### Combined Luminous Radiators and Convector.

I notice in the current issue of the ELECTRICAL REVIEW a description of the "Lynton" radiator, in which an electric heating lamp and heating elements are employed, and this is claimed to be a new type of radiator.

I would call your attention to enclosed Patent No. 15,591 of 1902, which covers a combination, in one frame, of the use of electric heat lamps and non-luminous heating elements. The Dowsing Radiant Heat Co., Ltd., have manufactured these combined radiators for the past 10 or 12 years, and they have proved very successful.

Radiators of this description would infringe my patent, and I may say that all necessary legal proceedings will be taken by my company to uphold their rights.

For the benefit of those who may not be acquainted with this patent, the claims are as follows:—

1. An electric stove comprising in one casing one or more electric glow lamps and one or more heating resistances, adapted to be connected either separately or otherwise to a source of electric current substantially as described.

2. An electric stove comprising electric glow lamps, and a resistance coil or coils disposed respectively in front of or behind a reflector, and adapted to be connected either separately or otherwise to a source of electric current, substantially as described.

3. An electric stove comprising in one casing, one or more electric glow lamps, and one or more resistance coils, adapted to be connected either separately or otherwise to a source of electric current, opening in the casing and passages leading therefrom to the heating resistances and lamps substantially as described.

May I add that this combined form of electric radiator, which we call our Radio-Convactor, is of very great value, as the good points of both types of radiators are included in this design.

The Dowsing Radiant Heat Co., Ltd.,

H. J. DOWSING, *Managing Director.*

London, W., May 9th, 1913.

### Mareconi Advisory Committee's Report.

I am not interested in any wireless scheme, but it strikes me as odd that no mention is made of the fact that Australia has not adopted the system favoured by the British Government; and yet the Australian system is effective over long distances. The same remark applies to the systems in use in Germany, France and in the United States; and, as an outsider, I cannot see wherein the so-called "Marconi" system is superior. There are thousands of capable amateurs who now receive signals from every part of the world, and the number of senders would also be very large if licences could be obtained. So there cannot be any great difficulty in the business!

London, May 12th, 1913.

Anti-Humbag.

[It is to be regretted that our correspondent was not invited to sit on the Advisory Committee in the first instance, instead of being obliged to take the initiative: his "facts" might have been useful to the members. They are certainly new to us.—EDS. ELEC. REV.]

## BUSINESS NOTES.

**Consular Notes.—Congo.**—The British Consul in the Congo, in a recent report, states that wireless telegraphy had been established between the following places up to June 30th, 1912:—Stanleyville and Lisala, 275 miles; Stanleyville and Lova, 132 miles; Lova and Kindu, 110 miles; and Kindu and Kongolo, 184 miles. Brazzaville, the capital of French Equatorial Africa, is in communication with Lisala, 610 miles further up the Congo, and even with Stanleyville, 740 miles distant. Kindu and Lova stations succeeded in communicating with Moanza on Lake Victoria, 453 miles distant. Atmospheric conditions on the Congo are not favourable to wireless telegraphy, the air being often highly charged with electricity, and the strong sunlight affecting the passage of the ether waves. Stations with wave lengths under 1,200 yards fail after 6 a.m., and only succeed at night. Two stations, Lova and Kindu, with wave lengths of 1,700 yards, however, have been found to operate equally well during the day. It is proposed to establish a high-power wireless station at Lusambo in the Kasai, which, owing to its central position, will be able to communicate with all the other Congo wireless posts. Stations are also contemplated at Niangara on the Upper Uele River. The powerful British station at Aden, able to send messages 2,000 miles, will be able to communicate with Niangara, and that with Stanleyville, Brazzaville and Boma, thus effecting communication across the Continent. Wireless communication between Boma and banana is steadily maintained, and Banana can communicate with Swakopmund. Connection with Coquilhatville, the terminus of the up-river land telegraph line from Boma and Stanleyville, has not been satisfactorily established so far on a regular basis, but is likely to be soon effected.

Steady progress is being made in pushing forward telegraph service. All the various new railways under construction carry the telegraph along as they proceed. A second line is being laid between Leopoldville and Coquilhatville to facilitate the service. Elizabethville and the frontier at Sakania have been linked, and a line is to be run from the former to the Star of the Congo mine. The Katanga line is connected with the telegraph network of South Africa, and international communications are assured by an agreement with Rhodesia. On January 18th, 1912, a convention was signed with Portugal for the erection of a line between Matadi and Noqui—five miles. Noqui, a Portuguese Angola port in the Congo, is connected with Loanda, where the Eastern Telegraph Co. is linked by cable with the world *via* St. Vincent or Tenerife. Connection with Lindu is also available by way of Brazzaville and Pointe Noire, the rate being 5s. 8d. per word to the United Kingdom. Telephone services connect Boma, Matadi, Thysville, Kinshasa and Leopoldville. Installations connecting these places cost £10 per annum. Rates are 1s. 6d. to 2s. 6d. for five minutes' conversation. Telegraph receipts rose from £1,680 in 1910, to £2,129 in 1911. The colony has adhered to the International Telegraph Convention concluded at St. Petersburg on July 10th-22nd, 1875, and to the Radiotelegraphic Convention, of Berlin, of November 3rd, 1906, and was represented at the last Conference held in London in June, 1912.

**Russian Far East.**—The British Consul at Vladivostok reports that a central electrical power station has recently been opened there, and supplies light for streets and houses, and power for industrial purposes. An electric tram system 4 miles in length is now completed.

**Paraguay.**—Reporting recently on the trade of Paraguay, the British Consul at Ascencion points out that whereas the imports from most of the principal supplying countries showed an increase in 1911, as compared with 1910, the total imports from the United Kingdom appear to have suffered a relatively heavy decline, viz., from £539,115 in 1910, to £370,040 in 1911, a difference of £169,075, which is to be accounted for mainly by the falling-off in the imports of railway material. On the other hand, the German imports show a total increase of £135,255, which is made up of food stuffs, textiles, fancy goods, drugs, hardware, and articles imported free of duty. The imports from France and the United States also show a relatively large increase. That British trade is not (so far as can be gathered from the available figures) on the increase is, however, not surprising; it is, on the contrary, somewhat remarkable that it maintains its present level, because in the whole Republic there are only two British importing firms. It may be regarded as a tribute to the quality of British goods that they are largely imported by foreign houses and foreign agents, but at the same time the conclusion is irresistible that the British share in the total import trade might be still larger if a larger number of British houses were established in this country. Many more travellers and representatives are said to have been sent to Paraguay during the last year or two from other European countries such as Germany, France, Italy, &c., than from the United Kingdom: the British firms are also said not to give such easy terms of credit as the foreign ones.

In cases where goods are brought from samples, some Continental firms are said to send out larger assortments (which, other than those of textiles, are bought by the importers, subject to a large discount) than is customary with British firms, thereby facilitating a selection and affording a more precise indication to the exporter of the class of articles desired in this market. These small points are mentioned because Continental competition appears to be likely to grow still keener than at present. The German community is said to be continually increasing its numbers. They are occupied in trade and in many other ways, having apparently satisfied themselves that Paraguay offers a good field

for their enterprise and activity, in relation to which the above quoted figures form a useful commentary. The United Kingdom imports practically no products of Paraguay, presumably because there are no British firms in the country exporting hides, tobacco, &c., like the German and Spanish firms. British trade-mark owners would do well to observe that the Paraguayan law has no cognisance of the fact that a mark may have been registered elsewhere, and consequently anyone, without adducing proof that he is the rightful owner or the owner's representative, may register any mark that has not already been registered in Paraguay, and by doing so he acquires the sole right to the use of it. The importer of goods bearing a mark that is not registered in Paraguay may therefore find it necessary in his own interest to register the mark.

**Dissolutions and Liquidations.**—THE ADAMS MANUFACTURING CO., LTD., Balfour House, Finsbury Pavement, London, E.C., and Bedford.—Pursuant to Sec. 188 of the Companies' (Consolidation) Act, 1908, a largely attended meeting of the creditors of the above was held on the 9th inst., at Winchester House, Old Broad Street, E.C. It was reported that the shareholders of the company had passed a resolution to the effect that it could not continue its business by reason of the liabilities, and that it was advisable that the concern should be wound up voluntarily. A further resolution was passed appointing Mr. Lewis Hardy, of Messrs. Hardy and Moritz, C.A., 8, Bream's Buildings, Chancery Lane, E.C., to act as the liquidator of the company. Mr. Hardy submitted a statement of affairs showing the position as at April 22nd last, the date of the resolution for voluntary liquidation. The statement disclosed ranking liabilities of £30,094, of which £15,382 was due to creditors on open account, and £2,058 in respect of bills payable. The bank were shown as unsecured creditors for £11,912, and in addition there were unsecured cash creditors for £742. There were also fully secured creditors for £2,728, who held as security a charge on the freehold factory of the company. The assets were returned at £52,326, from which had to be deducted £641 for preference claims, and £15,731 owing on debentures. The net assets were thus reduced to £35,954, and as regarded the unsecured creditors a surplus was shown of £5,860. The assets were as follows:—Stock-in-trade and work on hand at estimated cost £23,000, machinery and tools as per books £8,967, trade fixtures and fittings as per books £3,403, patents and patterns as per books £2,975, freehold factory £8,699, less mortgage of £2,728—£5,970, shares in public company £145, book debts (good) £7,740, doubtful and bad debts £464, expected to produce £100, and cash in hand £24.

Mr. Hardy reported that the company was formed in 1906. At the outset it was purely an automobile business, but subsequently an electrical side was started. He was appointed to act as the Receiver of the company on April 11th last. Eleven days later the shareholders passed the resolution in favour of voluntary liquidation, and with a view to saving expense, they also appointed him to act as the liquidator of the company. Since his appointment as Receiver, he had been carrying on the business, and there was plenty of work in hand. Some good work was being done at the factory, and there were numerous orders coming to hand. He was quite satisfied that he was carrying on the business at a profit, and was doing his utmost to safeguard the interests of all concerned. He did not consider it right that a Receiver should merely study the interests of the debenture-holders, and he was, therefore, also looking after the interests of the unsecured creditors. Mr. Waller asked if any of the debentures had been issued recently, and Mr. Hardy replied that the debentures were all issued more than two years ago. No debentures had been issued since 1911, and the consideration for their issue was cash advanced. Mr. Lea inquired if the directors of the company were also the debenture-holders, and he was told that three directors of the concern held the majority of the debentures. Mr. Lea stated that on the file of the company at Somerset House was a copy of a balance-sheet for 1911, which contained a very peculiar note by the auditors. The note stated that property had been purchased for £27,000 and shares issued, but there had been some irregularity in the issue of the shares, and for the purposes of the balance-sheet, neither the property nor the shares were brought into account.

Mr. Hardy replied that he knew nothing about the matter, and the solicitor also said he could not give any explanation.

Mr. G. G. Poppleton said that the stock-in-trade and work in hand formed a very considerable portion of the assets. He asked what was the value of the stock, and how the value of the work in hand was arrived at. Mr. Hardy said he understood that the work in hand was valued at about £3,000, while the stock was worth about £20,000. In answer to Mr. Figgins, who asked what the assets were likely to realise at a forced sale, the chairman said that the stock and other assets had not been taken at inflated prices. At a forced realisation he understood that the whole of the assets would realise from £25,000 to £30,000. The claim of the bank amounted to £11,912, and they held no direct security from the company, but were guaranteed by the directors. He understood that the bank were fully secured for the whole of their claim. Asked what the stock consisted of, he replied that it was a very varied stock, and was in good condition. Some £13,000 represented electrical stock.

Replying to further questions, the chairman said that the directors had never received any fees. The managing director was entitled to a salary of £1,200 a year, but in respect of the last 12 months there was about £500 due to him. The directors were really creditors of the company.

Mr. Poppleton expressed the opinion that the unsecured trade creditors could not expect to receive payment in full. Capital to the extent of some £54,000 had been issued and there was now a

surplus, so far as the creditors were concerned, of only £5,000. In other words, nearly £50,000 had to be accounted for since the formation of the company in 1906. He asked what had been the results of the trading. Continuing, he said he would also like an explanation of a circular which had been issued, which stated that the liquidation and receivership did not disturb the business, and that it would go on just the same under the same management. Did that mean that the trade creditors were to be paid in full?

The chairman replied that he had not had sufficient time to prepare the figures asked for, and at the present moment he was unable to give details as to the past history of the concern. The opinion was expressed by Mr. Poppleton that the liquidator ought to be in a position to tell the creditors what happened when the company was formed, and what its transactions had been since. He asked what assets were taken over by the company, and the chairman replied that he could not give the particulars.

A creditor expressed the opinion that unless there was a very careful realisation, these interested would come off badly. Mr. Hardy represented the debenture-holders, and it was advisable that the creditors should nominate someone to act as joint liquidator, who would represent their interests. The creditor suggested that the Rotax Motor Accessories Co. should be nominated to make the necessary application to the Court for the appointment of a joint liquidator to act with Mr. Hardy.

After a short discussion the resolution suggested was carried by a large majority, and the solicitor for the company then stated that there was every chance of the business being realised to advantage. Application might shortly be made to the Court with reference to the disposal of the business. He had advised the liquidator not to answer certain questions, as there might be some persons present who desired to bid for the business. A Committee of the principal creditors was also elected.

ADAMSON, RAMSBOTTOM & CO., LTD.—A meeting of creditors was called for May 15th at 6, Castle Street, Liverpool; Liquidator, Mr. B. Cookson.

PATENT BRAKE BLOCKS, LTD.—A meeting is called for June 10th at 8, Old Bank Buildings, Chester, to hear an account of the winding up from the liquidator, Mr. W. Conway.

WESTERN ELECTRIC CO. (AUSTRALIA), LTD.—A meeting is called for Norfolk House, W.C., on June 13th, to hear an account of the winding up from the liquidator.

OUTSHOORN ELECTRIC LIGHT AND POWER CO., LTD.—A meeting is called for June 12th at 71A, Queen Victoria Street, E.C., to hear an account of the winding up from the liquidator, Mr. E. West.

ROSSENDALE BELTING CO., LTD.—First meetings of creditors and contributories are called for May 23rd at the Official Receiver's Offices, Byron Street, Manchester.

**Trade Announcement.**—MR. R. B. BEATTIE, of Burnley, has opened a branch shop at 5, Orchard Road, St. Anne-on-the-Sea, and he desires to receive lists from makers of heating and cooking apparatus and electric light fittings.

**France.**—La Société Dynamo Phare Eyquem is the name of a new company which has just been formed at Levallois-Perret (85 and 87, Rue Chaptal), with a capital of £18,000, to manufacture the car electric lighting dynamo of that name.

**"Deleoblast."**—THE DAVIS ELECTRICAL CO., of 17, Moor Street, Charing Cross, London, W., are supplying the "Deleoblast" frosting process for lamps, for which they make a number of claims.

**Catalogues and Lists.**—THE ELECTRICAL CO., LTD., 122-124, Charing Cross Road, London, W.C.—Priced leaflet relating to "Goliath" holders for H.C.P. metal lamps, also a priced card relating to their frosted radiator lamps. Both of these lines are carried in stock.

MR. O. N. BECK, 11, Queen Victoria Street, London, E.C.—Illustrated list describing the "Triplex" valve, line drawings being given to show several schemes of connections for these valves.

MESSRS. TURNERS & MANVILLE, LTD., Houghton House, Lloyd's Avenue, London, E.C.—Twelve-page pamphlet dealing with their "J. M." dry batteries, "T. & M." adhesive tapes, and "T. & M." fireproof and "Niagrite" tapes. Prices are given.

MESSRS. EVERSHED & VIGNOLES, LTD., Acton Lane Works, Chiswick, London, W.—Four new catalogues have just been issued in uniform style containing fully-illustrated matter with tabulated prices, and connection and other diagrams. The ground covered may be understood generally from the following:—No. 113 (28 pp.) is devoted to Murday recorders, and contains interesting particulars of new types; No. 117 (36 pp.) deals with portable electrical instruments, and gives particulars of the firm's ammeters, voltmeters and wattmeters; No. 118 (24 pp.) is devoted to Foster practical pyrometers, a new type of instrument, suited particularly for engineers; and No. 120 (32 pp.) is the new edition of the firm's catalogue of "Megger" testing sets.

MR. CHAS. E. MILLER, Reade Street, New York, U.S.A.—Catalogue No. 25, giving illustrations and prices of a host of apparatus and supplies for motor-cars, motor-boats and cycles.

MESSRS. BRUCE PEEBLES & CO., LTD., Edinburgh.—Specification sheet No. 59 details and shows the Peebles standard turbo-alternators. The enclosed type, which is the standard arrangement of all their turbo-alternators, excepting the two smallest sizes, is shown. A separate specification sheet details the excitors.

MESSRS. PHILLIPS & TURNER, 71, Broad Street, Birmingham—12-page preliminary list of general electrical accessories—bell material, lampholders, distribution boards, switches, hand lamps, &c. THE CAR and GENERAL INSURANCE CORPORATION, LTD., 1, Queen Victoria Street, London, E.C.—Illustrated (colour) booklet, giving some interesting old pictures showing very early motor-

vehicles running on public thoroughfares. Copies will be sent to any interested reader.

BRITISH THOMSON-HOUSTON CO., LTD. Rugby—List No. 2,440, fully describing and illustrating, and showing prices of, their four different forms of current transformers.

MESSRS. PASS & SKYMOUR, INC., Selway, New York, U.S.A.—Two bulletins effectively dealing with their "Shurlock" device for preventing stealing of electric lamps, also their electric advertising signs.

MESSRS. ISAAC STOREY & SONS, LTD., Empress Foundry, Cornbrook, Manchester.—Twenty-page fully illustrated catalogue dealing in detail with Scott's patent air compressors.

MESSRS. WHITTAKER & CO., 2, White Hart Street, E.C.—Catalogue of scientific and technical books, 1913.

**Ghent Exhibition.**—MESSRS. GENT & CO., LTD., Faraday Works, Leicester, are exhibiting at Ghent a full range of apparatus as supplied by them to the British G.P.O., comprising secret and C.B. interphones, the "Borough" and "Nugent" water level indicators and recorders, water level alarm contacts, &c.

**Bankruptcy Proceedings.**—T. A. FLATHER, electrical engineer, lately at Park Electrical Works, Leeds.—Application for debtor's discharge to be heard on June 9th, at the County Court House, Leeds.

BERNARD MUSGRAVE, director of a limited company, Howick, near Preston, lately Astley Bridge, near Bolton.—Application for debtor's discharge to be heard at Bolton on June 11th.

FRED. SHAW, electrical contractor, Hull.—May 29th is the last day for receipt of proofs for dividend. Trustee: Mr. G. H. Acheron, York City Bank Chambers, Lowgate, Hull.

E. J. CROSER (Croser, Stephens & Co.), engineer and merchant, Newcastle.—A third dividend of 6d. in the £ is payable May 26th. Trustee: Mr. J. A. Gardner, 145, Pilgrim Street, Newcastle-on-Tyne.

**Exhibitions.**—The *Times* states that movements are on foot for holding a Universal Oil Exhibition, at Earl's Court, in March, 1914, and an International Exhibition in Manchester, from May to October, 1914.

**E.M.B. Resistances.**—We are informed that the ELECTRO-MECHANICAL BRAKE CO., LTD., are doing a large business in their "E.M.B." unbreakable, jointless and rustless grid type resistances. Orders have recently been received for the Corporations of Leeds, Manchester, Oldham, Newcastle, Leicester, Birmingham, Blackpool, L.C.C., West Ham, &c., and a number of well-known firms and railways, making 2,500 resistances of this type in use or on order.

**Book Notices.**—The Anglo and South American Publishing Co., Ltd., of London, is about to publish an "Encyclopedia of South America" in four large quarto volumes, copiously provided with coloured maps and other illustrations, under the general editorship of Mr. W. H. Koebel. This will be followed a few weeks later by a "South-American Year Book."

"Cab Signaling," summary of a lecture delivered to the London Section of the Permanent Way Institution on February 15th, 1913 by W. H. Dammond. From the Author.

*Engineering Directory of Advertisers.* No. 56, April, 1913. London: "Engineering," Ltd.

**Electric Clocks.**—We have received the following communication from the SILENT ELECTRIC CLOCK CO., LTD., of Goswell Road, E.C., in reply to the letter published on page 756 of our last issue:—"In your current issue we observe a communication from the Magneta Time Co., in which exception is taken to a paragraph in your issue of April 25th, mentioning that electric clocks manufactured by the Silent Electric Clock Co. are being exhibited at Ghent Exhibition 'of the standard pattern as supplied to H.M. Post Office.' While we have no desire to in any way belittle the admirable work achieved by the Magneta Time Co., we think that they overlook the fact—when giving their list of installations in postal buildings—that their system was supplied to the Office of Works, who formerly supplied fittings and furniture, including clocks, to all Government buildings. The Magneta Co. are, therefore, contractors to the Office of Works. Now we have supplied electric clocks to the Post Office direct. No doubt the Post Office exhibit at the Ghent Exhibition is confined to those firms who are contractors to that Department, and does not include exhibits from contractors to other Departments. We apologise for troubling you in so small a matter, but we feel that we must protest against any (even indirect) suggestion that we had tried to appropriate another firm's prestige."

## LIGHTING and POWER NOTES.

**Algeria.**—An electric power plant is being installed in connection with the iron ore mines at Rouina, belonging to the Société des Mines de Fer de Rouina; it will comprise two Diesel engines and alternators, of a total of 250 H.P., one set being held in reserve. The station will mainly supply current for the Mermet workings, where an electric crane, capable of lifting 50 tons of ore per hour, from a depth of 164 ft., two large Sulzer pumps, and an air compressor, are being installed.

**Bangor.**—The City Council's electricity undertaking shows a loss of £624 on the last year's working; it was suggested that the price per unit be increased by 1d.

**Basinstoke.**—The T.C. on May 8th instructed the surveyor to prepare plans for an E.L. station to be erected in Rectory Meadow.

**Birmingham.**—The City Council has approved of the report of the Electric Supply Committee, authorising it to proceed with the new power house at Nechells, the equipment of substations, the provision of underground mains, &c., (referred to at length in our last issue), and instructing the Finance Committee to borrow £500,000 in respect thereof.

**Brighouse.**—In his annual report, Mr. A. Aspinall, engineer and manager of the electricity department, states that the revenue account shows an increase as compared with the previous year, of £613.

**Broadwater.**—The Worthing T.C. is making a canvass in order to ascertain what demand there is at Broadwater for electricity, with a view to the cables being extended to that parish.

**Burton-on-Trent.**—The Gas and Electricity Committee has decided to invite members of the Council to visit the gas and electricity works on May 30th, on which occasion the new electrical plant will be brought into use.

**Bury St. Edmunds.**—The B. of G. has referred to a Committee the question of having the old and new workhouse premises lit by electricity.

**Canterbury.**—The T.C. has decided to install at the electricity works a Harris-Anderson water-softening plant with a capacity of 3,000 gallons, at an estimated cost of £300.

**Continental Notes.**—FRANCE.—Great progress is being made with the establishment of the new central electricity station of the Société Nantaise d'Éclairage et de Force par l'Électricité at Nantes. The plant, which has a capacity of 17,000 kW., is expected to be completed during the coming summer.

ITALY.—La Società Ligure-Toscana d'Electricità, of Leghorn, is putting down a new 3,000-H.P. steam turbine and alternator at its central station in Leghorn; a new hydro-electric station of 10,000 H.P. capacity is also being established on the River Serchio. A 30,000-volt transmission line is also being established between Pescia and Prato to connect the company's system with that of the Società Mineraria e Elettrica della Valdarno, with which concern a contract for the supply of any surplus energy available at nights and on *fête* days has been entered into.

**Dudley.**—At the T.C. meeting last week, Councillor Ballard directed attention to a statement which had been made that negotiations in respect of the sale of the electrical undertaking were being delayed owing to some difficulty which had arisen. He asked if that was correct, and how long it would be before the negotiations would be completed? Councillor Hughes said it was perfectly obvious that the negotiations were delayed, or they would have been completed. As to when they would be concluded nobody knew, but the matter was a purely legal one.

**Dundee.**—The Corporation electricity department has just finished a most successful year, having generated considerably over 10,000,000 units, which is a big increase over the previous year's output.

**Easington.**—At a special parish meeting last week, it was agreed to adopt the Lighting Act, and to carry out a scheme for public and private lighting, the idea being that the Easington Coal Co. will supply the necessary energy.

**Emley (near Wakefield).**—The U.D.C. has decided that the Yorkshire Electric Power Co. be asked to reopen negotiations for the lighting up of the village.

**Fife.**—The whole of the running staff of the generating and sub-stations of the Fife Electric Power Co. recently resigned their positions, owing to a number of grievances culminating in a demand that the shift engineers should work 12-hour shifts (81 hours per week) at bare "time" rate during the annual holiday period, there being no spare men. The case being put before a director of the company, he denied all knowledge of any dissatisfaction amongst the men, and promised to bring the whole matter before the rest of the directors at their meeting next week. He persuaded the men to provisionally withdraw their resignations, and promised that no action would be taken by the management or directors in the meantime.

**Heckmondwike.**—The annual report of the Council's electricity undertaking shows an increase during the year in units sold of 163,872, or 12 per cent. Notwithstanding the high price of coal during the strike, the fuel cost per unit was only 31d., as compared with 36d. in the previous year. The cost of energy purchased from the Yorkshire Power Co. was 75d., as against 62d. per unit from the Council's own plant. The total income increased by £931, and the sum taken to profit and loss account increased from £850 to £1,873, and the balance on this account to meet capital charges was £10,258, whilst the sinking fund balance stands at £8,161.

**Hereford.**—The T.C. has received from the L.G.B. sanction to loans of £500 for mains, £600 for pumping machinery, and £950 for cables, the two latter being in connection with the electrical pumping at the water-works.

**Hertford.**—The North Metropolitan Electrical Power Supply Co. has applied to the R.D.C. for consent to the supply of energy within the district under the company's 1907 Act; the Council has deferred its decision for a month.

**Heysham.**—The U.D.C. has given consent to Morecambe T.C. supplying current to premises in the town under an order to be obtained from the B. of T. The Council has also asked Morecambe Corporation at what price per unit it will supply electricity for lighting Sandilands Promenade.

**Honiton.**—The T.C. has accepted the tender of the Electric Supply Co. for a portion of the public lighting at £7 15s. per 150-c.p. lamp per annum.

**Hull.**—The E.L. Committee is again submitting to the Council its proposal regarding the supply of electricity to Hessele, which was defeated at the last Council meeting.

**Ilkley.**—The District Council is considering a scheme for including in the town some portion of Middleton, a township across the river, and for obtaining powers for an extended electric lighting scheme for Ilkley and district, including Middleton, as Ilkley already possesses powers to supply the latter with gas and water. At a meeting last week the District Council approved a report of Mr. Geo. Wilkinson, the electrical engineer to the Harrogate Corporation, on a scheme of electric lighting to cost £18,000.

**Leeds.**—At a meeting of the City Council last week, reference was made to a resolution of the Tramways and Electric Committee promising to defer further consideration of the question of instituting a scheme of motor hiring, in order to give time for a trial of the scheme submitted by Mr. H. S. Ingleby. Mr. D. B. Foster, in moving the rejection of this resolution, maintained that it was an attempt to prevent the development of direct trading by the Corporation. The amendment was seconded by Mr. G. H. Pearson. Alderman H. Brown, in opposing the amendment, said that whilst they were all desirous of extending the use of electricity in the city, the Corporation meant to see that whilst the tradesmen should have motors, those tradesmen engaged in the manufacture of the electric motors could supply them. Alderman Penrose-Green also opposed the amendment, and said they had no right to take away the trade of hard-working electricians. Alderman Hepton said that whilst he was in favour of municipal enterprises in monopolies, he did not think it would be wise at present to adopt the system of hiring out motors. Electrical apparatus was being constantly improved, and they might find themselves with a mass of old stock on hand. The amendment was defeated, and the minutes approved.

**Leyburn.**—The U.D.C. on May 9th decided to consent to overhead lines being used at Leyburn for electricity supply by the local gas company.

**Llanfairfechan.**—At a meeting of the U.D.C. last week, the question of the feasibility of lighting Llanfairfechan with electricity was re-opened, and a committee was appointed to go into the matter.

**London.**—The Westminster City Council's contracts with the Charing Cross and Metropolitan Electric Supply Co., and the St. James' and Pall Mall Co., for the supply of energy to the Council's buildings, are to be continued for a further period of 12 months from June 24th next.

**POPLAR.**—At the meeting of the B.C. last week, the Electricity Committee reported having had under consideration a proposal of the electrical engineer that an oil fuel apparatus should be provided for use at the generating station. This apparatus, the Committee stated, had been specially designed to meet the demands of power stations, for use over peak loads, and to meet any sudden demands caused through increased load, or in case of breakdown due to fan motors failing. If fitted to the new Babcock boiler with underfeed stokers, the normal evaporation rate of 36,000 lb., approximately, could be increased to 53,000 lb., without the abnormal increase in coal consumption necessitated by forcing the boiler. The Committee recommended that this apparatus with the necessary tank, pump and pipe connections be provided at an estimated cost of £133. This was agreed to.

**HANMERSMITH.**—The mains arc to be extended to Messrs. Waring's factory, which it is expected will be electrically driven, and require some 200 kW. The Electricity Committee has had under consideration the question of enforcing penalties for delay by Messrs. Richardson, Westgarth & Co. in completing their turbine contract of 1911. The Committee felt that in view of the satisfactory work carried out by the contractors, the Council might reasonably forgo the imposition of penalties.

**Manchester.**—The scheme for the improved lighting of the streets has now been confirmed by the City Council; the streets in which electric lighting will be installed are as follows: Peter Street, Oxford Street (excluding St. Peter's Square), Oxford Road, Wilmslow Road to Fallowfield, Denagate from Quay Street, Great Ducie Street to Waterloo Road, Cross Street, Corporation Street, Cheetham Hill Road to Queen's Road, Oldham Street, High Street, Shudehill, Withy Grove, Market Street, St. Mary's Gate, Stretford Road. The total length of the streets allocated to electric lighting is 13,421 yards, and to high-pressure gas lighting is 13,550 yards. Plans are now in course of preparation with a view to an early commencement of the constructional work, which will be spread over a period of three years.

The Corporation Gas Committee has instructed the chairman and engineer to visit certain Continental towns for the purpose of

inspecting certain installations, and also "to make an inspection of large gas engine plants in view of the likelihood of an extensive use of gas for the generation of electricity."

**Middleton.**—The working of the electricity undertaking of the Corporation for the past year has resulted in a loss of about £1,800.

**Morley.**—The electricity undertaking made a gross profit of £1,528 during the past year, and after meeting financial charges there was a deficit for the year of £116, as compared with last year's deficit of £783.

An exhibition of cookery by electricity is to be held during the week commencing June 2nd, by Messrs. Gillespie and Bealca, the T.C. supplying current for the period.

**Oldham.**—Arrangements have been made between the Electricity Committee and the Royton U.D.C. in regard to a supply of electricity to Royton. Should the U.D.C. obtain at its own expense a prov. order for the supply of electricity within its district, the Committee would be prepared to take a transfer of such order upon terms and conditions to be arranged and give a supply upon the same terms and conditions as electricity is supplied in the borough of Oldham.

The Electricity Committee reports a profit of £1,043 on the past year's working against £664 last year.

At a meeting of the Electricity Committee last week, it was reported by Mr. Newington (Electrical Engineer) that during the past year there had been an increase in the units sold of about 10 per cent. for lighting and 47 per cent. for power. There were 6,463,416 units sold, against 5,992,476 in the previous year.

**Olton Broad.**—The U.D.C. has asked the Electricity Co. on what terms it would be prepared to undertake street lighting for a year from September 29th next.

**Penmaenmawr.**—The U.D.C. has decided to write asking the North Wales Electric Power Co. whether it is willing to provide a supply of electricity for public purposes in the district.

**Pontefract.**—The Yorkshire (West Riding) Electric Tramways Co., Ltd., has applied to the B. of T. for permission to erect overhead lines at Pontefract for the transmission of energy at a pressure of 10,000 volts for the purpose of supply under the Electric Light Orders of 1907 and 1912.

**Preston (near Stockton-on-Tees).**—The P.C. is negotiating with the Cleveland and Durham Electric Power Co. for the lighting of the parish by electricity. The company has made a survey of the district, and if sufficient private consumers are secured, the scheme will be carried out.

**Redditch.**—The question of the financial position of the electricity undertaking came up for discussion at the Council meeting last week, when it was decided to appoint a new works manager at £300 per annum.

**Rotherham.**—The electrical engineer (Mr. E. Cross) in his report upon the undertaking for the 12 months ended March 31st last, draws attention to the remarkable reduction in the cost of operation, as against any figure that had hitherto obtained, particularly when the high cost of fuel and the increased cost of materials generally are taken into consideration. The cost of generation, 541d. per unit, he considers as distinctly good when compared with the results obtained by towns of a similar character to Rotherham. The reduction in costs is due to the increasing power load, and the adoption of turbine machinery instead of continuing with reciprocating plant. The increase in the units sold was as follows:—Tramway department—(a) 1912, 1,414,449; (b) 1913, 1,568,247; (c) per cent. increase, 10.87. Power—(a) 1,118,912; (b) 1,596,142; (c) 42.65. Lighting—(a) 370,292; (b) 451,193; (c) 21.85. The total receipts obtained amounted to £21,823, as against £18,860 in 1911-12, but the average price per unit sold had decreased from 1.558d. to 1.448d. Notwithstanding the latter, the net profit carried to appropriation account increased from £3,376 last year, to £5,179, which represents a percentage of 6.47 per cent. on the total capital expenditure to date of £79,921. The accumulated renewals fund at March, 1912, stood at £12,737, representing 18 per cent. on the capital expenditure for that year.

**Rhondda.**—A L.G.B. inquiry was held on the 7th inst. into the application of the Council to borrow £23,400 for the electrical undertaking and £38,500 for a refuse destructor. The proposed expenditure was opposed by the local colliery and railway interests. An agreement has been entered into by which the energy produced by the destructor plant between 6 a.m. and 3 p.m. will be sold to the local power company, who will resell electricity to meet the Council's requirements between 3 p.m. and 6 a.m.

**Salford.**—One of the members of the T.C. has given notice of a resolution asking for the appointment of a committee to make inquiries as to the general lighting of the borough.

**St. Helens.**—The T.C. has applied to the B. of T. for an order to supply current to Messrs. W. Neile & Sons' ironworks at St. Helens Junction, which is outside the borough, and for permission to give the supply by overhead lines.

**St. Margarets.**—The Dover T.C. has decided not to proceed at present with the proposed extension of overhead mains to St. Margarets, a village some five miles from the town. The estimated cost of the extension is £1,500.

**Sheffield.**—The Extensions, Works and Stations (Electricity) Sub-Committee of the Corporation has just issued a report upon the method which should be adopted to carry out the powers given the Corporation under its Act of 1912. So far as the sale of electrical fittings through a contractor carrying on his business independently of the Corporation is concerned, the report states that a conference was held between local electrical contractors and the Sub-Committee when, after a deal of discussion, the deputation expressed the opinion that a scheme based upon the lines of the Bristol scheme might be acceptable to the contractors. Accordingly, a scheme on these lines was prepared and submitted for consideration to a meeting of the contractors who, in a letter to the town clerk, stated that from evidence taken, the Bristol traders were unanimous in their condemnation of the scheme which was only in operation by the goodwill of the Corporation, and the opinion was expressed in the letter that it was not possible to frame a scheme which would not contravene the judgment the local traders had obtained by the Chancery action of February last, and the subsequent provisions agreed in the 1912 Bill, and upon which action and Bill they had been compelled to expend so much time and expense. Continuing, the letter stated that in the opinion of the traders, the only practical and impartial interpretation of the Act is (1) If the Corporation desires, it has the right to keep a showroom for exhibits only, but not in any way to use it for trading, either directly or indirectly; and (2) a printed list of all contractors should be kept or delivered occasionally with bills for current, or in any other method it thinks desirable to extend the business, and in which it will have the full co-operation of all electrical contractors. In conclusion, it was stated that the contractors having given ample time for the consideration of the above matters are not now agreeable to any continuation of Corporation trading by the electrical supply department in any form other than allowed by the 1903 and 1912 Bills, and the judgment obtained. Having considered this letter, the Sub-Committee states that it is still considering the way in which to carry on the work of the department, and will shortly submit a recommendation dealing therewith.

**Stockport.**—The T.C. has rejected a claim for £463 made for damage done by fire, by a local firm, on the ground that the conflagration was caused by the fusing of cables placed through the premises affected without any earthing. The Council denies liability for the fire.

**Swansea.**—At a meeting of the Tramways and E.L. Committee. Mr. Alex. Sinclair, the chairman, said the net profit of the undertaking for the past financial year was about £2,000, as against £3,600 for the previous year. The revenue had increased satisfactorily, but the financial results were lower by reason of the coal strike, the higher price of fuel, advances in wages, increased interest and sinking-fund charges, and reductions in prices to consumers, who had been allowed a rebate of 2½ per cent. all round. He thought the net result most satisfactory, in the circumstances. The question of lighting the new Swansea Asylum with electricity was raised, and it was suggested that, if this were done, the whole of the Sketty area might be taken into consideration. For such purpose, the consent of the outlying authorities would have to be obtained. The town clerk was asked to report on this aspect of the matter. Arising from a request from the Housing Committee, the electrical engineer, Mr. Prussmann, reported on the lighting of the 300 workmen's dwelling the Corporation proposes to erect on Town Hill. He suggested that six lights be installed in each of the smaller houses, for which a sum of 1s. 2d. should be added to the weekly rent, this amount to include installation, the supply of electrical energy, and the supply of one metallic-filament lamp per annum; the six lamps to average not more than 32 C.P. per lamp. The chairman strongly recommended the adoption of the proposal, which would be the first of its kind in Swansea, and it was agreed to.

**Swinton.**—The electrical engineer has submitted an estimate of the cost of electrically lighting Cromwell Road and Warwick Street, and the matter has been referred to a Sub-committee of the Council.

**Torquay.**—The electrical engineer has prepared a model showing the proposed scheme of illumination of the Winter Gardens. Prices are to be obtained from firms for carrying it into effect.

**Tunbridge Wells.**—Application is to be made to the L.G.B. for sanction to the borrowing of £3,100 for the purpose of main, sub-station pillars, transformers and house service. Notice has been given the Tunbridge Wells Gas Co. of the Council's intention to convert a further 50 gas lamps for electric lighting in the streets in which cables are already laid.

**Wakefield.**—The city electrical engineer, having reported that the question of extension of plant and mains, to ensure continuity of supply next winter, should be taken into consideration, the matter is to be dealt with at a special meeting of the Electricity Committee.

**Walsall.**—The Electric Lighting Committee has received a protest from the Local Tradesmen's Association against the increase in the charge for electricity for lighting purposes from 4d. to 5d. per unit.

**West Hartlepool.**—At last week's T.C. meeting it was reported that the new generating station would be in working order by the next meeting of the Council.

**Wimbledon.**—The Council has offered to supply energy for power purposes, at 1½d. per unit, to the site of the L. & S. W. Rly. Co.'s new railway power house off Durnsford Road, for the use of the contractors, &c.

**Workshop.**—At the last meeting of the U.D.C., the clerk reported upon the financial position of the Council. With regard to electric lighting, it was explained that the total income (including £1,226 charged for street lighting) was £6,271. The expenditure on the revenue account was £3,165, and after allowing £100 for machinery, £160 for reserve stock of coal, and £2,382 for repayment of loan and interest, the net profit was £139. Surprise and regret was expressed at the small profit, and considerable discussion took place. Several members urged that in future the energy supplied for public lighting should be charged for by meter, and not at a fixed charge of £15 per annum per arc lamp, and £3 per incandescent lamp. The chairman having pointed out that there were abnormal items of expenditure during the year, the matter was referred to the Committee, together with a proposal to substitute underground cables in certain streets instead of overhead wires.

**Wrexham.**—The T.C. has decided to supply electricity for three months for a showroom, and to provide a youth to assist therein, to a firm who have offered to open a showroom for electrical devices and to canvass for electric wiring and fittings; the firm desired the Corporation also to pay the rent of the showroom, but the Council declined to do this.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—The Corporation's first week's experience of pay-as-you-enter cars on the Woodside route has been entirely satisfactory. Compared with the corresponding week in 1912, when ordinary cars were in service, there was an increase of over £7 in the receipts, of 11,275 in the number of passengers carried, and of 403 $\frac{1}{4}$  in the number of miles covered.

**Aldershot and Farnborough.**—The Light Railways Co. has applied to the B. of T. for an extension of time until June 4th, 1914, for commencing and completing the works under the 1909 order.

**Birmingham.**—The receipts from the working of the Corporation tramways during the year ended March 31st last amount to £574,248, an increase of £140,200 over the previous year. Against the total income for the 12 months (£581,566) there is an expenditure of £370,178, which works out at an average of 6'764d. per car-mile, as against 6'907d. in 1912. Of this total, £160,277 or 2'929d. per car-mile went towards traffic, and £100,725 or 1'840d. to power expenses. According to the report of the Tramways Committee, there is a net profit of £101,352, after meeting interest and sinking-fund charges and charging the expenses of promoting the Birmingham Corporation Bill, 1912, and the Halesowen Light Railway order, amounting to £5,896. From this sum the Committee proposes to place £45,000 to reserve fund, which will then amount to £220,368, and to transfer the surplus of £56,352 to the borough fund. Referring to the receipts, the Committee attributes the large increase partly to the receipts from new tramways, and partly to the fact that the receipts for a full 12 months' working on the Bristol Road, Pershore Road, and Handsworth lines have been brought into account, as against only nine months the previous year. As regards rolling stock, the Committee states that in connection with the new tramways authorised by the Birmingham Corporation Act, 1912, now in course of construction in the Hagley Road, and the tramways about to be constructed in the Warwick Road, and Stratford Road (from College Road to Hall Green), it is necessary to purchase 40 new tramcars, and in order to augment the existing tramway services it recommends that 75 new cars be purchased at a cost of £83,000, including spare electrical equipment and incidentals. The question of constructing tramways from the Selly Oak tramway terminus through Northfield to the city boundary at Longbridge has also been under the consideration of the Committee, which is actively engaged in preparing a scheme for this purpose, which it hopes will be ready for submission to Parliament next year. The Council already possesses power to provide a service of omnibuses in prolongation of any tramway route in the city, the extension of which is contemplated by the Corporation. The Committee expresses the opinion that it is desirable that in accordance with this section, a service of omnibuses should be immediately instituted, and recommends the purchase of 10 suitable buses for this purpose at a cost not exceeding £10,000, to include spare parts and other equipment.

**Black Country.**—Towards the close of last week there was grave danger of the employes on the South Staffordshire and East Worcestershire Tramways coming out on strike, in which event the whole Whitesuntide traffic would have been dislocated, but happily, wiser counsels prevailed. A short time ago a memorial on behalf of the men, claiming increased wages for all grades and better conditions of employment, was presented to the British Electric Traction Co., and subsequently representatives of the men interviewed the leading officials of the company, who promised a definite reply within 10 days. The notice of the men expired on Friday in last week, on which day a letter was received from the company intimating that their decision had been postponed until this week. This aroused considerable indignation amongst the men,

who, at first, seemed determined to strike, but eventually decided to take no drastic action until the receipt of the company's decision. If, however, that should not prove conciliatory, the temper of the men is such that the tramway services in the Black Country may be peremptorily suspended.

**Bolton.**—At a meeting of the T.C. on May 7th, it was suggested that the amount of £13,500, which was being allocated from tramway profits in relief of rates, was excessive, and that £10,000 was ample. Ald. Milee said if he told them what the Committee could have given to the relief of rates they would be surprised. The rates had a perfect right to the money allocated. The minutes of the Tramways Committee which had relation to the allocation of £13,500 were then approved.

**Bournemouth.**—At the last meeting of the Council, the general manager of the Corporation Tramways (Mr. Bulfin) presented his annual report for the financial year ending March 31st, 1913. The total receipts and revenue for the year amounted to £96,720, being an increase of £4,323 on last year's result, which up to this date was a record, the receipts per car-mile being 12'33d., in place of 12'022d. in the previous year. The working expenses, exclusive of capital, amounted to £52,640, being a decrease on last year's expenses of some £2,190, and, having regard to mileage run, established a record for the system, the percentage of working expenses to receipts working out at 54'83 per cent., as against 59'83 per cent. in the previous year, and the working expenses per car-mile were reduced from 7'13d. to 6'71d. The large advance in receipts was mainly due to the alteration of the services on the side routes, the revenue being increased by some £900 at a reduced car-mileage of over 4,000; the adoption of the bonus scheme for the best takings on all routes, which made the staff more keenly alive to intending passengers, and the advantage of two Easters occurring in the one financial year. The working expenses showed a decrease under each of the separate headings with the exception of power, a slight increase here being due to the higher price of coal. The total sum spent in renewals was £2,470. The capital and loan charges for the year amounted to £34,000, making the total costs £86,640, and leaving a net balance of some £10,080 to be carried to the renewals fund. As regarded the coming financial year, the general manager pointed out that the reduction of hours to the traffic staff and the increase in wages granted to the other employes meant an extra cost of some £1,500 a year; the increased cost of coal and materials an additional £1,000; no Easter occurring in the coming year meant a loss in receipts of some £1,500, making a total extra charge to the undertaking of £4,000. It was hoped the revenue from Sunday cars, advertisements in cars, and charges on parcels might make good this extra amount, but, in order to maintain the undertaking in its present financial position, it was absolutely necessary that no further concessions of any kind should be granted.

**Burnley.**—The Tramways Committee has made a recommendation that the centre poles on the local tramway system be removed, and replaced by side poles, with wire suspensions, at an estimated cost of £775.

A sub-committee of the Tramways Committee is to meet a deputation from the Rawtenstall Tramways Committee to consider the question of establishing better communication between Burnley and Rawtenstall.

**Bury.**—The report of the general manager of the tramways states, in addition to the information given last week, that in order to provide the extra number of cars required at the week ends, and, if possible, to avoid the use during inclement weather of cars which are not fitted with top-deck covers, it has been decided to purchase four additional 56-passenger double-deck single-truck cars, fitted with top covers, similar to those already in use, with the exception that the staircase and platform have been re-designed, so as to allow the ends to be covered in for the better protection of the motormen, in case the Corporation eventually decides that this is to be done.

**Continental Notes.**—**FRANCE.**—The light railway system in the Valenciennes district belonging to the Société Economique du Nord is about to be electrified, and at the same time greatly extended; at the present time the line is mainly a single one, which is the cause of much delayed traffic. Under the new scheme a double line is to be constructed and all level crossings suppressed. The necessary electrical energy for the line will be supplied from a new power station which is being established near Valenciennes by the Société d'Electricité de Valenciennes-Anzin.

**GERMANY.**—A new company has just been formed in Berlin with a capital of £5,000 and the title Die Automobil Droschken-Gesellschaft "Elektric" to start a new service of electric taxicabs in the German capital.

**RUSSIA.**—The horse tramways in the town of Tasikent have now all been converted to electric traction, the last horse having just been taken off the service. There are at present 9 $\frac{1}{2}$  miles of line in operation, and 10 miles more have yet to be built. The company has applied to the municipal authorities for a concession for the supply of electrical energy for public and private lighting and power purposes in the town.

**SPAIN.**—La Société des Tramways de Barcelone a entered into a contract with the Compagnie Barcelonaise d'Electricité for the supply of all the energy for its different tramway lines in Barcelona as from January 1st, 1914. The necessary electrical energy will be supplied from the large hydro-electric power stations which the last-named company is establishing in the Upper Pyrenees.

**SWITZERLAND.**—Plans have been prepared in respect of a proposed narrow-gauge electric railway between Arzier and St. Cergue, and to La Cure and Momez. The line would be about 25 miles long, about 8 miles of which would be in French territory.

**NORWAY.**—Work is well in hand on the conversion of the railway between Christiania and Drammen, a distance of about 33 miles, from 3 ft. 6 in. to the standard gauge, and also to electric traction. As far as Sandviken, 8½ miles, a double line will be laid. The question whether the necessary energy shall be taken from privately-owned companies, or whether the Government will establish its own power station, has not yet been decided. As regards the rolling stock, 17 electric locomotives of from 320 to 800 H.P., and 11 combined locomotives and carriages of 300 H.P., have been ordered. The latter are intended for use with a trailer on the Christiania-Asker section of the line, which has a length of about 14 miles.

**SWEDEN.**—Good progress is being made with the electrification of the railway between Kiruna and the Norwegian frontier. The construction of the transformer stations is now proceeding, and it is expected that the line will be ready for operation before the close of the present year.

**Dunfermline.**—The Electricity and Tramways Committee has considered the doubling of the tramway track in the Market Place, and also, as an alternative, the laying of a new track along Silver Street, in order to link up the lines in Sunny Bar and High Street, but after a resolution and an amendment, both of which were lost, it was eventually decided to recommend nothing being done in regard to either proposal before the July meeting of the T.C.

**Dunfermline.**—What was described as an indignation meeting was held last week to consider the failure of the Dunfermline and District Tramway Co. to extend its tramway system to the western boundary of the burgh. A resolution was adopted urging the T.C. to offer strenuous opposition to any application for additional powers within the burgh which the company may make.

**Edinburgh.**—The Colinton Tramways Co. has unanimously approved of the terms of a draft prov. order for an extension to Fountainbridge, Edinburgh.

**Gretna (near Halifax).**—The U.D.C. has resolved that the scheme for the running of the tramways from Elland to West Vale *via* Long Wall be further considered in committee.

**Heywood.**—For the year ending March 31st, 1913, there is a loss on the tramway undertaking of £809. The profit and loss account shows a debit balance of £2,036. The Finance Committee has been recommended to apply a sum equivalent to a rate of 2d. in the £ towards the tramway deficiency, and the balance, amounting to £1,058, is to be carried forward to next year's working account.

**Huddersfield.**—The suggested extension of the Huddersfield tramways from Birchencliffe to West Vale, Elland, is likely to come to a successful fruition, as it is now thought that all financial and other difficulties with the Elland Council have been got over; in fact, some of the members of the Elland Council are to go to London to give evidence in favour of the Huddersfield Corporation's Parliamentary Bill.

**L. & Y. Railway Electrification.**—Last week the heads of several of the departments of the Lancashire and Yorkshire Railway visited Bury to inspect the newly-erected equipment for the electrification of the line from Bury to Holcombe Brook. It is understood that the electrically-driven trains are expected to be in use in two months' time.

**Leeds.**—A resolution was submitted at the last City Council meeting to put into operation ½d. fares on all the Corporation tramway routes. Half-penny fares are in use on some routes, and as the question of fares is to be reconsidered, the matter was not pressed.

**London Tramways Assessment.**—With reference to the circular notice issued by the L.C.C., asking the various Borough Councils to reduce the assessment on the County Council's tramways in their respective boroughs on the ground "that the hereditament had been reduced in value in consequence of the falling-off of the receipts from the tramway undertaking due (among other things) to competition from motor-omnibuses," Camberwell B.C. has decided to insert the assessment of the lines in the borough in the June Provisional Valuation List, at a nominal reduction of £1 rateable value.

**Manchester.**—Consideration has recently been given to the question of the price to be charged for electrical energy supplied for tramway purposes, and a scale has been approved by the Electricity Committee and Tramways Committee respectively. Under this scale the charge to be made by the Electricity Committee to the Tramways Committee for energy supplied for traction purposes, and also for lighting and power purposes at the ca. sheds and car works, will be at the rate of 1d. per unit, based upon the price of coal at 11s. per ton; the charge for energy will, however, be increased or decreased at the rate of 0.02d. per unit in respect of each 1s. per ton increase or decrease. The charge mentioned will apply so long as the consumption for traction does not exceed 30,000,000 units per annum. If and when that is exceeded the supplies for all purposes, over and above 30,000,000 units, will be charged for at the prevailing rate which the electricity department charges to large industrial power users under similar conditions of supply. The arrangement is to be in force for a minimum period of three years, but either Committee

has the option of determining the agreement in the event of the City Council altering the basis upon which the contributions from the profits of the undertakings to the relief of the rates are made, thereby increasing the amount of such contributions.

The Corporation Tramways Committee has instructed the general manager to submit a report upon the suggestions recently made by a deputation which urged the adoption of half-penny fares and an all-night service of cars.

At the City Council on Wednesday last week, Councillor Clyne asked if the agreement of Mr. J. M'Elroy, the tramway manager, did not preclude his devoting any time to tramway work for other undertakings. He had acted as arbitrator in a tramway matter concerning Bradford and Leeds, and for eight days' services he was said to have received £165. Dr. Chapman said the Committee gave its permission as it was necessary that the arbitrator should be a gentleman connected with a municipal undertaking. The payments were high, but the bulk went to the special lawyer engaged to draw up the agreements. Councillor Clyne expressed himself satisfied with the answers given.

**Nelson.**—The B. of T. has sanctioned the running of a goods wagon on the tramways between Nelson and Padham, and Burnley and Harle Syke, for a further period of six months.

**Newport.**—So far the rearrangement and increase of the tramway fares at Newport have benefited rather than hurt the concern. The first week of the changed fares showed that there was a total of 162,218 passengers and of £701 in takings, as compared with 156,852 passengers and £631 in takings in the corresponding week of last year.

**Rochdale.**—A threatened strike of tramway employees has been averted. The trouble arose in consequence of the suspension of a motorman, who declined to turn out for a fresh spell of duty when requested to do so by an inspector. The Tramways Committee heard his explanation last week, and subsequently it was announced that the Committee, whilst regretting the man's act of insubordination, and also that he did not seek an interview with the manager, had decided to annul the effects of the week's suspension, and pay him the week's wages which he missed. The men expressed satisfaction with the decision.

**Rotherham.**—The manager reports an increase of £6,858 in the total receipts of the tramways department, as against the previous year, the actual figures being £42,714, as against £35,856, an increase of 19½ per cent. This increase, he states, is largely due to the extension of the Broom Road and Dalton sections, and to the additional feeding value to the former of the Maltby trolley bus system. The receipts per car-mile are on a paying basis on each section except the Broom section, and there is no doubt that on a full year's working, the receipts per car-mile on this section will prove to be a satisfactory figure. The number of car-miles run were 772,610, as against 720,132, and the number of passengers carried increased from 7,813,922 to 8,774,539. The cost of repairs to permanent way during the year amounted to £1,262, and to cars £3,332. The gross profit of £13,966 compared with £10,642 obtained in the previous year, and represented 434d. per car-mile, as compared with 328d. for the previous year. After deducting the usual allowance for redemption of debt and contribution to sinking fund and interest, the net profit was £5,787, as against £3,723 in 1911-12.

**South Shields.**—At a meeting of the T.C. on the 7th inst., Alderman Wylie, in moving the adoption of the Tramway Committee's report, stated that the new system of penny fares had proved a great success, and, in the opinion of the manager, had met the convenience of the public better even than had been expected. Now the traffic was divided between two routes, instead of being largely restricted to one, and there had been a great levelling-up of the traffic. The increase of receipts had been very satisfactory, and the increase of the number of passengers carried had been as follows:—Ordinary adult fares, 14½ per cent.; children's fares, 15 per cent.; penny workmen's fares, 55 per cent.; and in 2d. workmen's fares, as against 3d. fares, 240 per cent.

**Swansea.**—The T.C. has decided to apply to the Light Railways Commissioners for an order to construct three lines of railways in the borough, which will join the existing tramways at various points.

**U.S.A.**—After numerous tests of an experimental locomotive which will develop 5,000 H.P. for short periods, the New York Central Railway has placed an order for nine similar locomotives with the General Electric Co. The new engines will weigh 100 tons, or 15 tons less than those now in use; this weight is carried on four two-axle bogie-trucks, and every axle will carry a motor, no gearing being employed. The motors are electrically connected permanently in parallel in pairs, and the pairs can be connected in series, series-parallel and parallel. In order to obtain flexibility, the locomotive is built up of two 22-ft. trucks, hinged together at the centre, and each mounted on two two-axle bogies. The cab, which is 33 ft. long, is mounted on the centre pins carried on these trucks. The locomotives are designed to haul a 1,000-ton train at 60 miles per hour continuously, developing 1,400 H.P., but, as previously stated, they can develop 5,000 H.P. for a short period.

**Wakefield.**—The City Council has decided to oppose the Morley Corporation Bill, unless the promoters give an assurance to amend the Bill so as not to be able to construct a railless trolley system on any part of the route over which the Yorkshire (West Riding) Electric Tramways Co. has power to construct light railways.

**Warrington.**—Last week it was reported that the Corporation tramways had had a record year, the profits having increased from £2,456 to £2,981. The reserve fund now amounts to £10,000, and the system has paid £6,000 towards the reduction of the rates, including £1,500 in the latest returns.

**Wigan.**—The profit on the past year's working has been £1,178 compared with a loss in the previous year of £4,189.

## TELEGRAPH and TELEPHONE NOTES.

**Imperial Wireless System.**—On Wednesday last week the report of Mr. G. W. Knox and the chairman on their examination of the pass-books submitted by Sir Rufus Isaacs and Mr. Lloyd George was received by the Select Committee on the Marconi contract. No items were found relating to dealings in Marconi shares, except those already explained to the Committee.

Mr. Marconi then made a long statement, reviewing the history of wireless telegraphy from the date of his first experiments in 1895. He said that he first received signals across the Atlantic by day on December 12th, 1901, and official messages were transmitted on December 16th, 1902. A news service was commenced in March, 1903, but was discontinued on account of increasing difficulties as the spring advanced. At every stage he experienced the necessity of increasing the power of the plant employed. In 1905 he patented his horizontal directional aerial, which at once brought about a most marked improvement in the strength of signals; it was from this point that real progress in long-distance work was dated. He had used wires laid on the ground for war purposes in Tripoli, but that method was not suitable for commercial work. To achieve equal efficiency without the horizontal aerial, a mast two or three times as high as the Eiffel Tower would be necessary. In October, 1907, a service of Press messages was inaugurated between England and America, and in 1908 commercial service was commenced, and had never been discontinued except when the station at Glace Bay was destroyed by fire. In October, 1910, messages were transmitted from Clifden to an Italian ship over a distance of 3,473 miles by day, and from Clifden to Buenos Ayres at night, 5,849 miles. Communication was carried on between Coltano and Massana, 2,238 miles, and between San Francisco and Honolulu, 2,078 miles, the former span including 1,599 miles over land surface, partly in the Tropics. He had been responsible for the equipment on over 1,000 ships, and four stations working over 2,000 miles, as well as 20 stations having ranges of over 1,000 miles. His present long-distance system included several patents which he considered as important as the "four sevens" patent, and these, together with his experience and that of 200 able engineers, and an expenditure of £360,000 on experimental work, constituted the right for his company to ask what he considered very reasonable terms for the long-distance stations required by the Government. His system had been developed without the assistance of the Government. He could not agree that the system used by the British Admiralty materially differed from his own system; he had inspected the installation on a British warship in September, 1911, and stated that the system there installed was the Marconi system pure and simple. He was employing a continuous-wave system at Clifden without any sparks whatever; it was wrong to say that the Marconi system was a spark system. Automatic working was not new; he had used it in his trans-Atlantic service, and was prepared to transmit and receive automatically on that service. If the Poulsen system were adopted for the Imperial stations, every installation on board British ships would have to be altered before it could receive messages from the long-distance stations. His company never sought to purchase the Poulsen patents. He totally disagreed with much of the evidence given by Mr. Taylor, of the Post Office, and statements by Sir Henry Norman. The U.S. Government had a number of Marconi stations at work and under construction, and the Marconi Co. had important agreements with the French Government. Sir H. Norman had said he believed there was no experience of working 2,000 miles largely over tropical lands; yet Sir Henry had visited the Coltano long-distance station, and had been informed there that it communicated with Massana, which was well within the tropics. He had never speculated in the shares of his companies. No syndicate ever existed in connection with any of the shares of any of the Marconi companies. Neither he nor his company was responsible for the fluctuations of the prices in the market. Mr. Marconi protested against the reflections which had been made upon his company and himself for having innocently entered into a contract with the Government; he resented the inquiry into the affairs of his company, which had no relation to the contract, particularly the transactions in America related by Mr. Isaacs, whose evidence he endorsed, and he regretted that the services which his company and he had for so many years rendered to the nation should not have been deemed worthy of higher consideration. He objected to the use of his name as a by-word in party politics. He considered that his was the only company that was capable of fulfilling the requirements of the Imperial chain. The long delay had been very hard on his company, which had engineers waiting to do the work; the price of materials had gone up and the circumstances had changed.

The Committee adjourned for the Whitsuntide recess.

**Japan.**—A sum of £300,000 is allotted in this year's Japanese Budget for the provision of new telephone apparatus. It is stated that over 12,000 applications for the installation of the telephone are awaiting attention.

**Long-Distance Wireless.**—On May 9th the wireless station at Nauen, near Berlin, succeeded in establishing communication with the station at Sayville, Long Island, near New York City, a distance of over 4,000 miles.

**Poulsen System.**—It is stated that Mr. A. S. Baxendale is the chairman and managing director of the Universal Radio Syndicate, which has purchased the patents controlling the Poulsen system of wireless telegraphy; the other directors are Messrs. Rommell, Barton and Gandil. Dr. Erskine-Murray has been appointed consulting engineer to the syndicate. Messrs. Wernher, Beit & Co., Messrs. Kleinwort, the Imperial Tobacco Co., and Sir Robt. Jardine are said to be interested in the system as shareholders.

**Telephone Rates.**—The Postmaster-General hopes to be able to make an announcement on the subject of the revised scale of telephone rates before the end of June.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—May 29th. Cables, street work, junction boxes, incandescent fittings for street lighting, meters, &c. for the Council. See "Official Notices" to-day.

**Australia.**—VICTORIA.—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

May 16th.—One 15-ton overhead travelling crane, for the Melbourne City Council. See "Official Notices" May 2nd.

June 2nd.—20,000-volt H.T. switchgear and L.T. switchgear and accessories, for the Melbourne Suburban Railways. See "Official Notices" May 2nd.

June 11th.—Switchgear and instruments, for the Melbourne City Council. See "Official Notices" April 25th.

July 1st. Telephone instruments and submarine cable, for the P.M.G. See "Official Notices" to-day.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

July 8th.—Rubber-covered wire, batteries, telephone switchboards, measuring instruments and telephone instruments, for the P.M.G. See "Official Notices" to-day.

TASMANIA.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" May 9th.

QUEENSLAND.—May 21st. Copper wire and accessories, for the P.M.G.'s Department. See "Official Notices" April 11th.

August 27th.—Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

WESTERN AUSTRALIA.—May 28th. Condensing plant, pump and piping, for a Government power station at Perth. See "Official Notices" May 9th.

July 9th and 30th and August 6th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

June 11th. Metal-filament lamps, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telegraph and telephone instruments, for the P.M.G. See "Official Notices" to-day.

SOUTH AUSTRALIA.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

NEW SOUTH WALES.—July 9th. Switchboards, for the P.M.G. See "Official Notices" to-day.

**Austria.**—May 23rd. The Austrian State Railway authorities at Stanislau are inviting tenders for an installation of electric lighting and for a number of electric lifts at the new railway station buildings at Stanislau.

**Barnes.**—May 19th. Feeder and distributor cables, for the U.D.C. See "Official Notices" April 25th.

**Belfast.**—May 19th. Circulating-water pump, for the Corporation Tramways and Electricity Committee. See "Official Notices" April 25th.

**Belgium.**—May 20th. The municipal authorities of Schaarbeek, Brussels, are inviting tenders for a low-tension network of mains in connection with the electric lighting undertaking. Particulars from the Service de l'Electricité, 30, Rue de la Ruche, Schaarbeek.

May 24th.—The Belgian telegraph authorities in Brussels (La Salle de la Madeleine) are inviting tenders for telephonic apparatus for central-battery operation at the headquarters in Antwerp.

**Bulgaria.**—May 29th. The District Administration of Finance in Sofia is inviting tenders for the supply of two boilers, two steam engines, three dynamos and an electric motor, with accessories, for the Bulgarian State Collieries at Pernik.

**Colchester.**—May 27th. Steam coal for a year (about 5,000 tons) for the Corporation electricity department. Mr. W. Frisby, Borough Electrical Engineer, 36, Osborne Street.

**Croydon.**—May 29th. Electric lighting of the fire station and library, Thornton Heath, for the Corporation. See "Official Notices" to-day.

**Derby.**—May 23rd. One 750-kw. motor-alternator, for the Corporation. See "Official Notices" May 9th.

**Douglas (Isle of Man).**—May 19th. Good steam coal (about 190 tons) double screened for the cable tramways. Mr. A. Robertson, town clerk.

**Dundee.**—May 30th. Steam and feed piping, steam feed pumps and hot-well tank, &c., for the Corporation electricity department. See "Official Notices" to-day.

**Glasgow.**—May 26th. Two steam turbo-alternators, with condensing plant (5,000 kw. and 2,000 kw. respectively), for the Corporation Tramways Department. See "Official Notices" April 26th.

**Grimsby.**—Pipework, extension of Klein cooling towers, conduits, seven-way D.P. distribution board and motor-driven rotary air and water extraction pumps and circulating pump, for the Corporation. See "Official Notices" May 2nd.

**Leeds.**—May 19th. Economiser chamber at the generating station, Whitehall Road; extension of engine room flooring at generating station, Whitehall Road. Specifications, &c., from I. Whitehall Road, Mr. C. N. Hefford, engineer.

**London.**—L.C.C.—May 28th. Electrical installations at Lewisham Bridge and Fairfield Road (Bow) elementary schools. See "Official Notices" May 9th.

Applications are invited from persons and firms wishing to be included among those from whom the Council invites tenders for the supply of stores and the execution of general maintenance contracts. See "Official Notices" May 9th.

June 3rd.—High and low-tension cables for Tramways Department. See "Official Notices" to-day.

**MILE END.**—Two 30-kw. and one 15-kw. compound engines and dynamos, for the Guardians (from municipal authorities only). See "Official Notices" May 9th.

**ROYAL MINT.**—May 19th. 50 tons of copper in ingots. See "Official Notices" to-day.

**METROPOLITAN ASYLUMS BOARD.**—June 4th. Extension of internal telephone system and installation of signal bells at the Western Fever Hospital, Fulham, S.W. See "Official Notices" to-day.

**Malta.**—May 22nd. Arc lamp carbons. Receiver-General and Director of Contracts, Valletta. Forms, &c., from Crown Agents for the Colonies, Whitehall Gardens, S.W.

**Manchester.**—May 20th. (a) Canopy trolley standards; (b) steel fishplates for tramway rails; (c) steel tie bars for tramway rails; (d) pitch for paving purposes, for the City Tramways Committee. Mr. J. M. McElroy, General Manager, 55, Piccadilly.

**Mexborough.**—May 30th. Lancashire boiler, for the U.D.C. electricity department. See "Official Notices" April 25th.

**New Zealand.**—CHRISTCHURCH.—May 22nd. City Council. Two 500-kw. converters and switchboard panels. Tenders, c.i.f. Lyttelton, to office of High Commissioner for N.Z., 13, Victoria Street, S.W. Specification, &c., at Board of Trade C.I. Department in London.

**Portsmouth.**—June 11th. Wiring for electric light installation at Workhouse Infirmary extensions, &c., Milton. See "Official Notices" to-day.

**Rathmines and Rathgar.**—May 19th. Electrically-driven jet condensing plant, for the U.D.C. See "Official Notices" May 2nd.

**Rochdale.**—May 21st. Boiler feed pumps, for the Corporation Electricity Committee. See "Official Notices" May 2nd.

**Salford.**—May 19th. Tenders invited for 10 car bodies and 10 Brill trucks. Tramways General Manager, 32, Blackfriars Street, Salford.

Wiring of new secondary school, Pendleton, for the Education Committee. See "Official Notices" to-day.

**South Africa.**—STELLENBOSCH (CAPE PROVINCE).—June 4th. The Municipality is requiring tenders for buildings, generating plant, cables, public lighting, meters, &c., in connection with the electric lighting scheme. Specifications from Prof. Bohle, South African College, Cape Town.

Two 40-kw. Diesel engines and dynamos, pipework, battery, feeders, aerial cables, street lamps, &c.

**Spain.**—May 24th. The municipal authorities of Tabanera de Cerrato (Palencia province) are inviting tenders for the concession for the electric lighting of the town during a period of eight years.

May 29th.—Tenders are being invited by the municipal authorities of Almeria for the concession for the electric lighting of the town during a period of 15 years.

Tenders have just been invited by the municipal authorities of Urda (province of Toledo) for the concession for the electric lighting of the town during a period of 12 years.

**Walthamstow.**—May 28th. Natural draught cooling tower, for the U.D.C. Electricity Department. See "Official Notices" May 2nd.

**CLOSED.**

**Barrow.**—The B. of G. has accepted the tender of Mr. Drysdale, Barrow, amounting to £670, for the electric lighting of the workhouse.

**Belgium.**—Six German and two Belgian concerns competed for the contract, last week, for the supply of armoured high-tension cables required by the municipal authorities of Schaerbeek, Brussels, in connection with their electric lighting undertaking. The lowest tender was that of the Société des Ateliers de Constructions Electriques, of Charleroi.

**Birmingham.**—The Corporation has placed a contract with the Electro-Mechanical Brake Co., Ltd., of West Bromwich, for 40 Maley electro-mechanical brakes of a new design for maximum traction bogie trucks, after test of a trial brake. This is the second large order placed with the same company by the Corporation.

**Blackburn.**—The Corporation has placed a contract with the British Westinghouse Electric and Manufacturing Co., Ltd., for a turbo-generator for the electricity works.

**Cheltenham.**—The T.C. has accepted the tender of the British Westinghouse Co. for the new condensing plant at the electricity works, at £1,000.

**Doncaster.**—The Electric and Tramways Committee has recommended the acceptance of the following tenders in connection with the supply of new tramcars:—

United Electric Car Co., Ltd.—Car bodies, with top covers, at £456 each. Peckham Trunk Co.—Pendulum trucks, at £90 10s. each. Dick, Kerr & Co.—Electrical equipments, at £284 10s.

**Dover.**—The T.C. has received the following tenders for 4,000 tons of coal (washed nuts) for the electric light works:—

W. Cory & Son.—17s. 9d. per ton. Featherstone Colliery Co.—17s. 4d. Settle, Speakman & Co.—Queenboro' washed nuts, £1 1s.; and Pearl slack, 19s. 10d. Myers, Rose & Co.—19s. 3d., with alternative prices ranging from 17s. 5d. to £1 0s. 2d. Main Colliery Co., S. Wales.—19s. 7d. Mowll & Co. (Dover).—Washed steam smalls (Haignmore), 16s. 11d.; Hastings steam smalls, 16s. 11d.; and another kind, 17s. 5d.

A truck load of Mowll & Co.'s coal, at £1 1s. 5d. per ton for the sample, is to be tried, and if satisfactory, that firm's tender is to be accepted; otherwise, the contract is to be placed with the Featherstone Colliery Co., last year's contractors, at 16s. 2d. per ton.

**Eastbourne.**—The T.C. has received the following tenders for the supply and erection of a coal conveyor at the electricity works:—

R. Dempster & Sons, Ltd.	Babcock & Wilcox, Ltd.
Walton & Clough, Ltd.	E. Pennis & Co., Ltd.
Mechan & Sons.	G. Robson & Co.
	Strachan & Henshaw, Ltd.
	Spencer & Co., Ltd.

The T.C. also received tender from the following for flame arc lamps for public street lighting:—

Electrical Co., Ltd. (accepted)	G. Braulnik.
Engineering and Arc Lamps, Ltd.	Johnson & Phillips.
Maxim Lamp Works, Ltd.	Ridings Arc Lamp Co., Ltd.
Siemens Bros. Dynamo Works, Ltd.	Union Electric Co., Ltd.
Oliver Arc Lamp Co., Ltd.	Electrical Engineering and Equip-
Jandus Arc Lamp and Electric Co.	ment Co.

The question of the sale of the old lamps and transformers has been deferred.

**Finchley.**—At the last meeting of the U.D.C. the following tenders were received for the supply of a new oil engine for the electricity works:—

(1) Cole, Marchant & Morley, Ltd.	.. .. .	£2,650
(2) Williams & Robinson, Ltd.	.. .. .	2,857
(3) Burmeister & Wain, Ltd.	.. .. .	2,850
(4) Swiss Loco. and Machine Works	.. .. .	2,950
(5) R. Hornsby & Sons, Ltd.	.. .. .	3,051
(6) Consolidated Diesel Engine Co.	.. .. .	3,123
(7) Hick-Diesel Engine Co., Ltd.	.. .. .	3,147
(8) Ditto (alternative for horizontal engine)	.. .. .	3,235
(9) M.A.N. Co. (vertical)	.. .. .	3,391
(9) Mirlees, Bickerton & Day	.. .. .	3,925

The Electricity Committee reported that tenderers Nos. 1, 2, 3, 6 and 9 had not agreed to any system of deferred payments; tenderers No. 4 offered an engine at 200 revs. per minute in place of a maximum of 180 as specified. They recommended that the tender of Messrs. Hornsby be accepted, their price, on a system of deferred payments (one-third on delivery, one-third 12 months after delivery, and one-third 18 months after delivery), being:—Engine, £3,428; generator, £834; bedplate, £65. In the discussion which ensued.

Councillor Nicholls asked if it was a fact that the reason for not accepting the lowest tender, £2,650, was that that tenderer would not supply an engine on the deferred-payment system. Councillor Syrett replied that machinery was a matter that required other consideration than figures. The Committee had to take into consideration the efficiency of the machine and economy in working. The engineer was satisfied that the engine recommended was the cheapest, taking everything into consideration. Councillor Butcher asked what was the spot cash price for the machine. It did not seem a very great business proposition for a Council like theirs to buy an engine on the hire-purchase system. Councillor Syrett replied that the spot cash price was £3,051 and the Council would have to pay £3,218. The principle had already been adopted by the Council. On two occasions the Council had sanctioned the purchase of an oil engine out of revenue. The only other method was by loan, for which the sanction of the L.G.B. must be obtained. That meant unnecessary delay and expense, besides adding to capital. The Council would have to pay 6 per cent. under the deferred-payment system. It was not at all unusual to buy machinery on the lines proposed. The Committee would have preferred to pay cash if it had the revenue, but it had not £4,000 to its credit. After it had paid off the final instalment, the revenue account would be in as good a condition as ever. The Committee's recommendation was eventually carried by six votes to four.

**Glasgow.**—The following contracts have been entered into for the ensuing 12 months by the Tramways Committee:—

Steel car wheels.—John Baker & Co., Ltd., and Hadfield's Steel Foundry Co., Ltd.  
 Steel tires.—Brown Bayley's Steel Works, Ltd.  
 Steel axles.—Glasgow Railway Engineering Co., Ltd.  
 V.I.M. cables.—Siemens Bros. & Co., Ltd., and B.T. & Helsing Cables, Ltd.  
 Chilled iron brake blocks.—Miller & Co., Ltd.  
 Fireclay goods.—Glenboig Union Fireclay Co., Ltd., and Currie & Co., Ltd.  
 Springs.—Geo. Turton, Platts & Co., Ltd. and L. Sterne & Co., Ltd.  
 Steel tool, &c.—Ibbotson Bros. & Co., Ltd., and L. N. Ledingham & Co.  
 Wrought-iron tubes, &c.—Stewarts & Lloyds, Ltd., and Scottish Tube Co., Ltd.  
 Cotton waste, &c.—Wm. Wiseman & Son, R. & W. Cutlbertson, and Jas. Paxton & Co.

Ordinary contracts closed included:—

Scrap copper, filed coil, armature coils.—F. W. Harris.  
 Brass.—G. Bill-Gozzard.  
 Lead-covered cable.—Trsiner & Allison.  
 Rubber cable.—Ballardie, Holden & Co.  
 Zinc and dry cells.—R. M. Esdaile & Co.  
 Rubber.—John Wilson.  
 Cast-iron stopping place sign-posts and brackets.—J. & A. Law, Ltd.

The Electricity Committee recommends the acceptance of the following for 12 months:—

C.I. joint boxes, section pillars, &c.—Carron Co., Ltd.; Falkirk Iron Co., Ltd.; McDowall, Steven & Co., Ltd.  
 Fireclay bricks.—Heathfield & Cardowan Co., Ltd.; Glenboig Union Fireclay Co.  
 Wooden troughing and cover.—Robinson, Dunn & Co.  
 Malleable iron tubes and fittings.—Scottish Tube Co.

The T.C., at its next meeting, will be asked to approve of the following:—

It having been reported that the electrical engineer had completed an electric lamp for constables, which had been thoroughly tested and had given entire satisfaction; that the necessary plant for recharging the lamps had been fitted up, and that, to substitute electric lamps for oil lamps at present in use, 850 would be required, authority be granted to said engineer to obtain offers for additional lamps (100 being already in use), that official submitted six offers, and the sub-committee, having considered the same, agreed to recommend that 100 lamps be obtained from each of the following firms, viz.:—Messrs. Watson & White, Messrs. Ross & Co. and Messrs. Peto & Radford (per Messrs. Colin Scott & Co).

**Hereford.**—The T.C. has accepted the tender of Callender's Cable and Construction Co., Ltd., for cables, at £833; and that of the Rees Roturbo Manufacturing Co., Ltd., for pumps and motors, at £415.

**King's Lynn.**—The T.C. has accepted the following tenders:—Messrs. Browett, Lindley & Co., Ltd., one 400-kw. high-speed steam engine, £1,289; steam, exhaust and feed pipes, foot-plates, &c., £427; the Rees Roturbo Manufacturing Co., Ltd., one rotary jet condensing plant, £305; the Phoenix Dynamo Co., Ltd., one 400-kw. dynamo, £500; total, £2,521. The Committee also accepted the tender of Mr. W. F. Smith, of King's Lynn, amounting to £778, for the erection of an additional boiler house.

**Lancaster.**—The T.C. has accepted the tender of Messrs. Milnes, Voss & Co. for two top-deck covers for trams, at £120 each.

**London.**—HAMMERSMITH.—The B.C. is to enter into a contract with the Main Colliery Co. for an annual supply of free burning coal to the Electricity Department, at 17s. 6d. per ton.

BATTERSEA.—The B.C. has accepted the tender of the Rees Roturbo Manufacturing Co., at £955, for additional pump-house plant at the generating station.

SOUTHWARK.—The following tenders have been received by the B.C. for machinery required in connection with the plant extension at the electric lighting station:—

CONDENSING PLANT AND COOLING TOWER.

	Condenser.	Cooling tower.
Klein Engineering Co. . . . .	£4,136	—
Worthington Pump Co. . . . .	3,570	—
Rees Roturbo Co. . . . .	3,895	—
Isaxo Storey . . . . .	3,180	—
" " " " (alternative)	6,630	—
W. H. Allen & Co., Ltd. . . . .	4,582	—
Cole, Marchant & Mosley . . . . .	3,576	—
Mirrlees Watson & Co., Ltd. . . . .	3,450	—
Davenport Engineering Co. . . . .	3,505	2,257
" " " " (alternative)	3,418	2,197
Balcks & Co., Ltd. . . . .	—	2,199
Kater & Ankersmit . . . . .	—	1,685

WATER-TUBE BOILERS.

British Nielauss Co. . . . .	£6,976
Stirling Boiler Co. . . . .	6,293
" " " " (alternative)	6,834
Babcock & Wilcox, Ltd. . . . .	6,147
" " " " (alternative)	6,629
Howden & Co. . . . .	5,690
Clarke, Chapman . . . . .	6,853
" " " " (alternative)	7,171
" " " " " "	7,337

TURBO-GENERATORS, ROTARY CONVERTERS AND SWITCHBOARD.

	Turbo-generators.	Rotaries.	Switchboard.
Oerlikon Co. . . . .	£8,196	£7,175	—
" " " " (alternative)	—	5,715	—
Dick, Kerr & Co., Ltd. . . . .	9,395	5,414	£948
Howden & Co., Ltd. . . . .	8,495	9,985	—
" " " " (alternative)	8,842	—	—
General Electric Co., Ltd. . . . .	7,990	4,030	861
" " " " (alternative)	8,852	3,626	—
" " " " " "	7,820	4,489	—
C. A. Parsons & Co., Ltd. . . . .	10,536	—	—
Siemens, Ltd. . . . .	8,080	4,400	140
" " " " (alternative)	7,734	3,548	—
Brit. Thomson-Houston Co. . . . .	8,873	4,009	858
Willans & Robinson, Ltd. . . . .	7,710	10,180	887
" " " " (alternative)	7,740	—	869
" " " " " "	8,030	—	—
" " " " " "	8,950	—	—
" " " " " "	8,810	—	—
British Westinghouse Co. . . . .	8,885	4,620	826
Vickers, Ltd. . . . .	—	4,460	—
" " " " (alternative)	—	3,532	—
Brush Electrical Co. . . . .	8,997	—	—
Richardson, Westgarth and Co., Ltd. . . . .	—	8,704	—
" " " " (alternative)	—	8,380	—
" " " " " "	—	8,700	—
" " " " " "	—	8,304	—
Fraser & Chalmers . . . . .	—	8,494	—
" " " " (alternative)	—	8,485	—
Whip & Burne . . . . .	—	—	725
Electric Construction Co. . . . .	—	—	6 2
Bertram Thomas . . . . .	—	—	517
Ferranti, Ltd. . . . .	—	—	827
Union Electric Co. . . . .	—	—	691

The Electric Light Committee recommends the acceptance of the following tenders:—

General Electric Co., Ltd.—Two 1,500-kw. turbo-generators and rotary converters, £7,980 and £10,000 respectively.  
 Bertram Thomas.—Switchboard, £517 (provisionally).  
 Davenport Engineering Co.—Surface condensing plant and cooling tower, £3,418 and £2,187 respectively.  
 Babcock & Wilcox, Ltd.—Boiler plant, £6,147.

The Committee stated that, as would be observed, it had not recommended the acceptance of the lowest tender in each case, but, acting on advice, had selected those firms whose machinery was best suited to the work of the station. The recommendations were agreed to.

**Manchester.**—The Corporation Tramways Committee has accepted the following tenders:—

R. Johnson, Clapham & Morris, Ltd., Manchester.—Block tin.  
 Normanton & Son, Ltd.—Roofing over of the avenues at the Hyde Road car works.  
 B.I. and Helsing Cables, Ltd.—Tramway rail bonds.  
 F. Smith & Co., Ltd.—Copper trolley wire.  
 British Mannesmann Tube Co., Ltd.—Steel tramway poles.  
 Naylor Bros., Ltd.—Span wire brackets.

The following tenders have been accepted by the Corporation Electricity Committee:—

Reavell & Co., Ltd.—Air-compressing plant for boiler tube cleaning.  
 W. T. Healey's Telegraph Works, Ltd.; Messrs. Siemens Bros. & Co., Ltd.; I.R., G.P. and T. Works Co., Ltd.; and Charles Macintosh and Co., Ltd.—Paper-insulated and rubber-insulated cables.

**Morley.**—The T.C. has accepted the tender of Messrs. Bedford & Co. for 1,000 tons of pea slack for the electricity works.

**Rochdale.**—The Corporation Gas and Electricity Committee, on May 7th, placed contracts for 60,000 tons of coal. The prices showed a very substantial increase over last year's figures, when £2,777 more was paid on this account than in the previous year. On the contracts now placed there is an average advance of just over 1s. 1d. per ton, or an aggregate increase of over £3,250.

**Rugby.**—The tender of Mr. S. P. Marsh, Rugby, has been accepted for the electric light installation at New Empire Picture House, now in course of erection in Henry Street.

**Salford.**—The Electricity Committee has accepted the following tenders:—

Lancaster & Tonge.—Brass and gun-metal castings.  
 British Electric Transformer Co., Ltd.—Three compensator transformers for the meter house, in connection with the bulk supply of electricity, £239 each.  
 W. T. Glover & Co., Ltd.—Extra-high-tension cable.  
 Bell Bros.—Crank chomb r oil, 1s. 2d. per gallon, value £398.  
 M. Wells & Co., Manchester.—Turbine oil, 1s. 6d. per gallon, value £110.  
 Stern, Sonneborn Oil Co.—Black oil, 11d. per gallon, £50.  
 Baxendale & Co.—Wrought-iron tubes and fittings, £60.  
 L. Andrews & Co.—Mica, rubber gloves, &c., rubber caps, £24.  
 N. British Rubber Co., Ltd.—Rubber overshoes, 2s. per pair, £2.  
 Wm. Geipel & Co.—I.R. cables (£200), twin flexible cable (£17), plain white tape (1s. 6d. per lb., £12).  
 W. T. Glover & Co., Ltd.—I.R. cables (£1 0), multiple-core cables (£300).  
 John Bassett.—Tin and lead (£150).  
 Albion Clay Co., Ltd.—Stoneware conduits, stoneware pipes, cable protectors and bearers (£70).  
 W. H. Keys.—Bitumen (£4 8s. 6d. per ton, total £240).  
 W. T. Healey's Telegraph Works Co., Ltd.—Rubber strip (7s. 6d. per lb., £72) and black bitumen compound adhesive tape (£8).  
 T. Hart.—Cotton driving rope (£40).

**Worcester.**—The City Council has accepted the tender of Messrs. Hough & Jacobsen, Birmingham, at £273, for supplying to Hylton Road electricity station induced-draught fan, ducts, dampers, platform, &c.

**Sheffield.**—The City Council has accepted the following tenders:—

- Willans & Robinson, Ltd. Turbo-alternator, £24,119.
- Hirling Boiler Co., Ltd.—Three water-tube boilers, mechanical stokers, superheaters, economisers, pipework and other accessories, £25,208.
- Longbottom & Co.—5,100 tons steam coal for the electricity department.
- Edmund Taylor.—Excavations, retaining walls and extensions to waterway at Neespond power house site, £10,718.
- United Electric Car Co., Ltd.—25 double-deck top-covered extended canopy cars, £60 per car, plus 5 per cent. for contingencies.
- British Thomson-Houston Co., Ltd.—10 E 20 motors for above cars, £105 each; also B. 19 C. controllers for ditto, £23 16s. each.

**South Africa.**—The *African World* states that Germiston municipality has now decided the tenders for the railless traction system, the successful contractors being:—

- Hlubert Davies & Co.—10 Cedes-Stoll cars, £11,460; overhead fittings, £1,328; and poles, £5,899.
- Connocks S.A. Motor Garage.—Tower wagon, £875.
- Telegraph Manufacturing Co. (Colonial), Ltd.—Electric mains, £4,064.
- S. Sykes & Co.—Motor converters, £3,272; and spare stator, £450.

All are Johannesburg firms.

**Tunbridge Wells.**—The following tenders have been accepted by the T.C. for an annual supply of coal to the Electricity Department:—

- Myers, Rose & Co.—Bwlfa large, 26s. 2d. per ton.
- Main Colliery Co., Ltd.—Dynevor Duffryn, 25s. 8d.
- Harris, Hardman & Co., Ltd.—South Hetton, 19s. 8d.
- Wm. Cory & Sons, Ltd.—Shirebrook natty slack, 18s. 7d.

**Walsall.**—The following tenders have been accepted by the T.C.:—

- E. Green & Son.—Economiser, £623.
- Callender's Cable Co., Ltd.—Laying alternating-current main, £601.
- British Westinghouse Co., Ltd.—Sub station equipment, £147.
- Johnson & Phillips, Ltd.—Ditto, £16 10s.
- Walsall Electrical Co., Ltd.—Overhead telephone wires, £11.

**Winchester.**—The T.C. has accepted the tender of Messrs. Wise & Lansdell, Ltd., for the erection of new offices and stores at the electricity works, at £1,697.

**York.**—The T.C., on May 9th, accepted the tender of Callender's Cable and Construction Co., Ltd., for high-tension cables, at £2,137; and that of the Brush Electrical Engineering Co., Ltd., for four tramway cars, at £2,960.

**FORTHCOMING EVENTS.**

- Physical Society.**—Friday, May 16th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Experiments to Detect  $\beta$ -rays from Radium A," by Drs. W. Makower and S. Russ.
- Junior Institution of Engineers.**—Friday, May 16th. At 89, Victoria Street, S.W. Discussion on "Electrical Propulsion of Ships," introduced by Mr. W. P. Durnall.
- Wednesday, May 21st. At 8 p.m. At the I.E.E. Paper on "Heat Accumulators and their Use in Exhaust Steam Turbine Plants," by Mr. A. Alison.
- Friday, May 23rd. At 89, Victoria Street, S.W. Discussion on "The Organisation of an Engineers' Employment Bureau," introduced by Mr. S. M. Hills.
- May 24th. At 3 p.m. Visit the King George reservoir at Chingford.
- Institution of Electrical Engineers (Newcastle Students' Section).**—Monday, May 19th. At 7.50 p.m. At Armstrong College. Annual general meeting.
- May 20th—24th. Visit to Paris.
- Royal Society.**—Thursday, May 22nd. Annual Bakerian Lecture, by Sir J. Thomson, F.R.S.
- Concrete Institute.**—Thursday, May 22nd. At 4.30 p.m. Annual general meeting. At 8 p.m. Annual dinner.
- Royal Institution of Great Britain.**—Friday, May 23rd. At 9 p.m. Discussion on "The Secret of the Permanent Magnet," by Prof. S. P. Thompson.
- Saturday, May 24th. At 3 p.m. Lecture on "Radioactivity: the Alpha Rays and their Connection with the Transformations," by Prof. E. Rutherford.

**THE ELECTRICAL ENGINEERS (LONDON DIVISION).**

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

- Monday, May 19th.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 6th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.
  - Tuesday, May 20th.—"B" Company. As for "A" Company.
  - Wednesday, May 21st.—All Companies. Annual course of musketry at Purfield rifle ranges. Railway tickets will be sent to those notifying headquarters of their intention to attend.
  - Thursday, May 22nd.—"C" Company. As for "A" Company.
  - Friday, May 23rd.—"D" Company. Ditto.
  - Saturday, May 24th.—Headquarters will be opened for regimental business from 10 a.m. to 12 noon.
- (Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.  
For Officer commanding L.E.E.

**NOTES.**

**Wanted—Six Hundred Pounds.**—Our readers are already aware that at the annual festival dinner Mr. E. G. Byng offered to give £100 to the funds of the Electrical Trades Benevolent Institution, if nine other firms or gentlemen would do the same within three months from April 16th. The £100 which Mr. Sutton had already given was to be counted as one of the nine; Mr. H. Hirst, through Mr. Sutton, promised a like amount; and Mr. Garcke's promise brings the total up to £400 out of the required £1,000.

It has been thought that some of our generously disposed readers would be willing to follow the splendid example set by these gentlemen and ensure that the conditional offers are fulfilled by making or influencing six other offers. We hope that in later issues it will be possible for us to fill names into the six spaces now standing vacant below:

1	Mr. E. G. Byng	...	...	...	...	...	...	...	...	£100
2	Mr. G. Sutton	...	...	...	...	...	...	...	...	£100
3	Mr. H. Hirst	...	...	...	...	...	...	...	...	£100
4	Mr. E. Garcke	...	...	...	...	...	...	...	...	£100
5	*	...	...	...	...	...	...	...	...	
6	*	...	...	...	...	...	...	...	...	
7	*	...	...	...	...	...	...	...	...	
8	*	...	...	...	...	...	...	...	...	
9	*	...	...	...	...	...	...	...	...	
10	*	...	...	...	...	...	...	...	...	

**Walking Race.**—We are informed that the second annual London to Southend-on-Sea 41½ miles Amateur Walking Race, promoted by the Hackney Walking Club, a club which was formed as a result of the Electrical Trades London to Brighton Walking Race in 1911, took place on Whit Monday, and was the means of bringing to light two excellent novice walkers in S. C. Haynes, of the Associated Fire Alarms, Ltd., and C. H. Malivoire, of the Crypto Electrical Co., who finished first and second respectively. The event, for which no entrance fee was charged, was most interesting throughout, for the first three positions were ever in doubt right to the finish, so close together at times were the leading men. Eight entered, six started, and five finished, Swann, of Southend, retiring at 20 miles, suffering with cramp in the legs. Result:—S. C. Haynes (Associated Fire Alarms, Ltd.), 7 hr. 54 min. 9 sec., first; C. H. Malivoire (Crypto Electrical Co.), 7 hr. 57 min. 16 sec., second; J. H. Williamson (Manchester), 7 hr. 59 min. 25 sec., third; A. Weston (Clapton), 8 hr. 56 min. 50 sec., fourth; W. J. Spayne (Upper Tooting), 9 hr. 22 min. 6 sec., fifth. The record for the course (6 hr. 47 min. 37½ sec.) is held by Mr. A. R. Edwards, late of the May-Oatway Fire Appliances, Ltd. It is probable that a London to Brighton, or 100 kilometres race, may be held in September.

**Copper.**—Messrs. Merton's circular giving statistics for April 30th shows further reductions in visible supplies during the month. English stocks are less by 763 tons. French stocks are less by 311 tons. Stocks in England and France, and afloat from Chile and Australia, stand at 30,437 tons, a reduction of 1,824 tons on the quantity for March 31st.

Total European stocks, including Rotterdam, Hamburg and Bremen, and estimated stocks in other European ports stand at 45,828 tons, a reduction of 1,746 tons on the quantity for end of March. European arrivals from North America were considerable at 33,628 tons, the average being 27,600. Spain and Portugal to England and France were low; to other countries average. Chile shipments were average, Australian low at 2,950 tons (average for past 12 months 3,790 tons). Deliveries, at 45,932 tons, are fairly high, the two preceding Aprils showing 43,000 and 39,000 tons.

American stocks for the end of March were 46,550 tons, or 8,050 tons lower than on February 28th. The world's visible supply on the same date was 91,624 tons, a reduction of 7,649 tons on the quantity for February 28th.

Returns made by the American Copper Producers' Association, quoted by the *Times* of 9th inst., show a decrease in stocks during April of 12,800 tons, the largest decrease for any month since January, 1910, when the drop was 19,000 tons. The total deliveries during April were 73,000 tons, the largest recorded. Of these, home consumers took 35,000 tons, and export 38,000. The production during April amounted to 60,000 tons, less than in March, when it was 60,800 tons.

Commenting on the general situation, a writer in the *Financier* of May 9th points out that the statistical position, combining with a more favourable situation in Europe, is in favour of higher prices. The same article refers to a combination favoured to maintain the price of iron, and says that a "somewhat similar combination has taken place with regard to copper." The buyer, however, is hampered by dear money. The general conclusion is that, however the various adverse conditions on this side may affect commercial concerns, the political atmosphere in the States should continue to improve, and with it activity in industries. Naturally, as the largest copper producer, America must strongly influence the market.

**Electricity in the U.S. Navy.**—The Navy Department has recently established an electrical school at the Navy Yard at Brooklyn for the training of marines for electrical work. It is estimated that in a crew of one thousand men on a modern war vessel over 40 skilled electricians will be found.

**Parliamentary.**—METROPOLITAN ELECTRIC TRAMWAYS (RAILLESS TRACTION) BILL.—Sir Ivor Herbert's Select Committee of the House of Commons has found the preamble of the above Bill proved; the Bill gives the company power to establish a system of railless traction from Finsbury Park, eastward through Tottenham to a junction with the Walthamstow tramway system, and also contains clauses for the sale or transfer of the undertaking to the Middlesex County Council, which is the tramway authority for the county. The chief opposition came from the Lea Navigation Conservancy Board, in regard to the bridge over the Lea at Tottenham, but matters were adjusted between the parties.

In the House of Commons, on May 6th, the Northern Counties Electricity Supply Bill was read a third time, and in the House of Lords, on May 5th, the following Bills passed third reading:—Wimbledon and Sutton Railway Bill, London Electric Railway Bill, the Metropolitan District Railway Bill, and the Porthcawl and District Gas and Electricity Bill.

**Accident.**—John Stead, of Halliwell Street, Milnrow, was engaged in repairing an electric wire at the premises of the Milnrow Spinning Co., when a pair of pliers fell on to the wires. The flare caught Stead in the face and burned him badly about the eyes. After being treated by a medical man he was removed to the Rochdale Infirmary and detained.

### What Canadian Correspondents think of Canada.

—A young man (non-electrical) who went out to Canada some 10 years ago and has had to rough it, experiencing serious privation, in a brief personal note writes from Alberta:—"Am glad to hear that . . . has emigrated to this part of the world, for this is certainly some country. I came to . . . first in 1910, when there was but one house here and that a log building. To-day there are over 2,000 inhabitants, all fairly prosperous. We have a large stone school-house, two banks, two hotels, a newspaper, a town hall, a fire brigade, four churches, a "co-op," and one policeman. I will send you a copy of our local paper to make you laugh. The ridiculous items, the dogmatic tone of the leaders, the misspells, are common to every paper in the country, and yet each person seems to have had a fair education. Art and literature are at a discount, but science is at a premium. The kids play with miniature aeroplanes, wireless telegraphs, motors, internal combustion engines, &c.; the toys we used to play with—hoops, tops and marbles—are quite unknown."

A friend, who went over from British electrical engineering work to one of the leading cities of Canada some three years ago, delivers himself thus:—

"I am still not enamoured of this country, and would fain return to dear old England if a chance should arise. Do you think that any home firms doing, or desirous of doing, business with Canada, would have any opening at home for a man with Canadian experience, a knowledge of Canadian ways, methods and character? Beyond the mere fact that I earn my living here, there is nothing which tempts me to stay—perhaps both my wife and I are too fond of the Old World to settle down here well; we are fond of historical scenes and old associations which have no existence here; besides, there are few people here who have any ideas at all beyond making money. A knowledge and love of music, painting, sculpture, literature, &c., are very rare indeed, and few people can talk about anything except their own 'shop.'"

Another correspondent, who went out to Canada from England five years ago, after many years' experience with municipal electrical and tramway systems as charge engineer, installation inspector, &c., as well as in machine shops, both in electrical and general mechanical engineering, writes from Alberta:—

"I never, in all that time, sought association with the Institution of Electrical Engineers, as I found so many fellows with scarcely knowledge enough to put up a ceiling rose, pluming themselves with A.I.E.E. on their visiting cards, and I got disgusted at the face of it all, particularly as I found other men whose experience and learning made them stand high in their profession, little caring whether they were known as M.I.E.E.'s or not. However, five years in Canada has changed all that, for out here, where brains and learning are at a discount, and the biggest bluffer gets the most pay, I have come to the conclusion that the only way to make headway is to cram your abilities down people's throats, and make them see that you are 'Someone great.' I have had quite a few jobs since I came out here, and seen examples of electrical work that would make your hair stand on end, yet the salaries paid to the men that did them would make many a 'chief's' mouth water.

"As this place develops they will want a lighting scheme laid out for the town, and a tramway system when the place grows to warrant it, besides large mining plant. I have built a little office, and am selling farm machinery and doing repairs, while I hold my 320-acre farm eight miles away. It's pretty hard work, but I hope the reward is coming, and if I can just have the A.M.I.E.E. as a bit of extra weight at the end of my club, I believe I can drive it into the heads of some of those ignorant financiers that there's a man on the spot capable of doing the work as well as, if not better than, anybody they can get from Montreal or New York.

"With good wishes for the continued success of the ELECTRICAL REVIEW."

Another correspondent (also non-electrical) writing from Vancouver eight months after his arrival, says:—

"After eight months you can imagine me as quite an 'old timer,' long enough out to feel quite at home, and imbued with the infectious optimism that surely permeates and enters into the heart of the man who steps out of the more confined atmosphere, into a Land of Promise. It is a thing that I have never ceased to

wonder at, the spirit of hope that prevails, a man will quit his job, be absolutely 'up against it,' and yet look smiling; he may be sweeping roads one day, a dry-goods clerk the next, and getting tired of that, try his hand at farming; and so the glorious uncertainty goes on, ending, perhaps by his 'striking good,' and earning enough to take a trip home to the Old Country; returning, of course, to start the same experience all over again.

"For my own part, having a definite end in view, I am running no such risks, but holding to my present situation with the ——. They are a fine firm, and treat me well; and I hope to gain the necessary experience from them to enable me, when I can manage it, to strike out on my own account.

"Like most 'green ones' just out, I was tempted to buy a small portion of B.C. (33 x 120), but, so far, have not been able to sell again, yet sharing the everlasting hope of all others who dabble in Real Estate, hope to realise at an unheard-of profit, and live happily ever afterwards.

"The short time that I have been here has been a busy time as regards the building that is going on in and around Vancouver; the place is growing at a remarkable pace. The B.C. Electric Railway, who own the tram system, are extending in every available direction. They have the 'Pay-as-you-enter' system, but the overcrowding at certain times of the day is a sight for the gods. As long as you can get at least one foot on, or hang on at the back, you may ride.

"From the door of my little bungalow I have a grand view of the mountains, snow-topped, and every morning on my way to work I have only to 'look up' to receive an inspiration.

"We Englishmen out here have to drop the Old Country way of talking to a great extent, and it is a case of coming to Rome and doing as Rome does. The average Canadian has no love for the man from England unless he is prepared to be as 'one of them,' and I must say, without conceit, they have treated me very kindly and will always do so as long as I let the impression remain in their minds that 'England belongs to Canada; and not Canada to England!'"

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS.—The Council has awarded two Salomons Scholarships of the value of £50 each, one to Mr. Grahame George Dawson, of University College, London; and one to Mr. Robert Burleigh, of the City and Guilds (Engineering) College, South Kensington; and a David Hughes Scholarship of the value of £50 to Mr. John Hansant Lee, of King's College, London.

The Institution Premium, value £25, has been awarded to Mr. A. E. Hadley, for his paper, "Power Supply on the Rand"; the Ayrton Premium, value £10, to Mr. F. H. Whysall, for his paper, "The Use of a Large Lighting Battery in connection with Central Station Supply"; the Fahie Premium, value £10, to Mr. A. J. Aldridge, for his paper, "Practical Application of Telephone Transmission Calculations"; the John Hopkinson Premium, value £10, to Dr. E. Rosenberg, for his paper, "Self-Synchronising Machines"; the Kelvin Premium, value for this year £21, to Messrs. C. C. Paterson, E. H. Rayner and A. Kinnes, for their paper on "The Use of the Electrostatic System for the Measurement of Power"; the Paris Premium, value £10, to Mr. J. S. Peck, for his paper, "Earthen & Unearthed Neutrals on Alternating-current Systems"; an Extra Premium, value £10, to Mr. M. Solomon, for his paper, "Yellow Flame Arcs"; and an Extra Premium, value £5, to Dr. A. C. Michie, for his paper, "The Formation of Deposits in Oil-cooled Transformers."

Students' Premiums, value £10 each, have been awarded to Mr. H. R. Constantine and to Mr. J. Hacking; and £5 each, to Messrs. C. H. Goulden, S. N. C. K. Whitehead, P. Grice and A. T. Robertson.

On Friday, May 30th, at 8.30 p.m., or immediately after the conclusion of the annual general meeting, called for 8 p.m., a paper on "Practical Application of Telephone Transmission Calculations," is to be read by Mr. A. J. Aldridge.

VICTORIAN INSTITUTE OF ELECTRICAL ENGINEERS.—The report of this Australian Society for the 1912 session shows satisfactory progress. Seven papers were read on various subjects, including the licensing of wiremen, storage battery practice, electrical cooking and heating, the Diesel engine, and so on. A premium of five guineas was awarded to Mr. Victor Nightingall for his paper on "Electric Cooking and Heating." There is a balance of £148 in hand.

The question of amalgamation with the New South Wales Association was referred to by the president of the Victorian Institute at the annual meeting of the latter body at Melbourne. Mr. J. H. T. Brearley, in reviewing the year's work, said there was now a large section of the New South Wales Association desirous of bringing about amalgamation and the formation of an Australian Institute. The annual report stated that the membership of the Institute was now 165. Mr. W. J. Newbigin was elected president for 1913; Prof. Payne and Mr. W. H. Alabaster were appointed vice-presidents; Mr. A. E. Pepper was chosen as honorary treasurer.

LIVERPOOL AND DISTRICT AMATEUR WIRELESS ASSOCIATION.—The usual fortnightly meeting of this Association was held at the Creamery Café, 56, Whitechapel, on May 8th. We are informed that there was a crowded attendance, and a number of new members were nominated. The meeting was a free and easy one; the members had been invited to bring some pieces of apparatus for exhibition and discussion, and this request was well responded to, making a very interesting display. There was also Morse code practice, elementary and advanced. The next meeting will be held at the same Café, on Thursday, May 22nd, at 8 p.m. Communications to Mr. Samuel Frith, 6, Cambridge Road, Crosby, Liverpool, the hon. secretary.

**TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.**—The Congress of this Association takes place at Blackpool on June 12th and 13th. The papers announced are:—"Possibilities for Increasing Profits on Interurban Lines," by Mr. E. H. Edwardes; "Tramways—a *Résumé*," by Mr. F. Bland; "Railless Traction and Motor-Buses," by Mr. H. England; "Standard Rules for Motormen and Conductors," by Mr. A. V. Mason.

**ROYAL INSTITUTION.**—On Saturday, May 24th, Prof. Rutherford commences a course of three lectures on "Radioactivity":—(1) "The Alpha Rays," (2) "The Origin of the Beta and Gamma Rays," (3) "The Radioactive State of the Earth and Atmosphere." The Friday evening discourse on May 23rd will be delivered by Prof. S. P. Thompson, on "The Secret of the Permanent Magnet."

**THE CONCRETE INSTITUTE.**—A paper by Mr. Harold Cane, entitled "The Stability of Brick Chimneys," was read at the meeting on May 8th. The annual general meeting of the Institute will take place on May 22nd.

**Appointments Vacant.**—Assistant station superintendent at Edinburgh (£200); switchboard attendant for Bray U.D.C. (20s.); electrician, for Abertillery U.D.C.; electrical engineer (£120 +), and electrician attendant (£40 +), for the County Asylum, Rainhill, near Liverpool; manager, for the Redditch electricity works (£300). See our advertisement pages to-day.

**The National Physical Laboratory.**—The annual meeting of the general board of the National Physical Laboratory was held recently at the rooms of the Royal Society, when the report and accounts for the year 1912 and the statement of work for 1913 were presented and approved for transmission to the President and Council of the Royal Society. In former years this meeting has usually been held at Teddington during the month of March, and has been combined with an inspection of the Laboratory by the members of the board. In consequence of a change in the financial year, the annual inspection will in future be held at a later date. This year it is to take place on Thursday, June 26th, when the Right Hon. A. J. Balfour will open the new buildings recently erected.

These buildings complete a scheme initiated in 1909 to provide laboratories for metallurgy and optics, with administrative offices, at an estimated cost of £30,000, exclusive of equipment; of this sum the Treasury undertook to provide £15,000 provided the remainder were forthcoming from other sources. In 1910 the late Sir Julius Wernher generously presented £10,000 for the erection of the metallurgy laboratory, and on learning lately that the actual cost had exceeded the sum available by £936, Lady Wernher kindly defrayed the deficit.

To secure the further sum necessary for the completion of the scheme, and to obtain funds for the equipment of the buildings, an "Additional Funds Committee," of which the late Sir William White was chairman, was appointed during 1912. In its report this Committee states that the Royal Commissioners for the Exhibition of 1851 generously gave a donation of £5,000 to the building fund, thus completing with the gift from Sir Julius Wernher the £15,000 required to meet the Treasury grant.

General help towards the equipment has been received from many sources, including a number of the city companies. The Committee, however, points out that considerable sums are still necessary to provide adequately the equipment which is essential for the proper development of the work.

The Report of the Laboratory for the year 1912 contains as usual matter of great technical interest, with which we hope to deal on a future occasion.

**Water-Tube Boilers in Canada.**—In the last few years some of the leading firms of boiler makers in the Dominion have turned their attention to the manufacture of water-tube boilers, chiefly of the Heine, Atlas and similar types with water legs built up of wrought-steel plates and stays. Recognising the increasing demand for the sectional type and the numerous inquiries received for this pattern, a large and well-established firm in Western Ontario has entered the field with a boiler somewhat similar to the "Continental" type, as described in our issue of November 6th, 1908, but with this difference, that the forged-steel headers are made either with internal hand-hole plates or with the hand-holes flanged outwards, to suit the requirements of any particular customer, and the cross box is forged solid out of a steel plate instead of being riveted together. To carry out this work new plant was installed, a large and powerful hydraulic press being purchased in the United States, but the supplementary hydraulic machinery and other special appliances have been made by the firm in their engine works. The general design of the plant and details of the header-making and other machinery were prepared by Mr. A. Venning, late of the Water-Tube Boiler Co., London, who is at present residing in Preston, Ontario. We understand that other firms abroad are also considering the manufacture of this pattern of boiler, recognising the superiority of its design and working qualities.

**The "Yorke" Wiring System.**—Many of the principal castles and country houses of Scotland, and not a few further south, are fitted with electric light on a system peculiar to the contractor who installed it, some 10 to 15 years ago—the late Mr. R. F. Yorke, of Glasgow and Stirling.

All of them—about 50 altogether—are run either by water-power or by an oil engine. The plant as a whole does not call for particular notice, though in most cases it has points seldom met with nowadays. For instance, where oil engines are used they are started by motoring the dynamo; and the battery is generally

fixed up at the house, away from the plant, two switchboards being used. More distinctive was the practice Mr Yorke usually adopted of charging the two halves of the battery in parallel, and discharging it in series. The resultant working pressure appears to have been rather a matter of chance, 60, 75 and 90 being the voltages most usual.

It is, however, his wiring system which presents the most unusual and interesting features. Briefly, it may be considered as a clumsy but quite effective forerunner of modern metal-sheathed single-wire systems, inasmuch as its chief feature was an earthed return, without the complicated special fittings and switchgear which at that date formed essential parts of all concentric systems. It was simplicity itself, consisting of a single insulated wire or cable of suitable capacity run throughout in compo tubing. Each length of tubing was carefully soldered to the next, so as to ensure perfect electrical continuity. But it was not entirely relied upon for the earthed return, being supplemented by a bare copper wire, run sometimes inside and sometimes outside the tubing. This copper wire was, as a rule, single and smaller than the insulated conductor, the compo tube being supposed to make up the difference in current-carrying capacity of the two. It was connected at suitable points—such as behind fuseboards—to an earthen plate, to which the compo was also soldered, and served as a convenient means of connecting up to the earthed terminals of switches and fittings, which were standard throughout.

The net result was a simple and efficient installation, cheaply erected and durable; its only disadvantages, as compared with modern systems, were a certain clumsiness and poor mechanical protection. The tubing, too, being of compo, would be liable to melt should arcing be set up as the result of a fault on the inner conductor, and might thus be a source of fire danger under certain conditions. Developed, however, in accordance with modern experience, it certainly has in it the basis of an ideal system for the class of work for which it was designed.—H. R. T.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—MR. PAGE having obtained another appointment, the Worcester Corporation was recommended by its electrical engineer to promote the other members of the staff with the following salaries: MR. H. H. SMITH, from £125 to £150, rising by annual increments of £10 to £180; MR. H. BAYNHAM, £91 to £104; MR. J. ADDYMAN, £78 to £91, rising to £104 in six months; MR. R. POWELL, £65 to £78; MR. R. F. SEWARD, just appointed at £65. Mr. Clarke (the chairman of the Committee) said that the successful issue of the undertaking was nearer than many of them thought. Mr. Fairbairn said the salaries were no more than should be paid by any self-respecting Corporation. The recommendations were carried with one dissentient only. Mr. Page was chief assistant.

The E. L. Committee of the Coventry T.C. has recommended the Corporation to increase the salary of the electrical engineer and manager, MR. G. TOUGH, from £550 to £650 per annum.

The Whitby U.D.C. on May 6th confirmed the appointment of MR. J. W. PIGGOTT as electrical engineer at £130 a year, rising to £150.

The Gillingham (Kent) T.C. has renewed the agreement with the borough electrical engineer (MR. CHALMERS) at the present salary of £300 a year, his commission on the gross profits to be increased from 1 per cent. to 1½ per cent.

The Crewe T.C. has appointed MR. W. M. TRUMP, of the staff of the Midland Electric Corporation, as charge engineer at the electricity works, vice Mr. A. H. Smith, who has taken up an appointment with Salford T.C.

MR. COLBECK, assistant mains engineer at the Dover Corporation Electricity Works, has resigned.

MR. NAYLOR, who held the appointment of chief assistant at Nelson has been appointed electrical engineer in place of Mr. Helme who recently died. MR. R. H. THOMPSON has been appointed station superintendent and MR. J. STANWORTH mains superintendent.

The Wakefield T.C. have increased the salary of Mr. J. VANCE, mains engineer, from £140 to £150 per annum, and advanced the commission of the Commercial Manager, MR. S. W. GARSIDE, from 3d. to 1d. per 30 wats of additional supply secured.

The Glasgow electricity department has recommended the following increases of salary:—MR. W. W. LACKIE, chief engineer, £1,000 to £1,100; MR. ARCH-PAGE, chief assistant, £600 to £650; and MR. R. B. MACCALL, chief clerk and accountant, £375 to £400.

MR. E. W. POWERAKER, senior switchboard attendant of Walthamstow Council Electricity Works, has been appointed fourth engineer-in-charge to the Ilford Council undertaking.

**Tramway Officials.**—At a meeting of the Southport Town Council last week a recommendation was brought forward that MR. B. ANDREWS should be appointed manager of the Corporation tramways undertaking, and that the services of the deputy tramways manager, MR. T. J. KENDREW, should be dispensed with. An amendment was moved that Mr. Kendrew should be appointed tramway manager, and this was carried by 23 votes to 16.

The staff and employes of the Cork Electric Tramway Co. last month presented a marble clock to MR. J. PERIHO, traffic super-

intendent, on the occasion of his marriage. The presentation took place in the Men's Recreation Room at the power house, being made by Motorman Kelleher, Mr. George Davies presiding.

**General.**—The staff of Messrs. Ackroyd & Best, Ltd., miners' safety lamp makers, electrical engineers and ironfounders, have presented MR. S. REID, A.M.I.E.E., with a marble clock on the occasion of his marriage.

MR. C. H. ARMSTRONG has severed his connection with the Reason Manufacturing Co., Ltd., of Brighton, with which firm he has for some time past held the position of their representative in the Lancashire district.

MR. A. W. MAKOVSKI, electrical engineer of Reigate, has been elected chairman of the Reigate Chamber of Commerce.

MR. F. BOBDESSA, of the technical staff of the British Insulated and Helaby Cables, Ltd., who is leaving for British Columbia, has been presented by his colleagues with a dressing case.

MR. LOUIS DUNCAN, consulting engineer, has removed from 55, Liberty Street, to 50, Church Street, New York, and has associated himself with Messrs. S. Marsh Young and H. A. Pressey, under the firm of Duncan, Young & Pressey, Inc.

MR. PAKENHAM W. BEATTY has resigned his position as manager of the River Plate Electricity Co.'s lighting undertaking and of the Electrica del Norte lighting and tramway undertaking in Tucuman, Argentine, having been appointed chief engineer of the Compania de Tramways Lacroze de Buenos Aires, Limitada. It may be remembered that the River Plate Co. (whose doings are reported in our "City Notes" to-day) and the Electrica del Norte in Tucuman, amalgamated with the object of being in a stronger position to meet the competition of the recently inaugurated Hydro-Electric Co. of Tucuman.

MR. ERNEST A. HILL has resigned his position of advertising manager to the Foster Engineering Co., Ltd., and has commenced business at 24, Stanton Road, Wimbledon, as an advertisement writer and agent.

**Obituary.**—We desire to express our deep sympathy with Mr. L. M. Waterhouse, managing director of Messrs. Simplex Conduits, Ltd., on the death of his wife, which occurred last week.

## CITY NOTES.

### Hong Kong Tramway Co., Ltd.

THE directors' report states that the accounts for the year to December 31st show a profit of £19,302, plus £3,918 brought forward, making £23,220. Of this the interim dividend paid upon November 23rd absorbed £2,031, and the board have allocated to the reserve for depreciation and renewals £10,000. The *Financier* states that the board now recommend the payment of a final dividend for the six months at the rate of 10 per cent. per annum, free of income-tax, making 7½ per cent. for the year, and that £7,127 be carried forward. In spite of the boycott (to which reference is made later) there was a considerable increase in the traffic receipts during the year, but the result is affected to a considerable extent by the favourable rate of exchange. In the directors' report on the year 1910 reference was made to the charge of an additional cent for every five-cent fare paid in Chinese copper coins, in consequence of the loss which was being sustained on subsidiary coinage. On July 1st, 1912, such action was followed up by refusing to accept copper coinage at all, the Government having brought in an ordinance prohibiting its circulation. No trouble whatever was experienced by the company in connection with this action. The shareholders were informed by circular dated January 21st, 1913, as to the further action taken in November last against Chinese subsidiary silver coin, which unfortunately resulted in the boycott of the cars, estimated by the manager to have been in full force from November 23rd, 1912, to January 21st, 1913. The boycott, which was considerably influenced by political action, was but slowly suppressed. It is impossible to say to what extent the company is still feeling the after-effects, but the board are advised that the receipts are now being affected to a small extent only by that cause. The company's action in the matter was initiated by the Hong Kong Government, and during the period in which the boycott was in full force the Government strongly supported the company. It is difficult to gauge accurately the extent of the loss of receipts, but it is considerable, and representations have been made to the Government for compensation additional to the \$30,000 already agreed by them. It is hoped that such representations will result in the payment of satisfactory compensation.

### Rangoon Electric Tramway and Supply Co., Ltd.

MR. FRANK TOBIN (chairman) presided on May 7th at the annual meeting held at the offices, 3, Great Winchester Street, E.C.

In moving the adoption of the report (see *ELECTRICAL REVIEW*, page 774), the CHAIRMAN said the accounts were most satisfactory, and during the year there had been a healthy expansion and growth in every single department of the business. This was the more gratifying, because in 1911, owing to the economic disturbance and bad state of trade in Rangoon, there was a certain check to their prosperity. The profits for that year were larger than they had previously been, but at the same time there was a diminution in traffic takings, and generally

the growth and expansion stopped. They began to emerge from that state of depression in the early months of 1912, and since then there had been a pleasing increase of revenue not only from the tramway, but also from the light and power services. In following and judging the monthly traffic returns, they must remember that the tramway was practically working with the same capital as was expended on it five years ago, and the increases shown were increases on the same amount of working capital. This was not, however, quite the case with regard to the light and power. They were constantly extending their business, and expending new capital on mains and equipment, and on connecting up new sources of revenue, so that the increased income which they derived from these two services, was what they should naturally expect in any case, owing to the larger amount of capital which was being employed, and which was becoming from month to month productive. In 1912 their revenue from all sources had been £110,000, as compared with £99,300 in 1911, and as they had been able to keep their working expenses again within 50 per cent. of their takings, the net result had been a profit of £56,793, as compared with £50,700. During 1912 they had expended £15,000 on capital accounts, of which only £1,000 was used on the tramway, mainly for new cars, while over £7,000 was spent on laying down new mains, and over £5,000 on substations and their equipment, and on buildings. The laying of mains meant that they had business in sight, and the capital employed very quickly became productive. The demand for the supply of light and power was a constantly increasing one, and the demand would continue without doubt from year to year, and as a consequence fresh capital outlay would be required. They were in Rangoon to supply the service of the city, and would extend their connection wherever it was required, so long as they could satisfy themselves that the capital expended would bring in adequate and proper profit to the company. For several months they had been studying recommendations for extensions in Rangoon which were absolutely necessary, and which they were satisfied would bring in a proper profit for the company. The outlay they had in sight would amount altogether to about £10,000. They had unissued about £28,000 ¼ per cent. debenture stock, and also about 70,000 ordinary shares available for issue. For some years they went without a dividend on those shares, but now they were paying 5 per cent., and without venturing to prophesy as to the future, they felt satisfied that the outlook for those shares was so good that they ought not to sacrifice them at a low price. Hence, to meet their capital expenditure they had come to the conclusion that it would be best to issue 5 per cent. terminable debentures, which would be wiped out in the course of time.

MR. J. HALLIDAY seconded the motion, and the report was adopted.

On the motion of the CHAIRMAN, a dividend of 5 per cent. was declared on the ordinary shares.

**Neuhausen Aluminium Co.**—The dividend proposed by the Aluminium Industry Co., of Neuhausen, is at the rate of 20 per cent. for 1912, this comparing with 14 per cent. in the previous year, on a nominal share capital of £1,040,000, of which 50 per cent. is paid up. In addition, the reserve fund, which exceeded £82,000 at the end of 1911, is to be raised to the statutory amount of £104,000. It has been suggested at different times that as the shares are only partly paid a fund should be formed out of the profits in order to gradually provide for the payment of the shares in full. The directors have again had this question under consideration, and now propose to make a beginning by making an allocation of £24,000 to the share payment fund. It is calculated that the fund will reach 10 per cent. of the share capital by the end of 1914.

**Continental.**—FRANCE.—A new company has just been formed in Paris (90, Boulevard de Menilmontant), with a capital of £3,000 and the title *La Société du Dynamo Fareloc*.

The balance-sheet of *La Compagnie Continentale Edison*, of Paris, for the last financial year, shows a net profit of £146,348, as compared with £154,420 in the preceding 12 months.

*La Compagnie Française pour l'Exploitation des Procédés Thomson-Houston*, of Paris, reports a net profit of £171,978 for the last financial year.

*La Société Française des Cables Electriques, système Berthoud Borel & Co.*, of Lyons, reports a net profit of £10,788 for the last financial year.

BELGIUM.—*La Société des Constructions Electriques de Charleroi* reports a net profit of £38,338 for the last financial year.

*La Société Belge pour la Fabrication des Cables et Fils Electriques* of Brussels, reports a net profit of £9,294 for the last financial year, out of which a dividend of 7 per cent. is being declared.

GERMANY.—The Berlin-Hagen Accumulatoren-fabrik Gesellschaft is declaring a dividend of 25 per cent. for the last financial year.

The Felten und Guillaume Carlswerk Gesellschaft, of Mulheim is declaring a dividend of 8 per cent. for the last financial year, as compared with only 6 per cent. for the preceding 12 months.

RUSSIA.—*La Société Russe d'Electricité A.E.G.*, of St. Petersburg, is declaring a dividend of 9 per cent. for the last financial year, as compared with only 8 per cent. for the preceding 12 months.

HOLLAND.—The report of the Philips Glowlamp Works, of Eindhoven, the manufacturers of the Philips incandescent lamps shows a profit of £81,120, out of which a dividend at the rate of 10 per cent. per annum is being declared.

(Continued on page 817.)

# THE BETULANDER AUTOMATIC TELEPHONE SYSTEM.

In telephony, as in other branches of electrical engineering, finality is never attained. It is not a matter for surprise,

the highest power of 10. During this operation the levers return to their zero positions in the same order, so that the subscriber can, so to speak, see his call being sent to the exchange by the instrument, which in this process is entirely automatic. It will be noticed that the number is completely set before any impulses are sent out; an error in setting any one of the levers, therefore, can be corrected at any time before lifting the telephone, without necessitating a fresh start, and without calling up a wrong number. The rate at which the impulses are sent is also independent of the subscriber, being controlled by a centrifugal governor. The moment the last impulse has gone, the subscriber either is through to the called subscriber, and can hear the bell ringing with the aid of his receiver, or is receiving the "busy-back" signal from the exchange. We give in fig. 1 a view of the subscriber's instrument, with cover removed, so as to show the impulse senders separately, the governor being visible on the right-hand side of the latter. This instrument is suitable for

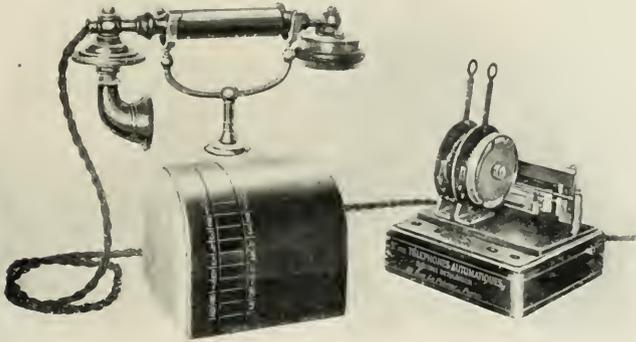
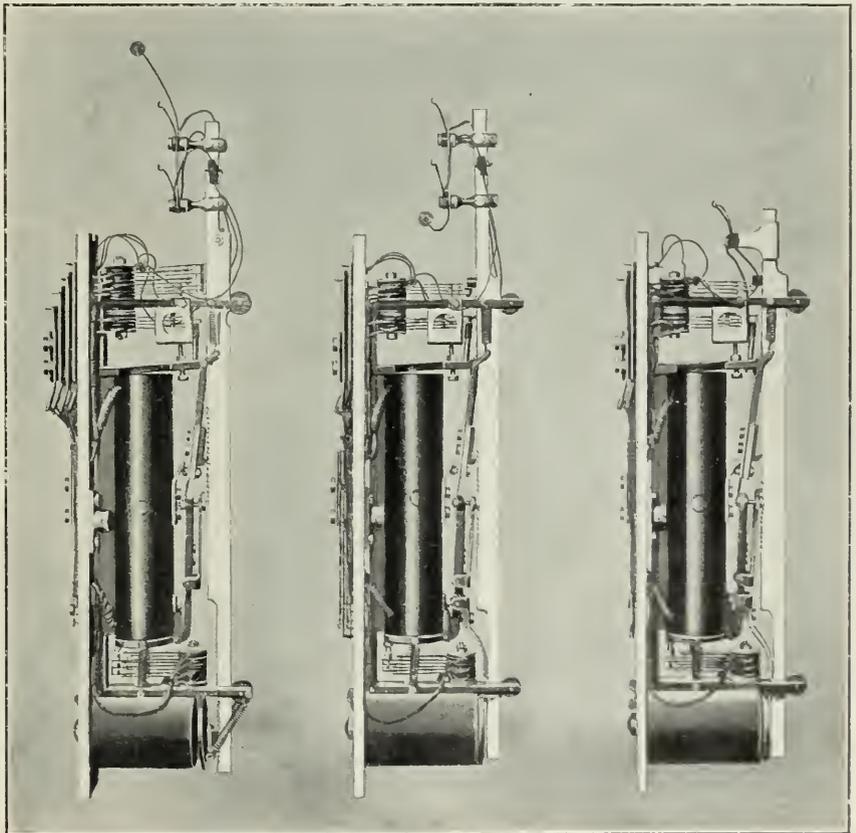


FIG. 1.—SUBSCRIBER'S TELEPHONE AND ACTUATOR.

therefore, that a new automatic telephone system, possessing novel and interesting features, should have been introduced, and we have pleasure in placing a description of it before our readers. Strange as it may seem, in connection with so complex a problem as the substitution of a machine for a human operator, the most marked characteristic of the Betulander system is its comparative simplicity. It may be called the "straight-line" system of automatic telephony, for practically all its operations take place in straight vertical lines; the principle by which the number wanted is arrived at is that of successive selection, and the process may be carried on absolutely without limit, so far as the mechanism is concerned, the number of subscribers connected to an exchange being limited only by other considerations.

Briefly, the subscriber sets a number of levers on his instrument to the digits representing the number wanted; he then lifts the telephone, and by this movement a set of impulse senders is allowed to come into operation, one after another, transmitting to the exchange consecutive groups of impulses, beginning with the set corresponding with

a 100-line exchange, but by adding more levers it can be adapted for anything up to a 100,000-line exchange. These



A. B. C.  
FIG. 2.—PRE-SELECTOR, UNITS SELECTOR AND GROUP SELECTOR.

levers can be added to existing instruments with but slight modification.

Passing on to the exchange, there are here provided four

relays for each subscriber, no matter how large the system may be. Three of these relays receive the subscriber's instrument (which is called the "actuator"), when he originates a call, and the fourth is used when he is called, connecting the ringing current to his line. Condensers are also provided, and these, with the relays, perform the usual functions in a central-battery system. The sets of relays and condensers are assembled together in blocks of 10, serving 10 subscribers, and no extra sets are needed; additions can be made at any time, as the number of subscribers increases.

For finding the wanted number, a series of "selectors" is provided. These devices are extremely interesting; they are all very much alike, the principal parts being identical, and they all move in a vertical plane only. On large systems three patterns are used, which are illustrated in fig. 2. The selector consists of three electromagnets, two of which are assembled in a common sheath, but have separate magnetic circuits; each of these is connected to a line wire, and

receives the impulses sent out by the actuator, through the subscriber's line relays. These magnets operate and

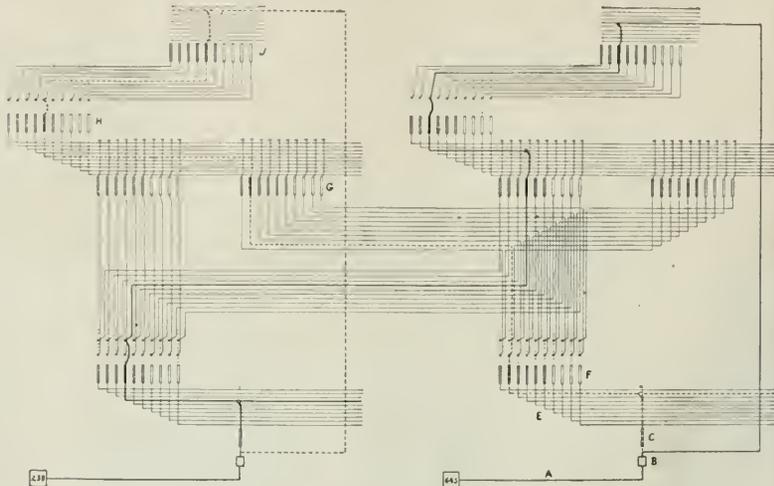


FIG. 3.—DIAGRAM SHOWING THE METHOD OF CALLING SUBSCRIBERS ON THE BETULANDER SYSTEM.

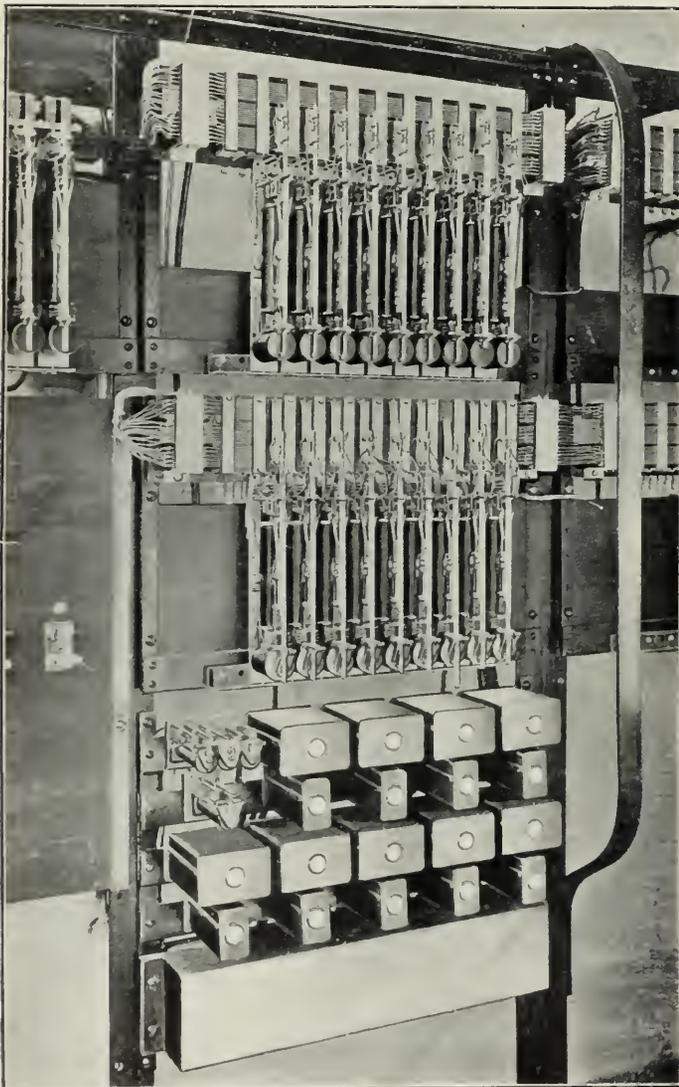


FIG. 4.—PANEL OF SELECTORS.

release the selector by an ingenious arrangement of pawls working against a ratchet. The function of the third electromagnet will be explained later. The selectors are mounted in an iron frame in groups of ten, but each can be taken out and replaced by a spare one in a moment by any person of ordinary intelligence, being held in position by a spring clip; all the necessary connections are automatically made in the act of replacing the selector.

The arrangement of the fixed contacts over which the selector works, called the contact field, is one of the most ingenious features of the apparatus, the field consisting simply of continuous lengths of bare wire, suitably supported, or in some cases metal segments. It will at once be seen that this device greatly reduces the number of soldered connections required, and is so simple and accessible that faults are practically impossible. The selector carries wipers, which make contact with these wires, stepping from wire to wire in accordance with the impulses received. The third electromagnet mentioned above is operated from a local circuit through the contacts of one or other of the first two magnets, and serves mainly to tilt the selector frame, so that the wipers do not touch the wires as they pass over them until the appropriate wire in the contact field is reached, thus preventing unnecessary wear and ensuring secrecy. In fig. 4 is shown a panel, from which a pre-selector and a units selector have been removed, while fig. 5 illustrates part of a panel of group selectors. In the case of very small systems, the contact fields can be arranged so that the central exchange is reduced to one set of relays and one selector per subscriber, as shown in fig. 6, representing a complete switchboard for 10 stations.

We have mentioned that there are three types of selector; the first is the "pre-selector" (fig. 2A), with which each subscriber's circuit is provided. The moment the subscriber's telephone is lifted the pre-selector automatically selects the first

disengaged junction leading to a "group selector"—dropping down instantly to the idle line and stopping there. Normally there are 10 junction lines per 100 subscribers, represented by 10 wires in the contact field of the "pre-selector," and any number of these junctions can be equipped with group selectors, according to the requirements of the service. It is considered that 10 per cent. provides an ample margin, 6 or 7 being usually sufficient. The subscriber's actuator and relays are thus extended through the pre-selector to a group selector (fig. 2c), which receives the first series of impulses sent out by the actuator—the pre-selector having been automatically locked in position and disconnected, so that it is not affected by subsequent impulses.

To each group selector there is allotted an auxiliary selector (fig. 2A) in each of the 10 following groups, the function of which is to find an idle junction and selector in the next group; the last-named selector receives the second series of impulses sent out from the actuator, and picks out the corresponding group, and the same sequence of operations continues until the final or units selector (fig. 2B) has found the line wanted, when, if the line is free, the signalling relay is actuated and the ringing current is sent on the line of the called subscriber, until the latter replies, or the caller (who can hear the ringing) replaces his telephone on the rest.

If the line, however, is engaged, the units selector, directly it reaches this line, instantly returns to normal, causing all the selectors in the series also to return to the normal position, and the subscriber receives the "busy" signal. When either of the telephones is placed on its rest, the whole of the selectors used in the connection are immediately restored to normal.

In order to make clear the operations described above, we show in fig. 3 the apparatus which would be employed in establishing communication between two subscribers in a system designed for 1,000 lines, but, for the sake of clearness, only 200 lines are shown on the diagram. The maximum traffic is here assumed to require 10 per cent. junction lines or "trunking," but the six selectors shown hatched would usually suffice. In the figure, two subscribers' instruments are represented by Nos. 238 and 645, and it is assumed that the latter, after setting the levers on his actuator to the figures 2, 3 and 8, lifts his telephone from

This instantly selects the first idle line of the group of trunk lines assigned to the group of subscribers to which

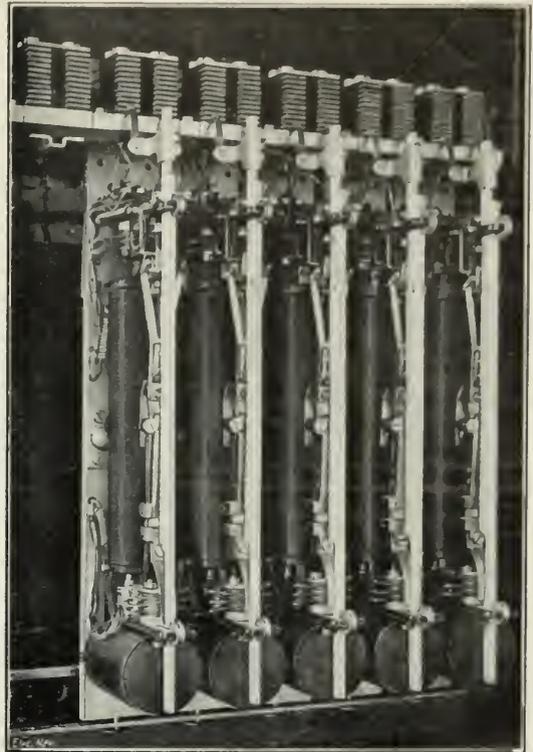


FIG. 5.—PART OF A PANEL OF GROUP SELECTORS.

No. 645 belongs—in this case, assumed to be the second—and puts the connection through, therefore, to the second in the hundreds group of selectors F, which receives the first series of impulses from the actuator and steps up to the third position, representing the third hundred (200—299). This extends the connection to the group of auxiliary hundreds selectors at G, to which all subscribers between the numbers 600 and 699 have access when calling for any number between 200 and 299. The auxiliary selector instantly finds an idle trunk—say the fifth—leading to a tens selector in the group H, which receives the second series of impulses sent out by the actuator, and steps up to the fourth position (controlling the numbers 30-39). The connection is now extended to a units selector—the fifth in the group J—which is operated by the last set of impulses, and steps up to the wanted subscriber's line. The complete path of the connection is shown by a dotted line, and similarly the course of a call for No. 645, originated by No. 238, is shown by a heavy line.

Summarising the leading features of the system, it is claimed that its simplicity and flexibility allow the equipment to be provided in exact agreement with the actual number of subscribers' lines; the apparatus is readily accessible at all times, and in every part, without interfering with the working, and it can be extended indefinitely without modification of the general design; as the actuator is completely set up before any

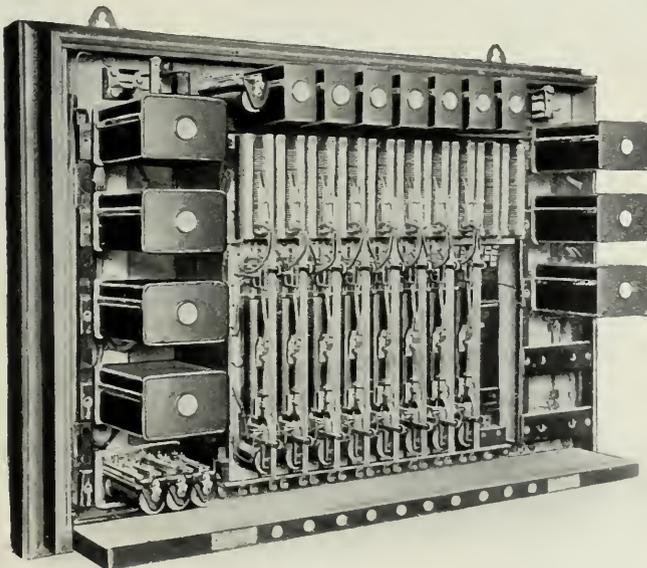


FIG. 6.—COMPLETE BETULANDER AUTOMATIC SWITCHBOARD FOR 10 STATIONS.

the switch hook. An impulse is then transmitted over the line A to the relay set B belonging to the calling subscriber, which in turn operates his pre-selector C.

interfering with the working, and it can be extended indefinitely without modification of the general design; as the actuator is completely set up before any

impulses are sent to line, delays on the part of the calling subscriber do not affect the exchange, and therefore the selectors are engaged for the minimum time: they are also instantly released on the conclusion of a conversation, or if the line is found to be busy, thus setting free the junctions and enabling an unusually low percentage of trunking to be

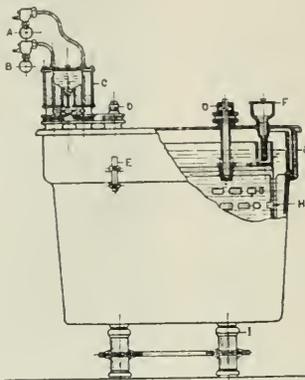
### THE COMMERCIAL PRODUCTION OF OXYGEN AND HYDROGEN.

THE commercial uses of both oxygen and hydrogen have extended enormously during the last few years, particularly in connection with engineering work, for the purpose of cutting steel and iron by means of the oxy-hydrogen and oxy-acetylene flames and for autogenous welding.

For such purposes as these purity of the gas is essential, as the presence of even small percentages of inert gases, such as nitrogen or chlorine, greatly reduces the efficiency of the operation.

Many firms could with obvious advantage produce oxygen and hydrogen on their own premises, given suitable apparatus, and effect a saving over the usual procedure of purchasing such gases in cylinders.

Apparatus for this purpose, constructed by the International Oxygen Co., Newark, N.J., has been adopted in some of the largest works in America, notably by the General Electric and Westinghouse Companies, the Edison Battery Co., and in the Brooklyn Navy Yard. The company has placed on the market simple equipments of various capacities suited to the industrial needs of manufacturers; these consist of a series of electrolytic cells, each generating 7 cb. ft. of hydrogen and 3½ cb. ft. of oxygen per kw.-hour. Each cell requires 300 to 400 amperes at 2 volts.



A, oxygen offtake; B, hydr. gen offtake; C, indicator and pressure equaliser; D, positive electrode terminals; E, negative electrode terminals; F, filling cup; G, hydraulic joint; H, diaphragm; I, insulating supports.

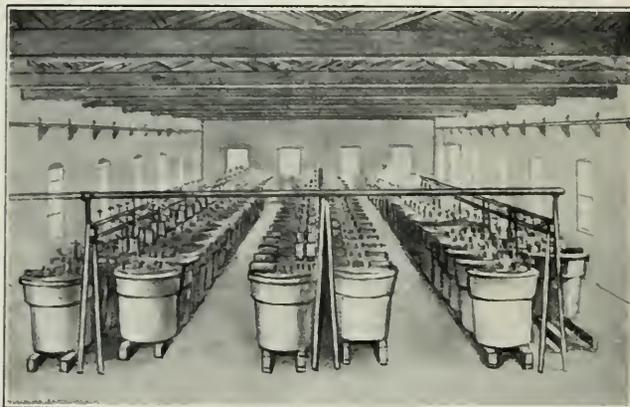
I.O.C. OXYGEN-HYDROGEN GENERATOR.

employed, rarely exceeding 6 or 7 per cent. The energy consumed is small, and the ringing device only runs whilst ringing, being self-starting. Skilled attendance is not necessary, as any of the selectors can be exchanged for spare ones with ease, and the arrangement of the contact fields reduces cabling and faults to the minimum.

An exchange on the Betnlander system for 100 lines

has been installed at Marconi House, Strand, London, where it will be used to control the local circuits; for this purpose it will be increased to a capacity of 200 lines. The simplicity of the apparatus, and the small space occupied, are striking features of this board. We understand that the Marconi's Wireless Telegraph Co., Ltd., has acquired the patents for every country except Sweden, where the system originated, and has appointed Mr. C. B. Clay, formerly Metropolitan Superintendent to the National Telephone Co., as manager of the department. Every effort is being made to expedite the manufacture of the apparatus, and we have no doubt that a good deal will be heard of the system in the near future. An exchange controlling 1,000 stations, installed at No. 38, Rue de l'elletier, will be open for inspection during the visit of the I.E.E. to Paris next week.

We are indebted to Mr. Clay and his assistant, Mr. Ward, for facilities to inspect the installation and to prepare this brief description of the system.



I.O.C. GENERATORS INSTALLED AT THE WORKS OF THE INTERNATIONAL OXYGEN CO.



AN INSTALLATION OF OVAL TYPE I.O.C. GENERATORS.

The construction of the I.O.C. cell is shown diagrammatically in one of our views; an outer iron tank serves as the negative electrode and a perforated inner iron tank, suspended from the cover, as the positive electrode.

An asbestos sack or diaphragm suspended from an hydraulic joint or water seal, encloses the inner electrode, dividing the cell into two compartments, so that the oxygen generated on the walls of the inner tank is kept separated from the hydrogen formed on the walls of the outer one.

As a further check against mixture of the gases the asbestos sack, when impregnated with alkali solution, forms an effective barrier between the two gases.

A solution of caustic potash and water forms the electrolyte; this is introduced into the hydraulic joint through a filling cup, and distributed in the two compartments, the joint automatically regulating the working of the cell.

The oxygen and hydrogen in passing from their respective compartments to the gas mains pass through indicators and pressure equalisers; the latter indicate at a glance how the cell is working, and equalise the gas pressure in each compartment, also they protect the cell from the effect of excessive pressure in the discharge mains, and should the latter become clogged, allow the gases generated in the cell to escape into the atmosphere.

The makers claim that the I.O.C. apparatus will produce pure gases—99·5 per cent. in the case of the hydrogen and 98·5 per cent. or more for oxygen—without other manipulation than the addition of distilled water daily to make up for the liquid decomposed.

As an example of the saving in cost obtained by the apparatus, we gather that in the case of a works using 1,000 cb. ft. of oxygen daily, the I.O.C. plant would supply this for \$6 per day, taking energy at  $\frac{1}{2}$ d. per unit, while the chlorate of potash method, or cylinder oxygen, would figure out at \$25 per day.

In the case of large installations, such as the company's own plant at Newark, N.J., the cells arranged in rows, are connected to gas-holders, the contents of which may be drawn off, metered and compressed for bottling if required.

Our views show the latest oval pattern cell turned out by the company, which has placed its English business in the hands of Messrs. Arthur Lyon & Co.

## NEW COMPANIES REGISTERED.

**British Sherardisers, Ltd.** (128,789).—This company was registered on May 5th, with a capital of £10,000 in £1 shares, to acquire any interest in the process known as "Sherardising" or any process for covering iron, steel or other metals with a coating of zinc or other metallic substances, &c., and to adopt an agreement with H. M. Delacour, as receiver and manager of United Sherardising, Ltd. The subscribers (with one share each) are—H. M. Delacour, 58, Norbury Crescent, Norbury, S.W., mechanical engineer; W. J. Halsey, 25, Queen Anne's Gate, S.W., solicitor. Private company. The number of directors is not to be less than two or more than five; the first are W. J. Halsey and H. M. Delacour; qualification, one share; remuneration (except general managers), £100 each per annum. Registered office, Elythe Road, Willesden Junction, N.W.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Charing Cross, West End and City Electricity Supply Co., Ltd.** (29,123).—Capital, £2,100,000 in £5 shares (420,000 pref., 150,000 ord., 80,000 cum. pref. and 80,000 cum. ord.); return dated March 18th, 1913; 80,000 pref., 80,000 ord., 80,000 cum. pref. and 70,000 cum. ord. shares taken up; £5 per share called up on 80,000 pref., 80,000 ord. and 80,000 cum. pref.; £1,200,000 paid; £350,000 considered as paid on 70,000 cum. ord. Mortgages and charges: £1,037,178.

**Clarke, Chapman & Co., Ltd.** (39,045).—Capital, £200,000 in £10 shares (7,000 pref.); return dated March 14th, 1913; 12,736 ord. and 6,985 pref. shares taken up; £10 per share called up on 3,536 ord., £2 10s. on 200 ord. and £10 on 4,485 pref.; £80,210 paid; £90,000 considered as paid on 9,000 ord., £25,500 on 2,550 pref. and £1,600 on 200 ord. Mortgages and charges: £100,000.

**Cunningham, Ltd.**—Particulars of £1,000 debentures, created April 23rd, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Javal Patents, Ltd.**—Particulars of £1,000 debentures, created April 9th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £200. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Lancashire United Tramways, Ltd.** (87,044).—Capital £200,000 in £1 shares. Return dated March 13th, 1913. 152,976 shares taken up. £7 paid. £192,971 considered as paid. Mortgages and charges outstanding, £605,500. Deferred debenture stock issued, having no charge over the assets of the company, £98,350. Note: Deb. stock to the nominal amount of £20,000 included in the above £98,350 is issued as security for advances up to £15,000.

**Ferranti, Ltd.**—A memorandum of satisfaction in full on December 31st, 1912, of trust deed dated June 18th, 1907, securing £20,000, has been filed.

**Kensington and Knightsbridge Electric Lighting Co., Ltd.** (26,193).—Capital £200,000, in 50,000 ord., 10,000 first pref. and 10,000 second pref. shares of £5 each. Return dated March 13th, 1913. 21,900 ord., 10,000 first and 10,000 second pref. shares taken up; £5 per share called up on 15,999 ord., 10,000 first pref. and 10,000 second pref.; £19,940 paid; £25,160 considered as paid on 6,022 ord. Mortgages and charges £115,059 in respect of debenture stock issued by this company in conjunction with Notting Hill Electric Co. Ltd., £227,500.

**Newmarket Electric Light Co., Ltd.** (14,450).—Capital £90,000 in £10 shares. Return dated March 31st 1913; 2,656 shares taken up £25,560 paid. Mortgages and charges: £14,260.

**New System Private Telephone Co., Ltd.** (73,732).—Capital £10,000 in £1 shares. Return dated March 24th, 1913; all shares taken up £8,000 paid; £2,000 considered as paid. Mortgages and charges: £2,000.

**Egham and Staines Electricity Co., Ltd.**—Issue on April 30th, 1913, of £100 debentures, part of a series of which particulars have already been filed.

**Veritys, Ltd.**—Mortgage dated April 28th, 1913, to secure £800, charged on freehold land and premises at Nechells, Birmingham, &c. Holders: J. N. Brown, C. F. Brown and A. J. Williams. Also mortgage dated April 29th, 1913, to secure £400, charged on same property. Holder: Annie M. Gowan.

**Tyer & Co., Ltd.**—Charge on freehold property in Metcalf Street, East Nelson Street, and land adjoining, all in Carlisle, dated April 14th, 1913, to secure all moneys due from the company to London, County and Westminster Bank, Ltd., 41, Lothbury, E.C. The charge is given by the company to the bank as collateral security for an overdraft not to exceed £7,000, which is already secured by debentures for that amount, registered March 11th, 1913.

## CITY NOTES.

(Continued from page 812.)

### Elmore's German and Austro-Hungarian Metal Co., Ltd.

The directors' report for the year ending December 31st, 1912, says that the accounts, beyond the increase of the amount standing to the debit of profit and loss account, show but little alteration. On the debit side there is a small decrease, £7,729, as against £8,021 in 1911. The receipts were greater by £872 than the actual expenditure, but including debenture interest, the net loss is £5,195, such loss being due to the non-receipt of dividends from the "Metall" Co. The loan account with the Metall Co. is increased by £764, and now stands at £45,144.

The accounts of the Metall Co. show a considerable improvement, the gross profit being larger by M. 103,073 than in 1911, and after making full allowance for depreciation, the net result of the year's working is a profit of M. 1,639, as against a loss in 1911 of M. 67,992. The improvement is due partly to decreased cost of production, and partly to the increased prices obtained during the last three months of the year, owing to the re-constitution of the Copper Tube Syndicate in Germany. The weight of finished goods sold was somewhat greater than in the previous year. The cessation of the price war will, it is believed, result in a steady improvement in the earning capacity of the company, and there has been a considerable increase in the selling price obtained for the company's goods. Apart from the low selling prices obtained during the year, syndicate expenses amounted to M. 26,333, a charge which it is anticipated will not be incurred again. In addition to the decrease in the cost of production, general expenses are less by M. 13,557 than in 1911. Interest, however, shows an increase of M. 12,694. This is partly due to the high price of copper which ruled during the year, and partly to the high Bank rate. The amount due to Messrs. Sal Oppenheim, Junr. & Co. has been reduced by M. 91,643, and sundry creditors by M. 22,612, while the total value of copper, stores and book debts show an increase in value of M. 230,313. As against this, however, bills payable show an increase of M. 275,539. The directors are unable to report any substantial progress in connection with the Mertens process, but the sales of rollers during the first three months of the present year were considerably more than for the same period last year.

Mr. JOHN MACFARLAN presided on May 5th, at the offices, Finsbury House, E.C., over the annual meeting. He said that the directors were sorry that the results of the year's work were so small. They had, however, some satisfaction in knowing that the causes which prevented a more successful result were causes over which they had no control, and which were not in any way due to the failure of the company to produce good work, or a sufficient quantity. Taking the lowest price obtained in any year previous to the dissolution of the old syndicate, compared with the prices obtained during the last four years, they found that the price war had caused a loss of profit of M. 1,383,539, or say £69,000. This was no exaggeration, and it was very disappointing to the directors, because at that time they had completed the large extensions which were deemed necessary, and were in a position to produce larger quantities at a reduced cost, and then, when it was hoped that the benefits arising from such extensions would mature, the price war commenced. He desired to draw the attention of both the debenture-holders and shareholders to the inherent financial stability and strength of the company, which enabled it to experience such a large loss of profit and at the same time increase its sales from, say 1,360 tons in 1908 to 1,936 tons in 1912, and to

expend over £20,000 on additions to land, buildings, plant, &c., during the same period. A new syndicate was formed on August 1st last, but at that time they had in hand a large number of contracts and orders to execute, so that it was not until quite late in the year that they began to reap the benefit of increased prices. Their expenditure upon additions to land, buildings and plant last year represented a comparatively small sum, less than the amount written off by way of depreciation, viz., £3,100. Notwithstanding this small expenditure, their sales for the 17 weeks of the present year showed an increase of more than 10 per cent. over those for the same period last year at considerably better prices. They had an abundance of work on hand. It was a source of great regret that the profit made by the Metall Co. last year was not sufficient to permit that company to declare a dividend, so that the interest due on January 1st last to the debenture-holders of the Austrian Co. could be paid, but with the improved condition of matters, it was only reasonable to believe that dividends would be forthcoming in the future. With regard to the Mertens process, some progress had been made, and they were selling an increased quantity of rollers, but nothing like the amount they should be selling. The business was a very important one for the Metall Co., and Mr. Preschlin, their works' manager, was doing his best to bring about a complete understanding amongst the parties interested. The directors had just returned from a visit to the works at Schladerm, which they found to be in excellent order. They saw two new improvements in the manufacture, which promised to give valuable results in the near future in the direction of further reducing the cost of production.

Mr. J. HEAL seconded the motion. Mr. BARKWORTH criticised the figure taken as the value of the patents, and also that taken as the holding in the Metall Co., and said it seemed to him that they had lost the whole of their share capital in the Austrian Co. In view of that would it not be well to wipe out these items and write the capital down accordingly?

The CHAIRMAN said they had some very valuable patents in connection with Mertens process. They had patents in 22 countries. Times were hard, and they could not deal with their holding in the Austrian Co. now. They would have to wait for more favourable times for that.

The report was adopted, and the retiring director was elected. The CHAIRMAN said he thought they could look forward to better times now, as in every way things were looking up. They were not so hampered for want of cash. The members of the board held 23,000 debentures as well as their preference and ordinary shares, and he thought they could see their way to pay some interest next July.

**Potteries Electric Traction Co., Ltd.**

THE directors report that the capital expenditure during 1912 was £2,559. The total receipts amounted to £117,101. The traffic receipts, £100,646, showed a decrease of £506, as compared with the previous year, due to the unrest in industrial circles during the early part of the year. After deducting all expenses chargeable to revenue, including £11,524 for debenture and other interest, there remains a balance of £35,189, as compared with £35,100 for 1911. Adding the balance of £681 brought forward, there is a balance available for distribution of £35,870, which the directors recommend should be applied as follows:—Depreciation—reserve account, £2,000; renewals account, £12,500; dividend 5 per cent. per annum on the preference shares, £12,250; dividend 3½ per cent. per annum on the ordinary shares, £8,575; carry forward, £545. The depreciation and reserve account will then stand at £21,000, and there will be a credit balance on the renewals account of £13,869. During the year £17,486, as compared with £18,040 in 1911, has been expended on the improvement, renewal and repair of the permanent way.

The annual meeting will be held on May 19th.

	1911.	1912.
Miles open—Route miles	31 68	31 66
Number of passengers carried	19,819,027	19,575,568
Average receipts per passenger	1 23d.	1 23d.
Average working expenditure per passenger	7 1d.	7 1d.
Proportion of expenses to receipts	58 %	57 %
Number of cars	110	110

**Calcutta Electric Supply Corporation, Ltd.**

THE directors' report for the year 1912 states that 12,043,398 units were sold, compared with 10,566,038 units in 1911. The number of consumers connected at December 31st last was 7,030, compared with 6,383 in 1911, an increase of 647, and the equivalent connections in 33-watt lamps show an increase of 92,726. The results for the past four years are as follows:—

Year.	Con- sumers.	Equip. con- necting in 33-watt lamps.	Units sold.	Gross revenue.	Net revenue.
1909	5,078	452,272	7,856,383	£127,576	£87,024
1910	5,695	528,938	9,400,005	£137,998	£85,597
1911	6,383	616,721	10,566,038	£151,905	£95,697
1912	7,030	709,447	12,043,398	£173,907	£110,168

Exchange is calculated at 1s. 4d. per Rupee.

The profits for 1912 amount to £110,169, which, with the balance brought forward from 1911, and interest received on money at deposit, makes a total of £114,989. The directors have invested an additional £10,053 on account of the reserve fund, increasing the investments to £50,561. Some of the investments, in common

with many gilt-edged securities, have depreciated in value, and the board have accordingly written off £1,500 from the cost price. After deducting the interim dividend at the rate of 7 per cent. per annum paid on the ordinary shares in November, 1912; the dividends paid and accrued on the preference shares; the £1,500 for depreciation of securities, and the other items set out in the net revenue account, there remains an available balance of £68,903. The directors recommend that £35,000 be placed to the credit of the depreciation and renewals account; that £5,000 be added to the reserve fund, and that a final dividend be paid on the ordinary shares for the second half-year, at the rate of 10 per cent. per annum, making 8½ per cent. for the year, which will leave £2,862 to be carried forward after providing for the directors' extra remuneration of £2,500. The reserve for depreciation and renewals will thus be increased to £114,311, and the reserve fund, with the addition of £1,988 from dividends on investments, &c., will stand at £91,088. The high-tension station at Cossipore was opened in July last, and is now practically complete. The amount expended up to December 31st last has been divided up under the proper headings in the capital account. The demand in Calcutta for electrical energy continues steadily increasing, and the result of the working for 1912 must be considered satisfactory. The directors regret to report the retirement, on April 30th of this year, of the agent and manager, Mr. F. Rawson, C.M.G., who has efficiently occupied that position since January, 1908. Mr. R. E. Winkfield, chief engineer, has been appointed agent and chief engineer. Major-General Mahon, one of the directors, has visited Calcutta, and furnished the board with a valuable report upon the working of the company.

Units generated, in kw.-hours	15,369,028
Units sold—Public lamps	7,425
By special contract	726,807
By meter for lighting	8,681,511
By meter for power	7,627,855
Total sold	12,043,398
Used on works	1,869,265
Not accounted for	1,926,865
Accounted for	13,442,668
Max. supply demanded, kw.	5,598

**River Plate Electricity Co., Ltd.**

THIS company held its annual meeting on Monday, May 5th.

The report for the year ended December, 1912, showed continued progress. The net revenue, after providing for administration expenses, bad debts and all necessary depreciations, amounted to £51,176, plus £7,659 brought forward. Deducting interest on 5 per cent. debenture stock, £10,000, there is a surplus of £48,835, out of which a dividend at the rate of 6 per cent. for the year upon the preference stock absorbs £7,500, a dividend of 10 per cent. for the year upon the ordinary stock, £12,000, interest at the rate of 10 per cent. on the instalments upon the new shares absorbs £890, addition to general reserve, £15,000, income-tax reserve, £2,000, further remuneration to directors, £1,029, carry forward, £10,416. With the above-mentioned £15,000 from revenue and £30,000 transferred from premium account hereafter mentioned, the general reserve will stand at £145,000. In addition, £8,450 has been charged against the year's revenue for depreciation of plant, increasing that reserve to £44,872, and bringing, with the carry forward of £10,416, the total reserves of the company to over £200,000. Though there have been delays due to the non-delivery of plant contracted for in this country, good progress is being made with the extensive additions to the new generating station at Ensenada, and it is anticipated that by the early autumn of the present year the new plant will be finished and put into commission. This will enable the generation of light and power to be wholly conducted at Ensenada, from which added efficiency and considerable economies will result. The important work of placing the company's cables and electric connections underground in the leading streets and squares of the city of La Plata has been started, and it will be completed and the company's generating station at La Plata dismantled well ahead of the time stipulated for in the contract with the Government of the province of Buenos Ayres. On their part the Government propose largely to increase the public arc lighting in the central districts of La Plata. The arrangement between the Electrica del Norte and this company for joint working at Tucuman is now in operation. The Hydro-Electric Co. of Tucuman has been running in competition since early in November, and for some time past non-commercial rates of charge for light and power have prevailed. This company and the Electrica del Norte will continue to make competitive rates at Tucuman so long as may be necessary to retain their business.

30,000 new ordinary shares of £1 each were, in May last, issued to the stockholders at a premium of £1 per share. The shares were fully subscribed and in due course allotted. The full premium of £30,000 received has been added to the general reserve. The shares will be converted into ordinary stock immediately. The fourth payment on account of the amortisation of the 5 per cent. obligations of the German Trans-Oceanic Electric Co. (Series 1) held by this company, viz., £1,900, was duly made on April 1st, 1912, reducing the amount outstanding to £142,900.

MR. M. W. MATTINSON, K.C., presiding at the meeting at Capel House, 62, New Broad Street, E.C., said that the net profits for the year ending December 31st, 1911, amounted to £47,200, whilst those for the year ending December 31st last amounted to £51,175. During the last nine years their net profits had grown from £20,000 a year to £61,000, whilst, during that time, the addition to their capital liabilities was only £55,000. This satis-

factory position was due to the large amount of undivided profits which had been carried to the reserve fund and applied to the extension of the business. The available profits for the year enabled them, after meeting all prior charges, to recommend, for the fifth year in succession, a dividend of 10 per cent. on the ordinary share capital, to add £15,000 again to the reserve fund, and to carry forward £3,757 more, bringing up the carry forward to £10,416. They had distributed less than their available profits, and their conservative policy in this regard needed no apology. The result of their policy was that they were in a very strong position, and could face the competition in Tucuman with the confident assurance that it was well within their powers to sustain it as long as might be necessary. The chairman proceeded to deal with the items in the profit and loss account, and said the revenue from the La Plata, Ensenada and Tucuman stations had increased by £5,773, which was eminently satisfactory in view of the circumstances of the year, which, apart from the growth of business in La Plata and Ensenada, were not favourable. All the extra profit was made at La Plata and Ensenada, for the competition at Tucuman, although it only commenced in the middle of November, affected the net results of the station for the whole year. The conditions were also unfavourable in respect of the price of coal, which last year cost them a considerable sum, and would also cost them extra this year, although next year he was confident there would be a material alleviation. In addition, during the whole of the year they had the cost of running two stations instead of one, and this would also continue during the greater part of the present year; although here again, barring unforeseen circumstances, it would come to an end in the autumn. There had been a steady growth of business, both at La Plata and Ensenada, which had fully realised their expectations, and in addition the modern turbine plant erected at Ensenada had justified their calculations as to economy of production. Interest from investments was down by £461, which was due to the failure of the La Plata Tramways Co. to pay its preference interest. The cause was well known, being due to defalcations by the company's cashier. The La Plata Tramways Co., however, was a sound concern with excellent prospects, and its earnings were steadily growing, and before long the arrears on the preference shares would be paid, as well as dividends on the ordinary capital, in which they were also interested. Their miscellaneous receipts, outside of the profit of their generating stations were equal to over 80 per cent. of the debenture interest—a proportion likely to be still further improved in the future. Dealing next with the balance-sheet, the Chairman pointed out the considerable increase in the item of stations, which was mainly represented by the expenditure during the year on the large extension at Ensenada; the making of extensions for customers, and the provision of arc lamps for the Government. If they added the items set apart this year, and the amount carried forward, they had total reserves of over £200,000. There was a further considerable reserve in the appreciation of the value of their real estate at La Plata and Ensenada, and he thought he was justified in saying that they were not in an unfavourable position for a company with an ordinary capital of £150,000. As regarded the future, there would be further economy when they shut down the station at La Plata and worked only from Ensenada. The growth of La Plata was justifying the most hopeful prognostications of those who believed in it. Apart from their business in private lighting, they were looking to a material growth in public lighting business and traction and power. The Government of the provinces of Buenos Ayres were adding largely to the public lighting. The two tramway companies they served were also steadily extending, whilst a large number of freezing and other establishments were being promoted at Ensenada, which would require large quantities of power, and at present there were negotiations on the subject. Until the completion of their extensions at Ensenada they could not have attempted large supplies, but when, as would be the case in the autumn, they had established 9,000-kw. turbine plant, they would be able to take on bulk business unthought of a few years ago. It was too early to say what would be arranged, but he was not unhopeful of seeing a considerable amount of business obtained, and, in any case, with their extensions they would be able to serve the industries of Ensenada and La Plata with power on terms as satisfactory as in any other town in the Republic. The chairman next dealt at considerable length with the position of affairs in Tucuman, and pointed out that on the private business they were making a loss. Their competitor, the Hydro-Electric Co., had a big organisation for a business which was comparatively trifling in extent, and obviously they must be making a still greater loss. On the other hand, the arrangement made by their company with the Electrica del Norte was working most satisfactorily and was benefiting both concerns, and they had now also a share in the profits of the Santiago station and in the tramway system of Tucuman, which was also non-competitive. This latter remark might be difficult to reconcile with the statements made in the prospectus issued by the Hydro-Electric Co., in 1912, in which it was stated that that company had a valuable electric tramway concession within the city of Tucuman and suburbs, "a considerable proportion of which was already constructed." He knew nothing one way or the other about the concession; but, as a matter of fact, in April, 1912, there was not a single yard of electric tramways in Tucuman or its suburbs belonging to the Hydro-Electric Co., and even now there were no electric tramways in the city or suburbs which did not belong to the Electrica del Norte. Another interesting factor in the Tucuman problem was that of oil fuel, and in this connection the most interesting development might be imminent. Last year he told them that a Diesel engine would be a much more economical producer of current

than a costly hydraulic system situated many miles away transmitting over long distance lines, and with transforming plants at the points of distribution. The difficulty was that oil fuel was not available in Argentina at remunerative prices, but, as they knew, there had been an enormous increase in the output from the Mexican oilfields and the Mexican Co. were arranging for the transport of oil in bulk to Argentina. They were in correspondence with the company on the whole subject, and sooner or later there would be fuel available from that source. He had also read lately that large deposits of oil had been found in the province of Salta, which immediately adjoined Tucuman, and if this was so, the supply would be really a local one. There would be no question of scrapping their steam plant if they got the oil fuel, for it could be kept for spare and auxiliary purposes, and then they would be able to quote a tariff which would be more to the benefit of the inhabitants than any advantage they derived from cutting rates at the present time. In the meantime, he supposed, the competition must continue, and so they had earmarked the £15,000 placed to reserve as a Tucuman contingency fund, and this, so long as was necessary, would be resorted to to meet any losses at that place. They were confident that by doing this they would maintain their position over the next few years, apart from the fact that the growth at La Plata and Ensenada was likely to meet any such losses at Tucuman.

MR. R. MILLER seconded the motion, and the report was adopted.

**Shanghai Electric Construction Co., Ltd.**—The directors report that the accounts for 1912 show a profit of £21,727, against £14,139 for 1911. Including the sum brought forward, the amount available is £28,028. There has been transferred to reserve for renewals account £8,500, and there has been applied in reduction of the preliminary expenses account £1,554, leaving £17,974. The directors recommend a dividend of 5 per cent. for the year, less income-tax, leaving to be carried forward £1,974. The percentage of loss by exchange on subsidiary coinage was higher in 1912 than 1911, but has recently shown a tendency to decrease. The loss under this head for the year was £23,937, and is almost equal to 7½ per cent. on the capital. The sanction of the Municipal Council of Shanghai has been obtained to a new type of motor-car, and the rolling stock is being increased this year by 15 motor-cars and 10 trailers, raising the total numbers to 80 and 40 respectively. In addition, further facilities have become necessary to meet the growing traffic, and an application to the Municipal Council to introduce a system of railless electric traction has resulted in the sanction of a preliminary installation in Fokien Road. It is anticipated that such a system affords the best means of dealing with traffic in thoroughfares which are too narrow for tramways, and that, as the initial expense of laying a permanent and costly roadbed is avoided, the financial result should prove profitable to the company. The power agreement, under which the company purchases electrical energy from the Council, became due for revision as regards rates in March, and negotiations for a reduction in price are in progress. Through running was inaugurated on June 19th last, on which date the lines of this company and of the French Tramway Co. were linked up *via* South Chekiang Road Bridge, and on August 18th through running over the reconstructed Bund Bridge commenced. Increased traffic has resulted, but the full benefit of the through running cannot be obtained until an increased service of cars and through tickets are provided for.

**Mexborough and Rawmarsh Construction Syndicate, Ltd.**—The directors' report, given in the *Financier*, states that the net revenue account of the Mexborough and Swinton Tramways Co., after providing £91 for depreciation on furniture, fittings, plant and tools, and on motors, &c., on hire, and writing £201 off stock, is £5,043, plus £152 brought forward. After providing £1,500 for reserves for the tramway and lighting undertakings, there is a balance of £3,695, out of which the syndicate will receive £3,501. The balance to the credit of the syndicate's profit and loss account for the year to December 31st is £3,522, to which has to be added £172 brought forward, making a total of £3,695. The directors recommend the payment of a dividend of 2 per cent., free of tax, amounting to £3,500, and that the balance of £195 be carried forward. The decrease in the traffic receipts of the Mexborough and Swinton Tramways Co., as compared with those for 1911, is a result of the national coal strike, mining being the chief industry in the district served by the tramways. The traffic receipts to May 5th of this year show an increase of £776 over those for the corresponding period of last year. The revenue and expenditure of the lighting undertaking were also affected by the coal strike, the increased cost of fuel alone amounting to £328. The tramway company's consulting engineers having advised that the present plant is inadequate to deal with present and future requirements of the company, the directors have decided to instal additional plant, involving a capital expenditure of about £5,000. Considerable economies in working costs should be effected by this installation.

**Brazilian Traction, Light and Power Co., Ltd.**—There has been published in the daily Press a copy of a circular sent out to shareholders, calling a meeting for May 23rd at Toronto, at which a resolution will come forward to create an issue of \$10,000,000 par value of 6 per cent. cumulative preference shares (100,000) for the purpose of meeting the requirements of the Rio de Janeiro Tramway, Light and Power Co. and Sao Paulo Tramway, Light and Power Co., of both of which the company is the principal shareholder.

### Nairobi Electric Power and Lighting Co., Ltd.

The meeting of this company was held on May 7th at the office, 50, Mark Lane, E.C., General Sir Stanley Edwardes, K.C.B., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 652), said that the capital expenditure on works now stood at £32,368, an increase during the year of £3,001. The property account stood at £513, an increase of £238, due to the purchase of a town stand on which the company's new offices and stores were to be erected. Stocks on hand and in transit at £3,263, were only a trifle higher than at the end of the previous year. On the other side of the account, the share capital had increased to £23,000 by the issue to the vendor of the balance of the purchase price payable to him. The increased capital expenditure of over £2,200 had been partly met by the issue of a further £2,000 debentures, and the balance had been provided out of revenue. Passing to the revenue account, the principal item of sale of current amounted to £5,400, an increase of £1,044, this being nearly 20 per cent. increase. The other items of receipts also showed satisfactory increase, making the total £7,607, which was £1,811 more than in the year before, or 31 per cent. increase in gross receipts. The expenses naturally showed some increase in an expanding business, but in the past year they had had to face some abnormally heavy expenditure. The directors expected that for the present year they would have a substantial further increase of gross receipts, with a smaller expenditure than for 1912. No sum had yet been set aside for depreciation. The plant had been efficiently maintained out of revenue, and, in view of the fact that the company held properties acquired in its early days, before the great increase in local values of the past two or three years, which properties were estimated to have a realisable cash value considerably exceeding the amount of depreciation on machinery and plant, the directors were of opinion that the position of the company was quite sound in this respect. The result of the year's working was a net profit of £2,643, and, after wiping out the adverse balance remaining in revenue account at the end of the previous year, there was left available a net balance £1,456. There was a contingent liability of the dividends on the cumulative preference shares, and the directors duly declared and paid in January last by way of an interim dividend, the preference dividends for the years 1906 and 1907, during which years the shares were being taken up and paid for. This absorbed £532, thus leaving a balance of £923 still available for dealing with. The directors had decided that while the available balance was more than sufficient to pay the preference dividend for another year, it would strengthen their financial position to defer the payment of such a dividend for a short time.

The HON. R. C. BAYLON seconded the motion, and the report was adopted.

### Great Northern Telegraph Co., Ltd., of Denmark.

This company held its meeting on April 26th at Copenhagen. The chairman (Commodore E. Suenson, D.R.N.), in his account of the working during the year 1912, said that, in spite of the disturbances nearly all over the world caused by war and political or social conflicts, commencing in 1911 with the revolution in China and the war between Italy and Turkey, and followed in 1912 by the sanguinary struggle between the allied Balkan States and their common enemy, &c., the company's telegraphic system had worked quite normally, thanks to its distant situation from the principal theatre of events. During the year 10 of their cables in Europe had been interrupted 12 times, whilst six in Asia had been subject to 15 interruptions. Their cable steamers had been less engaged in repairing their cables than during the previous year, and they had also had less to do for other administrations. The *H. C. Orsted* had been occupied in Europe for 62 days, of which 15 were for the account of other administrations, against 165 and 32 respectively in 1911; and the *Store Nordiske* and *Pacific* in the Far East for 230 days, of which 68 were for other administrations, against 281 and 120 respectively.

The movement which had manifested itself in Outer Mongolia and also in Tibet for a separation from Chinese domination had fortunately, so far, not seriously affected the transmission of their traffic between Europe and the Far East, either by the Kiachta route, which traversed the whole of Mongolia, or by the Wladivostock route, which on Russian territory skirted the whole of the frontiers of Mongolia and Manchuria. On the contrary, the authorities of those countries seemed to take special interest in protecting and maintaining the lines, and in conserving their discreet and neutral service. The company's negotiations with Japan regarding future relations with that Empire after the expiration of the company's exclusive privileges, were resumed in July last after a suspense of several years. These negotiations had kept the company fully occupied both in Japan, at Tokio, and here in Europe, because the wishes and proposals of Japan made it necessary for this company to obtain the consent of several of their concessionary Governments, and also the concurrence of other Government and private administrations interested in the transmission of the traffic with Japan and with other countries in the Far East. All these negotiations had necessarily taken a considerable time, and they were further delayed by the death on July 30th last of the Emperor of Japan.

In spite of all these obstacles they had by means of mutual concessions, succeeded in arriving at an understanding with the Imperial Administration embodied in "Heads of Agreement," which were signed at Tokio on December 28th, 1912, the date of

expiration of their exclusive privileges, and shortly afterwards approved by the Imperial Government.

The stipulation of these "Heads" fixes in principle the solution of all questions in dispute, and also the future relations between Japan and the company in a sufficiently clear and detailed manner so as not to leave any doubt as to their definitive interpretation.

The main points are the following:—

1. The company loses its exclusive privileges in Japan without any compensation whatever.

2. The perpetual rights of the company with resulting duties and obligations will be embodied in a new document in conformity with the terms of the old concessions.

3. It was of great importance to Japan to arrange for the laying of a Government cable between Nagasaki and Shanghai for the transmission of telegrams written in Japanese Kana characters, and for Government telegrams exchanged terminally between Japan and Shanghai. They also desired to use the existing Japanese cable between the island of Formosa and Poochow, which had hitherto carried only terminal Formosan traffic, for the transmission of all telegrams from and to the whole of the Japanese Empire.

Although the realisation of these wishes would constitute an infringement of the privileges granted by China to the company until 1930, and shared by the Eastern Extension Co. which had with the approbation of the Chinese Government agreed to the wishes of Japan, but, in order to avoid too serious a competition between all the interested parties, subject to the condition that a joint purse arrangement be made for the next 18 years for the division of the receipts between Japan, China and the company, in an impartial manner to be fixed beforehand.

4. Lastly, the sacrifice which would most seriously affect the financial interest of the shareholders was: Large and numerous tariff reductions varying from 20 to 67 per cent. of the old rates for the different classes of Japanese correspondence. These reductions were the more perceptible because it would be impossible to grant several of them to Japan without also granting them to China and other countries in the Far East. In 1870 and 1871 these countries, simultaneously with Japan, were brought by the company into telegraphic communication with the rest of the world, and they had honoured the company with the same confidence and hospitality as they had enjoyed in the Empire of the Rising Sun.

There was another Great Power which through its honoured and respected organs manifested its salutary influences everywhere, viz., "The World's Press," for whose benefit they desired to make considerable tariff reductions in the hope that its telegraphic correspondence with the Far East would lead to a more intimate and intelligent mutual knowledge and a more cordial understanding between the peoples of the East and the West.

The introduction of the aforementioned reduced rates would result in a very considerable, and as yet indeterminate, decrease in their telegraphic receipts. The board, nevertheless, accepted it with equanimity, thanks to their reserve and other funds. It was an advantage that the reductions would probably not come into force for another month or two, because the losses of the first 12 months under the new régime would thereby be distributed over two financial years of the company.

Another, and a still greater advantage, was that the financial receipts of the year 1912 had been considerably better than those of the preceding year, in which the loss of the Norwegian concessions caused a perceptible decrease in the receipts. During the last year the receipts had risen afresh, thanks to the extraordinary events of the year which, without interfering with the stability and working of the lines, had created an almost prodigious increase in the telegraphic correspondence. The receipts had been large enough to enable them to propose an increase of the bonus by 2 per cent., or a total distribution of 20 per cent. for 1912, in spite of the large loss of revenue which they expected to have shortly. Shareholders were, however, recommended not to draw conclusions too lightly as to the future from the increased bonus this year, the prospective losses being, as previously stated, impossible to estimate at present.

The chairman went on to refer to the placing of an exceptional dotation of £16,600 to the pension fund, as a well-merited appreciation of the fatiguing work of the employees. Traffic receipts had increased by about £57,850, but of this £19,680 was due to the fact that the loss on exchange of the previous year of £7,160 had this year been changed to a gain of about £12,250; interest had decreased by £670, whilst sundries had decreased by £3,500. The total expenses had increased by £9,520. Participation in other telegraph undertakings had decreased by £16,480, representing the amortisation of the advances made to the Chinese Administration. The board had thought it necessary to write off about £69,400 in consequence of the decreased value of investments through the universal depreciation of gilt-edged securities during the last few years.

### Singapore Electric Tramways, Ltd.

The ordinary general meeting was held on Tuesday at the offices, 19, St. Swithin's Lane, E.C., Sir Frank A. Swettenham presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 776), said that during the past year £3,900 worth of debentures had been paid and cancelled, thus reducing the total debenture liability to £326,500. The tramway undertaking stood at £678,757, as against £689,055 at the end of 1911. A small expenditure of £1,828 had been incurred on capital during the year in respect of additions to buildings, plant, workshop equipment, &c. The cash and loans stood at £39,717 as against £27,072 in the previous year. The traffic receipts had increased by £1,446, and sales of energy to the Government and the municipality by £1,865. The working expenses had risen from £42,613 in 1911 to £43,916, due almost entirely to the increased cost of fuel. The profit of £5,358 reduced the debit balance on the profit and loss account to £3,824. The reduction of the debit balance, which at December 31st, 1908 stood as high as £16,200, and in 1911 and 1912 was reduced by £5,055 and £5,358 respectively, was conclusive evidence of the progress which the company was making, and they hoped that the next accounts would show not only that the debit balance had disappeared, but that its place had been taken by a credit.

Whilst the passenger receipts and the number of passengers carried had increased, the general manager had been able again by carefully studying the traffic requirements, to reduce the car-mileage. That was a satisfactory feature as considerable wear and tear of rolling stock was avoided and working expenses were consequently reduced. The increase in the number of passengers carried was 398,080 as against an increase in 1911 over 1910 of 344,155. The decrease in car-mileage was 29,698 miles following a decrease in 1911 of 75,402 miles. The passengers carried per car-mile were 6.71 in 1912 and 6.42 in 1911 and receipts per car-mile were 7.44d. in 1912 as against 7.30d. in 1911, whilst the expenses per car-mile had advanced slightly—from 4.03d. in 1911 to 4.12d. Considering only the tramway undertaking the expenses represented 57.25 per cent. of the receipts, but the total Singapore expenses represented only 52.66 of the total Singapore revenue, compared with 56.96 per cent. and 52.64 per cent. in 1911. The Singapore tramway ordinance of 1902 fixed the maximum charges to be made for energy by the company, but they had found it to be in their interests to charge considerably lower rates and to give special terms in exceptional circumstances. With the rapid advance in the application of electricity all over the world since the ordinance was granted, it became necessary on nearing the last quarter of their ten years' period of supply, to consider the possibility of competition or of the municipality laying down its own plant. The company, therefore, approached the municipal Commissioners in regard to a renewal of the contract, and after very lengthy negotiations an extension had been granted. The municipality had decided to add to its field of electrical supply the residential districts of Tanglin, and it had granted them an extension for ten years from the date of the current first being supplied to that district. A reduced scale of charges had been agreed upon, and whilst the new scale would naturally not yield the same amount of profit as the old, it was hoped that the increased output would counteract the reduction in price. The traffic receipts for 1913 already showed an increase over the corresponding period of 1912 of £18,944, or over 9 per cent., equal to an increase of \$997 per week. That increase in 19 weeks compared very favourably with the progress of 1912, for the increase during the whole year only amounted to \$10,697. He thought the shareholders would agree that they had good reason to be satisfied with the work done by the general manager and his assistants in Singapore.

SIR CHARLES PETRIE, J.P., seconded the motion.

MR. BLES said he thought that an expenditure of £43,000 to secure a profit of £22,000 was altogether too large a proportion. He considered that too much was being spent on ticket inspectors, and he also thought there should be a reduction in fees paid to the board.

The CHAIRMAN, in reply, said that the expenses of the company compared with its revenue were about as moderate as could be found anywhere—in fact, he thought they were extraordinarily moderate, in view of the condition under which the work was carried on. If they were to spend less on inspection, they were advised that the receipts would immediately decline. With regard to the directors' fees, that point had been raised at previous meetings, and in consequence, one director resigned. The affairs of the company were now in a much better condition than they were some years ago, and he could assure them that the management of the concern gave the board a good deal of anxious thought and consideration. If the shareholders wished to reduce the fees, they would have an opportunity of doing so by refusing to re-elect the retiring directors.

The report was adopted, and the retiring directors, Sir John Anderson and Mr. F. Baynes, were unanimously re-elected.

### West India and Panama Telegraph Co., Ltd.

THE meeting was held on May 7th, at Winchester House, E.C., under the presidency of Mr. W. B. Kingsford.

In moving the adoption of the report, the CHAIRMAN said that the amount to the credit of revenue was £38,508, a decrease of £2,098, as compared with the corresponding half year in 1911. The traffic receipts were £1,805 less. They attributed that decrease mainly to the reduction of the rates to which he referred at the last meeting. There had been rather a short sugar crop in the islands, which also accounted for some part of the decrease. The expenses compared favourably with the corresponding period, being about £2,500 less. They used 18 miles less cable in repairs than during the previous half-year, and they also hired their repairing steamer for a few days to the Cuba Submarine Co., and they sold a quantity of cable core, thus reducing the expenses attending the maintenance of cables from £9,103 to £6,429. In the working expenses at stations there was a new item of £86, share of pension fund at a joint station. That arose from the fact that the Cuba Submarine Co. recently established a pension fund for the benefit of their staff in Cuba. The station from Santiago to Cuba was worked jointly by the West India Co. and the Cuba Co., and therefore they felt bound to share equally in the expense of the pension fund at that station. The West India and Panama Co. was almost the only telegraph company which did not have a pension fund. The directors regretted that that was so, but they felt that to establish a fund on the lines of other companies would be too costly a matter for them to entertain. They thought, however, that a plan for granting allowances to the London staff on retirement after 40 years' service could be arranged without in any way increasing the present expenses of the London office. He felt sure that such a proposal would have the cordial approval of the shareholders, and they proposed to ask their sanction to the same at the next meeting. The development of the oil industry in Trinidad was being watched by them with much interest. They understood that

a powerful syndicate had recently been negotiating with one of the principal oil companies in Trinidad to obtain an interest in its property, and that the necessary arrangements had now been concluded. The successful development of that almost new industry could not fail to be beneficial to the commerce of Trinidad and, incidentally, to their company. A Danish company was formed some few months ago to undertake the work of deepening the harbour at St. Thomas, and carrying out other extensive improvements there in order to give better anchorage and wharf facilities for large steamers. The work had been commenced, and when it was finished, they might reasonably hope that those largely increased shipping facilities would tend to the creation of additional business, as the headquarters of the company were at St. Thomas.

MR. HENRY HOLMES seconded the motion.

The CHAIRMAN, in reply to questions, said that, at present they were not inclined to entertain the notion of extending wireless communication between the islands. At present they had wireless connection between Trinidad and British Guiana. With regard to any projected amalgamation, he had never mentioned the subject at any of their meetings, as they had never been approached by any other company with any proposals to that end. Of course, if any favourable opportunity should arise for entering into an amalgamation, or of doing anything else for the improvement of the company, they would only be too glad to enter into the question.

The report was adopted.

### South Metropolitan Electric Tramways and Lighting Co., Ltd.

—The directors report that the total revenue for the year to December 31st from all sources amounted to £61,941, compared with £59,222 for the preceding year. The expenses, according to the *Financier*, were £36,144, compared with £35,054 for 1911. The net revenue was therefore £1,631 more than in 1911. After deducting all expenses chargeable to revenue, including payments to local authorities under agreements and interest upon the debenture stock of the company, and after setting aside £3,000 to the renewals fund, there remains a surplus of £15,492, plus £604, brought forward. The directors propose to place to reserve £5,000; to pay a dividend at the rate of 6 per cent. per annum on the preference shares for the year, £10,174; leaving to be carried forward £922. The gross receipts from the tramways and light railways were £45,141, a decrease of £388, and the working expenses amounted to £24,509, an increase of £127. There was a decrease of £491 in traffic receipts for the year, which is attributable to the unfavourable weather, and to the fact that the Festival of Empire was held at the Crystal Palace in 1911. The gross receipts for the electricity supply section (including the amount represented by the sale of energy to the tramways) amounted to £14,124, and the working expenses to £7,184. The total number of units sold during the year, including 192,736 supplied to the tramways, was 920,316, as compared with 836,122 in 1911. The number of units sold for lighting and power purposes was 727,550, an increase of 86,255 units, or over 13 per cent. The number of consumers at December 31st was 1,535, as compared with 1,355 at the corresponding date of the previous year, an increase of over 13 per cent. The receipts for 1912 exceeded the receipts for 1911 by £1,340, whilst the working expenses were £751 in excess of those for 1911. Most of this increase in expenses was due to the increased output, but a considerable portion was attributable to the higher cost of fuel and the rise in price of all other materials. The Cheam Parish Council has accepted the company's tender for lighting of certain streets in Cheam (where cables are already laid) for a period of five years. A proposal is submitted to the shareholders that they should exchange their holdings for shares in the London and Suburban Traction Co., Ltd.

**Craigpark Electric Cable Co., Ltd.**—The tenth annual meeting was held in Glasgow on Monday, Mr. W. S. Brown presiding. The chairman, in moving the adoption of the report (see *ELECTRICAL REVIEW*, page 775), said that the profits for the year had been far better than the profits for the previous 12 months, which was due to the company doing a much larger trade upon the occasion under review. They had had, however, many difficulties to contend with, fuel had been very expensive, and there was a heavy increase in expense through the Insurance Act, and on other matters. The works were well employed at present, in fact they had never had so many orders upon their books. Some of the shareholders were aware that they had a golf-ball business as a subsidiary section of their concern. Owing to the high prices of rubber, it was not worth taking part in for some time, but they had put a new ball on the market, and experts had spoken highly of it. They intended to make this a more important part of the business as a dividend-paying section.

### Lima Light, Power and Tramways Co., Ltd.

—The directors report that the total profits obtained during 1912 were £p.175,156: less—bond service, £p.62,904; interest and discount, £p.7,795; European expenses, £p.1,762; provision for bad and doubtful debts, £p.2,805; provision for extraordinary renewals, £p.1,000; leaving a net profit of £p.98,890. There is to be placed to reserve and redemption fund, £p.25,994; a dividend of 4 per cent. requires £p.53,996, leaving a balance of £p.18,900, out of which an additional dividend of 1½ per cent. is recommended in respect of 1912, carrying forward £p.2,026.

**Auckland Electric Tramways Co., Ltd.**—The directors have declared an interim dividend of 7½d. per share, free of income-tax, on the ordinary shares for the half-year ended December last.

### Sunderland District Electric Tramways, Ltd.

THE report of the directors for the 12 months ended October 31st, 1912, states that during this period the property was still in the hands of the Receiver, who controlled the outgoings. After providing for interest on the prior lien bonds, the first and second mortgage debentures, and the expenses of the receivership, the accounts show a loss on the past year's working of £1,176, bringing the aggregate loss to date up to £18,065. In consequence of the coal strike in the early part of last year, the traffic receipts show a decrease of £483; but, on the other hand, a saving was made in working expenses, which averaged 61.22 per cent. of the gross receipts, as against 64.68 per cent. for the previous year. Since the close of the year on October 31st, the scheme of arrangement referred to in the last report has been carried into effect, and the board has again assumed the entire management and control of the company. The new prior lien bond money has now been received, and the old prior lien holders have been paid off. The balance of the money provided under the scheme, together with that handed over by the Receiver, is sufficient to provide the new cars required and to make other needed improvements. Certain additions and alterations have been made to plant, machinery and permanent way, which should still further reduce operating expenses. For the 26 weeks for the current financial year, the traffic receipts show an increase of £2,175 over the corresponding period of last year, and the general position of the undertaking may be regarded as much more satisfactory than it has been for some years past. Messrs. Charles Eves and Albert Counter, who were appointed directors in accordance with the arrangement made with the new prior lien holders in December last, offer themselves for re-election.

The revenue account on the debtor side shows the following:—Expenses at Sunderland, power, £2,489; operating, £6,050; repairs and renewals, £3,972; management expenses (including salaries, rents, &c.) £2,630; a total of £15,141. Trustees' fees (prior lien bonds and first and second mortgage debentures), £273; directors' fees (May 1st, 1910, to October 31st, 1912), £773; there is a balance carried down of £9,849. On the credit side, traffic receipts are £23,778; advertising parcels, &c., £648; sundry sales, £126; royalties receivable (annual royalty under agreement and royalty on current supplied), £1,586; and other small items make a total of £26,349.

### Cuba Submarine Telegraph Co., Ltd.

MR. GEORGE KEITH presided over the meeting of the company held on May 7th at 58, Old Broad Street, E.C.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 732), the CHAIRMAN said that the monthly traffics, as a whole, compared favourably with those of the corresponding period of the previous year, notwithstanding the reduction which had taken place in some of their through rates during the year. The rainy or slack season in Cuba generally began with June, but last year the exceptionally dry and favourable weather enabled the milling of the sugar canes to continue much longer than usual, which accounted for the increase shown in the July traffic. The total in December also showed an increase, due principally to interruptions in other lines, which brought their traffic outside their usual business. The traffic of the other months was somewhat short of what it was in the preceding year. As regarded the revenue account, there was an increase of £520 in the traffic, while interest showed a decrease of £136 in consequence of the sale of some of their securities to meet the cost of laying the Cape Cruz-Santiago cable. The total revenue, including transfer fees, amounted to £19,073, or £383 more than in 1911. Altogether the total expenditure amounted to £7,085, or £586 more than in 1911. The result of the year's business gave a profit balance of £11,988, out of which £2,000 had been added to the pension fund and £2,000 carried to the general reserve. After providing for a dividend on the preference shares, the directors recommended the payment of the usual dividend at the rate of 6 per cent. per annum on the ordinary shares, and increasing the balance carried forward by £188 to £7,931. In the balance-sheet the general reserve fund now stood at £94,000 and the pension fund at £4,115, which included the interest accrued on the same. The investments, less reserve for depreciation, remained the same as last year. Their market value had considerably depreciated since the commencement of the Balkan war, but it was hoped when peace was finally arranged they would appreciate and make it unnecessary to increase the depreciation reserve. This year business generally in Cuba and the West Indies continued prosperous, and the traffic passing over their cables up to the present was satisfactory, although not quite up to what it was for the corresponding period of last year, which was very exceptional. In these days of low rates the amount earned per message was gradually falling, and they had to do a great deal more work for the money received. Their cables were all in a perfect working condition. It was, however, with much regret he had to mention that their Cienfuegos building was completely wrecked in February by the terrific explosion at a store on the opposite side of the street. One messenger was killed, and four of their staff were seriously injured. Fortunately their manager escaped with a severe shock and was able to resume charge immediately after the disaster. Business at Cienfuegos had since been carried on in a temporary office, but steps were being taken to fit up a new building in the place of the old one. In conclusion, the chairman said that he hoped the proposal to hold only one meeting during the year would meet with the shareholders' approval, because he thought that dealing with the year as a whole would give the shareholders the opportunity for comparing the progress made.

MR. C. W. PARISH seconded the motion.

In replying to a SHAREHOLDER, the CHAIRMAN said that the damage done to the station at Cienfuegos was covered by insurance. MR. LIDDON said he noticed that their shares had been quoted very much lower than usual for some time and he asked the chairman if he could give any explanation of that.

The CHAIRMAN said it was impossible to explain the fluctuations in shares on the market. The reduction of the rates naturally reduced the amount received per message.

The report was then adopted.

### Eastern Telegraph Co., Ltd.

THE directors report that for the six months ended December 31st, 1912, the revenue amounted to £753,326, from which are deducted £273,246 for the ordinary expenses, and £82,904 for expenditure relating to maintenance of cables, sundry differences in exchange, and income-tax payable abroad, leaving £397,176, plus £52,418 brought forward, making a total available balance of £449,593. After providing for income-tax payable in England, interest on mortgage debenture stock, and dividends on the preference stock, which in all absorb £83,212, there remains £366,382, out of which the directors have placed £160,000 to the general reserve fund, and have paid an interim dividend of 1½ per cent. on the ordinary stock, amounting to £50,000. The directors now recommend a final dividend on the ordinary stock of 1½ per cent. and a bonus of 2 per cent., amounting together to £130,000, both payable on May 21st, free of income-tax, and making, with the three previous payments on account, a total distribution of 7 per cent. for the year ended December 31st, 1912. It is proposed to carry forward £26,382 to the next account. As foreshadowed at the last general meeting, it has been found necessary to increase the carrying capacity of the cables east of Suez, and the board has, therefore, decided to carry out important renewals to one of its Red Sea and Aden-Bombay sections. An additional cable will also be laid between Suez and Aden, and application has been made for landing rights for a cable between Aden and Colombo, to join the new cable from Colombo to Penang which has lately been laid by the Eastern Extension Co. A contract has been placed with the Telegraph Construction and Maintenance Co., and instalments of cost amounting to £65,100 have been charged against the general reserve fund. The present articles of association which have been in force for many years are out of date in some respects. New articles of association will be submitted for approval at the general meeting on May 21st.

### Eastern Extension, Australasia and China Telegraph Co., Ltd.—

The directors report that the gross receipts for the half-year to December 31st, amounted to £379,445, against £359,596 for the corresponding half-year of 1911. The working expenses, including £19,774 for maintenance of cables, absorb £154,779, against £159,232, leaving £224,666. From this is deducted £3,766 for income-tax payable in England and £15,048 for interest on debenture stock, leaving £205,851 as the net profit for the half-year. After adding £56,684 brought forward, there is an available balance of £262,535. One quarterly interim dividend of 1½ per cent. has been paid for the half-year, and it is now proposed to distribute another of like amount, making, with the interim dividends paid for the first half-year, a total dividend of 5 per cent. It is also proposed to pay a bonus of 4s. per share, or 2 per cent., making a total distribution of 7 per cent. for 1912. £100,000 has been transferred to the general reserve fund and £27,535 carried forward. The general reserve fund has been debited with £50,000 as a further provision on account of investment fluctuations, bringing the total provision against depreciation up to £200,000. In pursuance of the policy indicated by the chairman at the last general meeting, of strengthening the company's cable capacity in the Far East, contracts have been entered into with the Telegraph Construction and Maintenance Co. for the manufacture and laying of new cables between Colombo, Penang, Singapore and Hong-Kong. The first section was completed a few days ago, and the expenditure on this account up to the end of last year (£86,704) has been charged against the general reserve fund. The other sections are expected to be completed in the early part of next year.

**Western Telegraph Co., Ltd.**—For the half-year ended December 31st, 1912, the directors report that the revenue was £438,888, and the working expenses £176,474. After providing £16,373 for debenture stock interest, and £8,361 for income-tax, there remains £237,679, plus £33,517 brought forward, making £271,196. First and second interim dividends, amounting to £62,379, have been paid, and after transferring £140,000 to the general reserve fund, £25,000 to the provision on account of investment fluctuations, and £10,000 to the land and buildings depreciation fund, there remains £33,817 to be carried forward.

**Cuban Telephone Co.**—The directors report that the income for 1912, including \$292,640 brought forward, was \$1,064,658: \$50,000 is transferred to surplus account. After meeting working expenses and other charges, there is a credit balance of \$498,379. Four quarterly dividends of 1 per cent. each were paid on the common stock.

**Simmonds Bros., Ltd.**—A petition to the Courts to confirm reduction of capital from £50,000 to £29,505, will be heard on May 27th.

### Callender's Cable and Construction Co., Ltd.

SIR J. FORTESCUE FLANNERY, Bart., M.P., presided on May 8th, at Hamilton House, Victoria Embankment, E.C., over the seventeenth annual general meeting of the company.

The CHAIRMAN, in moving the adoption of the report (see ELEC. REV., page 733), first referred to the loss sustained by the company in the death of the late chairman, Mr. H. Drake. The number of the board had been decreased not only by the death of Mr. Drake, but by a previous loss, and the directors were considering the question of replacing these losses. He was pleased to present a report and balance-sheet which he believed would be considered very satisfactory, and which would have been even more so but for labour troubles. Just a year ago there was the coal strike, affecting practically the whole of the mining industry throughout the country. This strike, whilst embarrassing the operations of all manufacturers at the time, had resulted in a permanent increase in the cost of coal, which must in the end prove an international disadvantage in raising the cost of what was the very life blood of the manufacturing interests of Great Britain. Six months ago there was a strike, which, whilst less national in its character, affected the company very seriously. He referred to the strike of lightermen upon the Thames. Their works at Erith were very advantageously situated upon the banks of the river. They had a wharf which had excellent appliances for the reception of their raw materials sea-borne, and for the discharge into ships of their manufactured finished products. Greatly to their advantage, the bulk of their trade was sea-borne trade, so that they were affected in the most serious manner by the stoppage of the traffic. The thanks of the shareholders were due not only to the managing director, but in this connection to the subordinate officials, for the very special and successful efforts they made to minimise the loss and inconvenience during the strike, the result being that, serious as was their loss, still it was much less than it would have been but for the efforts of these officials. Then they had another labour difficulty of a more direct kind. They employed a large number of engineering workmen at their Erith factory, and he was sorry to say there was a dispute between them and the company, which lasted, however, for only a comparatively short time. Long ago it had been amicably settled, and that day he was able, with the utmost satisfaction, to report that their relations with their employés in all their works, both in the South and in Lancashire, were excellent. The employés had regular employment and a standard rate of wages, and every advantage that could reasonably be expected, and they looked forward to a continuance of the good understanding between employés and employer so far as they were concerned. Last year they turned out more work than in any preceding year in the history of the company. Some was at competitive prices, leaving little or no margin of profit, while some was at competitive prices which did leave a profit. The result, taking it all round, was that they had had a better year than ever before. At the Erith Works they manufactured heavy cables, and in Lancashire they manufactured rubber goods and did lighter work generally. They had transferred the plant for the manufacture of telephone cables to Erith, because they wanted more room in the Lancashire works for their extending trade, and they had charged the cost of this to revenue. They had enlarged the works in Lancashire. These works were very favourably situated in respect to canal transport and otherwise, and they were thoroughly well satisfied with what had been done in connection with them. The policy of maintaining all their plant out of revenue, which had always characterised the company, had been again carried out during the past year. The enlarged trading of the company had necessitated more capital, and the board were very unwilling to increase the direct burden on revenue by issuing more shares or debentures; they therefore formed a subsidiary company, known as Callender's Share and Investment Trust, Ltd., the object of which was to convert into available liquid capital, to be used in the company's trading operations, part of the money invested by the company in past years in securities which had been held since. He was glad to tell them that this investment proved a most attractive one, and the whole of the capital was readily absorbed. The result of the year's operations showed a balance to the credit of profit and loss of £97,000, as compared with £77,000 in the previous year, which with the £58,000 brought in from 1911, gave them £155,000 to deal with. After deducting the debenture interest and preference dividend and depreciation, they were left with a balance of £117,000, as compared with £84,000 a year ago, and it was proposed to pay a dividend of 10 per cent., and a bonus of 5s. per share, and to carry forward £91,745. The question arose as to whether a part of this £91,000 should be put to reserve, but they knew that when money was put to reserve, it was locked up, whereas if they carried it forward it was equally a good reserve, but remained liquid, and available generally for the purposes of the company. Therefore, in view of the extending trade of the company, they thought it wiser to carry the money forward. There was no need to go through the figures in the balance-sheet, and he need only say that owing to the larger trade the company had done there were increases in most of them. They had had during the year the most skilled and indefatigable attention to the interests of the company by Mr. T. Callender, the general manager, and his two associates, Mr. Petersen and Mr. James Callender. The managing director made a journey to India in the interests of the company's business, and whilst they were sorry to lose him at home during that time, yet he left behind him very efficient substitutes in the two colleagues he had named. As only four months of the present year had elapsed, it was too early for them to be certain of the results which would accrue in 1913, but, so far as they could judge,

their prospects were excellent. They were full of orders received from customers at home and in the colonies, and he hoped that the balance-sheet they would present 12 months hence would be as good as the one he put before them that day.

Mr. T. CALLENDER, in seconding the motion, said that, in looking back on the past year, they found it was one in which they had had a great deal of trouble and a great deal of anxiety, but also, fortunately, a very large amount of work. Their factories never were fuller of work than in 1912. They started this year under very excellent circumstances, as the factories were full. They had as much work as they could do at present, and there was every prospect of that excellent condition of things continuing for some time at least. From their knowledge of the trade, and the experience they had of the views of their customers at home and abroad, they thought that, unless some serious political disturbance took place or some great labour trouble occurred, the output of 1913 would be good; and he hoped, when they met next year, they would have an excellent report to lay before the shareholders. So far as their business was concerned, they were extending on every side, and were always opening up some new agency or department. A few minutes before coming there, he was in consultation with one of their engineers, who only returned the previous day from Switzerland, where he had been testing cables which the company had supplied, and this was the first occasion on which any English company had done any such work in that country. Their progress had also been considerable in various parts of Germany, Belgium, Spain and elsewhere on the Continent. Their overseas business in the Colonies and in South America was also large and increasing, and they were leaving no stone unturned to bring their products before electrical consumers everywhere. He considered it of sufficient importance to go himself to India and spend some weeks meeting those at the head of affairs with whom they were in the habit of dealing, and he was thoroughly well satisfied with the results of his journey. There was very little to tell the shareholders, because such history as they had made was told in the profit and loss account, the reading of which should give satisfaction to every shareholder. As usual, they had dealt most liberally with the replacement of machinery, and an increased business necessarily meant more wear and tear and added to the cost of repairs. During the year the large staff, both at home and abroad, had been of the utmost assistance, and had worked in the most loyal way, and no company could be better served.

The report was adopted without discussion, and the retiring director and auditors were re-elected.

**West Coast of America Telegraph Co., Ltd.**—The directors' report for the year ended December 31st, 1912, states that the gross receipts amounted to £53,737, as against £53,891 in 1911. The working expenses were £39,646, as compared with £39,689 for the previous year. After providing £6,000 for the interest on the 4 per cent. debentures and £800 for the interest on the 4 per cent. income-bonds, there remains £7,291, plus £1,182 brought forward, making a total of £8,473. Of this £5,000 has been placed to the general reserve fund, and the directors recommend a dividend of 2½ per cent., free of income-tax, amounting to £2,813, leaving £660 to be carried forward.

**Stratford-upon-Avon Electricity Supply Co., Ltd.**—Mr. G. M. Bird presided at the annual meeting recently, and, in moving the adoption of the report (see ELEC. REV., page 733), he said that the income from current was £123 in excess of that of the previous year, and from other sources £30 more. Expenses were up by £75. The units sold for lighting and heating showed a considerable advance, but the power units were somewhat down, as the principal consumers, the mill-owners, had no necessity to use it owing to the heavy rains of the season. With a dry summer, however, this would come on again. Their coal contract was higher, and they had had a slight breakdown to one of the engines—both of these items would somewhat increase the expenses of the current year. The report was adopted.

**International Railphones, Ltd.**—The *Times* states that at the annual meeting of this company, held on 21st ult., it was resolved to offer at par the balance of the unissued capital, amounting to 1,746 shares, to the existing shareholders *pro rata* to their present holdings. An agreement has been made regarding the working of the patent rights for Germany.

**Thomas Tilling, Ltd.**—In their report for 1912, the directors mention that during the year they acquired a preponderating interest in the business of W. A. Stevens, Ltd., motor manufacturers and engineers, who are the patentees of the electrical portion of the "Tilling-Stevens" motor-omnibus.

**London and Suburban Traction Co., Ltd.**—An extraordinary general meeting is called for May 21st, at the Holborn Restaurant, at which a proposal will be put forward for increasing the capital from £3,250,000 to £3,600,000, by the creation of 200,000 new preference shares and 150,000 ordinary shares of £1 each.

**Bahia Tramway, Light and Power Co.**—A meeting has been called for June 5th, at Winchester House, E.C., at which there will be put before the debenture-holders particulars of the proposed sale of the company's undertaking to the Bahia municipality.

## Anglo-Portuguese Telephone Co., Ltd.

Mr. HERBERT ALLEN (chairman) presided on Friday, at 48, Cannon Street, E.C., over the general meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 777), the CHAIRMAN said that last year he expressed the hope that the meeting would be held a little earlier, but sickness amongst the staff at Lisbon delayed the making up of the accounts. This was the twenty-sixth annual meeting over which he had presided, and in looking over the records he found that each year had invariably shown an advance on its predecessor. For 1912 the gross revenue amounted to £62,919, an increase of £5,874 over the previous year. Their gross profit amounted to £25,195, and their ratio of expenses to receipts was a trifle over 57½ per cent., which, he believed, compared favourably with that of other similar undertakings. The number of new subscribers connected during the year was 1,283, which was more than double the number of withdrawals, and gave them a net increase of 671 subscribers. This showed that the business in the past year had been very active, and there were no signs up to the present of any falling off in that activity. As the result of the increased revenue, the Portuguese Government obtained £1,780 more in royalties. The total number of calls for the year was 17,993,503, which, at 1d. per message, would equal about £75,000, but as their subscriptions and installation charges were only £60,000, it worked out at an average of about ½d. per message. Many of them in this country would be glad if they could feel that their telephone messages only cost them on an average about ½d. They had to be thankful if they got a call at any price sometimes. Unofficially, he would say that if they gave Portugal such a telephone service as the British public had to put up with, they would have been kicked out years ago, and very properly so. However, he did not ask his colleagues to endorse that sentiment. Whilst the increase in the company's business must be considered satisfactory, it must be admitted that the conditions of the country during the period under review were not satisfactory. At the end of January there was a great deal of agitation amongst the working classes, and an attempt made to organise a general strike. It was not altogether successful, but it resulted in the closing of many factories, and the tramway service in Lisbon was brought to a standstill. The Government placed Lisbon under martial law, and for six days they had to have troops to guard the exchange. The working of the exchange during the whole period was very active, and was so satisfactorily carried out that a special vote of thanks to the company was passed by the Portuguese House of Parliament in February. Could they imagine anyone getting up in the British House of Commons and proposing a vote of thanks to the Government for the British telephone service? They had expended £12,670 on capital account on the reconstruction of some of the more important trunk lines of Lisbon and in the laying of 4½ miles of underground cables, which was an expensive matter at first, but led to great economy in the long run. In Oporto also, they made considerable additions to the underground cables. Owing to the large increase in the company's business of late, there had been a certain amount of inconvenience arising from want of space in the central exchange, and after careful consideration it had been determined to erect an additional exchange in the northern part of Lisbon. A site had been obtained from the Municipality, and building operations had commenced. Turning to the revenue, the gross profit for the year was £25,195, and adding £5,382 brought in from last year, they had £30,577 to deal with. Of this, debenture interest and sinking fund absorbed £3,600, and income-tax £868. It was proposed to add £12,500 to reserve as last year, bringing the fund up to the respectable sum of £62,500. This was the sixth year in succession in which they recommended the payment of 8 per cent. dividend, and this on the ordinary share capital of £100,000, would absorb £8,000, and thus leave £5,609 to be carried forward. On the whole, he thought they might congratulate themselves on the progress and stability of the business, and if they never did worse than in 1912, they would not have much to complain of. They were largely indebted to their able staff in Lisbon and Oporto, who deserved their hearty thanks.

Mr. F. W. KERR seconded the motion.

Mr. HIBBERT congratulated the board on the successful year, and said the amount now placed to reserve was a large one. Some time ago the board gave the shareholders a little bonus, and he suggested whether they might not distribute £25,000 to the shareholders in the way of shares.

The CHAIRMAN said the little bonus Mr. Hibbert referred to was 3½ per cent. Having regard to the fact that their concession was not interminable, they had to be prudent. If the board thought it prudent to distribute any of the reserve fund they would do so, but their first business was to keep the finances of the company sound.

The motion was then carried, and the chairman was re-elected a director.

**Stock Exchange Notices.**—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

General Electric Co. (of New York)—\$1,000,000 5 per cent. gold debenture bonds (London issue), Nos. T1 to 2,700 of \$1,000 and OT1 to 2,600 of \$500 each, in lieu of the scrip, together with \$5,000,000 6 per cent. gold debenture bonds (issued abroad), Nos. T2,701 to 8,600 of \$1,000 and OT2,601 to 3,000 of \$500 each.

La Plata Electric Tramways Co. Ltd.—£100,000 5 per cent. 1st mortgage debenture stock.

**Castner-Kellner Alkali Co., Ltd.**—The directors announce an interim dividend at the rate of 18 per cent. per annum for the six months ended March, 1913.

## STOCKS AND SHARES.

Tuesday Evening.

At the time of writing, as the newspapers say, the principal influences in Stock Exchange markets are holiday ones. The House has scarcely recovered from its Whitsun rest, and as the settlement of the account takes place this week, fresh business has not developed up to the present to any great extent. Now that there is a definite chance of the Bank Rate coming down still further, the demand for investment securities is again a feature; and even those new issues which are left to a great extent in the hands of the underwriters command attention from bargain-hunters who are on the look out for discounts.

The Home Railway market is somewhat pressed upon by the fact that the bull account in certain of the popular stocks has come into prominence owing to the settlement this week. Apart from this consideration, there is a fairly general opinion that the outlook promises well, so far as can be seen. The labour trouble in Wales appears to have simmered down; and the month of May, so prolific as a rule in labour agitations, is proceeding quietly enough this year. Prices are on the firm side, and after the holiday there was a strong disposition to put prices better. Metropolitanians went back a little with the Steam stocks, and Districts eased off to 39½, both of them recovering later on. Nothing fresh has transpired in the Underground group, speculation even in the 1s. shares of the Underground Electric Railways Company having come to something of a stop. British Electric Traction issues remain dull, and although there are no further falls to record, there is also no improvement from the recent steady decline.

The Latin-Canadian group shows considerable firmness. Reliable information from Mexico repeats that a great deal of the recent "news," purporting to come from that country, had its origin in New York. But still, time will be required to allay the nervousness and anxiety caused by the late troubles of Mexico, and evidently there remains unsettlement on an extensive scale. The investor is picking up 1st mortgage bonds of Latin-Canadian companies, while for the time being he is rather ignoring the common shares. The Brazilian Traction, Light and Power Company, as we mentioned briefly last week, is taking powers to issue \$10,000,000 6 per cent. Cumulative Preference shares, convertible into Ordinary shares, the issue to take place at par, Canadian terms, on or before June 1st next; and a meeting to arrange for this will be held in Toronto next Friday week.

The issue of 5 per cent. Debenture stock by the Consolidated Baltimore Gas and Electric Company was taken up by the public to the extent of about 50 per cent., and dealings started on the basis of 1½—1¼ discount, there being ready buyers at the lower price, which, considering the excellence of the security, is natural enough. By the way, another well-covered security is the 5 per cent. 40-year First Mortgage Bonds of the Jardim Botânico Tramway Company, which carries the full guarantee of the Rio Tramways. The price of the bond is 96 middle, with coupons due on January 1st and July 1st. The Rio Company's First Mortgage bonds, with interest payable on the same dates, stand 6½ points higher.

After their recent bout of mild excitement, Marconi shares have subsided into quietude again, with prices tending to re-act. The effect of Technical Committee's report seems to be wearing off; and with the hint of competition from another direction, the "bulls" of Marconi are not particularly courageous. The old shares eased off to 4½; while Canadians, which rose to 16s. 9d., fell back nearly a florin, Americans and Spanish also being easier, after exhibiting a flicker of strength.

The telegraph market is supported by several good reports. One of these came last week from the Great Northern Telegraph Company, the principal feature of which was a warning note that the proprietors must not take the increase of 2 per cent. in the dividend as being permanently assured, having regard to the reductions in tariffs to the Far East which will have to be made before long. The Company, however, is in an exceedingly strong position, and it is hoped that the 20 per cent. will be maintained. Anglo-American Deferred came to market this Tuesday afternoon, and the price went back. Direct United States Cable shares have weakened also. West India and Panama Ordinary improved with other speculative issues, but the first Preference shares reacted to 10½. The Eastern group continues very firm.

United River Plate Telephone shares are now quoted at the rights to apply for the new issue, and on this the quotation moved down to 7½, which, allowing for the value of the rights, shows practically no net change. The new shares are quoted at 1 premium, and business is being done for cash in the allotment letters. Anglo-Portuguese Telephone 5 per cent. Debenture stock put on another two points. National Telephone Deferred has scarcely moved. The rise in Reuter's new shares went a trifle further, the price now being 11½ middle.

The English Electricity Supply division is firm, the feature being a rise of 1½ in Edmondsons' Debenture stock to 84. County of London Preference hardened to 12, while Edmondsons' shares at 11s. 3d. are ½ higher. The Electric Supply Corporation has just issued its report, showing quiet progress. Edison & Swan partly-paid shares are easier at 3s. 9d.

British Weatlinghouse Preference rose a point, and manufacturing shares, as a whole, are a good market. Rubber shares have taken a distinct turn for the better in consequence of a sharp rise in the price of the raw stuff which came unexpectedly and found the bears unprepared for it. Gossip says it is going better still, just as gossip, when the price was flat a week or two ago, was lugubrious over the outlook.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations May 13th.	Rise + or Fall	Persons Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations May 13th.	Rise + or Fall	Persons Yield p.c.
Bournemouth & Poole, Ord. ..	10	1911. 5	94-104	..	5 13 5	Kensington & Knightsbridge, Ord	5	1911. 5	74-74	..	5 14 3
Do. 4 1/2 % Pref. ....	10	4 1/2	84-94	..	4 14 9	Do. 4 % Deb. ....	Stock	4 4	90-90	..	4 6 0
Do. Second 8 % Pref. ....	10	8	100-104	..	6 14 3	Kent Elec. Power, 4 1/2 % Deb. ..	Stock	4 1/2	78-80	..	5 12 6
Do. 4 1/2 % Deb. Stock ..	Stock	4 1/2	96-98	..	4 11 10	London Electric, Ord. ....	8	2 1/2	118-118	..	4 0 0
Brompton & Kensington, Ord. ....	5	10 10	84-94	..	5 6 8	Do. 8 % Pref. ....	5	6	47-54	..	5 17 1
Do. 7 % Cum. Pref. ....	5	7 7	88-94	..	8 18 10	Do. 4 % First Mort. Deb. ....	Stock	4 4	91-91	..	4 5 1
Central Electric Supply, 4 % Guar. Deb. ..	100	4 4	95-98	..	4 1 8	Metropolitan ....	5	4 4	82-91	..	5 6 4
Charing Cross, West End & City	5	5 5 1/2	43-5	..	5 0 0	Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	42-44	..	4 17 4
Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	43-48	..	4 17 4	Do. 8 1/2 % First Mort. Deb. ....	Stock	4 1/2	94-101	..	4 9 3
Do. "City Undertaking" ..	5	4 1/2	32-44	..	5 0 1	Do. 8 1/2 % Mort. Deb. ....	Stock	4 1/2	82-85	..	4 2 4
Do. Do. 4 % Cum. Pref. ....	100	4 4	91 1/2-93 1/2	..	4 5 7	Midland Electric Corporation	100	4 1/2	90-102	..	4 8 8
Obelisk, Ord. ....	5	5 4 1/2	44-5	..	6 0 0	4 1/2 % First Mort. Deb. ....	100	4 1/2	90-102	..	4 8 8
Do. 4 1/2 % Deb. ....	Stock	4 1/2	96-99	..	4 10 11	Do. 7 % Pref. ....	5	7	84-9	..	5 11 7
City of London, Ord. ....	10	8 9	16-17 1/2	..	5 6 8	North Metropolitan Power Sup- ply, 6 % Mortgage (Fixed).	100	6 5	97 1/2-100 1/2	..	4 19 6
Do. 8 % Cum. Pref. ....	10	8 6	12-18	..	4 10 7	Notting Hill, 8 % Non-Cum. Pref. ....	10	8 6	92-102	..	5 11 7
Do. 5 % Deb. ....	Stock	5 5	116-120	..	4 8 4	Oxford ....	5	7 1/2	54-64	..	5 13 9
Do. 4 1/2 % Second Deb. ....	100	4 1/2	100-102	..	4 8 3	St. James' and Pall Mall, Ord. ..	5	10 10 1/2	84-9	..	4 16 7
County of London, Ord. ....	10	8 8	104-11	..	5 9 1	Do. 8 1/2 % Deb. ....	100	8 1/2	84-87	..	4 0 6
Do. 8 % Pref. ....	10	8 6	114-124	+ 1/2	4 18 0	South London, Ord. ....	4	6 8	27-84	..	7 7 8
Do. 4 1/2 % Deb. ....	Stock	4 1/2	104-106	..	4 5 0	Do. 5 % First Mort. Deb. ....	100	5 5	94-100	..	5 0 0
Do. 4 1/2 % Second Deb. ....	Stock	4 1/2	97-100 xd	..	4 10 0	South Metropolitan, 7 % Pref. ....	1	7 7	100-100	..	5 17 11
Edmundson's, Ord. ....	23	Nil	44-48	+ 1/2	Nil	Do. 4 1/2 % First Deb. Stock ..	100	4 1/2	96-99	..	4 10 6
Do. 8 % Cum. Pref. ....	5	Nil	44-48	..	..	Urban, Ord. ....	23	Nil	44-48	..	..
Do. 6 % Non-Cum. Pref. ....	5	..	114-124	..	..	Do. 8 % Cum. Pref. ....	5	..	124-84	..	..
Do. 4 1/2 % First Mort. Deb. ....	100	4 1/2	84-85 1/2	+ 1 1/2	5 4 8	Do. 4 1/2 % First Mort. Deb. ....	100	4 1/2	83-86	..	5 2 8
Folkestone ....	5	8 8	44-5	..	6 0 0	Westminster, Ord. ....	5	10 10	84-9	..	5 11 1
Do. 5 % Cum. Pref. ....	5	5 5	44-6	..	5 0 0	Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	84-9	..	4 3 9
Do. 4 1/2 % First Deb. ....	100	4 1/2	90-92	..	4 17 10						
Hove ..	5	9 9 1/2	72-74	..	5 16 2						

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ....	5	6 6	5-5 1/2	..	5 14 3	Monterey Rly. Light & Power, } 5 % 1st Mort. Deb. ....	100	6 6	81-84	..	5 19 1	
Calcutta, Ord. ....	5	6 8 1/2	62-74	..	5 19 4	Montreal, Lt., H. and Power ..	\$100	8 9 1/2	229-234 xd	..	3 17 0	
Do. 5 % Pref. ....	5	6 5	44-54	..	4 17 7	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$500	5 5 1/2	15-25 xd	..	..	
Calgary Power, 1st Mort. Bds.	100	5 5 5	93-95	..	5 5 8	River Plate, Ord. ....	Stock	10	..	217-227	..	4 8 0
Canadian Gen. El. Com. ....	\$100	7 7	115-119	..	5 17 8	Do. 8 % Non-Cum. Pref. ....	Do.	5 5	100-102	..	4 18 0	
Do. 7 % Pref. ....	\$100	7 7	119-124	-1	5 13 0	Do. 5 % Deb. Stock ....	Do.	5 5	100-102	..	4 18 0	
Cordoba Lt., Power and T., Ord.	1	8 8	94-96	..	5 4 2	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb. ....	100	4 1/2	100-102	..	4 8 3	
Do. 5 % Deb. ....	100	5 5	94-96	..	5 4 2	Shawinigan Water, Capital ..	\$100	6 5	137 1/2-142 1/2	..	3 10 2	
Elec. Lt. and P. of Cochabamba, 4 % Bonds	100	6 6	93 1/2-95 1/2	..	8 6	Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	107-109	..	4 11 9	
Elec. Supply Victoria, 5 % 1st Mort. Deb. ....	100	5 5	90-93	..	5 7 6	Do. 4 1/2 % Per. Deb. ....	Stock	4 1/2	101 1/2-103 1/2	..	4 7 0	
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5 5	94-96	-1	5 4 1	Toronto Power, 4 1/2 % Deb. ....	Do.	4 1/2	95-101	+ 1/2	4 9 0	
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	14-14 1/2	..	Nil	Vers Cruz Lt., P. and T., 5 % 1st Mort. Deb. ....	100	5 5	91-94	..	5 6 5	
Do. 6 % Pref. ....	1	8 8	100-102	..	8 6 8	Victoria Falls Power, Pref. ....	1	11 1/2	172 1/2	..	4 18 0	
Kamistiquia Power, 5 % G. Bs.	\$600	5 5	100-102	..	4 8 0	West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6 6	106-108	..	5 11 1	
Madras, Ord. ....	5	Nil	14-14 1/2	..	..							
Melbourne, 5 % 1st Mort. Deb.	100	5 5	103-106	..	4 18 4							
Mexican El. Lt., 5 % 1st M. Bds.	100	5 5	81-84	..	5 19 1							
Mexican Lt. & Power, Common	\$100	4 4 1/2	75-78	..	5 2 7							
Do. 7 % Cum. Pref. ....	\$100	7 7	101-103 xd	..	5 16 0							
Do. 5 % 1st Mort. Gold Bds.	..	5 5	91-93	- 1/2	5 7 6							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph ....	10	4 4 1/2	62-72	..	6 2 0	Monte Video Telephone, Ord. ..	1	8 6 1/2	1-1 1/2	..	5 6 8
Do. 6 % Deb. Red. ....	Stock	5 5	97-99	..	5 1 0	Do. 5 % Pref. ....	1	5 5	..	..	5 14 8
American Telep. & Teleg., Cap.	\$100	8 8 1/2	132-134	..	5 19 6	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	97 1/2-98 1/2	..	4 11 2
Do. Collat. Trust ..	\$1000	4 4	92-94	..	4 5 1	Oriental Telep. and Elec. ....	1	8 10	114-114 1/2	..	5 3 8
Anglo-American Telegraph ..	Stock	8 8	54-60 1/2	..	4 10 3	Do. 8 % Cum. Pref. ....	1	5 5	118-118 1/2	..	4 16 0
Do. 8 % Pref. ....	Do.	8 8	1104-1124	..	5 7 8	Do. 4 % Red. Deb. ....	Stock	4 4	88-90	..	4 8 11
Do. Del. ....	Do.	80/-	244-248	- 1/2	6 3 0	Pacific and European Tel., 4 % Guar. Debs. ....	Do.	4 4	98-103	+ 1/2	4 0 0
Anglo-Portuguese Tel., 5 % Mort. Deb. ....	100	5 5	103-105	+ 2	4 15 3	Renters' ....	10	10 10 1/2	11 1/2-11 1/2	..	8 12 0
Chili Telephone ....	5	7 8	74 1/2-74 1/2	..	5 1 1	Do. New Shares ....	10	..	104 1/2-111 1/2	+ 1/2	4 14 6
Commercial Cable, Sig., 4 % Deb.	Stock	4 4	85-87	+ 1	4 12 0	Submarine Cables Trust ..	Cert.	8 8	124-127	..	4 14 6
Cuba Telegraph ....	10	8 6	84-94	..	5 8 4	Telephone Co. of Egypt, 4 1/2 % Deb. Red. ....	Stock	4 1/2	90 1/2-98 1/2	..	4 11 5
Do. 10 % Pref. ....	10	10 10	18-17	..	5 17 8	United River Plate Telephone	5	8 8 1/2	74 1/2-74 1/2	..	5 8 6
Direct Spanish Telegraph, Ord.	5	4 4 1/2	84-82	..	5 8 8	Do. 5 % Cum. Pref. ....	5	5 5	64-68	..	4 9 0
Do. 10 % Cum. Pref. ....	5	10 10	84-74	..	5 18 0	West Coast of America ....	2 1/2	2 1/2	12-13	..	4 3 4
Direct United States Cable ..	10	5 4	64-64	- 1/2	5 18 6	Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel.	100	4 4	86-99	+ 1	4 0 10
Direct W. India Cable, 4 1/2 % Reg. Deb. ....	100	4 1/2	99-101	..	4 9 0	West India and Panama Teleg.	10	1 1 1/2	21 1/2-84 1/2	+ 1/2	3 18 5
Eastern Telegraph, Ord. Stock	Stock	7 7 1/2	135-138	..	5 1 6	Do. 5 % Cum. 1st Pref. ....	10	0 0	10-10 1/2	- 1/2	5 14 3
Do. 8 1/2 % Pref. Stock ..	Do.	8 8 1/2	77-79	..	4 8 1	Do. 6 % Cum. 2nd Pref. ....	10	8 8	9 1/2-10	..	5 0 0
Do. 4 % Mort. Deb. ....	Dc.	4 4	94-96	..	4 3 4	Do. 5 % Debs. ....	100	5 5	101-103	..	4 17 1
Eastern Extension ....	10	7 7	134-138	..	5 2 7	Western Telegraph, Ltd. ....	10	7 7 1/2	13-13 1/2	..	5 3 2
Do. 4 % Deb. ....	Stock	4 4	96-97	..	4 2 6	Do. 4 % Deb. ....	Stock	4 4	86-97	..	4 6 0
East and S. Africa Tel., 4 % Mt. Db. Maurilius Sub.	25	4 4	98 1/2-100 1/2 xd	+ 1/2	3 11 7	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	90-93	..	4 11 0
Globe Telegraph and Trust ..	10	8 6 1/2	103-11 1/2	..	5 6 8						
Do. 8 % Pref. ....	10	8 8	122-134	..	4 11 4						
Great Northern Telegraph ..	10	18 20	30-32	..	5 3 1						
Indo-European Telegraph ..	25	13 13	59-61	..	5 6 7						
Mackay Companies Common ..	100	5 5	83-86	..	5 16 3						
Do. 4 % Cum. Pref. ....	\$100	4 4	69-72	..	5 11 1						
Marconi's Wireless Telegraph	1	20	41-4 1/2	- 1/2	4 11 4						
Do. 7 % Cum. Partio. Pref.	1	17	82-8 1/2	..	4 7 9						

\*Unless otherwise stated, all shares are fully paid. † Interim Dividend. ‡ Bs. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations May 13th, Rise + or Fall, Present Yield p.c., and similar columns for another set of companies.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations May 13th, Rise + or Fall, Present Yield p.c., and similar columns for colonial and foreign companies.

MANUFACTURING COMPANIES.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations May 13th, Rise + or Fall, Present Yield p.c., and similar columns for manufacturing companies.

Unless otherwise stated, all share are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

NEW WORKS OF THE CIE. PARISIENNE DE DISTRIBUTION D'ÉLECTRICITÉ.

ON March 21st, 1907, the Union des Secteurs of Paris was first given official recognition, and on January 1st, 1914, the Cie. Parisienne de Distribution d'Electricité absorbs the six existing supply companies. The onerous conditions on which its concession has been granted include payment of 10 per cent. per annum of the gross receipts (nominally as rental for that part of the distributing system belonging to the municipality), with a sliding scale increasing this rent, the minimum annual payment being £120,000. The whole property will be taken over by the municipality in 1910 without payment, or in 1924 on payment of the balance not then provided for by the statutory sinking fund. The authorised tariffs are 1'8d. per unit for lighting and 2'9d. for power.

*Power House.*—The power house (182 ft. x 85 ft.) is spanned by two 50-ton electric travelling cranes and accommodates eight 10,000-15,000 kw. turbo-alternators and three 750-kw. converter sets for station and auxiliary supply. Further particulars of this equipment are promised for a later date.

*Switch House.*—The switch house (33 x 45 ft.) opens out from the power house, into which the main control balcony projects, with the alternator and feeder-control panels in area of circles. The two main switchboard storeys are surrounded by oilies, and the outgoing high-tension sub-station feeders are carried in galleries below the switch house. The eight turbo-alternators at present installed are connected to 32 outgoing feeders through two sets of bus-bars, so arranged that either of the two groups of alternators can supply all the feeders if required (see fig. 2). Normally, the two sets of bus-bars are disconnected by a remote-control isolating switch. Each alternator is protected by a continuous-flow liquid pressure discharger and a reverse current cut-out connects the machine to a special group of bars, thus forming a "bridge" of

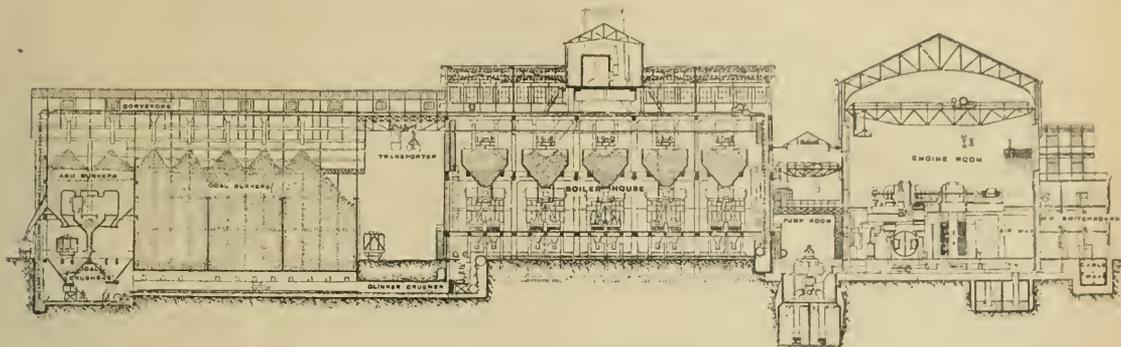


FIG. 1.

A further condition stipulated was that two generating stations be erected, one in the north, the other in the south-west of Paris, both being on the banks of the Seine and interconnected electrically. These works are now practically completed, and from a detailed description in *La Technique Moderne*, we draw the following particulars.

USINE NORD (NORTHERN STATION).

This station, situated at St. Ouen les Docks, covers an area of 3'21 acres, and is at present of 50,000 kw. rated capacity; the ground occupied and the kw. capacity will be doubled by the extensions ultimately contemplated. The special features of the various divisions at the station are as follows:—

The works are connected to the Seine by a viaduct terminating on a pier which carries a coal and ash-handling equipment. Coal and ashes are taken to and from the boiler house by an electric loco, capable of hauling 100 tons at 5½ M.P.H. on the level, and provided with a drum winch at one end. Each boiler house is provided with a double set of bunkers, each of which contains three coal divisions and accommodates 5,000 tons of fuel. The coal and ash bunkers are filled and emptied by a system of conveyors, transporters and motor hoppers (see fig. 1). Conveyors and electric transporters are used to distribute coal from the bunkers as required. A system of water pipes is laid to enable the bunkers to be flooded in case of spontaneous combustion.

*Boilers.*—Two groups of boilers, separated by a lane 33 ft. in width, comprise respectively 10 Belleville, 10 Babcock and 20 Babcock boilers. The groups of 20 are arranged in rows of five on either side of a firing aisle and the feed-purifying plant is between the two boiler houses each of which is 145 ft. square. Each boiler provides 22,000 lb. of steam per hour (or 31,000 lb. on overload), at 228 lb. pressure per sq. in. and superheated to 620° F. to 700° F. The economisers are placed above each boiler and, like the latter, are totally enclosed by steel plates lined with diatomite and refractory bricks. The flues (5 mm. sheet lined with diatomite and refractory brick) from each set of boilers are led to a common stack mounted over the firing aisle. The smoke stacks (four in number), are of reinforced concrete 16 ft. 5 in. in internal diameter and rise 186 ft. above the grate level.

The feed pumps for the Belleville boilers at Usine Nord are of the horizontal multi-cellular five-disk Neumann centrifugal type, coupled to motors.

Low and medium-pressure pumps are installed to supply reserve tanks and to clean the circulating water galleries.

*Circulating Water Supply; Pump Room.*—Below the pier on the river front is an intake chamber for the circulating water supply; this chamber is protected by a coarse grill of stationary trapezoidal bars, cleaned by a special rake, and by two movable galvanised iron screens of fine mesh. The latter are driven electrically, and, when raised, pass through a pressure jet of water which cleans them. The intake conduits can be shut off from the intake chamber in case of need. The incoming water passes into two large chambers below the pump room whence it is drawn by the circulating pumps. After leaving the condensers the water flows into two chambers parallel to the first and returns to the Seine through a quadruple subterranean gallery. Reservoirs above the pump room contain the water required for general works purposes.

machines, which can be connected to one or other of the two main bus-bar systems by maximum cut-outs with time relays.

The high-tension feeders, each of 4 x 100 sq. mm. section, are connected to the bus-bars in groups of four. Each feeder is provided with maximum cut-outs, and the bridge connections for each group of four feeders contain two further maximum cut-outs. Between each feeder and earth is connected a Wurtz arrester, with carborundum resistances in series. The alternator cut-outs are designed for 800 amperes and the feeder cut-outs for 200 amperes; a double break (16 in.) is arranged on each pole, so that each cut-out (8 ft. 6 in. x 3 ft. 3 in. x 10 ft. 9 in.) comprises four distinct unipolar elements.

The low-tension station circuits are supplied at 210 volts from the four 750-k.v.a. converters and two 3,000-ampere-hour accumu-

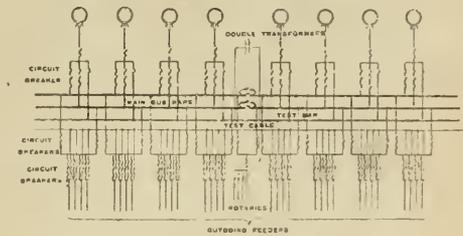


FIG. 2.

lators. In conjunction with the latter is used a double 2,000-ampere 22-step horizontal regulator, electrically-controlled from the low-tension board.

The alternator excitation may be controlled by hand or by automatic Orutin regulators. A maximum voltage relay is included in each regulator circuit, to prevent an indefinite increase in the alternator voltage should a cut-out operate, and a maximum current relay is also provided to suspend the action of the regulator in case of short-circuit.

To enable load tests on the alternators to be made, a special system of bus-bars is provided, to which each machine can be connected (as shown in fig. 2), and thus placed on a water load capable of absorbing 15,000 k.v.a. at 12,300 volts. No feeder is connected to the main bus-bars till it has been subjected to full working pressure by a variable transformer connected to the feeder-test bus-bars.

USINE SUD-OUEST (S.W. STATION).

This station is at Isy les Moulineaux, occupies a site of 5'3 acres in area, and is of 25,000 kw. present, and 50,000 ultimate capacity. As regards its general arrangement and the provision made for water supply and distribution, the works much resemble the Usine Nord. Coal and ashes are carried between the station and a 130 ft. x 46 ft. quay on the Seine, by a bucket conveyor installed in a subway below the Rue Bara. Ten Belleville and ten

Babcock boilers flank two firing aisles in a single boiler house, and the power house (220 ft.  $\times$  85 ft.) contains three turbo-alternators and three 500-converter sets.

*Station Buildings, Foundations, &c.*—In both stations the buildings are almost entirely of reinforced concrete construction, and some of the main beams carried by the steel skeleton pillars are 4 ft. 3 in. in height. The circulating water galleries have concrete walls, more or less strongly reinforced according to the size of the gallery and the load carried.

The foundations of the main building pillars, alongside the circulating water galleries, were subject to a very much higher

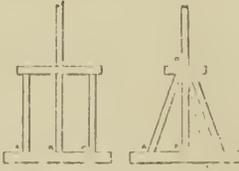


FIG. 3. FIG. 4

pressure (2.3 tons per sq. ft.) than those of the galleries, hence the foundations had to be independent, though so closely contiguous. It was originally intended to carry the foundations on piles, but the urgency of the work forbade adoption of this method—in anticipation of the use of which, reinforced piles had already been made. Footings 4 ft. 6 in. in width were placed in excavations at the side

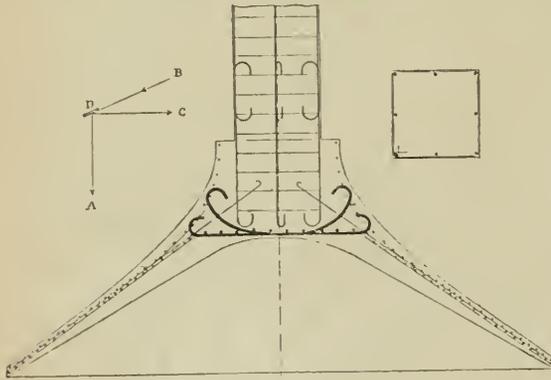


FIG. 5.

of the galleries; each footing carried one column and, to distribute evenly the concentrated load of the latter, cut-down piles were arranged as shown in fig. 4.

An alternative arrangement would be to place the three distributing pillars vertically, as in fig. 3, but, in such a case, the unequal resistance of the underlying soil might ultimately remove all load

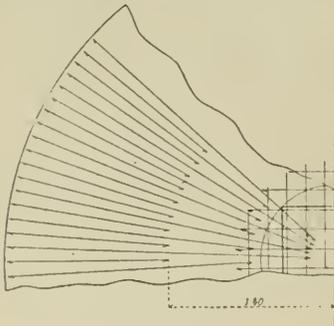


FIG. 6

from, say, pillar A. The pillar C would then be unable to offer any useful support, and the whole load would be concentrated on B, probably disastrously. On the other hand, in the case represented by fig. 4, should A fail, the pillars B, C, would still offer their maximum support, the resultant reaction being in the direction OD. The general flooring of the works would be able to supply the horizontal reaction required to establish equilibrium (this reaction being small owing to the small inclination of C), and the load on B, C, would be increased about 50 per cent., as compared with a treble loading of B in the case represented by fig. 3.

At the Usine Nord, the boiler houses and silos stand on a good gravel, capable of carrying heavy loads, but for safety the bearing pressure was limited to 2.25 tons per sq. ft. To distribute the pres-

sure from the less heavily-loaded pillars, ordinary foundation plates were used, but those pillars more heavily loaded were mounted on a special footing, designed by Considère & Pelnard, which has recently been employed in the naval yards at Havre and the magazines at Alexandria. Using the ordinary type of foundation, those boiler house pillars carrying 625 tons would have required foundation plates 270 sq. ft. in area formed of heavy radial ribbing, cross-connected by a secondary reinforcement and resting on a common foundation block. This type of foundation is costly in materials and labour, and, in it, load is concentrated on the reinforcing members, and the high shearing stresses set up require the use of numerous stirrups.

The Considère & Pelnard foundations actually used consist of hollow reinforced cones (fig. 5) resting on mounds of virgin earth trimmed to shape and covered with a preliminary thin layer of cement, the function of which is to preserve the underlying earth from deformation during the subsequent stages of erection. On the mound thus prepared is laid a set of rings (or a conical spiral terminating in large hooks), which is tied to rods running up the cone (see fig. 6). The whole reinforcement is then embedded in concrete and the pedestal itself is complete.

The inclination of the generating lines of the cone to the horizontal being less than the angle of friction, the reaction of the underlying soil is vertical (DA, fig. 5, where D represents an element of the pedestal cone). This reaction resolves into a compression DB taken up by the concrete and a horizontal component balanced by the tension in the circular or spiral bars. The concrete is nowhere subjected to shearing, or any other stress than pure compression, along the generating lines of the cone, and the circumferential reinforcement is subject to pure tensile stresses which do not destroy its adherence to the cement. It is claimed that these foundations effect from 20 per cent. to 35 per cent. economy as compared with ordinary foundation plates.

## PROCEEDINGS OF INSTITUTIONS.

### The "Point Flves."

THE following is an abstract of the chairman's address at the meeting held at Bradford on April 18th, 1913:—

In Bradford considerable headway has been made in connection with the heating and cooking supply, more especially the former, and this has been almost solely due to the fact that a tariff under which current may be obtained by domestic consumers for such purposes at  $\frac{1}{2}$ d. per unit, has been in existence since July 1st, 1910. Electric heaters are extremely popular with consumers who have adopted the special domestic tariff, and a small number of complete electric cooking outfits are in use. No scheme, however, is in existence under which consumers can obtain such outfits on hire, as the types of cookers which have up to the present been put on the market have not proved altogether suitable for local requirements, more especially in connection with the baking of bread. For this reason, also, consumers have not been recommended by the department to purchase such cookers outright. In view of the prices at which heaters can now be obtained it appears to be hardly necessary to inaugurate a hiring scheme in order to popularise their use.

Up to March 31st last, the total number of private residences in Bradford in which electricity was in use was 918, and out of this number the occupiers of 471, or 51.3 per cent., had adopted the Special Domestic Tariff of 15 per cent. per annum upon the net rateable value of the premises occupied, plus one-halfpenny per unit for all current consumed as registered by meter, no charge being made for the hire of the latter. When giving consideration to the framing of a special charge for domestic purposes, the accounts of all the private house consumers connected to the mains were totalled, and particulars of the rateable value of each of the premises obtained. It was then found that if the whole of such consumers were charged at the rate of 3s. in the £ on their net rateable values, plus  $\frac{1}{2}$ d. per unit for all current used, the total revenue obtained from them would be practically the same as was then being obtained under the flat rate of  $\frac{1}{2}$ d. per unit, less  $\frac{1}{2}$  per cent. discount for prompt payment. The effect of such a tariff on consumers individually was, of course, found to vary considerably. It was, however, generally found that the consumers who would benefit by the new tariff had wired their houses for electric light throughout, whereas those who would not benefit by the rate had only wired the best rooms. It was extremely satisfactory to find that on inauguration of the rate, not only was it adopted by consumers who would immediately benefit, but a number of consumers who would only benefit by adding to their installations also made application to be charged on the new system.

The feature which seems to have proved most attractive to such consumers and to consumers who have since been obtained, is that it is possible to ascertain definitely within a few shillings the exact amount of one's bill for electric lighting, as it is impossible for the amount to vary to any considerable extent by reason of carelessness on the part of members of the household in leaving lights burning at times when rooms are not in use. Practically all the consumers who have adopted the rate have very considerably increased the illumination of their premises, and in many cases the increase has been as great as 100 per cent. This has had the effect of removing the reproach which was often flung out to the effect that houses in which electric light was in use were illuminated very much worse than those in which incandescent gas was the illuminant.

PARTICULARS OF INSTALLATIONS, ACCOUNTS, &C., OF VARIOUS CONSUMERS IN BRADFORD.

Lamps installed.	Other apparatus.		Total kw.	Rateab'o value.	Accounts for year ended December 31st, 1912.			Remarks.	
	No.	kw.			Units.	Rate.	Amount.		
27	1'10	1 cooker : 4 1,000-watt radiators, 1 vacuum cleaner, on 8 10-ampere plugs	10'0	11'10	30	— 3,940	15 % ½d.	£1 10 0 8 4 2 £12 14 2	= '77d. per unit.
22	'97	1 cooker, 2 radiators, 2 6-lb. irons, 1 boiler, on 6 10-ampere plugs	13'8	14'77	31	— 1,162	15 % ½d.	£2 6 6 2 8 5 £4 14 11	For half-year ended Dec. 31st, 1912, only. = '98d. per unit.
17	'79	1 iron	'66	1'45	(21)	153	4d.	£2 11 0 0 1 3 £2 9 9 0 11 5 £3 0 2	Less discount. Hire of meter. = 4'72d. per unit.
19	'776	1 4-light radiator : 1 8-lb. iron, 1 sewing machine motor	2'26	5'036	18	— 112	15 % ½d.	£2 14 0 0 17 2 £3 11 2	= 2'07d. per unit.
23	1'24	Radiators, convector, hot-plate, &c.	3'45	4'69	25	— 1,936	15 % ½d.	£3 15 0 4 0 7 £7 15 7	= '96d. per unit.
THE LOWEST ASSESSED RATEABLE VALUE CONSUMER :—									
0	'43	1 4-light radiator	1'15	1'58	7½	— 373	15 % ½d.	£1 2 6 0 15 7 0 2 6 £2 0 7	Added to June half-years/c., to bring amount to cover minimum charge. = 1'30d. per unit.

Up to December 31st last the total capacity of the heating and cooking apparatus which was known to have been connected to the Bradford mains exceeded 1,000 kw., and there are undoubtedly very considerable numbers of radiators, irons, &c., in use on the system which are not included in the above figures, but only appear in the department's books as 5 or 10-ampere plugs.

With all respect to my fellow-members of "The Point Fives," who have adopted a special flat rate of ½d. per unit for heating and cooking purposes, I submit that the majority of consumers (at any rate, of those in Bradford) supplied on the "Norwich" system with ½d. per unit as the running charge, are in a far more favourable position than if they were charged at one price for energy used for lighting purposes and on a ½d. per unit flat rate for heating and cooking. They have the advantage of only having one meter and one system of wiring, and can increase the candle-power and number of lamps in use to any desired extent without incurring a much larger charge for the additional energy required.

The percentage to be paid on the net rateable value as a standing charge must be worked out separately for each supply area, as it is quite within the bounds of possibility that 10 per cent. on a particular house in one area may represent a considerably larger sum than 15 per cent. in another area, for a house of exactly similar size. In London or Glasgow, for instance, the rateable value of a comparatively small flat would, I feel sure, exceed that of a fair-sized house in Bradford, although the light required in such a flat would be considerably less than in the case of a house.

The following statement gives particulars regarding the maximum demands and consumptions for the half-year ended December 31st, 1912, of 28 consumers charged on the rateable-value system, on whose premises demand indicators had been fixed. The net rateable values of these consumers' residences vary from £16 10s. to £150:—

Kilowatts of connections...	107
Combined maximum demands as per indicators	74 kw.
Units used during half-year ended December 31st, 1912	22,543
Average units per consumer for half-year	805
Average units per kilowatt installed for half-year	211
Load factor	6'95%
Average price per unit	1'65d.
Equal to a charge of £2 18s. 4d. per annum per kilowatt, plus ½d. per unit.	
Average price per unit if charged on maximum-demand rate of 7d and 1d.	4'26d.

Economies in the Use of Electric Power.

By W. E. MILNS.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Birmingham, February 26th, 1913.)

TECHNICAL knowledge is necessary in order to secure efficiency and economy. The electric motor is not suitable for every class of work, and in certain cases it should not be recommended, for commercial reasons. Technical knowledge and practical experience are required to determine these cases. The commercial canvasser who,

lacking any technical knowledge, possesses those qualities of salesmanship which enable him to get motors into consumers' premises, is a dangerous person to employ.

The author cannot too strongly emphasise the importance of technical advice in arranging an electric drive. Considering the many types of electric motors and the great variety of control gear, it is a pity that the shunt motor with an ordinary starting switch is apparently used on every possible occasion. Technical knowledge is also essential in handling alternating-current work.

The heaviest item in a manufacturer's expenses is usually the wages bill. The power arrangements should therefore be designed to affect the wages account rather than the power account. A well-thought-out power scheme will often increase the output for the same wages bill (this is equivalent to a reduction in a wages bill); and it will also cut down the manufacturer's expenses by saving material, reducing the floor space occupied, and minimising wear and tear and other maintenance charges. To design a successful power scheme for a works, the engineer must have some knowledge of the trade or manufacture carried on in those works. The works manager or works engineer is a most valuable ally, and much information can often be obtained from him.

The author does not advocate that the most efficient mechanical arrangements should be installed regardless of cost. The subdividing of shafting and the individual driving of machines will occasionally reduce current consumption, but the capital cost of such arrangements cannot always be justified. It is sometimes cheaper to consume a little more current and save capital outlay than to introduce expensive mechanical alterations. Each case must be decided on its merits.

Too much importance is attached to the cost of power, and it is also difficult to get a manufacturer to realise the many considerations which are put forward when comparing estimates for the cost of driving. The power user is usually told that, say, a 10-H.P. gas engine takes 20 cb. ft. of gas per horse-power-hour. On a 60 hours per week basis, this works out at 10,000 cb. ft. of gas, which, if charged at 1s. 6d. per 1,000 cb. ft., equals 15s. On the other hand, the customer is told that a 10-H.P. motor consumes approximately 1 unit per horse-power-hour, which is equivalent to 500 units per week. Taking current at 1d. per unit, he is thus shown that the electric motor would cost 41s. 8d., against 15s. for a gas engine.

Such comparisons are considered seriously by a man who has been fairly satisfied with gas engines, and who is entirely ignorant of electric driving. Of course, one may usually point out the gross unfairness of such comparisons, which omit a number of very heavy charges. It can also be shown that the saving in shafting losses reduces the horse-power-hours, and that the splitting up of drives reduces the number of running hours, and all the other practical arguments of the superiority of electric motors over gas engines can be brought forward. It is, however, in most cases difficult to put an exact value on these advantages, and the power user asks for more definite figures than a theoretical calculation based on either his maximum possible output or his estimated average load.

A method of estimating the cost of driving based on figures actually obtained from existing manufacturers' installations gives

a more common-sense and accurate comparison, and the figures can be backed by the evidence and results obtained from several years' working on various drives.

For the benefit of power users and engineers engaged in developing power loads, the author gives some figures obtained from the analysis of power costs in various trades. The figures given show the number of units used per annum per horse-power installed, the figure being the average of a number of manufacturers in the same class of business. The installed horse-power is such as is usually found in a factory where a little margin is allowed for development and extra load.

## ELECTRICAL ENERGY USED IN VARIOUS TRADES.

Trade.	No. of units per annum per H.P. installed.	Trade.	No. of units per annum per H.P. installed.
Bakers and confectioners	427	Leather-workers	730
Bedstead manufacturers	613	Metal-workers	672
Boot manufacturers	591	Opticians	354
Brassfounders	927	Paper box manufacturers	362
Brewers	689	Paper manufacturers	67
Brush manufacturers	454	Pen manufacturers	378
Builders	189	Photographic purposes	940
Butchers	278	Polishers	744
Button manufacturers	570	Printers	569
Chemists (manufacturing)	1,699	Printers (newspapers)	833
Organ blowing	246	Provision merchants	408
Clothers	938	Public offices (fans)	2,766
Cold storage	3,217	Public offices (lifts)	352
Corn merchants	267	Refiners	515
Die-sinkers	188	Rolling mills	486
Electroplaters	546	Surgical and dental purposes	353
Engineers (cycle)	987	Stamps and piercers	592
Engineers (general)	917	Upholsterers	167
Glass manufacturers	470	Vacuum machine companies (manufacturers)	371
Gunmakers	667	Varnish manufacturers	382
Hairdressers	178	Woodworkers	453
Ironfounders	781	Wireworkers	1,091
Jewel-case makers	893	Whip manufacturers	95
Jewellers	775		
Lamp manufacturers	1,331		
Laundries	421		

Actual comparisons of the cost of gas, steam and electric driving on the same work are given below. These figures have been obtained from manufacturers who previously need steam power and afterwards electricity, the work done in no case being less with electric driving than in the case of steam driving.

Horse-power installed.	Cost of driving by steam.	Cost of driving by electricity.
1,387	£6,000	£4,000
200	1,680	1,476
80	750	504

The following figures have been obtained from installations previously driven by gas plant operated with gas from town mains:—

H.P. installed.	Cost of driving by gas.	Cost of driving by electricity.
25	£130 0 0	£104 0 0
5	33 9 0	23 9 7
40	156 0 0*	144 6 10

\* Suction gas plant.

The following interesting example is from a large pen factory, the owners of which have taken very careful tests on the cost of steam, town gas, suction gas and electricity. The H.P. installed was 250. The cost of steam driving with Corliss compound condensing engines is £9 10s. per H.P. per annum; with gas from the Corporation mains, at 1s. 5d. per 1,000 cb. ft., £7 4s. 2d. per H.P. per annum; and with suction gas, £4 17s. 3d. per H.P. per annum. The cost of electric driving with current at 1d. per unit came to £3 13s. 9d. per H.P. per annum.

The above typical examples take into account maintenance, wages and repairs, while the example from the pen factory also takes into account interest, depreciation and all other charges.

Another method of comparison which will appeal to a manufacturer with an elementary knowledge of engineering is to obtain load curves for the steam engines by means of continuous recorders, or from electric motors by means of recording ammeters, and to submit such curves to a power user.

The owner of a rolling mill, which was steam driven, assured the author that the large number of rolls on his engine resulted in a practically steady load, so that the engine was worked at a very high efficiency throughout its run. He argued that under such conditions electricity could not compete with steam engines on the ground of cost. A continuous indicating diagram, however, showed that his load varied from 70 to 215 H.P.

Speed curves are also of considerable value. The steam engine falls to its lowest speed at the money-earning period. The fall of speed in the electric motor is much less than with the steam engine, so that the output and revenue are much increased. Diagrams may also be used to emphasise the saving in floor space.

The manufacturer too often considers the uses of electricity from a power standpoint only. The many other uses which can be made of the supply are often of considerable convenience and value to him. Efficient lighting has a direct influence on output. Evidence of this is found not only in the lighter trades, in pen factories, in the jewellery district, &c., but also in the heavier work of rolling

mills, casting shops, &c. Again, the uses of electricity for small portable apparatus are often of considerable value. Electric heating, welding, smelting, &c., offer peculiar advantages in certain trades.

In conclusion, the advocate of electric driving need not hesitate conscientiously to put forward his schemes. He stands for a system which all arguments and experience have proved to be so far the most ideal and perfect power in use.

A further and last argument, which, unfortunately, is rarely taken into consideration, is that the conditions of labour and employment in electrically-equipped factories are usually far superior to those found in works utilising any other form of power.

## DISCUSSION.

MR. N. B. ROSHER explained a method of checking the power costs adopted by a firm with which he was connected. They took the ratio of the total expenditure on power and fuel to the total sales. Thus in 1907, when the works were entirely driven by gas engines, the ratio was '83; but in 1910, when the conversion to electric driving had been completed, the ratio dropped to '74, or a decrease of approximately 12 per cent., due to electric driving, and this notwithstanding the fact that a considerable increase had taken place in the number of machines driven by power. About six months ago a sheet metal rolling mill driven by a horizontal condensing steam engine was converted to electric driving. The saving in running costs since the conversion had been so great that the whole of the electrical outfit, including cost of foundations, &c., would be paid for in two years by the saving effected.

MR. W. FENNEL said he had found the best means to convince a sceptical power user of the economy of electric driving to be a trial, taking one part of the works which could be easily isolated. In two cases he arranged for the hire, with option of purchase, of the equipment of quite large works, one of them taking about 400 H.P. He took the risk of cost of service, &c., and of temporary wiring. In both cases he convinced the intending consumers that electric driving would save them money. With regard to the damage done by irresponsible and unskilled arrangements, they made it a point at Wednesbury to get in touch with works users in the early stages, and in those cases where the work was not in the hands of specialists, they gave advice and kept more or less control of the arrangements from start to finish. He always made it clear that he took no moral responsibility for results where he was not consulted.

## Faraday Society.

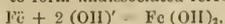
## GENERAL DISCUSSION ON THE CORROSION OF IRON AND STEEL.

At their April meeting, the Faraday Society met at Manchester, combining forces with the Local Section of the Society of Chemical Industry. A group of papers was presented dealing with the electrochemical aspects of the corrosion—and its prevention—of iron and steel, and a long and interesting discussion followed the reading of the papers.

MR. BERTRAM LAMBERT, M.A., put forward "An Electrolytic Theory of the Corrosion of Iron," which is claimed to be a simple and natural development of the ideas of Faraday on electrolysis. Everybody knows that commercial zinc dissolves freely in diluted acid, because the impurities in the metal set up ever so many minute voltaic cells, in which the zinc is the positive element, and so goes into solution through the action of the innumerable local currents. Pure zinc or amalgamated zinc—which is supposed to have an "electrochemically" homogeneous surface, will not go into solution, because no electrolytic action is possible. Iron, according to this conception, behaves in an exactly similar manner, and if the conditions are such that an appreciable current can pass between two electrically different (*i.e.*, different in their solution pressures) parts of the iron, the more electro-positive portions will dissolve away; this dissolution is a necessary preliminary to rusting. The conditions just referred to require the presence of oxygen dissolved in the water, for in oxygen free pure water the current that passes is almost infinitesimal, and the amount of iron dissolved can hardly be detected. The reason for this is, that the local current set up in the iron causes a film of hydrogen to be deposited on the more electro-negative portions, introducing an enormous resistance into the circuit. When oxygen is present, the hydrogen film is *depolarised*, and the current, therefore, persists and the solution of iron continues. That this explanation of the necessity for the presence of oxygen is a true one is borne out by what happens when a piece of commercial iron is dipped into a solution of pure copper sulphate in a vacuum. Here it is copper and not hydrogen that is deposited on the more electro-negative portions of the iron, and so the action is able to proceed until all the iron goes into solution or all the copper is removed. Mr. Lambert regards it as well-established that all that is necessary for the rusting of commercial iron is the presence of pure water and pure oxygen, and the carbonic acid theory which states that this, or some other acid, must always be present, must be abandoned in favour of the electrolytic theory, in face of the experimental evidence now supporting this hypothesis. The following experiments of Mr. Lambert must carry conviction on this point. He has prepared chemically pure iron that can be exposed to the action of tap-water and air for an indefinite time without showing signs of rust, and the same specimens would not replace copper from copper sulphate or nitrate solutions. Some of these specimens were, after careful drying, then subjected to pressure in a polished agate mortar by an agate pestle, and they were again put into water and exposed to the air

They rusted in the course of a few hours, rust forming first at the edges which had not been pressed by the agate, while the pressed portions remained quite bright. This is exactly what would be expected if the electrolytic theory is true, for the strained and unstrained portions of the iron will be two different modifications electrically considered, having different solution pressures, and so local currents will be set up when the metal is placed in water or copper sulphate.

The actual formation of rust is a secondary chemical action on the iron that has gone by electrolysis into solution in the form of ferrous ions. These ferrous ions combine with the hydroxyl ions present in the water to form unassociated ferrous-hydroxide.



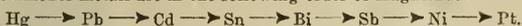
Then the oxygen in solution plays a second part, and converts the ferrous hydroxide into some hydrated form of ferric oxide, which is rust—



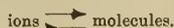
The behaviour of pure iron towards copper chloride or in dilute alkali chloride solutions is strangely anomalous, and at present altogether inexplicable. Specimens which remain unaltered in the sulphate or nitrate are immediately attacked by copper chloride and will corrode in quite dilute salt solutions, and this curious behaviour cannot be accounted for by the presence of a protective film of oxide or hydride on the iron. The matter is being further investigated by Mr. Lambert.

Very interesting is Mr. Lambert's suggestion—plausible, although as yet unsupported by experimental evidence—that substances which protect iron from corrosion have the power, in some way or other, of destroying or reducing the electrical differences which always exist in commercial forms of iron—that they have a passivating effect—and that the substances, like the chlorides of the alkali metals, which stimulate corrosion, do so by increasing these electrical differences. This would explain the remarkable behaviour of pure iron towards copper chloride and alkali chloride solutions.

MR. J. I. CRABTREE, M.Sc., read a paper on "The Nature of Over-voltage." Apart from the intrinsic interest of this peculiar phenomenon to the electro-chemist, Mr. Crabtree shows how direct a bearing the subject has on the question of corrosion, as will be explained presently. The over-voltage of a metal may be regarded as the excess of the anodic or cathodic decomposition voltage of a dilute acid with an electrode of that metal over that for platinum, or as the excess of the back E.M.F. set up at the electrode after polarisation over that set up by a platinum-plated electrode under identical conditions. Mr. Crabtree's method of determining this back E.M.F. is by alternately polarising an electrode in decinormal  $\text{H}_2\text{SO}_4$  for 30 minutes, and then measuring its single potential difference (against a "normal" electrode) by means of a potentiometer. The over-voltage is not a constant for any given metal, but it varies with such factors as the time of application of the polarising current, current density, thickness and physical condition of the surface of the electrode, depending to an unknown degree on the presence of some foreign bodies, such as colloids and alkaloids, in the electrolyte, and, of course, above all on the nature of the metal. The values for the cathodic over-voltage of the commoner metals are in the following order of magnitude:—



Over-voltage is, in all probability, closely connected with the transformation of the gas evolved at the electrode from the ionic to the molecular state, and it may be a measure of the difference between the rate of production of ions and of their combination to form neutral gaseous molecules or groups of molecules. Nerst supposes that this ionic combination can only take place within the electrode, which possibly acts as a sort of catalytic agent. This may explain why the over-voltage for metals like platinum and nickel, which easily occlude gases, is so low, although other factors would also come into play. Generally, therefore, it may be said that over-voltage is proportional to the power of the metal for affecting the velocity of the reaction—



Perhaps the ions, after being discharged, pass into a condition of unstable equilibrium, and give rise to a back E.M.F.

If the electrolytic theory of corrosion put forward by Mr. Lambert, as outlined above, be correct, the relation of over-voltage to corrosion will be obvious. The effect of over-voltage will be either to assist or retard the deposition of hydrogen or oxygen on the surface of the metal, thus directly affecting corrosion, or it will set up a back E.M.F., which will diminish the local currents that are the cause of corrosion; or, finally, it may assist or prevent the solution of the metal. Thus, a metal will only go into solution in an acid if its over-voltage is less than the difference between the E.M.F. of the metal and the back E.M.F. of hydrogen. If the over-voltage is large, no solution of the metal can occur; this is the case with amalgamated zinc, where the mercury is the cause of the high over-voltage. With galvanised iron, to take another example, very little solution of iron takes place, because the latter assumes the high over-voltage of its zinc covering.

PROF. W. W. HALDANE GEE delivered a lecture, illustrated by experiments and lantern slides, on "Electrolytic Methods for Preventing the Corrosion of Metals." The principle underlying all these methods is to make the metal to be protected a cathode, either by attaching to it a more electro-positive metal, or else by means of an external current. The use of zinc in boilers is the best known example of the first method. Unfortunately its efficacy is somewhat impaired by a lack of exact experimental data with regard to the resistance of boiler waters and the effective voltages brought into play at temperatures of 150-200° C. The zinc con-

sumption would appear to be much larger than it need be. In some marine boilers it is as great as 100-600 lb. per annum. This is equivalent to a constantly flowing current of 17 to 26 ampères, and Prof. Gee points out that currents of such magnitude can be produced much more cheaply from dynamos, and devices are now in use in which an external source of current is employed. Mr. Elliott Cumberland, for example, places iron anodes in the water of the boiler, which is made cathode, using a small motor-generator to supply current, and the method has been found effective in removing scale as well as in preventing corrosion. Prof. Gee has found that the current densities necessary for the protection of iron and copper from the corrosive action of fresh or salt water are quite low, so that the cost of anodes would be the chief item of expense. Messrs. Harris and Anderson have applied electrical currents for the prevention of the corrosion of condensers. They find a condenser with a cooling surface of 1,025 sq. ft. requires only 2 volts and 2 amperes, and the special anodes used by them cost from £3.5s. per 1,000 sq. ft. per annum. The use of electrical currents may also be applied in chemical works to prevent the corrosion of metallic screens and vessels by acid liquids.

### Phase Advancing.

(Discussion on paper by DR. G. KAPP before the INSTITUTION OF ELECTRICAL ENGINEERS. For abstract of paper see page 784.)

#### DISCUSSION AT BIRMINGHAM.

MR. R. A. CHATTOCK said that the apparatus appeared to be so simple and reasonable in cost that it would probably be to the interest of the supply undertakings themselves to install it in connection with large motors on their supply. In Birmingham the transforming machinery in the sub-stations, consisting of rotary converters, was used for correcting the power factor, and in this way about two-thirds of the system was run at a power factor approaching unity. The system of metering described was a very interesting one, but it would be very difficult to explain this to a consumer, and to convince him that he was paying correctly for his units.

MR. A. M. TAYLOR referred to Dr. Kapp's suggestion that if the central station would give a rebate to a consumer of 10 per cent. off the fixed charges, it would provide the consumer with the recompense which would warrant his incurring the extra capital expenditure to install phase-advancers. Dr. Kapp held that the Power Co. had no other expense to incur than that for fuel and water, and that as it gained new consumers without any further capital outlay, it was strongly to its interest to give the required discount. There was a fallacy in this reasoning, because in most cases the engineers of supply stations had already discounted for the power factor of their generators, and there was not the margin on the steam side, amounting to an extra 25 per cent., which Dr. Kapp's premises would involve. The conditions under which the station therefore obtained the new load were not very materially better than those under which it obtained its existing load, and in addition, the 4 per cent. loss on the consumer's motor had to be paid for from somewhere. Dr. Rosenberg, in his recent paper, stated that in order to improve the power factor from .707 to .8, the losses in a synchronous condenser able to give 250 k.v.a. would amount to 10 per cent. of the rating of the condenser. Dr. Kapp, however, appeared to allow that 4 per cent. would be sufficient.

MR. N. SHUTTLEWORTH said that the question of power-factor improvement was being forced upon central station engineers, because of the rapidly with which existing cables were becoming overloaded, and the only remedy, in many cases, to save duplication was the adoption of a phase-advancing device. The author had given the costs per extra saleable kW., first, with synchronous motors running light, and, secondly, with loaded synchronous motors used also for the purpose of power-factor improvement. The relative costs were £7 to £10 per kW., and £2 per kW. respectively. The speaker was able to add to these figures the costs of phase-advancers for the same duties; the variation was from 15s. to £2 extra saleable kW., the cost depending upon the size of the motor to which the advancer was applied. The cost per k.v.a. reduction in the wattless component of the power supply varied from 8s. to 25s. per k.v.a. correction. There was a limit to which the phase advancer could be pushed, if unnecessary expense was to be avoided. To cause the main motor to draw leading current at 0.8 power factor, it was necessary to increase the rotor current more than 60 per cent., and to increase the size of the advancer in a still greater ratio. Generally speaking, the leading power factor on any one motor should not be lower than 0.9 for good results.

MR. E. A. WATSON said he was very much struck with the Scherbius phase advancer described in the paper as a machine which had no stationary part, with the exception of the brush gear. He did not quite agree with Prof. Kapp that the driving motor supplied the losses due to windage, friction and hysteresis. The windage and friction losses certainly were supplied mechanically, but he did not see how the hysteresis or eddy-current losses could be. No mechanical torque could be exerted on the revolving member without a corresponding equal and opposite torque being exerted on a fixed one. Any hysteresis loss, if supplied by the driving motor, implied the presence of a mechanical torque acting on the shaft, and this must be accompanied by an equal and opposite one acting on some fixed portion of the machine. As the only fixed portions were the brush gear and, to some extent, the surrounding air, it was not quite clear how this could exist. He was inclined to think that the true explanation was that these losses were supplied electrically through the windings of the advancer itself. One of the chief points of Prof. Kapp's arrange-

ment appeared to be that, although the vibrator only had to inject a small E.M.F. into the circuit, this was, as it were, magnified by the motor itself in approximately the ratio of 1/slip, and produced a vastly greater effect at the stator terminals.

DR. M. L. KAPP said that the excitation of a synchronous motor required only a few per cent. of its output, and the excitation current was conveyed to such motors by short low-voltage leads. In the case of induction motors connected to a high-tension power transmission, the excitation had to be provided from the main station at the full voltage of the supply; with a power factor of .8 the K.V.A. required for excitation were 75 per cent. of the kilowatts of energy transmitted, and the line losses were increased by 53 per cent. above the losses through the pure watt current. The arrangement invented by Prof. Kapp reduced the K.V.A. required by excitation approximately in the ratio of slip to full speed, as the excitation was not supplied to the stator with the full voltage, but to the rotor with a voltage of the order of the slip voltage. This exciting current was conveyed to the motor by short low-tension leads. One could see from this that by Prof. Kapp's arrangement the K.V.A. required for excitation, and the distance the exciting current had to travel, had been reduced to a small fraction of the values which were necessary in the case of ordinary induction motors. The induction motor was thus brought in line with the synchronous motor, as far as the excitation was concerned—the phase advancer taking the place of the exciter—without the disadvantages of low starting torque and synchronising difficulties. Moreover, the apparatus invented by Prof. Kapp required, if anything, less attention and was less likely to get out of order than the exciter of a synchronous machine. In considering the cost of the apparatus, one must take into account that the size of the induction motor could be materially reduced if a phase advancer was added, for the following reasons:—(1) The stator had only to carry the watt current, and the heating in this part was materially reduced; (2) the overload of a motor of a given size was increased by attaching a phase advancer; (3) the increase of rotor current due to the exciting current in the rotor did not affect the design materially, as the rotor of an induction motor usually worked well below the heating limits. Considering the case of a 1,300-H.P. induction motor wound for 8,000 volts, 50 periods, 272 R.P.M., with a power factor of .82, which was made some years ago, it was found that by designing the machine for use in connection with a phase advancer, the diameter of the machine could be reduced 15 per cent., and the weight of the punchings could be reduced from  $7\frac{1}{2}$  to  $5\frac{1}{2}$  tons. This saving of material was effected without increasing the loading of the material, *i.e.*, the loss per pound of material. The losses in the motor itself were slightly reduced, which made up for the losses in the phase advancer, so that the total energy consumed was not increased. For small motors, the conditions were not so favourable, but in the case of motors above 200 H.P. the phase advancer offered a very attractive proposition.

MR. R. ORSETTICH said that it was very seldom realised that small motors running at slow speeds had generally a power factor below .8, especially as they were mostly run below their full load rating. The result was that mines, collieries, and works plants found that after a time it was necessary to lay new cables in order to cope with the increased current expected from the power consumed. In plants of this kind the phase compensator explained by the author would be of great advantage. Large corporation plants were not affected to the same extent. A phase advancer either of the Scherbius or the Kapp type enabled an ordinary standard motor to be installed, with the only difference that no short-circuiting gear could be used, as the slip rings had to carry the current of the compensator. Both compensators had the disadvantage of requiring commutators, through which the rotor current must pass. The Scherbius compensator was usually driven by a separate small motor, and this corresponded approximately to the expenditure of a small separate exciter, which had to be fitted to the induction motor when using the Kapp compensator. It was quite possible to put up an induction motor of the standard type, fitted with a small exciter and an independent phase compensator of the Kapp system, against the cost of supplying a synchronous motor of the standard type, fitted with a starting motor and a small exciter. The price of a synchronous self-starting motor was much higher.

DR. SUMNER stated that Mr. James Swinburne was the first to suggest using a magnetic vibrator as an A.C. load taking a leading current. Dr. Kapp's device was made possible commercially because he utilised the low frequencies of the rotor currents. It could be shown that the number of volt-amperes per phase taken by the Kapp vibrator was given by the formula—

$$VA = (Ar)^2 / \omega,$$

where  $A$  was the rotor current in amperes passing into the vibrator armature;  $r$  the voltage generated in this armature if run at constant speed (one radian per second);  $I$  the moment of inertia of the armature; and  $\omega = 2\pi\sigma f$ , where  $f$  was the circuit frequency and  $\sigma$  was the slip. The numerator of the fraction was a constant for a particular armature, since the allowable current  $A$  was inversely proportional to the number of conductors determining the voltage  $r$ . Hence, to increase the volt-amperes it was necessary to keep the values of  $I$  and  $\omega$  small. The importance of the smallness of the slip frequency  $\sigma f$  was two-fold. It not only increased the capacity of the armature in volt-amperes, but also reduced the number of volt-amperes needed for compensation.

MR. A. R. EVEREST said there was a large field for devices which would overcome the low power factor inherently associated with certain classes of load. It was somewhat surprising to find the self-starting synchronous motor regarded as a comparative novelty. In the United States they had been building self-starting machines for some years past. Dr. Kapp mentioned two British firms now

building such machines, and the British Thomson-Houston Co., Ltd., also built self-starting synchronous motors, having even better starting characteristics (in torque per ampere) than the corresponding sizes of squirrel-cage induction motors. They were started under the same conditions of load as the squirrel-cage motors, and with the same device to reduce the applied voltage at starting. No synchronising was required, as the motor pulled into step when the field was excited. Such machines were well suited for use with a surplus of excitation, so as to draw leading current and neutralise a bad power factor arising elsewhere.

#### DISCUSSION IN LONDON.

MR. W. M. MORDEY, who opened the discussion, regretted that the author had dismissed so briefly the use of electrostatic condensers as phase correctors. He had personally been attracted by the subject, and mentioned the paper he contributed to the Institution bearing on the matter in 1909. Now that condensers were so cheap it appeared that there was some chance of using them in this way. The Walker advancer cost about £2 per K.V.A., and he believed that proper condensers could now be obtained at a figure comparable with the apparent cost of the author's apparatus—say, 10s. per K.V.A. The apparatus described appeared greatly to increase the slip, and this might be a serious disadvantage in some cases. The efficiency (88 per cent.) of the Brown-Boveri motor appeared to be low, and might have affected the results. The figure attributed to Mr. Ashton—£19 per K.V.A. for static condensers—was much higher than he (the speaker) had found some years ago.

MR. A. W. ASHTON said it was three years since the first electrostatic condenser was used in this country on a practical scale—for improving the power factor of an arc lamp circuit in North London; within the last year three larger orders had been carried out by the B.I. and Heleby people for pressures of 550 volts, 50 periods, and for 7,000 volts, which showed that this type of condenser was not altogether out of the running. No breakdown had come to the notice of the makers; the condensers were, of course, largely confined to 50-period circuits. The condenser could be applied close to the apparatus having a poor power factor and was suitable for comparatively small motors. Looking over the cost of installing the phase-advancer, given in the paper, he thought the consumer would have to have 10 per cent. discount before he obtained any advantage, taking into account losses and repayment of capital.

MR. W. H. BOSWORTH thought the author's conclusions were rather unfair to the rotary condenser; he had over-estimated its size. In practice a machine used as a phase advancer and motor came out about 45 per cent. larger in capacity than a machine used as a motor alone, though the excess did not mean excessive cost on account of the higher speeds. This compared with 19 per cent. given by the author. The description of the Lancashire Dynamo Co.'s self-starting machine was not quite accurate; the latest starter was operated by one hand-wheel and interlocked switches. The combination of a phase advancer and motor cost more than a self-starting motor alone in his experience, and the latter machine seemed more suitable for ordinary commercial use. He congratulated the author on having drawn attention to the commercial possibilities of the subject.

MR. F. CREEDY said the Miles-Walker machine could be used for artificially reducing slip to zero, or making it a negative slip. Small slip was important, and he believed a much smaller slip could be obtained by employing a wound stator. He asked why attention was always given to the series type of machine; a shunt machine could improve the power factor at no-load.

MR. J. T. IRWIN suggested that the vibrator could be made to have a larger mechanical movement by employing a spring control or air buffers for bringing the armature back to the mean position.

PROF. KAPP, in replying, said he was glad to hear that condensers were commercially used. He did not disparage their use, but they could not improve the load conditions of a motor by using them. He agreed that there must be additional loss with the phase advancer and motor, two machines, but the saving in copper loss would, he thought, pay for the power used in the advancer. The efficiency of the condenser had not been stated (Mr. Ashton here mentioned a loss of not more than 3 per cent.). It was a barbarous thing that they should chase thousands of amperes through the mains without getting anything for it. The objection to increased slip was not so serious if suitable cases were considered. As to the saving of weight, a speaker at Birmingham said there was a difference of 2 tons in favour of a 350-H.P. motor and advancer as against a motor without it. The movement of the vibrator was too great to make use of Mr. Irwin's suggestion.

#### Standard Clauses for Street Lighting Specifications.

REPLYING to Mr. Edgcumbe's letter (p. 788), Mr. F. W. Goodenough notes that he is still strongly of opinion that the average illumination in a street is of importance, and says this means that we have only got to arrive at some practical means for relating our specification to that average for us to get nearer the goal of agreement upon a standard specification. But first it is necessary to dispel the idea that minimum horizontal illumination is the only factor necessary to specify in an illumination contract. Mr. Trotter laid great stress upon the fact that the classification of streets made by the surveyors, as the result of an inspection of their lighting by night, was in agreement, to a considerable extent, with a classification of the same streets according to minimum horizontal illumination measurements. As Mr. Edgcumbe endorses Mr. Trotter's remarks in his letter, Mr. Goodenough wishes to point out the radical unsoundness of the argument, and to ask the surveyors to give careful consideration to the matter. If, the lighting of the streets which the

surveyors inspected had been planned and carried out by contractors working to the specification as drafted, then it might well have been urged (though it still would not have been true) that lighting of a certain grade of value would always be produced in a street if a certain minimum horizontal illumination were specified. But that was not the case, and that is where the radical fallacy of the argument lies.

The lighting of the streets surveyed was designed and carried out on the usual plan of deciding, by experience and by experiment, what number of lamps of a certain description, placed on columns of a certain height, would give the kind of illumination that was desired or could be afforded in those streets. Those lamps on those posts at certain distances apart produced the illumination of the streets which the surveyors classified as A, B, C or D, according to their impression of that illumination on inspecting the streets. But that impression was produced by the following factors in combination:—The apparent brightness of the lamps; the height of the lamps above the street; the distance of the lamps apart; the maximum illumination in the street; the gradation of maximum down to minimum illumination in the street.

All these factors, not the last one only, go to make up the good, bad or indifferent lighting of a street. If in two streets you have about the same number of lamps of similar power on columns of similar height, you will get about the same maximum, average and minimum horizontal illumination. By a different number of lamps of different power on columns of different height, you can get the same minimum horizontal illumination, but a different maximum and a different average illumination—a differently lighted street altogether, such as no surveyor would class with the others.

Is it not, then, obviously illogical to say that to ensure that a street shall be lighted up to a certain standard, it is only necessary to specify the minimum illumination which the contractor is to give, leaving it to him to give what maximum and average illumination he chooses?

We must get it clearly into our minds that minimum horizontal illumination is only one of the effects produced "under present conditions of lighting," which were not built up on a specification with minimum horizontal illumination as its basis. Once we have all got to the point of agreeing that a standard specification of street lighting must have regard to the general result produced, and not to one factor alone of the several which form the whole, there will not be any serious difficulty in arriving at a practical form of specification.

Mr. Goodenough would consider that a specification had sufficient regard to the maximum and average illumination of a street if it laid down within reasonable limits what relation should exist between the candle-power measurements of lamps (of given height at defined distances apart) at three specified angles below the horizontal—say, at 10°, 20° and 50°, taken in the line of maximum illumination—with a clause providing that measurements taken at similar angles in any other direction should not be less than a specified percentage of those taken in the direction of maximum illumination.

Such a specification would not entail a heavy amount of work upon the engineer having supervision of the contract; it would sufficiently guard against "freak" spots of lighting, and it would overcome many of the objections raised against the draft specification.

**The Dayton Flood.**—Our contemporary, the *Electrical Review and Western Electrician*, of Chicago, relates experiences of electrical men during the recent terrible floods. Mr. Frank M. Tait, president of the Dayton Power and Light Co., who is also president of the National Electric Light Association, was a prisoner on the second floor of his home for two days, and grave fears were at one time entertained for his safety. He reports: "Both power plants under 12 ft. of mud and water for 50 hours." Some of the company's employes were "prisoners in the plant while the water covered everything." They told of having kept alive on the fruit that floated in from a neighbouring market and the rain which they caught in their hats. Vice-President J. W. Lieb, jun., vice-president of the New York Edison Co., describing the Dayton plant as he found it on the day after the water receded from the streets of the city, said:—

"After trudging a mile and a half over the wreckage, we reached the power house at 8 o'clock. There wasn't a soul in sight, and everything was covered with mud. Mud, mud, mud and slime a foot thick was over the generators, the switchboards, the motors, the engines, and a line of dirt showed where the water had reached the operating room, 13 ft. above the floor level. High up on the main steamline extended a walkway, and there, the only living thing in sight, perched a dog. Onions! The place was filled with them. They were thicker in the mud than raisins in a raisin cake. Twelve feet above the floor, on a generator frame, there were two crates full of sprouting red onions, while the whole top of the switchboard was lined with them. The dog was chewing one when we arrived, and from that we named him 'Onion.' But the place was an awful sight—sickening and discouraging. The mud nearly reached our knees, and in some places water still stood a foot deep on the floor. After a good look at the boiler room, still filled with water, we got out to hunt our friends, so we could start the task of clearing the wreckage and muck and get things going. This was no small task, and it took nearly 30 hours before the work of drying out could be started."

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Adams Lift Controller.

Fig. 1 shows a new controller for lifts and hoists, which is being introduced by the ADAMS MANUFACTURING CO., LTD., of Bedford.

The controller for a small electric lift or hoist is as important as the motor itself, as on it depends the correct operation of the whole gear, and failure of even one small part is liable to upset the whole apparatus, while it is run by persons usually quite ignorant of electrical matters.

The lift controller illustrated is arranged for rope operation, the pulley for the rope being mounted on the spindle projecting from the top of the apparatus. It consists essentially of a box containing the necessary starting resistance. On the front of the



FIG. 1.—ADAMS LIFT CONTROLLER.

box is mounted one of the new "Z" type automatic starters, which consists of a number of contact fingers which are brought into operation by the solenoid, and so arranged that the motor-starting resistance is gradually short-circuited and the motor brought up to speed. An adjustable dashpot controls the rate at which this part of the apparatus works. On top of the box is mounted a drum-type reversing switch which, by the operation of the rope, makes the circuits for the motor to revolve in the required direction, and then energises the solenoid on the "Z" type starter. The makers claim that it is an ideal controller for small reversible motors.

### A Dutch Oven Type Cooker.

We have received from MESSRS. SIMPLEX CONDUITS, LTD., 116, Charing Cross Road, W.C., some particulars of their dutch-oven type "Plexsim" cookers.



FIG. 2.—PLEXSIM DUTCH-OVEN, OPEN.

These have been designed particularly for small householders, and will appeal to station engineers who favour hiring schemes on account of their low first cost and loading.

The small oven (14 in. × 14 in. × 15 in.) takes a maximum of 600 watts, and will cook up to 7-lb. joints; the larger one (21 in. × 21 in. × 22 in.) has a total loading of 1,200 watts, and takes joints up to 12 lb. weight. With the assistance of one or two extra hot-plates or self-contained utensils, it is claimed to carry out all the functions of the ordinary cast-iron stove.

Our views, figs. 2 and 3, show the arrangement of this cooker, for which it is claimed that heat losses from radiation and from the opening of the oven are to a great extent avoided owing to the construction adopted, and that this economises in energy consumption.

The explanation given is that the opening of the door or hood induces a partial vacuum behind the upright partition at the back of the shelves, and that in fact the heated air is retained in the hood.



FIG. 3.—PLENSIM OVEN CLOSED.

We gather that the cooking temperature is reached within 5 minutes of switching on, and, moreover, that the apparatus has undergone exhaustive trials in the firm's own kitchen in practical use.

The oven is arranged for heat regulation, and is fitted with inside grids, two shelves and a drip tin. Temperature regulation is effected by a one-piece connector.

The elements are of the incandescent type, and actually roast; they are guaranteed for 12 months, and are readily renewable in a few minutes at home.

#### Inspection Lamp for Motor-Cars.

MESSRS. SIMPLEX CONDUITS, LTD., of Garrison Lane, Birmingham, have recently introduced the inspection hand lamp, shown in fig. 4, in its cheapest form, for motor-car and similar work.



FIG. 4.—INSPECTION HAND LAMP.

The lamp shown is made in brass, with suspension hook and cord grip at the top, and has a substantial guard. Another pattern dispenses with the guard, the lamp being enclosed in an outer strong glass globe and provided with a solid handle and legs to

stand the lamp upright; the latter pattern can also be supplied with a guard over the outer globe. The lamps are supplied for 1, 6, or 8 volts, and 3 yd. of flexible cord are provided.

#### Static Discharger Panel.

A compact and serviceable panel has been introduced by MESSRS. A. REYROLLE & Co., of Hebburn-on-Tyne, for use separately or in conjunction with their enclosed sheet-steel switchgear, including multi-disk type spark gaps in series with isolating switches and

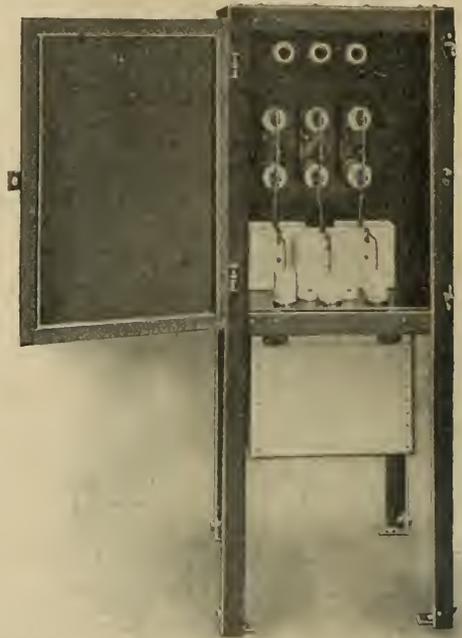


FIG. 5.—REYROLLE STATIC DISCHARGER PANEL.



FIG. 6.—REAR VIEW OF G.E.C. STANDARD HIGH-PRESSURE "MISTAKE-PROOF" CONTROL PANEL, WITH A DOOR OPEN.

current-limiting resistances. Fig. 5 shows the arrangement of the spark gaps and isolating switches. The resistances are of an oil-

immersed type, and the containing tank shown is arranged for lowering if required.

The panel illustrated is suitable for use on 3,000-volt three-phase systems. Other standard designs can be obtained for voltages up to 20,000, one form being made suitable for plugging into the solid type armoured switchgear.

**G.E.C. "Mistake-proof" Switchboards.**

A new line of "mistake-proof" panels has recently been designed by the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, London, E.C. In this design there are several noteworthy features. The isolating links and bus-bars are contained in a separate compartment situated at the top of the cubicles, and are partitioned off from the main cubicle by solid metal barriers, thus making it impossible for anybody accidentally to come into contact with live metal; cleaning and adjusting can therefore be carried out in absolute safety. The isolating links are firmly locked in position during the time the panel is in commission; they are operated from the front of the board, this doing away with the necessity of opening the doors to isolate the cubicle. The interlocking of the various pieces of apparatus is arranged in such a way that it is impossible to open or close the circuit with the links; this can only be done with the oil switch, a point of great importance. Neither marble nor slate enters into the construction of the board, the bus-bars, terminals and isolating links being supported on porcelain insulators. The framework and panels are of boiler plate, rendering the whole fireproof. No special foundations are required, and this, together with the fact that the whole of the gear is concentrated in the panel, reduces the erection cost to a minimum. A view of the panel is given in fig. 6, showing the arrangement of the interior.

**LEGAL.**

**GARDINER v. LONDON UNITED TRAMWAYS, LTD.**

ON May 7th before Mr. Justice Bucknill and a special jury in the King's Bench Division, an action was concluded in which Mr. C. E. S. Gardiner, consulting engineer and expert in oils, residing at St. Margaret's-on-Thames, sued the defendant company to recover damages for personal injuries sustained through the alleged negligence of the defendants' servants, while he was riding on the top of one of their electric cars in High Street, Brentford, on April 22nd, 1912, in the direction of Hampton Court.

The plaintiff's case was that he had his hand on the handrail, and as another car passed, his hand was struck by something, the flesh torn, and the wrist very seriously injured. The plaintiff also said that the line in the roadway was defective, and that the cars were oscillating considerably. The defendants denied negligence, and said plaintiff was guilty of contributory negligence by having his hand extended over the rail in disregard of a public warning to passengers as to the risk of doing so. Plaintiff denied that he had his hand extended beyond the rail.

The jury awarded the plaintiff £500 damages; judgment was entered accordingly against the defendant company, with costs, and a stay of execution was refused.

**POULSEN PATENT.**

IN the Chancery Division, on May 8th, before Mr. Justice Warrington, Mr. Austen Cartmell again mentioned the petition for the extension of the period of a Poulsen patent. He said the Solicitor-General was not able to name any day for the hearing of the petition, and he asked his Lordship to allow it to be mentioned at the beginning of next sittings.

His LORDSHIP assented.

**AUSTIN v. L.C.C.**

MR. CHAS. AUSTIN, comedian, in an action tried by Mr. Justice Lush in the King's Bench Division, was on May 8th awarded £120 damages against the London County Council in respect to damage to a motor car which was sandwiched between two electric trams in Camberwell New Road one foggy night last October.

**BRITISH VACUUM CLEANER CO., LTD., v. JAMES ROBERTSHAW AND SON, LTD.**

MR. JUSTICE SARGENT, in the Chancery Division on Friday, May 9th, delivered his reserved judgment in this action, by which the plaintiffs sought to restrain an alleged infringement of their patent, granted to Hugh Cecil Booth in 1901.

The plaintiffs' case was that the defendants were advertising a domestic vacuum cleaner that was capable of being worked by electric or other motor power, which apparatus was an infringement of their patent. The defendants pleaded anticipation and non-infringement.

His LORDSHIP said that with regard to anticipation, two patents by Harvey, one of 1893 and one of 1894, were relied on, but, in his opinion, neither of these covered the patent sued upon. They were for the removal of dust and not for its extraction. With regard to non-infringement, Messrs. Robertshaw said they made

no high-power machines, and any machine that did not give a 5-lb. pressure per sq. in. did not come within the ambit of the plaintiffs' patent. He could not hold that the plaintiffs' patent was so limited. Moreover, he was not satisfied that the defendants' "Ideal" machine when attached to the domestic electric supply which would enable it to be moved nearer the work to be done would not give a 5-lb. pressure. He must hold, therefore, that the plaintiffs succeeded, and there must be an injunction asked, with an inquiry as to damages.

**FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.**

**NEW AMERICAN TARIFF.**

THE Board of Trade have now issued a complete copy of the new tariff Bill, recently introduced by the United States Government, together with a copy of the existing tariff which it is proposed to revise, showing a comparison of the present and proposed duties. The following are extracts of particular interest to readers of the ELECTRICAL REVIEW; the complete tariff may be obtained from Messrs. Wyman & Sons, Fetter Lane, E.C., and the cost is 1s.

Mica and manufactures of mica, or of which mica is the component material of chief value	Present duties.	Proposed duties.
Mica, ground ... ..		15 % ad val.
The existing classification is—		
Mica, unmanufactured or rough, trimmed only.		5 cents. per lb. & 20 % ad val.
Mica, cut or trimmed, mica plates or built up mica, and all manufactures of mica or of which mica is the component part of chief value		10 cents. per lb. and 20 % ad val.
Carbon unmanufactured, not specially provided for	20 % ad val.	15 % ad val.
Porous carbon pots for electric batteries	20 % ad val.	15 % ad val.
Wire of iron or steel or other metal, except gold or silver, covered with cotton, silk or other material, and all flat wires and steel in strips, not thicker than No. 15 wire gauge, and not exceeding 5 in. in width, whether in long or short lengths, in coils or otherwise, and whether rolled or drawn through dies or rolls, or otherwise produced; telegraph, telephone and other wires and cables composed of metal and rubber, or of metal, rubber and other materials; iron and steel wire coated by dipping, galvanising or similar process with zinc, tin or other metal		Partly 40 % ad val. and partly 35 % ad val. 20 % ad val.
Electrodes for electric furnaces, electrolytic and battery purposes, brushes, plates and discs; all the foregoing, composed wholly or in chief value of carbon	30 % ad val.	25 % ad val.
Carbons for electric lighting, wholly or partly finished:		
Made entirely from petroleum coke	35 cents per 100 ft.	15 cents per 100 ft.
If composed chiefly of lampblack or retort carbon	65 cents per 100 ft.	40 cents per 100 ft.
Steam engines, locomotives and machine tools	30 % ad val.	15 % ad val.
Articles or wares not specially provided for in the tariff under the section of "Metal and manufactures thereof" (N.B.—This heading applies to a very large number of machines and metal manufactures):		
If composed wholly or in chief value of iron, steel, lead, copper, nickel, pewter, zinc, aluminium or other metal, and whether partly or wholly manufactured	45 % ad val.	25 % ad val.
Manufactures of india-rubber or gutta-percha	35 % ad val.	10 % ad val.

Of the proposed new regulations under the tariff, the following is one of the most important:—"That a discount of 5 per cent. on all duties imposed by this Act shall be allowed on such goods, wares and merchandise as shall be imported in vessels built in the United States, and which shall be the property of a citizen or citizens thereof."

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 9,898. "Electrically-operated drill of the percussion type." T. F. WALL. April 28th.
- 9,904. "Loud sound reproducing telephones." W. E. JENNINGS. April 28th.
- 9,930. "Electric water-heaters and the like." R. WEAVING and FERRANTI, LTD. April 28th.
- 9,946. "Portable electric battery lamps." B. PORDER. April 28th.
- 9,959. "Variable resistances for automatic regulation of electric currents." A. G. BLOXAM. (R. Bosen (firm of), Germany.) April 28th. (Complete.)
- 9,986. "Selective system of telephony." R. C. M. HASTINGS. April 28th. (Complete.)
- 9,987. "Spark-plugs for internal-combustion engines." S. WHITE. April 28th.
- 9,996. "Control of electro-mechanical transmission gears." H. F. HAWORTH. April 29th.
- 9,998. "Electrically insulated railway joints." W. W. LEWIS and T. A. R. TARRANT. April 29th.
- 10,004. "Electric incandescent lampholders." H. T. WILKINSON. April 29th.
- 10,006. "Means for filtering electroplating and the like solutions." A. H. RAILING and A. J. D. KRAUSE. April 29th.
- 10,018. "Substitution resistances for electric lamps." W. HEINS. (Addition to 9,590, 1913. Convention date, November 25th, 1912, Germany.) April 29th. (Complete.)
- 10,020. "System of electrical traction." F. STONE and F. J. CHAFFLE. April 29th.
- 10,031. "Deriving electric current formed by means of thermo-electric elements." P. FERRA. April 29th.
- 10,036. "Apparatus for the direct conversion of heat into electricity." J. GRUUS. April 29th. (Complete.)
- 10,046. "Electrical fire-alarms." T. W. GOSDEN. April 29th.
- 10,073. "Electrically-operated drills." H. W. DARBY and F. J. WEST. April 29th. (Complete.)
- 10,074. "Means for electrically transmitting and indicating orders, signals, information, or the like." C. J. EVANS. April 29th. (Addition to 26,694/12.)
- 10,075. "Incandescence lamps." J. R. QUAIN. April 29th.
- 10,077. "Electric switch having make and break contact immersed in a liquid." ALLOMPEINE ELEKTRICITÄTS GES. (Convention date, May 1st, 1912, Germany.) April 29th. (Complete.)
- 10,081. "Circuit controllers." H. W. DARRY and F. J. WEST. April 29th. (Complete.)
- 10,098. "Lighting operating or like tables." H. WADE. (Dr. Ing. Schneider and Naujoks Elektrizitäts Ges., Germany.) April 29th.
- 10,109. "Electric clocks." T. RUSHTON. April 29th. (Complete.)
- 10,105. "Electric hair singe." J. H. WATKINS. April 30th.
- 10,107. "Incandescent lighting and appliances therefor." J. BOOTH. April 30th.
- 10,153. "Wireless telephone." F. MAJORANA. April 30th. (Complete.)
- 10,154. "Telephone relay." F. MAJORANA. April 30th. (Complete.)
- 10,157. "Form of electric annunciator and circuit changer." E. E. MOORE. April 30th.
- 10,160. "Callor for wireless telegraphy." M. CORLON. April 30th.
- 10,164. "Flexible electric conductors." WESTERN ELECTRIC CO., LTD. (Western Electric Co., United States.) April 30th. (Complete.)
- 10,181. "Method of regulating the current in direct current arc lighting, search lights, electric weld, and the like." A. MARTIN, H. JACKSON, A. J. CAMPBELL, T. B. CAMPBELL and W. CAMPBELL. April 30th. (Complete.)
- 10,188. "Means for raising and supporting arc and other lamps and the like." G. A. HUGHES (trading as London Electric Firm.) April 30th.
- 10,190. "Electrically or mechanically-vibrated diaphragms for sound devices." G. S. B. WATKINS. April 30th.
- 10,195. "Telegraphy." P. O'NEIL. April 30th.
- 10,200. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) April 30th. (Complete.)
- 10,203. "Voltage control of electric circuits." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) April 30th.
- 10,205. "Electric couplings." J. A. ROSS. April 30th.
- 10,210. "Manufacture of electric carbons." J. ROUJAL. April 30th. (Complete.)
- 10,225. "Method of cleaning and coating inside and outside of tubes with metals or alloys by electro-deposition with the aid of mechanical devices." C. HATHORPE. May 1st.
- 10,232. "Apparatus for detecting weak electric currents." G. E. TURNBULL. May 1st.
- 10,252. "Substitution resistances for electric lamps." W. HEINS. (Addition to 9,590 of 1913. Convention date, March 11th, 1913, Germany.) May 1st. (Complete.)
- 10,273. "Telephone with poles arranged concentrically." SIEMENS BROS. and CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) May 1st. (Complete.)
- 10,289. "Electric radiators for heating." C. ARPIN. (Convention date, May 2nd, 1912, France.) May 1st. (Complete.)
- 10,304. "Electric arc lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 1st.
- 10,369. "Process for fusing difficultly-fusible metals." SIEMENS BROS. and CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) May 2nd. (Complete.)
- 10,373. "Arrangement for electrically operating jacquard machines." G. CORRI. May 2nd. (Complete.)
- 10,396. "Electrical interrupters or vibrators." F. KNABL. May 2nd.
- 10,399. "Telephone transmitters." A. PLECHER. May 2nd. (Complete.)
- 10,403. "Apparatus for heating water and other liquids by electricity, particularly applicable as a bath heater." C. ARPIN. (Convention date, May 3rd, 1912, France.) May 2nd. (Complete.)
- 10,416. "Electric motor-control apparatus." A. H. RAILING and C. C. GARRARD. May 3rd.
- 10,422. "Counterweights for pendant electric light fittings." J. M. DOUGHTY. May 3rd. (Complete.)
- 10,423. "Manufacture of electric incandescence light-emitting bodies by electrical means." E. M. BAILEY, W. TAYLOR and T. MIDDLETON. May 3rd.
- 10,431. "Arrangements of apparatus and circuits for counting and registering telephone calls." T. F. PEAVES. May 3rd.
- 10,454. "Lampholders for electric light." F. A. BASNETT and J. N. MOLLETT. May 3rd.
- 10,460. "Machines for reproducing patterns, pictures, or the like with the aid of electric currents." A. G. BLOXAM. (Siemens-Schuckertwerke G.m.b.H., Germany.) May 3rd. (Complete.)
- 10,468. "Means for increasing the efficiency of electric incandescent lamps." O. L. PEARD. May 3rd.
- 10,470. "Electric switches." J. STONE & Co., LTD., and A. H. DARKEE. May 3rd.
- 10,472. "Electrical relay arrangements." A. N. HOVLAND. (Convention date, May 6th, 1912, Norway.) May 3rd. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

- ELECTRIC STORAGE SYSTEMS. C. F. Kettering. 3,791. February 16th. (May 22nd, 1911.)
- TRANSFORMATION OF DIRECT CURRENTS. Akt. Ges. Brown, Boveri & Cie. 6,660. March 16th. (March 17th, 1911.)
- COMBINED INTERCOMMUNICATION AND PARTY LINE TELEPHONE SYSTEMS AND THE LIKE. Sterling Telephone and Electric Co. (Telephon Fabrik Akt.-Ges. vorm J. Berliner.) 6,680. March 16th.
- ELECTRIC ARC FURNACES. E. C. R. MARKS. (Patent Purchasing Co.) 8,791. April 13th.
- TELEPHONY. S. G. BROWN. 9,179. April 18th.
- ELECTRIC CABLES. Western Electric Co. (Western Electric Co.) 9,909. April 19th.
- SYNCHRONOUS DYNAMO-ELECTRIC MACHINES. E. ROSENBERG. 9,644. April 28th.
- DIRECTION "TELE-TALK" OR INDICATING APPARATUS. J. C. CLARKE and CHADBURN (Ship) Telegraph Co. 9,673. April 24th.
- AUTOMATIC WIRELESS ALARM. S. D. WILLIAMS. 9,882. April 26th.
- PHASE COMPENSATION OF DYNAMO-ELECTRIC INDUCTION MACHINERY. Akt.-Ges. Brown, Boveri & Cie. 10,115. April 29th. (April 29th, 1911.)
- ELECTRIC FLAME ARC LAMPS. F. W. E. SCHUER. 10,496. May 8th.
- SUPPORTING OF INSULATORS FOR ELECTRIC CONDUCTORS. E. C. R. MARKS. (Reinert.) 10,605. May 7th.
- CARVING OF METAL-SHEATHED ELECTRIC CABLES THROUGH BULKHEAD AND SIMILAR PARTITIONS. Metal Jointing Co., Ltd., and T. HARDE. 10,989. May 8th.
- MANUFACTURE OF METALLIC FILAMENTS FOR INCANDESCENT ELECTRIC LAMPS. J. A. SCUDLAR and Dick, Kett & Co. 11,455. May 14th.
- LUGS OF ACCUMULATORS. J. C. WOOD. 12,718. May 30th.
- ELECTRIC SWITCHES FOR MULTIPLE-UNIT CONTROL SYSTEMS. P. S. TURNER. 13,740. June 12th.
- RECEIVERS FOR PRINTING-TELEGRAPH SYSTEMS. G. S. HILZ. 14,881. June 25th.
- ELECTRIC BRAKES FOR TRAMWAY and LIKE VEHICLES. P. S. TURNER. 15,023. June 27th.
- TELEGRAPHIC APPARATUS. H. KNUDSEN. 15,591. July 3rd.
- ELECTRIC SWITCHES. British Thomson-Houston Co. and J. M. WALLACE. 15,776. July 5th.
- KEYBOARD-CONTROLLED ELECTRIC ILLUMINATED SIGNS FOR ADVERTISING AND THE LIKE. J. W. COOK. 16,765. July 18th.
- METHOD FOR THE PRODUCTION OF FILAMENT HOLDERS FOR METAL-FILAMENT ELECTRIC INCANDESCENT LAMPS. M. BAUM. 16,865. July 19th.
- MAGNETIC SPEEDOMETERS. J. K. STEWART. 17,492. August 2nd.
- ELECTROMETERS and APPLIANCES FOR INDICATING and MEASURING VARIATIONS IN ELECTRIC POTENTIAL, ESPECIALLY IN EARTH POTENTIAL, and a METHOD OF APPLYING THE SAME FOR METEOROLOGICAL PURPOSES. A. H. MAURICE. 18,065. August 6th.
- MOTOR-ACTUATED EXTENSIBLE LADDERS FOR FIRE ESCAPES and THE LIKE. "Cedes" Electric Traction, Ltd., and E. CHIFFORD. 20,244. September 6th.
- ELECTROMAGNETICALLY-OPERATED SWITCHES PARTICULARLY ADAPTED FOR CONTROLLING ELECTRIC MOTORS. E. SCHÄTTER. 20,247. September 6th.
- ELECTRICAL PROTECTIVE APPARATUS. S. de Stélan. 22,129. September 28th.
- OSCILLATING SPRING CONTACT FOR OPERATING ELECTRIC BELLS and SUCH LIKE APPARATUS. F. BURR, jun. 22,311. October 1st.
- TIME LAG DEVICES FOR ELECTRIC SWITCHES and OTHER APPARATUS. M. J. RAILING, J. STRACHAN and H. J. COSTES. 22,509. October 3rd.
- ELECTRICAL EGG TESTER. H. B. GARNHAM and A. E. GARNHAM. 22,603. October 4th.
- ELECTRIC DISCHARGE APPARATUS. Q. MAJORANA. 23,024. October 9th.
- PARALLEL WINDING OF SYNCHRONOUS MACHINES. E. C. R. MARKS. (Akt.-Ges. Brown, Boveri & Cie.) 24,097. October 22nd.
- MEANS FOR SETTING THE TIMING GEAR OF ELECTRICAL IGNITION SYSTEMS. J. E. STUEGGEN. 26,443. November 18th.
- CIRCUIT ARRANGEMENTS FOR THE RECEPTION OF SIGNALS TRANSMITTED BY MEANS OF ELECTROMAGNETIC WAVES. O. IMRAY. (Compagnie Generale Radiotelegraphique.) 28,070. December 5th.
- ELECTRIC CURRENT TRANSFORMERS. E. C. WESCOTT. 28,967. December 16th.

1913.

- HOT-WIRE ELECTRICAL MEASURING INSTRUMENTS. Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges.) 943. January 13th.
- ELECTRIC VULCANISERS FOR TIRES. B. KISSHAZY. 1,579. January 20th.
- ANTISETTLE GUARDS FOR TELEPHONE MOUTHPIECES. C. V. FULLER. 4,704. February 24th. (February 28th, 1912.)
- TELEPHONE SYSTEMS. Sterling Telephone and Electric Co., Ltd. (Telephon Fabrik Akt.-Ges. vorm J. Berliner.) 7,693. March 1st. (Divided application on No. 6,580 of 1912, March 16th.)

**Tramway Accidents.**—In the Parliamentary Papers, Mr. Watt asked the Secretary for Scotland whether, before instituting any Commission to consider means of reducing the number of accidents in the large cities of Scotland, he proposed to wait for requests for such Commission from the Town Councils of such cities; whether he was aware that the tramcars of such Corporations were permitted to run up to 16 miles per hour, as e.g. in Glasgow; that this regulation precluded the Corporations from insisting on the 10-mile limit of motor-cars; and that these facts caused unnecessary risk to the public; and whether he would introduce legislation limiting the speeds of vehicles in towns in Scotland? Mr. McKinnon Wood replied that he was not satisfied as to the need of special inquiries into the matters to which he referred, though he was, of course, prepared to consider requests from Town Councils or other quarters. He must not, however, be taken as assenting to the implications conveyed in the question.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

MAY 23, 1913.

No. 1,852.

## ELECTRICAL REVIEW.

## STANDARDISATION RULES.

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THERE is a community of interests of manufacturers and users in the electrical industry, as in all other industries, and any standardisation rules for electrical machinery can, therefore, scarcely be considered as entirely satisfactory unless they are the result of what has been so well termed sympathetic co-operation between the purchaser and the producer. Such being the case, the rules provisionally adopted by the British Electrical and Allied Manufacturers' Association, published in this issue, and which represent much strenuous labour on the part of the Committee of the Association appointed for that purpose, can only be regarded as an expression of the reasoned views of the manufacturers on this subject of deep interest to us all. Doubtless the rules will be most useful in preparing tenders, and they should, moreover, prove of material assistance to the Engineering Standards Committee in the revision of their Report No. 36, Standards for Electrical Machinery, now out of date. As the B.E.A.M.A. is officially represented on the Standards Committee, it is just a question as to whether the possibility of confusion which may arise from the issue of the rules, at the present juncture, might not have been entirely obviated if a few words by way of explanation had been added to the somewhat enigmatical preface. The economic advantages of standardisation have become increasingly recognised of late years, more especially in this country, but it would be a little unfortunate if every Association were to issue a set of rules on its own account.

At the same time, competition both at home and from abroad, makes it most desirable not only that the cost of production should be reduced, but that a uniform and satisfactory basis of rating electrical machinery should once and for all be established, with no more delay than is necessary for all parties concerned to be duly consulted.

The I.E.C. has recently brought together many eminent electrical engineers of various countries, our own included, who are discussing this very subject, and if they succeed in arriving at a satisfactory solution, as we sincerely hope they will, much simplification in commercial transactions will result, with consequent benefit to both home and foreign trade. Our esteemed contemporary, the *New York Electrical World*, in its issue of May 10th, calls attention to the revised rules of the Verband Deutscher Elektrotechniker, remarking that the German rules give evidence of considerable progress over the superseded rules, and of the increasing possibility of being able to look forward to the time when one set of standardisation rules for electrical machinery will be recognised universally. There appears, in fact, to be a very general desire on the part of the Standardising Committees of the different countries to do their best to bring their national rules into line, as far as possible, with the suggestions put forward by the I.E.C. The present views of the British manufacturers, however, as expressed in these provisional rules, appear to differ considerably from the inter-

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION.

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national proposals in such fundamental points as the limits of temperature permitted and the method of measuring them. This question of permissible temperature is so intimately connected with that of the method of rating, to say nothing of the influence of the time element in regard to the capabilities of a machine, and the method suggested by the makers for dealing with this subject is so complicated, that considerable enlightenment and simplification will be necessary if the recommendations are to find acceptance with consulting engineers and users generally.

The unsatisfactory and incomplete character of the report on British Standards for Electrical Machinery has been drawn attention to on more than one occasion, but it should be remembered that the B.E.A.M.A. was not in existence when the subject of the report was under consideration. Now, however, the problem is, happily, much simplified, and although many divergent interests may still exist and necessitate a certain amount of compromise in order to be reconciled, we are sure that, with the present rules of the Association as a basis, the issue may safely be left in the hands of the Engineering Standards Committee to be dealt with in a thoroughly impartial and satisfactory manner.

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## CHINA.

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THE smashing of idols in ancient temples, the lopping off of pig-tails—a Manchu heritage, and therefore to be banned—and the encouragement of a wiry crop in place thereof, an appeal to the nations of Christendom for prayer, and the conclusion of negotiations for a 25 million loan! Here we have indications of the astounding changes that are taking place in parts of the great Chinese Empire. They almost take our breath away with their suddenness. The new sentiment may not be unanimous, and there may be many troublesome days in store—has not Sun Yat Sen very grave suspicions as to the purposes upon which Yuan Shih-k'ai and his satellites intend to spend those Christian millions when they get them?—yet they are the outward expression of a very deep-rooted and wide-spread desire to throw off the yoke and get into line with other nations. The educated minds of China have not lived in the States and among Western nations, nor observed the progress of Japan, without learning how far behind they are, considered from the point of view of civilisation. How well the lesson has been learned is observed in the thoroughness with which it has been disseminated far and wide promoting the desire to move forward. We have mentioned the throwing off of the yoke, but the bit and bridle of reactionary forces and of internal jealousies, rivalries and strife will prevent the leap forward being too hasty. Japan may to-day be engaged in thorny controversy with the States respecting the ownership of Californian land by Japs, but China, at any rate, is not quite yet in a position to frighten Europe with its Yellow Peril fear. For the present, yes, and for a long time to come it will be the case, China will need our help. We are going to send it in part in the form of millions of money, but we have got to do it in other ways too. We heard of an enterprising little American, who, on finding his way into one of the old musty temples last year or the year before, pulled himself up to his full height, waved his hand round toward the 500 idols and remarked to an English missionary present:—“*We're* going to clear out the

whole bally lot of 'em!” Well, there is nothing like being ambitious when there is opportunity, and while we, of course, wish well to any such movement, we are here more immediately concerned with the necessity for the British manufacturer saying with an equally determined, but, perhaps, more diplomatic air: “*We* are hoping to bring our things into China, so that the people of this vast Empire may, with the aid of British manufactures, take fuller advantage of the enormous resources that await development.” We do not doubt that the money now asked for will be found, and we should like an assurance that a fair proportion of it will be spent with us again; but that is not the British method, and so we have got to scramble with the other manufacturing and exporting nations of the world, initiative, enterprise, quality, and so forth all entering into the game. We are not going to win our way in China all at once, nor are any of our competitors. They have a great reverence for the past in that country, and their estimation of the value of time is altogether different from ours, so that it will be long before they adopt our old saw about “Procrastination,” or the slogan, “Do it now!” They are not going to be driven by anybody, and this, to our mind, is one of the redeeming features of the situation considered from the British trade standpoint.

But it would be a suicidal policy for the British trader to fall into line with the Chinese and say, “any time will do.” If they are not in a hurry, and have no respect for undue haste, the truth remains that the awakening that has been proceeding, has created a need, which is fully recognised by the many thousands of modernised minds, for facilities characteristic of civilised countries, and those who are at hand, ready and willing to supply that need, will stand to gain.

They must have railways, and they talk of the construction of 60,000 miles in a record time, seemingly belying in this their reputation for slowness, and, if their dreams or anything like them are carried into effect, “foreigners,” be they British, American, or German, will all be required to co-operate, and industrial nations may look for busy times, for only a small proportion of the equipment can, so far, be provided from within. This slowness characteristic, after all, has to be considered in a comparative sense. Where population is counted by hundreds of millions, and a few millions more or less killed in the course of a revolution are of little account, and Chinese life is so prodigal that little store is set by it, what would it trouble the Empire, if it had the money, to put a million or so labourers to work on railway construction? The individual rate of working may not compare with ours, but in the bulk the pace would be rapid. When they have determined that the correct time and opportunity have arrived for moving, there will be no mistaking the movement. What will follow railways is a big subject, and we have ventured to indicate it in the merest outline in these pages on several occasions. What is a railway for but to promote movement of people and of goods? Give China ready money enough to keep the peace and to construct railways and telegraphs, and she will herself go a long way toward the development of her resources; the cultivation of all sorts of trade and traffic will lead to the release of wealth, and the progress of civilisation will encourage her people to take enlightened views as to industry and industrial occupations, and forces now dormant will reach unparalleled proportions. But in and through all of this, it is imperatively necessary that British prestige be kept well to the fore, that respect for British firms and British manufactures be strengthened, that the leading men, both in and out of Government circles, be inspired with the fullest confidence in us, that the creation of German and American sympathies be not permitted without some counter-influence being strongly at work from British authorities, Governmental, financial and trading.

When competitors rub shoulders in entering the “Open Door” to a ripening harvest field, a modern equipment and a diplomatic but determined carriage and gait will do more for British industry than a Ruth-like gleaning after the labourers of Boaz have gathered in the bulk of the crops.

We have frequently referred to what has been done at Hong Kong University in the hope of building up British engineering reputation at that important centre of Chinese

educational influence and of distribution, and we mention the matter again on another page to-day—we hope the latest appeal may not pass unheeded by our electrical manufacturers. We have also referred to the promotion of the British Engineers' Association and its activities, and we wish this organisation every success. But it can only rise to the occasion with fullest efficiency if the present propaganda work among firms in the provinces lead to a large increase in its membership. It asks for the co-operation of the entire British engineering industry, which will mean that it will have a commensurate financial backing, without which it cannot efficiently cope with so vast and difficult a field any more than the Chinese can pay debts, keep the peace, or build railways without loans. Meetings have lately been held at Sheffield and at Manchester, at which the objects of the Association have been well stated, and a number of additional firms have joined. We propose to revert to the arguments used in a later issue. Meantime, we can only imagine that it is because our people have not yet fully grasped that in China there is what may prove to be "the biggest market the world has ever known"—to use the words of Captain FitzHugh, the Association's Commissioner in China—that they have not more readily accepted the invitations to co-operate with an organisation which aims in various ways at strengthening the British trade position there.

60,000  
Employés;  
Profit on Sales,  
£1,630,000  
per annum.

DURING the past few months we have had through our hands the annual reports of many of our electric manufacturing companies, and though here and there we have, with disappointment, read of unsatisfactory results, these have been exceptional, and due to labour troubles. In the majority of cases there was plenty of work to do, and better profits were earned, while the outlook suggests a continuation of satisfactory manufacturing activity for, at any rate, some time to come. But in all these doings we are only able to think in tens or hundreds of thousands, and the reader may be pardoned if he feels that he has been entertained with comparatively small affairs when he contemplates the gigantic proportions of the business conducted by some of the Continental and American industrial electrical trust organisations whose operations and results we record from time to time. The position in this country is very different from that obtaining in the United States, with its vast territory and larger population, and all that those two things mean, and with its fiscal policy—now undergoing a change—that we do not, of course, refer to the results secured by a Brobdignagian American concern as in any way indicating what ought to have occurred in the British Isles with their naturally more limited home demand. We give the information that follows rather as a matter of interest showing the success of our American cousins in their own sphere, while it may also be suggestive of what *may* happen in the course of years in Canada—whence our own and other people are flocking in their hundreds of thousands. The General Electric Co., of Schenectady, and other centres in the United States has, of course, a hold on many interests, and it has grown remarkably, in spite of its early tribulations, as anybody who has watched its progress for 20 years and more, as we have done, will have noticed. It has, apparently, quite outgrown its difficulties, and being very strong financially, as well as very active in certain foreign markets, nothing seems now to be able to hinder its progressive course.

Twenty years ago, the company's plants stood at well under £800,000 value in the books. During the intervening period, £11,600,000 has been expended for such purposes, and £7,470,000 has been written off, leaving the book value of the plants at December last at £4,911,000.

The past year's outlay on patents and patent matters was £108,000, and this has been charged to profit and loss,

leaving the patent account standing at one solitary dollar. What a deep sigh reaches us from much nearer home!

The number of employés in factories, offices, and subsidiary companies is now in excess of 60,000, and excluding three departments dealing in lamps, there were 466,895 orders handled in the year 1912.

Presumably, the holders of stock to-day are reaping the benefit of the company's financial measures in early years, for last October there was a stock dividend of 30 per cent. paid out of surplus, "for the purpose of reconquering the stock-holders in part for dividends passed or reduced during the years 1893 to 1902." This distribution was in addition to the 8 per cent. dividend for the year. The total stock issued now stands at just over £20,000,000.

The figures relating to the year's operations are remarkable, but it may be mentioned that the businesses of the Fort Wayne Electric Works, the Sprague Electric Co., and the National Electric Lamp Co. are now merged into the G.E. Co., and their transactions appear in the report for the first time. These circumstances also account for the increase in the factory floor area from 8½ to 12 million square feet in two years. The value of orders received during 1912 was £20,600,000, and the "amount of sales billed" was £14,000,000. Profit on sales was £1,630,000, with £1,000,000 income from other sources. After the reduction of interest, &c., and dividends paid, there was available to carry to the surplus account for the year a very respectable sum, *i.e.*, £1,280,000. As the surplus previously stood at close upon £6,000,000, this item, after paying the special stock dividend, which absorbed between £4,000,000 and £5,000,000, still figures at £2,400,000.

Notwithstanding the above magnificent showing, President Coffin remarks that competition has continued to increase in severity during the year, "with the result that the percentage of profit realised from the sales of apparatus has materially diminished."

One passingly wonders who are the courageous competitors who can compel so big a concern to lower its prices. Clearly, in the States as in Germany, the building up of huge concerns does not stifle the undercutter nor do away with smaller enterprises when there is a large field. Still, we would not grumble at competition if we could make 8 per cent. per annum and a supplementary stock bonus of 30 per cent.

This excursion among American millions is useful by way of a change, and we must console ourselves with the less imposing figures characteristic of our large number of smaller, though not necessarily, on that ground, less satisfactory, manufacturing concerns.

We believe that there may be a better chance for British electrical manufactures even in the States before long. Some say that the chance now is better than we know. It would be interesting to see some States' selling prices placed in parallel columns against those of as nearly as possible similar British articles.

It may not have pleased some people to see the order for the Victorian railway electrification train equipments go out of this country; but then we may set off against this the ordering here of big turbo-generator sets for service in the States. "Exchange is no robbery."

The General Electric Co., of America, not only manufactures on a colossal scale, but it has stocks and bonds in other undertakings to the tune of close upon £5,000,000, and it is not difficult to see that these undertakings, in addition to yielding a fine return by way of dividends, also bring much business to the Schenectady and other factories. The same sort of thing has also been observed in Germany, but who will use the word success in regard to our largest efforts of a somewhat similar kind in the United Kingdom? Perhaps, however, we may take courage from the memory that even Schenectady had its nine lean years (1893 to 1902) and hope to think our profit in millions in future years. A point that must not escape us, however, is that those "lean" years in the States were our "fat" years, for we were then busy with new tramways and electricity works. On the other hand, our electrical industry 15 or 20 years ago really *was*, in a comparative sense, in its infancy. To-day we are told that it has a capital of 500 millions invested in it, and remembering that fact we are humiliated to have to continue to ask for £100 six times over for the Electrical Trades Benevolent Fund.

## REVIEWS.

*The Law of Electric Lighting, Power and Traction.* By the late JOHN SHIRESS WILL, K.C. Fourth Edition by W. E. TYLDESLEY-JONES, Barrister-at-Law. London: Butterworth & Co. Price 27s. 6d.

To adapt an old simile to modern requirements, a large number of kilowatts have passed through the cables since the third edition of the late Judge Wills's book made its appearance. It may be said of the fourth edition, for which Mr. Tyldesley-Jones is responsible, that under his capable editorship the book has grown in wisdom. If it has grown as much in wisdom as it has grown in weight, it will be of enormously added value to the profession.

That the law relating to electricity is fully deserving the serious attention of commentators will be appreciated when one remembers the advances recently made in the application of electricity to the varied needs of a prosperous nation. During the period which has elapsed since the last edition of this work these developments have been very remarkable. As Mr. Jones points out in the preface, the capital involved in electric supply and electric traction undertakings has now assumed enormous proportions. Local authorities in London and the provinces have been authorised to raise loans amounting in the aggregate to £45,704,059 for the purpose of such undertakings, and to borrow £45,903,038 for electric traction, whilst the total capital of electric supply companies exceeds £52,532,000, and of electric traction companies £165,516,000.

During the same period of 10 years important developments have taken place in the law regulating the supply and use of electricity. The Electric Lighting Act, 1909, has been passed, giving effect to many of the recommendations made by the Joint Committee presided over by Viscount Cross in 1898, and enacting, with regard to all electric supply undertakings, provisions which had previously been frequently inserted in the special Acts of particular undertakers.

It is to Mr. Jones's treatment of this new measure that one naturally turns in order to estimate his work at its true value, in view of the fact that his comments must in the nature of things be wholly independent of the views of any of the former editors of the work.

We may say at once that the notes to the various sections of this Act are admirably clear and concise, and are well calculated to aid the non-legal reader to understand its provisions with considerable ease.

The contents of the work may be thus briefly described. An introduction deals in a descriptive form with the Electric Lighting Acts as a whole; licences; provisional orders; electric supply undertakings in the County of London; Power Acts, and Factory Acts. The body of the work contains the statutes in force relating to electricity, with numerous notes and comments; a suitable form of provisional order, power Bill, &c., and rules and regulations, forms of account, &c.

A most useful feature of the work is to be found at pp. 309-313, where the Editor has set forth certain special clauses which are sometimes inserted in a provisional order or confirming Act. These are collected from various provisional orders now in force. What is known as the *Bermondsey clause*—providing for revision of prices so as to balance revenue and expenditure—is here set out at length. Another most useful form is the *Somerset and District Electric Power Act, 1903.*

An exhaustive index completes a work which, in its new form, can be heartily commended to the notice of the electrical and legal professions.

*Der Elektrizitätszähler Seine Wirkungsweise, Konstruktion und Praktische Handhabung.* By R. ZIEGENBERG. Berlin: Hermann Meusser. Price 10 M.

This book gives a comprehensive view of present day electricity supply meter practice and is evidently the work of an expert who is able to lay stress on the essential differences between the numerous types, instead of merely collecting a series of uncritical descriptions.

The whole ground, including the important question of cost, is covered, but, owing to the moderate dimensions of the book, a good deal of compression has been found necessary. The information given, however, is sufficient for readers having some practical experience of meters.

The first two chapters deal with electrical measurements generally and with direct-reading ampere, volt and watt meters. The remaining six chapters are devoted to electricity supply meters proper, and deal, respectively, with (1) the various principles available for electrical energy measurements; (2) detailed descriptions of the more important modern meters for D.C. and A.C. work; (3) special tariffs and the meters used with them; (4) the manufacture, testing and checking of meters; (5) legal regulations in Germany affecting the use and maintenance of meters; and finally (6) practical points affecting the installation and reliability of meters, with a useful table giving the most common faults to which meters are liable and the methods of curing them.

The book should be a useful one both for students and those in charge of meters.

*Foundations and Machinery Fixing.* By F. H. DAVIES. London: Constable & Co., Ltd. 1912. Price 2s. net.

In these days when the fixing of engines is thrown, by some firms, upon the responsible shoulders of a bricklayer's labourer, a book on machinery fixing should attract attention. Fixing machine foundations to-day is done by the aid of a spirit level, a few wedges and a lot of slushy grout. The more elderly of us were brought up to fix metal upon solid stone. Foundation plates were rubbed to and fro on the stone surface, tested by level, the blackened rubbed stone dressed down at the higher ends, or corners, the bedplates again let down and rubbed and levelled, and the stone dressed again and again until at last the plate was level all ways, and the stone was pretty well iron-blackened all over. Concrete and cement have simplified and cheapened the art—perhaps improved the job—but is it quite fair that engine builders, because cement is used, should decline their fixing responsibilities as they do to-day? The author of the book before us is of the new school, and says that stone scarcely merits consideration, and he is quite right to-day, for heavy Ashlar masonry has gone out of use, and it is better to devote space to concrete and its mixing, and to grout and the manner of its putting in.

The author begins with actual construction of foundations. It would be interesting just now to know what is the pressure per square foot of the foundations of St. Paul's dome.

Is it the 3 to 4 tons here tabulated for gravel, or the 4 tons for London clay? St. Paul's has stood for 250 years, and these more heavily loaded parts have sunk, possibly, 4 or 6 in. more than adjacent parts with consequent shear through vaultings. After all, it is not so much the pressure per square foot which matters, as the equality of pressure on every pier, and the avoidance of lateral escape of compressed material. Sand, held in, cannot be crushed, but a sand foundation can be wrecked by a child.

Foundations weigh, we are told, from one and a half to five times the weight of the machine they carry. Such extremes as this, derived from actual practice, are, if good samples in the cases they are drawn from, only a proof that the design of foundations cannot be taught, but must be the result of experience and engineering intuition. Actual examples are given in tables which, however, say nothing of the earth beneath the foundation. There are no fewer than 13 such tables of steam and gas and oil engine foundations.

The author speaks up for sharp sand as opposed to sand much water-worn. Opinion to-day is, however, much less inimical to water-worn sand. It has often the merit of being much cleaner than pit sand, and is usually sound stuff to which good fine-ground cement flour will adhere firmly. The rule for cement mixture is deficient.

The water to fill up a given measure full of the heavy aggregate is the measure of the sand to be used, and the water necessary to fill up a measure of dry sand is the minimum volume of cement to be used with that sand, and this volume should be increased at least 10 per cent.

It may be true that sand is not essential to the making of concrete and that it is only employed to save cement. But the

same could be said of the broken stone—the aggregate generally. A foundation might be made entirely of cement, but the cost would be greater. Actually the aim is to use so much cement that every bit of stone or sand shall be separated from any other bit by a thin wash of cement. The best concrete would be that made by tumbling the heavy aggregate with cement sufficient to dust it all over, doing the same with the dry sand and all the rest of the cement; then tumbling the whole, slowly adding the necessary water. Hand-mixing rarely extends to more than three turns over dry followed by other turns over with water in some bulk—a mistake. Concrete should be machine mixed, water being added in fine spray. Really well-mixed concrete may be merely damp enough to flush up wet on the surface when rammed.

In brick-built foundations it does not really matter that the cement joints should be as thin as  $\frac{1}{4}$  in. It is probable that with a well-wetted brick that will not perish the cement mortar, a half-inch joint is better, for it is a good brick that will not fail sooner than the cement joint. A brick-in-cement wall is monolithic if properly built, and the grouting not skimped, and a half-inch joint will better let in the grout than a thinner space.

Nor in hoop iron bonding does it now seem necessary to tar and sand the hooping. If free from grease the plain iron, if rusted to a clean surface free from scale, will stick to, and be protected by, cement mortar. On the subject of vibration, the author shows his hand in favour of allowing a moving machine to move with its foundation under vibratory influences. And why not? Mount an engine on a foundation with a spherical base and keep the block free laterally, and there would be no transmitted vibration. But could the block be prevented from walking away? Probably a layer of thick felt would admit of the equivalent effect of a spherical base surface and also provide against walking off. If a thing is vibrating, it is at least useless to try to stop it by lateral struts. A foundation on cannon balls will prevent lateral transmission of vibration, but the to-and-fro pitching which sets up pumping in a wet soil can only be met by allowing the whole mass to rock. Pure up-and-down movement of vibration cannot, however, be countered unless by a sufficient interposed elasticity of springs, cork, felt, or other agent. This is quite a good book.

*Wireless Telegraphy.* By H. T. DAVIDGE. London: Percival Marshall & Co. Price 6d. net.

The series of booklets to which the present volume belongs has already established a high reputation which should be further raised by Mr. Davidge's work. The author succeeds in presenting a simple and accurate explanation of the fundamental features and methods of wireless telegraphy while adhering to scientifically and technically correct terms. The preliminary chapter follows the usual lines of reviewing earlier systems of wireless communication, enumerating certain of the properties of ether as utilised in wireless telegraphy, and stating the relationship between velocity, frequency and wave length; the chapter closes with an account of the chief properties of Hertzian waves.

Chapter II deals with Essential Apparatus, and describes the construction and applications of condensers in conjunction with inductance coils; the calculation of the natural frequency of an oscillating circuit (pure capacity and inductance), and the phenomenon of damping. This leads to an elementary consideration of tuning—the mechanical analogy of the tuning fork being cited. The characteristic properties of high-frequency currents and the principle of the electric transformer are also considered.

In connection with Sending (Chapter III), power measurements, the induction coil, and improved forms of contact-makers are briefly considered, and the arrangement of small and large transmitting circuits and aerials is described and diagrammatically illustrated. With reference to the half-tone blocks of aerials, in this and in most other "wireless" works, we would suggest that the aerial wires should be inked over before the block is made; usually their course is barely visible on the original print, and it is quite exceptional to see any trace of them on the block made from the latter.

In the well-known equation:  $n \times \lambda = 300 \times 10^6$ ,  $n$  represents the frequency in cycles per second and  $\lambda$  the wave length of the oscillation in meters, but why not adopt the more convenient form:  $n, \lambda (n, \lambda) = 300$ , in which  $n$  represents the frequency in kilocycles (key.) per second, and  $\lambda$  represents the wave length in km. (a most convenient unit for all practical purposes)?

The receiving chapter deals with coherers and magnetic, electrolytic, and crystal detectors briefly and clearly, but without going into constructional details or instructions and without considering improved forms of the various detectors: space limitations, of course, forbid such full treatment, but it would have been well to have included particulars of one or two of the receiving sets which have been specially designed for use on fishing vessels and in receiving time signals, &c.

In Chapter V, the characteristic features and relative advantages of the Telefunken, Poulsen and Lepel systems are very briefly stated and, in Chapter VI, the author passes on to station working. Under this heading are described a number of accessories and refinements used in modern wireless station circuits; these notes are continued in the next chapter where are considered recent improvements in tuning and directive working and the effects of daylight and the nature of the surfaces over which the radiations pass. The other miscellaneous points dealt with include secrecy of working, regulations for wireless communication at sea, time signals and wave meters. The final chapter deals very briefly with the requirements and elementary arrangements of wireless telephony and its circuits. The production of the work is excellent, and the author has wisely arranged for the Morse code to be printed clearly on a fly-leaf which can be detached for mounting.

*An Elementary Course of Magnetism and Electricity.* By C. H. DRAPER. London: Blackie & Son. Price 2s.

This little book forms Section VII of the author's *Course of Physics*, and is issued separately for convenience of use. It claims to be a course "suitable for those commencing the subject," and is "intended chiefly for the laboratory." And so, to justify its first claim, we find it providing in the first chapters a variety of simple experiments up to and including the mapping of magnetic fields. Then, after warning us that "the exercises in this chapter are of a less elementary character," we are introduced to the mysterious conception of magnetic moments and their comparison by an approximate method: and although we eventually arrive at the Law of Inverse Squares in the last chapter on Magnetism, we are even then only permitted to verify it approximately!

Electrification by friction, electrical machines, and condensers, are treated in a similar manner, the last paragraph on this subject containing the first mention of electric lines of force and the electric field.

Early in the chapter on Voltaic Cells, the author finds it necessary to insert an illustration of a terminal. We would suggest that the draughtsman would have been better employed in improving the perspective of fig. 413.

The chapters on Resistance and Ohm's Law are straightforward and much more satisfactory than the rest of the book, but even in these the diagrams are in many cases little better than useless. The diagrams are, in fact, the worst feature of the book, and setting aside the fact that the electric telegraph is not exactly a suitable topic for a laboratory book, the diagrams illustrating this subject deserve severe criticism. We feel sure that fig. 409 could be found in many electrical books over 20 years ago, and equally sure that the "Telegraph Circuit" of fig. 410 would puzzle the most precocious schoolboy who attempted to discover its meaning.

Such a book may prove useful to some people, but we venture to think that most teachers of electricity will not be impressed by it.—P.K.

**Amendment of Patent.**—MESSRS. KORTING AND MATHIESEN A.G. have applied for leave to amend the specification of letters patent No. 22,342 of 1904, for improvements in arc-lamp electrodes. (*Ill. Off. Journal*, page 697.)

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

## The Mutual Protection of Engineers.

Recently in the experience of the staff of a large electrical manufacturing firm in the Midlands, an occasion has arisen demonstrating the urgent necessity for an organisation for the mutual protection of the engineers associated with such firms.

The situation has arisen as a result of the amalgamation of such firms under the British Electric Manufacturers' Association. This body, forming the nucleus of a gigantic trust, has for its purpose objects other than the control of prices. By their agreement it is, for instance, possible for them to prevent an engineer, who may have displeased those in authority, from obtaining employment in any constituent firm.

The realisation of this power has resulted in the proposal of a programme for curtailing the privileges and material compensations of our profession, as follows:— Extension of hours of employment of staff; reduction in holidays of staff; abolition of payment during holidays; reduction in status of staff engineers.

The precise instance referred to above as emphasizing the disabilities under which engineers are labouring, related to the treatment of the staff by the management on the occasion of the introduction of a system always resisted by English engineers.

Both the shops and the offices were similarly affected, but while an explanation was afforded to the shops, their co-operation invited, and a bonus offered as a compensation, not only were none of these extended to the office staff, but when a diffident petition was submitted to the management expressing their views, it was ignored and unanswered.

The strong feelings aroused by this high-handed treatment were recognised by the management, who offered a belated explanation of the introduction of the system to which objection was taken, but plainly intimated that the difference in the treatment given to the staff and the shops was because of the fact that in the former case they had to reckon with individuals only, whereas in the latter there was a strong and united body of men to deal with. This is a question the solution of which lies in the hands of the younger members of our profession.

It is not suggested that anything in the nature of trade unionism should be aimed at, but rather societies of the nature of the Law Society or the Medical Association. Such a society would not necessarily adopt an attitude of hostility to the managers of the Trust, but would protect individual members from any harsh and arbitrary abuse of the power with which such managers are vested.

You would be doing a real service to the profession by opening your columns to a discussion on the matter, and so assisting in the initiation of a movement which will be as far-reaching as it is inevitable.

It is quite possible that a new Society is unnecessary, since the Engineering Institutions, in which we hold controlling power, might be induced to extend their functions sufficiently to consider the material interests of their members.

Only an Engineer.

May 16th, 1913.

## The Prevention of Accidents in Electric Lifts.

I am obliged by Mr. A. R. Leaver's reply to my letter, but apparently he does not appreciate the difficulties which must be overcome before a lock can be constructed which is really safe, and, because I have had every-day experience with lifts for a good many years past, I disagree absolutely with his statement that combined electrical and mechanical locks have been successfully applied to lifts for several years past.

I agree with Mr. Leaver that it is a matter of simplicity to connect the electric portion of the lock with the controller in such a manner that the motor cannot be started unless all the gates or doors are closed, and this is, naturally,

the first idea which would occur to one when locking gear is required for a lift. But what about the mechanical portion of the locking operation? Neither mechanical nor electrical locking is sufficient by itself, and difficulties arise when an attempt is made to combine these actions so that the following conditions are fulfilled:—

1. Cage cannot move until the gates are both mechanically and electrically locked.

2. No gate can be opened unless the current has been cut off from the controller.

3. No gate can be opened unless the cage is opposite the floor.

The second condition is most important, for, as pointed out in my previous letter, it very often happens that intending passengers are waiting at various floors for the lift, who, by opening the gate, stop the cage when same arrives opposite their particular floor. Suppose, for example, the case of an automatic push-button lift (fitted with the ordinary modern locking gear) which has been called by a person at the bottom floor, and also suppose that, as soon as the cage has commenced to move, it is also required by another intending passenger who is waiting at the floor above. If the person on the upper floor uses the lift much he will soon find out that he can, by keeping pressure on the gate or door, open same as the lift passes, stop the cage by this means and appropriate same to his own use, instead of waiting until the person who first called the lift to the bottom floor has been served. Of course, this sort of thing may go on indefinitely in the case of a busy lift. The accident a short time ago in which the Duc de Lorge met his death, is one instance of the manner in which the proper operation of a lift provided with ordinary locking gear (such as Mr. Leaver appears to advocate) can be interfered with.

If your correspondent will refer to Patents 2,766 of 1905, 20,444 of 1910, 13,183 of 1911, and 26,802 of 1911, which fairly represent modern practice, he will find that in all cases the mechanical locking action can only take place after the cage has moved a certain distance from the landing. This locking action is accomplished by means of a spring-controlled lever, which can easily fail owing to the spring breaking or weakening, corrosion, or lack of lubrication, and in at least two of the above-mentioned locks, if the gate is not completely latched, the mechanical locking cannot take place, in which cases the lift could move away with the door not mechanically locked. As very often the lift door has the appearance of an ordinary room door, it can be seen how easy it is for a stranger to mistake the lift door for the proper room door, and, when the lock has failed, open the door and walk down the lift well.

Patent No. 2,766, of 1905, referring to doors fitted with switches and automatic catches operated by striker on cage, points out the various difficulties (such as making the electric locking and latching actions simultaneous) which must be overcome, but even in this patent the danger of the mechanical-locking lever failing has not been successfully obviated.

With due respect to Mr. Leaver's own experience with electric lifts, I venture to say that, judging from his remarks on the subject of locks, his experience has evidently not been sufficient to enable him to understand the various problems which arise in the design of lift safety locks, and which have only very recently been completely solved by but one type of lock.

W. J. F. Cooper.

London, May 19th.

Having inspected some hundreds of lifts by different makers, and having made a special study of the several locks used thereon and their failures, I have come to the conclusion that the absolutely safe combined electrical and mechanical automatic gate lock is yet to be invented. All automatic locks of this type have this vital failing, that on the gate being closed the control circuit is completed with the gate only latched, not positively locked, the locking device coming independently into action after the car has moved some distance away from the landing. Now these locking devices are generally operated by means of springs or by a gravity arm, and it is self-evident that

there is an element of danger here, for, should the springs break, as I have known them to do, or should the working parts not work freely for want of lubrication or through some other cause, the gate remains free to be opened when the car is away from that landing, and as your correspondent, Mr. W. J. Cooper, states, "is a veritable death trap." This is particularly so in the case of push-button lifts, where oft-times the lift wells are totally enclosed and the car cannot be seen from the outside. A person naturally under these circumstances, on finding that the door opens, steps into the well hole instead of the car, which should have been there, and the result is death or serious injuries. What is wanted is a combined electrical and mechanical lock which will positively lock (not latch) the gate before the control circuit is closed, the switch and locking device being so constructed as to be dependent on each other, so that if either should fail there is no possible chance of starting the lift away from the landing until the lock has been repaired. Seemingly this ideal lock cannot be made, for on reading a certain lift engineer's patent lock specification recently, I found it stated that the locking and closing of the control circuit cannot be done simultaneously. That being the case, I am under the impression that there is not existing an absolutely safe lock for lift enclosures.

W. H. Carroll.

London, E., May 19th, 1913.

### Electric Lighting Fittings.

With reference to the many catalogues and lists recently published, illustrating and advocating indirect systems of lighting, do you not think that this is a case of misdirection of energy? Why in these competitive days do we want to go round the corner, as it were, to illuminate instead of directing light to where it is wanted by the shortest route?

Surely it is possible to design some form of screen to protect the eye from the glare of naked light, and at the same time to direct the rays in the required direction. Indirect fittings certainly bring back pleasing memories of school days, of evening prowls with what we termed our moth trap (consisting of a large saucer of treacle with a night light spluttering in the middle of it), but in these strenuous days of "candle feet" and "as the inverse square of the distance," indirect lighting seems very much like running half a mile in the opposite direction and sprinting back in order to be in time to catch a train.

Why waste energy, either physical or electrical, in pushing against the competition of other illuminants an obsolete and notoriously inefficient form of lighting, which is bad enough when both ceiling and reflectors are clean, but when the dust settles, is hopeless?

H. A. W.

### Water Divination.

Your recent article on the "Dowsers" was somewhat crushing, but there are some big men on the other side. The late Sir Edward Fry, F.R.S., more than once successfully employed them to locate suitable sites for wells, and the late Marquis of Salisbury also gave evidence in their favour. The German Emperor believes firmly in their power after seeing how they were able to locate coins hidden underneath the carpets.

In 1909, the German Colonial Secretary officially "blessed" the divining rod of Herr Von Usler, who had been extremely successful in showing where water could be found in German South Africa. He indicated 600 sites, borings were made in 163 of these, and, as a result, 117, or 79 per cent., were successful.

The late Sir Henry Harman had similarly good cause to believe in them. Acting on *scientific* advice, at Horsham he spent over £1,000 in sinking wells, without any success. He then called in the "Dowsers," who indicated a spot where water could be found at less than 20 ft. A well was sunk, with the result that an immense supply was found at 15 ft. only.

Bohemia's health resort, Podiebrad, came into existence through the "Dowsers'" success in finding a lost well.

These are only a few instances on the other side, which, perhaps, explain why the Local Government Board also

show their faith in the water divining by allowing payments to be made for their services.

W. B. S.

[Despite the illustrious names arrayed against us, we are unblashed. The results of the recent tests showed that, as the Committee said: "Whatever sensitiveness to underground water may exist in certain persons, of which some evidence has been given, it is not sufficiently definite and trustworthily to be of much practical value. Moreover, the lack of agreement with each other shows that it is more a matter of personal mentality than any direct influence of the water. The diviners, as a rule, confine their attention to small streams of water, and as there are few places where these cannot be found they may well show a large percentage of success."

An examination of the diagrams given in the *Sanitary Record* clearly shows that the "indications" recorded by the diviners were absolutely haphazard, and bore no relation to any physical feature of the land whatever. People who can repose any trust in such performances must be lacking in the sense of humour.—EDS. ELEC. REV.]

## LEGAL.

### GLASGOW TRAMCAR ACCIDENT CLAIM.

A GLASGOW woman, who alleged that she was descending from the top of a car when it was suddenly started and she was seriously injured by being thrown to the bottom of the stairs, sued the Corporation, in the Court of Session, for £1,000. After the pursuer's evidence had been heard, the defenders tendered a sum and full expenses in settlement of the pursuer's claim. This tender was accepted.

### BATTERSEA BOROUGH COUNCIL v. THE COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.

THIS case on Tuesday came before the Court of Appeal, composed of the Master of the Rolls, Lord Justice Kennedy and the President of the Probate, Divorce and Admiralty Division, upon the appeal of the plaintiffs from the refusal of Mr. Justice Joyce, in the Chancery Division, to grant, upon the application of the plaintiffs, an injunction to restrain the defendant company from laying their electrical mains and conduits in Wandsworth Road, Nine Elms Lane, Battersea Park Road, York Road, or any other road, street or place within the Metropolitan Borough of Battersea.

It appeared from the statement of Mr. HUGHES, K.C., in support of the appeal, that the company, having already made connections between the various areas of supply and between those areas and their two generating stations at Clerkenwell and Wandsworth, now proposed to lay a further main between their area at Southwark and a portion of their Wandsworth area, this proposed main to run from their generating station at Wandsworth to a sub-station at Southwark in accordance with (as defendants alleged) the provisions of Sec. 4, Sub-sec. 2, of the London Electric Supply Act, 1908, which provided that "an authorised undertaker or a specified company may also, by means of electric mains, make a connection between any two or more areas which that authorised undertaker or specified company is authorised to supply, or between any such area and generating station of that authorised undertaker or specified company." The learned counsel contended that the natural meaning of Sub-sec. 2 was to give to the defendants power to make a connection where there was none existing already, but that did not give them the right to make any number of connections. The defendants did not claim that the proposed connection was a necessity, and the sub-section only gave them the right to make necessary connections.

MR. SYLVAIN MAYER followed on the same side.

MR. TYLDESLEY JONES (with him Sir Alfred Cripps, K.C.), in support of the decision of Mr. Justice Joyce, said that if his learned friends on the other side were right, it meant that a company would have to lay all the mains they would ever require at first, and that if the company had ever made a connection between two areas, their powers had gone, and the result was that they could not afterwards connect up their generating station with their different areas. He submitted that that was not the proper construction of the sub-section, and that the decision of Mr. Justice Joyce was right.

The parties agreed to treat the motion as the trial of the action.

In giving judgment, the MASTER OF THE ROLLS said that the case turned upon the true construction of Sec. 4, Sub-Sec. 2, of the London Electric Supply Act, 1908. Having stated shortly the facts of the case, he said that Parliament evidently seemed to have thought that it was for the permanent advantage and benefit that where there were various electric companies having separate areas, that they should be able to unite and operate, subject to the consent of the Board of Trade. Was it possible to say that under Sec. 4 there could be only one connection made? Making a con-

nection did not seem to him to mean the erection or construction of a particular tube or conduit. He thought it meant to connect up and do that which the agreement might authorise you to do and not once for all. He thought the learned Judge was right in the view he had taken, and that the relief the plaintiffs sought to enforce could not be sustained. For these reasons he was of opinion that the appeal failed, and as the parties had agreed to treat the motion as the trial of the action, the action would be dismissed with costs.

Lord Justice Kennedy and the President concurred.

## BUSINESS NOTES.

**Diesel Engines at the Ghent Exhibition.**—In the Belgian Electrical Section at the Ghent Exhibition, MESSRS. CAREL FRERES, of that town, display, in addition to a 2,500-H.P. steam engine, three examples of the Carel-Diesel engines, a 100-H.P. four-cycle engine, a 1,500-H.P. reversible six-cylinder engine, and a 1,000 H.P. two-cycle four-cylinder engine, the last-named being coupled to a generator, and used in connection with the electric lighting of the Exhibition.

**Electric Cooking.**—MESSRS. GILLESPIE & BEALES, sole wholesale selling agents for the "Tricity" cookers are prepared on behalf of their principals and manufacturers, the British Electric Transformer Co., Ltd., to enter into correspondence with electricity supply undertakings for the purpose of arranging cooking demonstrations of the "Tricity" cooker, which demonstrations would be given by Mr. F. S. Grogan. Messrs. Gillespie and Beales would be pleased to hear from those engineers who are desirous of taking advantage of this means of introducing electric cooking on their system, and to place their experience at the disposal of those who communicate with them.

**Book Notices.**—"American Telegraph Practice." By Donald McNicol. 1913. London: Hill Publishing Co. Price 17s. net.

"The Mechanical Engineer's Pocket-Book." By D. K. Clark and H. H. P. Powles. 1913. London: Crosby Lockwood & Son. Price 4s. 6d. net.

"Fifth Annual Report of the Hydro-Electric Power Commission of the Province of Ontario." 1912. "Rules and Regulations for Inside Electrical Installations." 1913. Toronto: L. K. Cameron.

"Journal of the Franklin Institute." Vol. CLXXV, No. 5, May, 1913. Philadelphia, Pa.: The Institute. Price 50 cents.

"Apparatus for the Exact Analysis of Flue Gas," by George A. Burrell and Frank M. Siebert. "The Preparation of Specifications for Petroleum Products," by Irving C. Allen. "Metal-Mine Accidents in the United States during 1911," by Albert H. Fay.

"Ignition of Mine Gases by the Filaments of Incandescent Electric Lamps," by H. H. Clark and L. C. Iseley. "Sampling Coal Deliveries," by George S. Pope. "Oil and Gas Wells through Workable Coal Beds," by George S. Rice and O. P. Hood. 1913. Washington: Government Printing Office.

"Proceedings of the Engineers' Club of Philadelphia." Vol. XXX, No. 2, April, 1913. Philadelphia: The Club.

"Bulletin de la Société Internationale des Electriciens." Vol. III, No. 24, April, 1913. Also "Annuaire pour 1913." Paris: Gauthier-Villars.

"Atti della Associazione Elettrotecnica Italiana." May, 1913. Milan: Stocchi, Ceretti & C. Price L. 50.

"Science Abstracts." Vol. 16, Part 4, April 30th, 1913. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Wiring Diagrams of Electrical Apparatus and Installations." Price 8s. 4d. net. "Dynamo Laboratory Outlines." By John Fay Wilson. 1913. Price 4s. 2d. net. London: Hill Publishing Co.

"Transactions of the University of Toronto Engineering Society." Vol. VII, No. 6, April, 1913. Toronto: The Society.

"Journal of the American Society of Mechanical Engineers." May, 1913. New York: The Society. Price 35 cents.

"Journal of the American Institute of Architects." Vol. 1, No. 5, May, 1913. Washington: The Institute. Price 50 cents.

"Boletín de Ingenieros." Vol. III, Nos. 7 and 8, March 16th and April 16th, 1913. Mexico: Departamento de Ingenieros de la Secretaría de Guerra.

Under the title of "Motor-Car Troubles: Their Symptoms and Their Cure," Messrs. Harper & Bros. are shortly issuing a pocket-book for motorists, by H. W. Slauson, M.E.

We have received a copy of the second edition of No. 1 of the *Asteroid*, the official organ of the B.T.H. Social Club. The publication is the *Donuts' Magazine* under a new name, this change following upon a discontinuation of its former name by the Donuts' Society. The new name is adopted because the aim of the magazine is to act as "the connecting link which will complete a well-ordered system of social activities" in B.T.H. circles. Furthermore, the B.T.H. telegraphic address is "Asteroid." There is a good deal of interesting matter relating to club and such-like doings, with some versification, sketches, and, of course, a pretty considerable spice of humour. Mr. T. H. Relton is the editor.

**Price Reduction.**—MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., announce reductions in prices of rubber insulated wires and cables, owing to the fall in the market price of rubber.

**British Trade in British Guiana.**—A report to the Board of Trade from its correspondent in British Guiana points out that greater quantities of machinery and wire for electric lighting come from the United States than from the United Kingdom. The Electric Light Co., in Georgetown, was started, and is maintained, by Canadian capital, and it is possible that purchases of their electric light plant are made in the States as a matter of convenience, especially as there is a varied and cheap supply of such articles to select from in that country. It may be, however, that some of the articles credited in the trade returns to the United States are really of Canadian origin, consigned through New York.

Speaking generally with reference to British efforts to extend trade in British Guiana, it cannot be said that British commercial travellers handle their samples to the utmost advantage. Travellers frequently represent upwards of six houses each, and, consequently, carry a numerous variety of samples, with many of which they are not infrequently entirely unacquainted. On the other hand, travellers from the United States specialise, so to speak, and each traveller carries with him the lines with which he is thoroughly conversant. It naturally follows that such intimate knowledge, well applied, helps to secure orders which might otherwise be lost.

Freight rates naturally have a direct effect on the selling price of imported goods. Great Britain's only competitor in British Guiana which has an advantage in freight rates is the United States, and, from inquiries made amongst importers, it would appear that freight on most goods from the United States averages 12 cents per foot, as against 21 cents per foot from the United Kingdom. Reducing these rates to a basis of value so far as it is possible to do so, it is reckoned that the Americans have an advantage in freight rates equal to an average of about 1 per cent. of the value of the goods. The rates of exchange are also in favour of the United States bills being obtained on New York at  $\frac{1}{2}$  per cent. discount, whilst a bill on London is at a premium of  $1\frac{1}{2}$  per cent.

American manufacturers, it is understood, seldom or never make any charge for packages or packing, and the absence of these charges, even if it does not in all cases reduce the landed cost of the goods from that country, removes a cause of irritation to importers who object to seeing these small extra charges on invoices. Complaints are also made that the majority of British houses do not pay sufficient attention to detail and to keeping their catalogues and price lists up-to-date, the Americans and Germans being ahead of them in these respects. Most British firms are said to supply the same catalogues year after year with very few, if any, additions thereto, whereas the American and German firms are always issuing new and up-to-date lists profusely illustrated with drawings, photographs, &c., and containing minute descriptions of even the smallest articles.

Another matter in which the British manufacturer is said to show to disadvantage as compared with foreign firms, is in the manner in which certain articles are prepared for sale. Goods imported from America and Germany are, as a rule, very attractively got up, so that given two articles of the same kind and selling price, the smart and attractive appearance of the foreign made one will usually result in its being taken in preference to a less attractively got up article of British manufacture.

On the whole, British trade would be assisted by the sending of fewer catalogues and more commercial travellers. The value of the catalogue as an advertising medium is quite realised, particularly in certain lines of business, and no doubt it yields profitable results, but as a method of creating openings for British trade it is overdone, and a smart traveller, with a good knowledge of his business, will do more to extend British trade in a week than advertising by catalogue will do in 12 months. American and German manufacturers will, as a rule, go to quite a lot of trouble to suit their customers' tastes, and their obliging disposition not infrequently secures for them a certain amount of trade which otherwise might have remained with British firms. It is mostly in the cheaper classes of goods that Britain is losing ground. Where quality is a prime consideration she can still hold her own, but in nearly all the Crown Colonies and Protectorates situated within the tropical belt, cheap articles find a ready sale, so that the British manufacturer cannot afford to despise the production of cheap and low grade quality even although he may feel disinclined to engage in such a trade.

**Kobe Tramways.**—The completion of the delivery of an order for 42 Warner trucks by the "M AND G" TRUCK AND ENGINEERING CO., LTD., makes 42 systems upon which the Warner axle has been fitted to date, including, we understand, no fewer than 10 lines in the United States. The first British passenger coach fitted by the same firm for the Warner International and Overseas Engineering Co., Ltd., has just been completed and successfully run for Whitsun traffic to, we are informed, the entire satisfaction of the railway company's engineers.

**After the Fire.**—The works of MESSRS. ENGINEERING AND ARC LAMPS, LTD., Sphere Engineering Works, St. Albans, Herts, are now in full running order again after the disastrous fire, which did damage to the tune of more than £3,600, on March 8th. One photograph before us shows how extensive was the damage, while a second shows part of the works with all its repairs completed. The company manufactures here its well-known arc lamps and accessories, but it also undertakes the production of repetition work, stampings, spinings, &c.

**Electric Clocks.**—The following further communication has reached us from THE MAGNETA TIME CO., LTD.:—"Referring to the communication from your correspondents in this week's issue of the ELECTRICAL REVIEW, until quite recently the Office of Works has issued official tenders for the supply of electric time

systems for the Post Office. Since the termination of that arrangement we have naturally been receiving the official orders and communications from the Stores and other departments of the Post Office. However, we are well content with the fact that all the chief postal distributing centres of London, including the galleries containing that huge mass of telegraph instruments at the central telegraph station, are equipped with Magneta, and we think your correspondents will understand that we are not very deeply concerned with the particular routine which the Government adopt in ordering their apparatus, or even the colour of the official form embodying the order. We mention this as we have both kinds on our files, and it may be interesting to note that the official orders of the Office of Works are on light buff paper, and those of the Post Office on white."

**The Lighting of York Minster.**—One of the most interesting of recent installations of Osram lamps for ecclesiastical authorities is that in the choir of York Minster. The installation of electric light has been so arranged that it enables the beautiful



THE CHOIR AT YORK MINSTER.

carving of the stalls, and the delicate tracery of the walls and vaulting, to be seen in all their pristine beauty, and at the same time preserves them from deterioration caused by deposits formed from other illuminants.

**Bankruptcy Proceedings.**—J. G. M. HILTON, electrical engineer, Birmingham.—Receiving order made May 15th on a creditor's petition.

**Lists Wanted at Catumbella.**—The manager and engineer of the Lobito, Benguela and Catumbella Electric Light and Power Co., Ltd., Post Office Box 25, Catumbella, Portuguese West Africa, asks us to state that he will be pleased to receive price-lists, catalogues, pamphlets, &c, from manufacturers of installation, lighting and power house accessories, E.H.T. line materials, &c.

**Catalogues and Lists.**—ST. HELENS CABLE AND RUBBER CO., LTD., Warrington.—New illustrated list (24 pages) of electrical cables and safety insulating appliances. In addition to particulars of the patent cab tire sheathed cables, several items are described, including patent electric vulcanisers, specially designed for jointing and repairing C.T.S. cables; insulating shoes of a novel type, the wear being easily apparent, and the buckle allowing for various sizes of feet to be used in the same shoe; insulating gloves with cab tire facing, also rubber switchboard matting with cab tire facing. A couple of photographs are included, to show the firm's considerable business with colliery cables of Dialite and cab tire sheathed types. Prices for rubber-insulating cables, including the C.T.S. type, were reduced on May 10th by about 7½ per cent.

**THE SCHNIEWINDT ELECTRIC CO.,** Staniforth Street, Birmingham.—Postal card, drawing attention to the Schniewindt resistance material.

**MR. JOHN JARDINE,** Dearing Street, Nottingham.—Sheet No. 63 (B Department) gives illustration and particulars of a new pattern of cast-iron pulley.

**THE BRITISH ALUMINIUM CO., LTD.,** 109, Queen Victoria Street, London, E.C.—New illustrated circulars; one relating to connectors for stranded aluminium conductors, and the other showing the use of aluminium feeders for railway electrification.

**MESSRS. WALLACH BROS., LTD.,** Royal London House, Finsbury Square, London, E.C.—New edition of their catalogue (56 pages) entitled "Blue Book of Safety Appliances." It contains fully illustrated particulars of smoke helmets, respirators, eye and hand protectors, rescue apparatus, first-aid equipments and cabinets, saw guards and other devices.

**THE SUN ELECTRICAL CO., LTD.,** 118 and 120, Charing Cross Road, London, W.C.—Folder No. 243 gives illustrated particulars and prices of their stoneware electric heating apparatus. Folder No. 244 shows and describes the "Rawplug" method of fixing screws in plaster, brick, metal, and in any substance in which a hole can be drilled or jumped. These plugs are manufactured in a large variety of sizes. Instructions for using are given. Details and prices of their buckle clips for use in conjunction with Rawplugs for fixing tubes and cables are also included. The Sun Co. are manufacturers of the Buckle clips and wholesale distributing agents for the plug referred to.

**MESSRS. SIMPLEX CONDUITS, LTD.,** London and Birmingham.—Folder relating to a "demon in the house," which upon further inquiry proves to be the kitchen range. The letterpress aims at assuring the reader that none of the drawbacks of the said range are found in the "Plexsim" electric cooker, nor will the latter perplex him as does the other "elaborate and costly abomination." Contractors and central station engineers can have supplies of the folder bearing their names and addresses.

**THE GENERAL ELECTRIC CO., LTD.,** 47, Queen Victoria Street, London, E.C. Leaflet No. 1,688 gives illustrations with brief particulars and prices of a number of artistic and novel electric bell pushes in silver, glass, &c.

**MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD.,** 38 and 39, Upper Thames Street, E.C.—Two new price leaflets No. 215.6 showing a nickel-plated electric toaster; and No. 215.7 illustrating and pricing new designs of electric water-heaters, saucepans, &c., with renewable elements.

**Trade Announcements.**—**THE CRYPTO ELECTRICAL CO.,** of Bernondsey Street, London, S.E., announce that their works will be closed for stock-taking on Friday and Saturday, 30th and 31st insts.

**MR. PAUL FREDK. OTTO** has taken over the business of Messrs. Lindsay & Co., electrical engineers, of Rose Place, Liverpool.

Expansion of business in the South-Western district has led **MESSRS. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD.,** to open a new branch at 56, Victoria Street, Bristol, where large stocks will be held. Mr. E. H. Brown, for more than 12 years in the sales department at the company's head office, is manager of the new branch. Mr. T. J. Hudson will in future devote his attention entirely to the South-Eastern district.

**MESSRS. WM. McWHIRTER & SON** have greatly extended and re-organised their works in Glasgow, and these are now under the direct management of Mr. A. S. McWhirter and a technical staff. The firm have recently opened new works at Wharf Street, Cardiff, where a complete modern plant has been installed. The works are situate on the Glamorganshire Canal, and close to the railways and docks. Mr. A. C. McWhirter is managing the Cardiff branch. It is 30 years ago since the firm opened their first works in Glasgow. They now confine themselves almost exclusively to electrical and mechanical plant repairs.

Increasing business has led **MESSRS. S. BILL & CO., LTD.,** to take larger premises at 146, Queen's Road, Aston, Birmingham, and all communications and goods should be sent there. The new premises are equipped with up-to-date appliances for the manufacture of electric switches, fuses, and other electrical accessories, also cabinet work for motor-car, telephone and electrical purposes.

**Dissolutions and Liquidations.**—**GILBERT ARC LAMP CO., LTD.**—With reference to the notice appearing in our issue of April 25th, we are asked to state that this liquidation is merely a formal matter, the whole of the assets and liabilities of the company having been taken over by Messrs. Engineering and Arc Lamps, Ltd., of St. Albans.

**H. A. HARVEY & CO., LTD.**—Mr. D. L. Honeyman, 18, St. Swithin's Lane, E.C., was, on 9th inst., appointed by the Court receiver and manager on behalf of the debenture-holders of this company.

**ELECTROCARS, LTD.**—A meeting will be held at 3, Great St. Helens, London, E.C., on June 16th, to hear an account of the winding up from the liquidator, Mr. J. E. Denney.

**LINDSAY & CO.,** electrical and mechanical engineers, 95, Rose Street, Liverpool.—Messrs. H. L. Crauford and P. F. Otto have dissolved partnership. Mr. Otto will attend to debts and continue the business under the same style.

**GEM DYNAMO BRUSH CO., LTD.**—This company is winding up voluntarily, with Mr. J. W. Massey, 46, Cherry Street, Birmingham, as liquidator. A meeting of creditors is called for June 2nd.

**SAMUEL HARTFORD & CO., LTD.**—Mr. F. H. Thornton, 51, North John Street, Liverpool, was on April 4th appointed receiver on behalf of the debenture-holders.

## LIGHTING and POWER NOTES.

**Argentina.**—For the past few years the *Compania Alemana Transatlantica de Electricidad* has been reducing the price of current for lighting purposes in private houses in accordance with the terms of its contract, the price for 1913 being 29 cents paper per kw.-hour. It has not, however, reduced the price for current for heating purposes, &c., in private houses, the rate for this being 28.4 cents, which is a fraction more than half a cent under the lighting tariff. As this company is pushing the application of electricity for heating purposes in houses, the *Review of the River Plate* suggests the advisability of a lower rate for heating.

**Balearic Isles.**—A central electric lighting station has just been completed and put in operation in the little town of Campos, in the Balearic Isles.

**Barnsley.**—In the annual report of Mr. E. A. Barker, borough electrical engineer, figures are given which show that there was an increase of 257,236 in units sold in 1912-13, as compared with a year ago. The following figures are also given (the figures in parenthesis being those for 1911-12):—Consumers connected 1,142 (1,063); equivalent 8-C.P. lamps 91,427 (85,870);

new consumers, 79 (92); motors on mains, 159 (148); equivalent S.C.P. lamps, 24,120 (20,960); public arc lamps, &c., 110 (110); public incandescent lamps, 724 (707); units sold, 2,055,570 (1,716,245). The average price paid for coal was 8s. 10d. per ton (6s. 3d. per ton), whilst the amount of coal used to generate 1 unit of electricity in 1913 was 6·27 lb. (8·58 lb.).

**Bexley.**—The U.D.C. has applied to the L.G.B. for a loan of £450 for the enlargement of the battery, and £575, part of the cost of reconstructing the H.T. switchboard. The balance of the cost of the latter work (£275) will be charged to the revenue of the year in which the work is completed.

**Birmingham.**—The accounts of the electricity undertaking for the year ended March 31st last showed a gross profit of £136,363, as against £150,295 in the previous year. After meeting all the charges for interest and sinking fund, there remains a balance of £27,634. Of this sum £6,000 has been carried to the renewals fund, leaving a surplus for the year of £21,634, which it is proposed to give in aid of the improvement rate. This sum represents a little more than was paid to the improvement rate in the previous year. The surplus for the year ended March 31st, 1912, amounted to £21,581. The total expenditure for the year under review amounted to £170,482 (£138,430 previous year), of which £98,049 represents the cost of generation, £21,367 the cost of distribution, and £21,182 the cost of management. Of the total income (£306,815, as against £288,725, previous year), £300,596 resulted from the sale of current, £203,755 representing lighting and power meter sales, and £98,087, the value of the units sold for traction purposes. In addition to the £300,596, £5,507 resulted from the hire and hire-purchase of motors, arc and incandescent lamps and other apparatus. The total number of units sold during the year amounted to 63,250,492, as against 40,190,547 in the previous year, of which 42,197,163 were for lighting and power, and 21,053,339 for traction. The average price per unit sold was 1·16d. The Electricity Committee reporting on the year's working, states that the financial result for the year has been affected by several causes. First, the reduction in rates of supply, which took effect from April 1st, 1912, has naturally reduced the revenue substantially; while there is no doubt that the output has been increased in consequence of the reduction in charges, the amount by which the receipts have been reduced being approximately £30,000. In addition, the effect of the coal strike on the quality and price of the coal purchased during the year cost the department about £9,400. Increased wages to workmen, over and above normal advances, cost about £1,200, and service connections £4,100, making a total of £44,700. As regards the result of the reduction in rates, the Committee states that it is obvious that this is felt most severely in the first year of operation, but, from past experience, it is satisfied that the increased output in the next year or two will more than compensate for the fall in revenue. The output for private lighting and power has shown a substantial increase, the units sold being 26·3 per cent. higher than in the previous year. The money value for this supply shows an increase of 1·25 per cent. There is an increase in the output for the tramway supply of 29·4 per cent., and an increase in the money value of 15·8 per cent. The revenue account has been debited with a charge of £2,351 in respect of new meters, and £5,076, the cost of service connections, which is now entirely borne out by the department, and not partially charged to consumers, as in previous years. The net increase in lamp connections (lighting only) is 21,173 60-watt lamps, and in motors connected 12,344 H.P., or 9,208 kw. These increases compare very favourably with previous years. The total length of new mains laid during the year has been 85,367 yards.

**Blean (Kent).**—The B. of G. on May 15th appointed a Committee to consider the advisability of having the workhouse premises lighted by electricity, which, it is considered, could be generated at very little cost.

**Bolton.**—In connection with the new electric power station at Back-o'-th'-Bank, the L.G.B. has sanctioned the borrowing of £24,344 for building, £26,266 for turbo-alternators, &c., and £16,238 for boilers, economisers, and steam pumps.

**Bridlington.**—The sanction of the L.G.B. has been received for the borrowing of £4,400 for 17 years, and £600 for 30 years, for extensions to the electricity works.

**Burnham (Somerset).**—The U.D.C. has approved of the proposal of Dr. Purves, of Exeter, to form an Electric Supply Co. with a capital of £5,000, instead of £10,000, as originally intended.

**China.**—According to the *Indian Textile Journal* the negotiations for the lighting of Wuchang city by electricity have been completed, an exclusively Chinese company having been formed with Government assistance for this purpose. The complete power station plant will be supplied by Messrs. Siemens China Electrical Co., and will include, to start with, two 400-H.P. three-phase generating sets which will supply by means of a network of overhead lines. The power plant will be laid out to accommodate turbines at a later date, and will be run entirely under Chinese supervision.

**Continental Notes.**—AUSTRIA.—The Siemens-Schuckert Co. of Vienna, is reported to have purchased the central electric lighting station at Soborten, near Teplitz, Bohemia, for the sum of £40,000, with the view of considerably extending the same.

FRANCE.—The central station at Wasquehal, of the Société Electrique du Nord de la France, which is supplying current for lighting and traction purposes to an area of over 200 miles, and which has a

capacity of 34,000 H.P., is to be further extended to 52,000 H.P. Orders for two new steam turbines and generators, each of 6,000-kw. capacity, have just been placed with the Compagnie Electro-Mecanique.

ROUMANIA.—La Société d'Electricité de Ploeshti, which owns the concession for the supply of electricity for lighting purposes in Ploeshti, has applied for the concession to construct and work a system of electric tramways in the town.

RUSSIA.—La Société des Tramways et Eclairage Electriques de Vladicaucase in its report for 1912, states that the year witnessed the greatest development in the company's electric lighting undertaking since its establishment, the number of clients increasing during the 12 months from 765 to 938. Current is now being supplied to 20,101 incandescent, and 109 arc lamps, as also to 77 electric motors. Owing to the great increase in the cost of petroleum, electric lighting is now being adopted by small householders, and with a view of meeting the increased demand, a new Diesel engine and generator is to be installed at the generating station.

SPAIN.—Good progress is being made with the establishment of the new hydro-electric stations of the Barcelona Traction, Light and Power Co., Ltd. The plant at Seros, which will have a capacity of 56,000 H.P., is expected to be completed by the end of the present year, while one of 81,000 H.P. that is being established on the River Pallaresa, will, it is anticipated, be completed in 1914.

**Eltham.**—The Avery Hill Training College hostels are to have an E.L. installation at a cost of £1,139.

**Felixstowe.**—The Suffolk Electricity Supply Co., in co-operation with the U.D.C., has arranged to supply current for lighting and heating to tents on the beach at a fixed charge of 10s. for the season, the charge for connecting up being 5s. Some 250 sites for tents have been let this year by the U.D.C.

**Five.**—At the Blairenbathie Colliery, Kelty, a large electric installation is being rapidly pushed forward.

**Galashiels.**—It has been decided not to make the local electrical supply a municipal scheme. Support will, however, be given to the proposed local company on the understanding that a satisfactory arrangement is made as to the maximum charges for public and private light and power. Terms will also be stated on which the undertaking can be acquired by the T.C.

**Hastings.**—At last Friday's meeting of the T.C., it was decided to light the unfinished west arm of the Harbour works with electricity. A watertight fitting is to be erected at the end to hold three 80-watt lamps, the whole cost being estimated at £150. At present the lighting by oil lamps costs, with labour, £43 a year, and by laying a submarine cable and installing the electric light, the annual cost will be reduced to about £12. The Harbour works, it may be explained, are derelict. The Commissioners have no funds, and the Corporation illuminates the works for the protection of the fishery. Both the B. of T. and Trinity House have refused to take up the matter.

The B. of T. has granted an order to the T.C. authorising the Corporation to supply current to property at Ore, which is outside the borough.

**Hebburn-on-Tyne.**—In regard to the recent explosion at Hebburn-on-Tyne, by which two lives were lost, the Council has resolved to call the attention of the B. of T. to the matter, and to request it to hold an inquiry into the circumstances of the explosion, and the general conditions and method of laying cables in the district, and to ascertain whether any, and if any, what steps should be taken or regulations made to ensure the safety of the public. The Northern Counties Electricity Supply Co. gave the Council notice that it intended to lay H.T. cables underground from Ellison Street along Lyon Street into the Hebburn "C" Pit, and the Council resolved that, so far as its approval may be necessary, it does not approve of laying the said cables unless they are lead-sheathed and in earthenware troughs.

**Hendon.**—The R.D.C. has sealed an agreement with the Colne Valley Electric Lighting Co. for the supply of current in part of the Council's area. It is hoped that a supply for Pinner will be available this year.

**Henley-on-Thames.**—The Reading Electric Supply Co. has decided to ask the B. of T. to override the decision of the R.D.C., which has refused consent to the company supplying electricity to houses at Shiplake. At a meeting of the Council on May 13th, the clerk expressed the opinion that the B. of T. would not accede to the company's request.

**Horsham.**—A L.G.B. inquiry was held on May 16th into the application of the U.D.C. for a loan of £2,000 for the provision of a refuse destructor at the electricity works. It was stated that the Council was likely to profit from the use of refuse as fuel, and that the destructor would be dealt with as adjunct to the electricity works. The value of the refuse to be dealt with from a fuel point of view was placed at £435 per annum. There was some opposition on the ground that the destructor would be a nuisance.

**Ilford.**—The engineer has been instructed to report on the electrical equipment required in connection with the Council's proposal to install a refuse destructor. In connection with the removal of the centre columns in Iligh Road, the electrical engineer reporting upon the sample fittings he had erected near the Broadway, states that it is impossible to see the effect of these lamps until after 11 o'clock in the evening, in consequence of the number of private lamps in the neighbourhood, which are kept

alight to that time. The Electricity Committee has deferred the consideration of the report until it has had a chance of inspecting the fittings.

**India.**—**BOMBAY MILL INSTALLATIONS.**—In connection with our recent note regarding the motor and transformer equipment for the textile and flour mills in the Bombay district, which are to derive their power from the mains of the Tata Co., we are now enabled to give further particulars of the valuable contract which has been secured by the British Westinghouse Co. The motors are all of the Westinghouse slip-ring protected type, suitable for double drive, and for three-phase current, at 2,000 volts and 50 periods. There are at present a total of 207 motors of this type on order, the sizes ranging from 50 H.P. to 500 H.P. The motor speeds are 290 R.P.M. and 365 R.P.M., there being several of each horse-power capacity at each speed, coupled direct to the line shafting in the great majority of cases without the intervention of countershafting. The motor switch pillars are of the Westinghouse ironclad type "S" pattern, which are so largely used in mining and other industrial work in this country, and starting is affected by liquid controllers. The transformers are Westinghouse three-phase oil immersed self-cooled units, and reduce the supply pressure from 6,000 volts to 2,000 volts for the motors. They number 64 in all, and are of four sizes, thus: 22 of 500 K.V.A., 11 of 600 K.V.A., 21 of 700 K.V.A., and seven of 900 K.V.A. The mills in which the above-mentioned equipment is to be installed are as follows:—Pearl, Finlay, Simplex, Naigum, Swan, Bombay Cotton, Janshed, Nahomednagh, Pabahe, Crescent, Fazulbhoj, David No. L. and Z. Down, Standard, Phoenix, Gold Mohur, Jubilee, Crown, Western India, Apollo, Ripon, Dharamsey, Hope, Alliance, Matildas Goculda, New City of Bombay, Colaba, New Great Eastern, Sun, Bombay Flour, Merchants Flour, and Union Flour. These particulars give some idea of the importance of this immense scheme for mill electrification, to which we hope to refer in detail at an early date.

**Ipswich.**—The report of Mr. Ayton, the Corporation electrical engineer, on the working of the electricity department for the year ended March 31st last, discloses a loss of £1,708, due more than anything to bad luck. The total revenue amounted to £21,733, and working expenses to £16,899, leaving a balance of £7,833 to meet financial charges. Interest and sinking fund amounted to £7,908, and, in addition, £1,633 capital charges on new plant, &c., was met out of revenue, leaving a balance on the wrong side as mentioned. This was made good from the reserve fund, which is reduced to £815. The department's bad luck arose from the coal strike, which it is estimated cost an extra £1,000, and, unfortunately, troubles with the recently installed turbine plant deprived the department of its assistance, and reconstruction work involving the running of the plant non-condensing also told its tale. Two turbine units are now running satisfactorily, but the capital charges for the year were increased by them, although they were not then in use. The units sold for all purposes were 2,606,119, as compared with 2,050,885 in 1911-12; power units jumped from 763,183 to 1,247,077, the motor H.P. increasing from 1,903 to 2,299. The power station capacity increased from 1,511 to 3,511 kw. Mr. Ayton draws attention to the necessity of having a hiring scheme in operation, in order to develop electric heating and cooking; also he refers to the possibilities of the electric vehicle and the advantage to the undertaking of encouraging its use.

**Japan.**—The Tokio Electric Bureau have lately issued a report for the 20 months from August, 1911, when the electric lighting and tramway undertakings in the city were municipalised, and during that period a profit of £546,052 was made.

**Johnstone.**—Messrs. Strain & Robertson, the engineers to the Clyde Valley Electrical Power Co., have notified the T.C. that at the expiration of one month they propose carrying out certain operations within the burgh. The Council has considered the proposal, which involves the laying of cables below the roadways, and decided to object to the plan. Other questions with reference to the future negotiations ament electric lighting were remitted to the Electricity Committee for further consideration.

**Kettering.**—The U.D.C. has applied to the L.G.B. for a loan of £1,600 for a new feeder cable, &c., and has decided to install at the electricity works a water softening plant, dealing with 1,500 gallons per hour, at a cost of from £160 to £170.

**Ledbury.**—The U.D.C. has decided not to offer any objection to a prov. order for electric supply being applied for by Messrs. Edwards & Armstrong, provided that plans for the generating station and the cable routes are submitted for approval.

**Leeds.**—The annual report of the working of the electricity department for the year ended March 31st last, shows a great development in the supply, due mainly to the growing power load, the increased output being 5,288,940 units, or over 29 per cent. The revenue amounted to £124,597 (an increase of £9,751), and the expenditure was £109,088 (an increase of £10,307), and the surplus profit £15,508 (a decrease of £556). The reduced surplus is, however, more than accounted for by an increase of £1,885 in capital expenditure out of revenue. The total output sold was 23,130,512 units, as compared with 17,841,572 in 1911-12; this included 5,086,774 units for lighting, 895,247 units for street lighting, 14,152,395 units for power and heating, and 2,996,096 units for traction. The power units sold increased by 25 per cent, the H.P. of motors connected having risen from 17,291 to 22,096. The heating apparatus supplied increased from 380 to 683 kw. The revenue per lamp installed decreased from 4s. 5/6d. to 4s. 3/8d.,

but the maximum price for lighting was reduced from 4d. to 3/4d. per unit in October, 1912; the revenue per motor H.P. installed also fell from £2 11s. 6d. to £2 10s. 9d. The maximum load on the generating plant increased from 9,560 kw. to 10,715 kw., the capacity of the plant remaining at 15,440 kw. Two additional 7,500-kw. turbines will shortly be added, bringing the plant installed up to 30,440 kw. The working expenses per unit remained stationary at 41d. per unit, but the cost of coal in 1913 was 17d., as against 14d. per unit in 1912, the excess having been saved on other items.

The report refers to the increased price of coal and increased working expenditure, which more than counterbalanced the revenue increase; notwithstanding this, the capital charges being spread over a much greater number of units, resulted in the total cost per unit sold being 20d. less than a year ago. An interesting analysis of capital expenditure allocates to the generating station, £413,558, or 37.9 per cent.; to mains, transformers, &c., £626,686, or 57.5 per cent.; and to cost of provisional order, discount on stock, premiums, &c., £50,403, or 4.6 per cent., of the total expenditure.

The Roundhay and District Lighting Co. has offered to sell its undertaking to the Corporation, and negotiations are proceeding.

**London.**—**HAMMERSMITH.**—The B.C. has requested the Electricity Committee to consider and report upon the desirability of establishing a showroom in connection with the electric light undertaking of the Council for the purpose of demonstrating the uses of electricity, and particularly in the establishment of such a showroom in the proposed extended Town Hall.

**BERMONDSEY.**—The electrical engineer advises the strengthening and connecting up of the feeders in seven roads, also the laying of additional distributors, to cope with the next winter's demand. The cost of the work is put at £8,682, which is to be raised by loan and taken up as required.

**Lowestoft.**—The T.C. has received from the L.G.B. sanction to a loan of £3,000 for mains and £2,000 for house services.

**Nelson.**—The T.C. has resolved that application be made to the L.G.B. for sanction to borrow the sum of £4,000, estimated to be required during the next three years for mains and services.

**Newport (Mon.).**—With reference to the experiments which are being carried on for the lighting of a portion of Caerleon Road, the Gas Co. has written the Council offering to supply gas, light and extinguish, repair lantern, paint and generally maintain two-light inverted burner lamps for £5 14s. per lamp per annum, the first cost of the lamp with its burners and fittings complete being £2 0s. 9d. and the illuminating power 320 candles. The company, in the letter, also quoted for higher candle-power lamps. The borough electrical engineer reported that 11 incandescent electric lamps, each of 300 c.p., and one 500-c.p. lamp could be supplied for a payment of £70 per annum, as against the gas company's proposed charge of £68 8s. Having regard to the fact that the Corporation has the necessary supply ready to hand, application is to be made to the B. of T. for permission to use overhead cables for the supply of current to such lamps, and the Newport Gas Co. is to be asked to discontinue the lighting of the lamps in the road in question from and after September 29th next.

**North China.**—The Peking Chinese Chartered Electricity Undertaking is just now in a state of great prosperity owing to the settling down of the country after the revolution. Mr. Sillar reports the addition of from 7 to 10 new consumers every day, and with the three new Senate chambers and the opening of the Forbidden City for the use of the President and Cabinet, the supply has more than doubled in the last six months. President Yuan Shih Kai has alone installed about 4,000 lights, and Mr. Sillar, who was formerly chief at Colchester, is one of the lucky few who has a pass into the Forbidden City, which is classed by all who have seen it to be the finest Imperial palace in existence.

**Peterborough.**—On May 14th Mr. T. C. Ekin held an inquiry into the application of the T.C. for a loan of £7,000 for extensions to the generating plant—£3,850 for a 500-kw. steam turbine and generator with condenser; £1,450 for Lancashire boilers and setting; £960 for mechanical stokers; £170 for foundations for turbine and condenser; £150 for piping; £220 for switchboard additions; and £170 for contingencies. There was no opposition.

It was stated that Messrs. Barford & Perkins, engineers, required 300 H.P., of which 100 H.P. was to be installed now; the G.N. Railway also required a supply of power. The city engineer (Mr. J. C. Gill) said he hoped there would be another of the large works coming on the mains, and they hoped to get an extension of power business with small consumers. He should like to purchase a number of motors and hire them out, but he understood that the T.C. could not use its surplus for that purpose. The Inspector thought the Council had the necessary powers, and could adopt such a scheme if it wanted.

**Pontefract.**—The B. of G. has decided to obtain expert advice on the electric light arrangements at the workhouse with the object of carrying out improvements and alterations which will result in economy.

**Portslade (Sussex).**—In reply to inquiries, the U.D.C. has intimated that the question of electric light is receiving attention, but that there does not appear to be a possibility of a supply of electricity for the district at present.

**Skye.**—A large electrical installation is being carried out on the Island of Raasay, off Skye, on the West Coast of Scotland. This island was recently acquired by Messrs. William Baird & Co., ironmasters, and the extensive deposits of iron ore are to be worked. Electricity is being used for the purpose of operating the service railway, cranes, boring tools, and for lighting.

**Stalybridge.**—The Corporation has approved of plans of extensions, &c., at the generating station, Park Road, for the Stalybridge Joint Electricity Board.

**South Africa.**—The Cape Town city electrical engineer has decided, owing to the very large demand for free wiring installations, to temporarily suspend the application of the system, so that the department may be able to cope with the additional work of connecting up the new consumers. In addition to this work, the department is also extremely busy in rearranging the supply to the consumers recently taken over from the Cape Peninsula Lighting Co. Some of the suburbs are being entirely rewired with overhead cables. It is expected that the new alternating-current supply will be in use in Mowbray and Observatory early in May.

**Torquay.**—The General Purposes Sub-Committee of the T.C. has under consideration the question of installing electrical cooking apparatus at the new Town Hall.

**Trowbridge.**—The U.D.C. has referred to a Committee a letter from Mr. Ronald C. Taylor, asking for powers to supply current for power to mills in the town at 1d. per unit, as the local electric supply company is not able to give a supply at the price.

**Watford.**—The B. of T. has granted a prov. order to the U.D.C. enabling it to supply current to the parishes of Abbots Langley and Watford Rural.

**West Hartlepool.**—This Corporation is the first municipal authority to adopt a system of generating electricity from waste steam obtained from outside sources. Its new power station contains two turbo-generators, each of 1,500 kw. These are supplied with exhaust steam from the six blowing engines, which are served by 16 boilers. After passing through the condensers, the water will pass through a Lea recorder back to the boilers at the ironworks. To supply the condensers with cold water, three cooling towers have been erected, each capable of cooling 115,000 gallons of water per hour. The total cost of the new scheme is £38,795, the plant alone having cost £30,000. In return for the use of the exhaust steam of the Seaton Carew Iron Co., the company will receive a supply of electric current free. The coal bill for the old station was about £4,000 a year, and it is expected there will be a great saving by the new scheme. The old station will be maintained as a stand-by.

**Whitehaven.**—The *Whitehaven News* recently contained a report of a debate in the local T.C. on the question of increasing the salary of Mr. Sankey, the borough electrical engineer. The Committee proposed to give him a bonus on the profits, but an amendment was carried referring the matter back, apparently on the ground that the nature of the bonus had not been settled. Alderman Walker said he understood that the Committee was unanimous that Mr. Sankey should receive increased remuneration, and another member thought the proposal as it stood might involve an injustice to the engineer—the exact nature of the bonus not having been settled. A bonus scheme based on sound lines is, undoubtedly, an incentive to increased business, and the Council might do worse than obtain information from Marylebone on the subject.

**Whitstable.**—Negotiations have been carried on by the promoters of the E.L. Co. and the U.D.C., for the company to undertake the public lighting. The Council was offered 2 per cent. of the gross profits of the undertaking if it gave the company the whole of the street lighting, and on the Council deciding to grant half the lighting to the company, the promoters replied that under those circumstances they could give the Council only 1 per cent. of the gross profits. The Council has decided to adhere to the original offer of 2 per cent. if any of the public lighting is undertaken by the E.L. Co.

**Wolverhampton.**—The Corporation Electricity Committee has been authorised to arrange for an electrical exhibition at the forthcoming floral fête, at a cost not exceeding £200.

**Wrexham.**—There is a profit on the electricity undertaking for the past year of £482.

**Yarmouth.**—The L.G.B. is to be asked to sanction the borrowing of £3,840 for the purpose of substituting electricity for gas for street lighting purposes. The scheme provides for the conversion of all the remaining gas lamps in the borough, 105 of which are to be carried out during the present financial year.

It is intended to install at the electricity works two superheaters, at a cost of £400.

On May 15th a L.G.B. inquiry was held respecting the application of the T.C. for a loan of £11,590 for electricity purposes. There was no opposition.

## TRAMWAY and RAILWAY NOTES.

**Argentina.**—According to the *Review of the River Plate*, the Concordia Tramways Co. has resolved to electrify its system.

**Australia.**—The city underground railway, which the Government intends to construct to relieve the congestion of traffic in Sydney, will be a three-line loop railway around the city, with connections to the eastern and western suburbs, and to North Sydney. Three lines will leave the great metropolitan Redfern Station on the northern side, and, falling in a grade of 1 in 40, pass wholly underground on the western side of the city, with stations under the principal city thoroughfares, to one of the city gardens known as Wynyard Square, in the vicinity of the Sydney General Post Office, where the first section will terminate.—*British Australasian*.

An electric motor street-watering cart has lately been put in service by the Melbourne City Council.

**Ashton.**—The manager of the tramways has reported to the Tramways Committee upon the question of removing the centre standards in the Stalybridge and Manchester Roads. He expressed the opinion that, inasmuch as the trolley wire would, under ordinary circumstances, last at least two years, it was inadvisable to incur the expense—£1,100 or £1,200, exclusive of the cost of new trolley wire and fittings—at present. The Committee felt that the suggestion for the removal of the centre standards was worthy of consideration, and decided that the matter should be raised again nearer the end of the life of the trolley wire.

**Bradford.**—Through the trolley of a tramcar coming off the wire last week, and the wire breaking and coming into contact with a car, considerable damage was done to the vehicle owing to its catching fire. There were few passengers on the car at the time of the occurrence, and, fortunately, no one was injured, though traffic was disorganised for some time. The broken wire was repaired, but upon another trolley being put on to it, it again broke, and a second car caught fire, the conductor and a passenger having a narrow escape. The cause of the mishaps is attributed to the fact that the tramlines in Toller Lane are "up," and the temporary rails are about 6 in. higher than the permanent way, causing greater pressure on the overhead wires.

**Continental Notes.**—**ITALY.**—So frequent have the labour troubles become with the employés of the Société des Tramways Napolitains, of Naples, that a novel departure has been made by the municipal authorities of the city with the view of putting an end to the difficulty. With this object, they have established a school where the police are being trained to drive electric tramcars, so that they may be in a position to assist in keeping the public service working. It is stated that no less than 300 policemen are now sufficiently trained to be entrusted with the driving of electric cars, should there be a further strike. The new departure is stated to have already had a beneficial effect on the attitude of the employés.

**SAXONY.**—It is reported that the Saxon State Railway authorities have decided on the electrification of their lines, and that in connection with the project several important collieries in Saxony have already been acquired by the State.

**Douglas.**—At a meeting of the T.C. last week, a member moved that all free passes held by aldermen and councillors in connection with the borough tramways be withdrawn. He declared that the inordinate use made of the passes interfered with the earning power of the tramways. The chairman of the Tramways Committee seconded the motion, but it was strongly opposed, and was lost by 13 votes to 4.

**Dundee.**—There was a lively debate at a meeting of the Corporation Tramways Committee following a report by Mr. Peter Fisher, the manager, on losses incurred on certain tramway routes. With regard to the High Street and Craig Pier route, on which there was an apparent loss of £600 per annum, the manager pointed out that if they stopped running to-morrow, they would not save one penny, so far as the wages were concerned. It was reduced practically to the price of electricity, and the saving would be so small that he would not advise discontinuance now. Later, Mr. Fisher told a councillor that he was not to put words in his mouth, and to his reply, the manager retorted "you are not to make a fool of me." Ultimately, Mr. Fisher's advice was accepted.

**Egypt.**—La Société des Tramways du Caire has applied to the Egyptian Government for a concession to construct and work a system of suburban electric tramways in the Province of Ghizeh, with the object of connecting Cairo with a series of populous villages at present without any system of communication. The system would extend to a distance of about 44 miles.

**Edinburgh.**—The members of the Corporation deputation who visited England to inspect and report on self-propelled cars, submitted their views at a meeting of the Tramways Sub-Committee of the T.C. The deputation visited London, Coventry and Morecambe, and were favourably impressed with the cars in operation in these places. It is understood there will be a recommendation for a trial of the system, in order to meet the difficulty that has arisen in Edinburgh. The report will be submitted to a full meeting of the Tramways Committee.

**Hford.**—The tramways manager has presented his report upon the advisability, or otherwise, of the Council adopting a universal 1d. fare over the whole of the tramway system. The consideration of the question has, however, been deferred. The Council's agreement with East Ham Corporation for the lease, upon certain terms of the Hford Hill track, and which expires on the 25th inst., is to be continued, subject to six months' notice on either side.

**Japan.**—A proposal was made some time ago in the Tokyo Municipal Assembly for the construction of two underground railways, one running between Jida-machi in Kojimachiku, and Mejiro in Koiskikawa-ku, under the control of the Johoku Electric Railway Co., and the other leading from Takamawa, Minami-cho, Shiba-ku, to Chayacho Asakusa-ku, *via* Ginza, and Ueno, under the control of the Tokyo Underground Railway Co. The Special Committee appointed by the Municipal Council for the investigation of the project has reported that although it approved the projects in principle, they must be rejected for the present, as they would interfere with the unification of the municipal systems of communication.

**London.**—An important question affecting the future of the tramway service in West London was raised at the Acton U.D.C. meeting on Monday. The clerk reported that the Parliamentary agents of the London United Tramways, Ltd. (Messrs. Stanley and Co.) wished to direct the Council's attention to the provisions of the Bill by which the London County Council sought power to enable it to work, when acquired from the company, such portion of the tramways in Hammersmith as the Council had not already powers to work. The London United feared that if the power was unconditionally conferred upon the L.C.C., it might result in the cutting of the tramway traffic at the county boundary, *i.e.*, the Askew Arms and Young's Corner, and so, amongst other things, cause very grave inconvenience to the travelling public. The company was, therefore, endeavouring to make the L.C.C.'s power of working the tramways, if granted, subject to an obligation to maintain the existing through-running facilities, and it was suggested that the Acton U.D.C. might be willing to support the opposition to the Bill on these lines. The Council decided to reply that its chairman, Councillor Boissonnade, J.P., would be willing to give evidence on behalf of the company in opposition to the L.C.C. proposals, having regard to the public interests involved, and to the fact that if the Bill, as drafted, became law, the Council was apprehensive of the breaking of the present through service of cars and the cessation of the through fares and booking arrangements.

**Luton.**—A further lease of the Corporation Tramways to Messrs. Balfour, Beatty & Co., Ltd., has been approved.

**Milnrow.**—At a meeting of the Tramways Committee last week, a letter was read from Mr. J. S. D. Moffet, general manager of the Rochdale Tramways, stating that the cost of the cars purchased in connection with the Milnrow tramways was £500 in excess of the amount provided for in the estimate. The L.G.B. is to be asked for permission to increase the borrowing powers for cars by £500.

**Plymouth.**—Mr. C. R. Everson, general manager of the Corporation tramways, in his annual report upon the working of the undertaking, states that the number of passengers carried for the year had increased by 438,725. This increase was due to the exceptionally fine weather experienced throughout last summer. Traffic receipts had increased by £1,855. The number of units used this year was 122,405 less than last year, although 6,641 more miles were run, showing that the motor-men had exercised more care in operating their cars. Traffic receipts totalled £37,083, and other receipts £2,087; the total revenue was £39,170. Working expenses accounted for £24,081, leaving a gross profit of £15,090. Other charges totalled £12,062, the net profit for the year in aid of the rates being £3,027. He was pleased to state that the improved trolley head he designed, which received their approval with instructions to fit it to the cars, had resulted in an absolute freedom from accidents from this cause. During the year they had renewed 2½ miles of overhead work, and seeing that the gauge of the wire was larger and the fittings improved, he hoped they would be relieved of serious cost on these sections for some years. The total sum expended on permanent way repairs and renewals for the past six years amounted to £23,375.

**Southampton.**—The B. of T. has sanctioned the doubling of the tramway track in Shirley Road, and instructions have been given the general manager to carry out the work by direct labour. Tenders are invited for a supply of tramway points and tires. The receipts of the tramway undertaking for the year ended March 31st last amounted to £64,185, which represents an increase of £336 on the previous year. There was an increase of 46,892 in the mileage run, and an increase of 127,135 in the number of passengers carried. The amount of current consumed totalled 1,964,804 units, which, at 1½d. per unit, represents an expenditure of £12,280. Compared with the previous year the current consumed shows an increase of 125,383 units, but the cost of the units during that year amounted to £174 more than in the year under review, owing to the fact that the charge for current was then at 1½d. per unit. The receipts per car-mile show a decrease of '263d. over last year.

**Tynemouth.**—The Tynemouth Traction Co. has written the Corporation expressing a hope that the negotiations for the extension of the tramways to Preston Village might result in the construction of that route at an early date, when the whole system of electrical distribution would have to be reconsidered. A reply is to be sent to the effect that the Council is waiting for the company with regard to the proposed extension.

**Wishaw.**—A conductor on the tramways at Wishaw, in an attempt to put a trolley pole back on the wire, was dragged off the car and suspended in mid-air. Before assistance could be rendered the rope broke and he fell heavily to the ground, his injuries necessitating removal to a hospital.

## TELEGRAPH and TELEPHONE NOTES.

**New Cable for Central and South American Telegraph Co.**—The Central and South American Telegraph Co. recently contracted with the Norddeutsche Seekabelwerke, Nordenham, Germany, for the manufacture and laying of 771 nm. of cable, to be laid between Panama, Republic of Panama and Santa Elena, Ecuador. The Norddeutsche Co.'s cable steamer, *Stephan*, with the cable on board, sailed from Nordenham, April 7th, and was expected to arrive at Panama about May 20th.

The laying of this direct cable from Panama to Santa Elena will materially expedite the telegraph traffic to and from Peru, Chile and Argentine, and is a preliminary step in providing additional facilities for the anticipated extension of the Central and South American Telegraph Co.'s lines from Argentine to Santos and Rio de Janeiro, Brazil, which extensions, it is expected, will be completed within a year. This will provide an all-American cable route to Brazil, which Mr. James A. Scrymser, president of the Central and South American Telegraph Co., has endeavoured for many years to accomplish.

On her homeward trip the *Stephan*, it is expected, will take soundings between Buenos Ayres and Santos and Rio de Janeiro, covering the route on which the proposed cables are to be laid.

The average time of transmission between New York and Buenos Ayres, "*via* Colon," is now about 16 minutes, and it is expected, on the completion of these Brazil extensions, that the average time between New York and Rio de Janeiro will not exceed 20 minutes.—*Telegraph and Telephone Age.*

**Wireless in the Antarctic.**—Continuous communication is now maintained between Sydney, *via* Hobart and Macquarie Island, and Dr. Mawson in his winter camp in the Antarctic. Dr. Mawson receives nightly wireless signals from Macquarie Island, the Government stations at Wellington (New Zealand), Melbourne, Hobart, and Pennant Hills, from warships and from shipping along the south coast.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aberdare.**—May 29th. Cables, street work, junction boxes, incandescent fittings for street lighting, meters, &c., for the Council. See "Official Notices" May 16th.

**Australia.**—VICTORIA.—May 30th. High-tension switchgear with remote control, for the Melbourne City Council. See "Official Notices" March 28th.

June 2nd.—20,000-volt H.T. switchgear and L.T. switchgear and accessories, for the Melbourne Suburban Railways. See "Official Notices" May 2nd.

June 11th.—Switchgear and instruments, for the Melbourne City Council. See "Official Notices" April 25th.

June 24th.—H.D. copper wire, telephone parts and telephones, for the P.M.G. See "Official Notices" to-day.

July 1st. Telephone instruments and submarine cable, for the P.M.G. See "Official Notices" to-day.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

July 8th.—Rubber-covered wire, batteries, telephone switchboards, measuring instruments and telephone instruments, for the P.M.G. See "Official Notices" to-day.

TASMANIA.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" May 9th.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—May 28th. Condensing plant, pump and piping, for a Government power station at Perth. See "Official Notices" May 9th.

July 9th and 30th and August 6th.—Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

June 11th. Metal-filament lamps, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telegraph and telephone instruments, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telephone switchboards and parts, for the P.M.G. See "Official Notices" to-day.

July 30th.—Cable switchboard, for the P.M.G. See "Official Notices" to-day.

PERTH, W.A.—CORRECTION.—In our last issue, in our advertisements, by a printer's error, we gave the closing date for the item "Metal-filament Lamps, Schedule 274," as July 11th. This should have read June 11th. Will tenderers please note?

SOUTH AUSTRALIA.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

NEW SOUTH WALES.—July 9th. Switchboards, for the P.M.G. See "Official Notices" to-day.

Bedford.—June 20th. About 10,870 tons of hard or soft coal, for the Corporation electricity works. Mr. Charles Stimson, town clerk.

Colchester.—May 27th. Steam coal for a year (about 5,000 tons) for the Corporation Electricity Department. Mr. W. Frisby, Borough Electrical Engineer, 35, Osborne Street.

Croydon.—May 29th. Electric lighting of the fire station and library, Thornton Heath, for the Corporation. See "Official Notices" May 16th.

Derby.—May 23rd. One 750-kw. motor-alternator, for the Corporation. See "Official Notices" May 9th.

Devonport.—June 2nd. Cables, wires and meters for 12 months for the Corporation. See "Official Notices" to-day.

Dundee.—May 30th. Steam and feed piping, steam feed pumps and hot-well tank, &c., for the Corporation Electricity Department. See "Official Notices" May 16th.

France.—June 5th. The French State Railway authorities (Service Electrique, 1<sup>st</sup> Division), 43, Rue de Rome, Paris, are inviting tenders for a number of electric tractors for working the engine turntables at the various railway stations on the system.

Glasgow.—May 26th. Two steam turbo-alternators, with condensing plant (5,000 kw. and 2,000 kw. respectively), for the Corporation Tramways Department. See "Official Notices" April 25th.

Halifax.—June 6th. One natural draught chimney type water cooling tower, for the Electricity Department. See "Official Notices" to-day.

Hoyle and West Kirby.—May 27th. Coal (3,000 tons washed peas or slack) for the U.D.C. electricity works for a year. Mr. Chas. J. Turner, electrical engineer.

Hungary.—May 28th. The municipal authorities of Aranymarot are inviting tenders for the establishment of a central electric lighting station in the town.

London.—L.C.C.—May 28th. Electrical installations at Lewisham Bridge and Fairfield Road (Bow) elementary schools. See "Official Notices" May 9th.

June 3rd.—High and low-tension cables for Tramways Department. See "Official Notices" to-day.

METROPOLITAN ASYLUMS BOARD.—June 4th. Extension of internal telephone system and installation of signal bells at the Western Fever Hospital, Fulham, S.W. See "Official Notices" May 16th.

ST. PANCRAS.—June 9th. Welsh and other steam coal for the Electricity Department. Apply E.L. Department, 57, Pratt Street, N.W.

Mexborough.—May 30th. Lancashire boiler, for the U.D.C. Electricity Department. See "Official Notices" April 25th.

Oldham.—May 31st. Extra-high-tension switchboard for the Corporation. See "Official Notices" to-day.

Portsmouth.—June 11th. Wiring for electric light installation at Workhouse Infirmary extensions, &c., Milton. See "Official Notices" May 16th.

Rawtenstall.—June 10th. One 1,500-kw. turbo-alternator complete with condenser, for the Corporation. See "Official Notices" to-day.

Rotherham.—The question of renewing and doubling the tramway track in Fitzwilliam Road is under consideration. Tenders are invited for the supply of rails required in connection with the renewal of the tramway track in High Street.

Salford.—Wiring of new secondary school, Pendleton, for the Education Committee. See "Official Notices" May 16th.

Spain.—The municipal authorities of San Juan de Palamos (province of Gerona) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

The *Times* of 16th inst. contains lengthy advertisements intimating to "foreign manufacturers" that they are invited to tender for the establishment of certain wireless telegraph stations in Spain.

Swansea.—June 6th. Installation of electric light and bells at the new training college, Glamor, for the Education Committee. See "Official Notices" to-day.

Walthamstow.—May 28th. Natural draught cooling tower, for the U.D.C. Electricity Department. See "Official Notices" May 2nd.

### CLOSED.

Admiralty.—The Admiralty has recently accepted a tender from the Dussek Bitumen Co. for "Triniáite" compound for use in H.M. battleships, dockyards, &c.

Ashton-under-Lyne.—The Corporation has accepted the tender of the Bastian Meter Co., Ltd., for the supply of 10 ampere-meters.

Ashton-under-Lyne and Lowestoft.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for two-rate meters from Ashton-under-Lyne, and also the contract for car meters from Lowestoft.

Barrow-in-Furness.—The T.C. has accepted the tender of Messrs. Drake for stoking plant, at £4,100, and for a generating plant, including gas engine, at £550.

Bedford.—The T.C. has accepted the following tenders:—

British Thomson-Houston Co., Ltd.—125 meters.  
British Westinghouse Co., Ltd.—25 meters.  
Dick, Kerr & Co., Ltd.—Lamps (one year).  
Siemens Bros. & Co., Ltd.—Cables.

Belgium.—Twelve concerns—five German, four Belgian, two French and one Austrian—last week submitted tenders to the Belgian Telegraph Authorities in Brussels for the supply of 1,200 metres of sub-river cable and 240 metres of submarine cable. The lowest offer was that of the Rheydt Kabelfabrik, of Rheydt, Germany.

Bishopstowton (Devon).—Messrs. Thomas & Son, of Bishopstowton, have received, through Messrs. Lord & Shand, electrical engineers, of Plymouth, an order for supplying and fixing a Blackstone oil engine for an electric light installation at the Hall for Mr. C. H. Chichester, at Bishopstowton.

Bolton.—The contract for installing electric light at St. Margaret's new church has been let to the Bolton Corporation Electric Fittings Department.

Burnley.—The E.C. has accepted the following tenders:—

British Thomson-Houston Co.—Supply of motors and starters required by the department for the ensuing year.  
Superheater Units, Ltd.—Supply of two superheaters.

Farnborough (Hants.).—The U.D.C. has accepted the tender of Messrs. Hughes & Stirling, Ltd., for a refuse destructor, at £2,006.

Glasgow.—A contract has been placed with Messrs. E. Bennis & Co., Ltd., for four Bennis chain-grate stokers, each 8 ft. wide, for the Corporation electric tramway station.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named:—

#### WAR OFFICE.

Electric cells (parts).—Atlas Carbon and Battery Co., Ltd.; J. C. Fuller and Son, Ltd.; J. R., G. P. and Telegraph Works Co., Ltd.; Siemens Bros. and Co., Ltd.

Telephones, &c.—Automatic Telephone Manufacturing Co., Ltd.; British L.M. Ericsson Manufacturing Co., Ltd.; Spagnoletti, Ltd.

#### INDIA OFFICE: STORE DEPARTMENT.

Wireless apparatus.—Marconi's Wireless Telegraph Co.

Cable.—W. T. Henley's Telegraph Works Co.

Insulator cups.—Taylor, Tunnicliff & Co.; Bullers, Ltd.

#### CROWN AGENTS FOR THE COLONIES.

Battery material.—Siemens Bros. & Co., Ltd.

Insulated cable.—Callender's Cable and Construction Co., Ltd.

Telephone cable.—B. L. & Helsby Cables, Ltd.

Insulators.—Bullers, Ltd.

Telegraph poles.—J. Spencer, Ltd.; Siemens Bros. & Co., Ltd.

Telephone switchboards, &c.—Siemens Bros. & Co., Ltd.

#### POST OFFICE.

Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.;

British L.M. Ericsson Manufacturing Co., Ltd.; Gent & Co., Ltd.;

Peel-Comer Telephone Works, Ltd.; Western Electric Co., Ltd.

Silence cabinets.—M. Hunter & Sons.

Telegraphic cable.—Callender's Cable Co., Ltd.

Telephonic cable.—B. L. and Helsby Cables, Ltd.; Callender's Cable Co., Ltd.; Connolly Bros., Ltd.; Western Electric Co., Ltd.

Stoneware ducts.—Albion Clay Co., Ltd.

Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Taylor, Tunnicliff and Co., Ltd.

Telegraphic ironwork.—Bullers, Ltd.; T. W. Lench, Ltd.

Cable distribution plugs.—Siemens Bros. & Co., Ltd.

Copper wire.—T. Bolton & Sons, Ltd.; B. L. and Helsby Cables, Ltd.;

Elliot's Metal Co., Ltd.; R. Johnson & Nephew, Ltd.; Shropshire

Iron Co., Ltd.; F. Smith & Co. (inc. in the London Electric Wire Co.

and Emiths, Ltd.); J. Wilkes, Sons & Mappleback, Ltd.

Copper-covered wire.—Union Cable Co., Ltd.

Electric light plant at Waterloo P.O.—Johnson & Phillips, Ltd.

Power plant, &c.—St. Just's Wireless Station, Cornwall.—Edmondsons'

Electricity Corporation, Ltd.

Telephone exchange equipment at Llanely, Kingston Exchange Extension

and Information Desk, Hampstead.—Western Electric Co., Ltd.

#### H.M. OFFICE OF WORKS.

Lift at H.M. Stationery Office.—Aldous & Campbell, Ltd.

Great Yarmouth.—The T.C. has accepted the tender of Messrs. Myers, Rose & Co. for 2,000 tons of hard steam coal for the electricity works, at 17s. 6d. per ton, f.o.r., and that of Messrs. E. Foster & Co. for 1,000 tons of slack, at 14s. 5d. per ton.

**Hastings.**—The T.C. has accepted the offer of the Main Colliery Co., Ltd., for a further supply of from 3,500 to 4,000 tons of Welsh through-and-through smokeless steam coal.

**Hford.**—Subject to the approval of the L.G.B., the U.D.C. has accepted the tender of Messrs. Heenan & Froude, Ltd., for a refuse destructor, at £12,065.

**Ipswich.**—The T.C. has accepted the tender of Messrs. Cockledge & Co. for constructional steel work and roofing for extensions to the tramway car shed, at £605.

**Leeds.**—The following tenders have been accepted by the Corporation:—

- British Westinghouse Elec. Co., Ltd.—Two 1,500-kw. rotary converters for Crown Point Station, at £5,295 each.
- Electro-Mechanical Brake Co., Ltd.—50 new type section insulators, at 35s. each.
- British Thomson-Houston Co., Ltd.—Three-phase sub-station switchgear, as required, up to a total of 12 sets, at £45 15s. per set.
- British Electric Transformer Co., Ltd.—Two sets of two to three-phase transformers, at £624 per set.
- Waywoods, Ltd.—Electric passenger lift at Central Entrance to Market Hall, at £302.

**Lincoln.**—For the Corporation electricity station, Messrs. Bennis & Co., Ltd., are to supply two of their chain-grate stokers, 5 ft. 4½ in. wide × 9 ft. 2 in. long.

The tender of Messrs. George Robson & Co. has been accepted for coal elevating and conveying plant for the electricity works.

**Manchester.**—The Corporation has placed a contract for fitting Bennis-Miller-Bennett new chain-grate links to the frame of a chain-grate already installed at the electricity works, with Messrs. E. Bennis & Co., Ltd.

**Rotherham.**—The T.C. has accepted the tender of the Daimler Co., Ltd., for the supply of three motor-omnibuses for the Tramway Department, at £822 per bus.

**Portsmouth.**—The T.C. has accepted the tender of Mr. John Griffiths for small coal for the tramway undertaking, at 19s. 1d. per ton.

**Sunderland.**—The Cable Accessories Co., Ltd., have just secured a contract with the Corporation to supply a further 100 street lighting brackets and fittings.

**Walsall.**—The Electricity Committee of the T.C. has accepted the tender of Messrs. E. Green & Son for an economiser, at £623.

**Wednesbury.**—The Mechanical and Electrical Engineering Co.'s head office, Walsall, has secured the contract for the electrical equipment of the Metallurgical Schools at Wednesbury, for the Staffordshire Education Committee.

**Wolverhampton.**—The Corporation has accepted the following tenders:—

- British Westinghouse Co.—Four converters, at £2,950.
- Electric Construction Co., Ltd.—Two switchboards for sub-stations, at £108 and £209 respectively.
- Reynolds & Co., Ltd.—Extra-high-tension switchgear for Commercial Road station, at £2,000.
- The Lorrain Steel Co.—Special work, £1,128.

**Worthing.**—The Corporation contract for additional cells required for the extension of the storage battery at the electricity works, has been placed with the Hart Accumulator Co., Ltd.

## FORTHCOMING EVENTS.

**Junior Institution of Engineers.**—Friday, May 23rd. At 89, Victoria Street, S.W. Discussion on "The Organisation of an Engineers' Employment Bureau," introduced by Mr. S. M. Hills.

**Royal Institution of Great Britain.**—Friday, May 23rd. At 9 p.m. Discourse on "The Secret of the Permanent Magnet," by Prof. S.P. Thompson.

Saturday, May 24th. At 8 p.m. Lecture on "Radioactivity: the Alpha Rays and their Connection with the Transformations," by Prof. E. Rutherford.

Thursday, May 29th. At 3 p.m. Lecture on "Recent Chemical Advances; Chemistry in Space," by Prof. W. J. Pope.

Saturday, May 31st. At 8 p.m. Lecture on "Radioactivity: The Origin of the Beta and Gamma Rays and the Connection Between Them," by Prof. E. Rutherford.

**Institution of Electrical Engineers.**—Friday, May 30th. At 8 p.m. Annual General Meeting. Paper on "Practical Application of Telephone Transmission Calculations" by Mr. A. J. Aldridge.

**Physical Society.**—Friday, May 30th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Electro-Thermal Phenomena at the Contact of two Conductors with a Theory of a Class of Radio-Telegraph Detectors," by Dr. W. H. Eccles.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, May 26th.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 14th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.

Tuesday, May 27th.—"B" Company. As for "A" Company.

Wednesday, May 28th.—All Companies. Annual course of musketry at Purfleet rifle ranges. Railway tickets will be sent to those notifying headquarters of their intention to attend.

Thursday, May 29th.—"C" Company. As for "A" Company.

Friday, May 30th.—"D" Company. Ditto.

Saturday, May 31st.—Annual course of musketry for all Companies at Purfleet rifle ranges.

Members are reminded that this is the last date on which they can fire their annual course to make themselves efficient, and should apply only for their railway tickets.

Headquarters will be opened for regimental business from 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adj. For Officer commanding L.E.E.

## THE I.E.E. VISIT TO PARIS.

[SPECIAL DISPATCH.]

PARIS, Thursday morning.

THE party of members of the Institution of Electrical Engineers which is now here for the joint meeting with the Société Internationale des Electriciens, numbers 150, including ladies. The journey from London was a pleasant one, at the end of which members distributed themselves at various hotels.

On Wednesday morning, in glorious weather, President Berthelot opened the Congress at 9.30 o'clock at the Conservatoire des Arts et Métiers. One section of the party then proceeded to explore the Conservatoire Museum, while the remainder discussed six papers on electric traction, of which the titles and authors were given in our issue of May 9th, page 767, the speakers being Messrs. Mazin, Roger Smith, Hammond and Bochet. In the afternoon, part of the company went down the Seine by steamboat to Sevres porcelain factory, the excursion proving delightful in every way; another company visited the magnificent works at Saint Denis of the Société d'Electricité de Paris, with its 120,000 kw. of plant, also the works of the Triphasé Co. at Asnières. In the evening of Wednesday the banquet given by the Société was held at the Palais d'Orsay, covers being laid for 360. Speeches of considerable interest were delivered by M. Berthelot and Mr. Duddell, and an excellent entertainment was afforded, the principal feature calling for mention being a cinematograph demonstration with Gaumont speaking films; noted artistes also took part.

This (Thursday) morning the Congress was resumed, with M. Marcel Deprés in the chair, the papers by Mr. J. S. Highfield and M. H. Leblanc on long-distance transmission receiving attention; visits are arranged for this afternoon.

To-morrow there will be a reception at the top of Eiffel Tower, with Mr. Duddell as chairman.

**Appointments Vacant.**—Head of Electrical Engineering Department, Birmingham Municipal Technical School (£300); lecturer in mechanical and electrical engineering at the Municipal Technical Institute, Belfast (£180); fitter-driver, for Severalls Asylum, Colchester (35s.); electrical engineer (£200) for the Aylesbury U.D.C.; assistant for sales department (£130), chief representative in publicity department (£130), and engineering representative in publicity department (£117), for the Sheffield Corporation. See our advertisement pages in this issue.

**Athletic Sports.**—The fifth annual athletic sports and Corps Championships and inter-company competitions for the "Le Rossignol" challenge cup of the London Electrical Engineers (Territorial Force) were held on Wednesday evening at Stamford Bridge Athletic Grounds, Fulham Road, S.W.

**Accident.**—It is reported that in a collision between two motor-cars at Aberdeen last Saturday night, William Ross, a "foreman electrician," who was in one of the cars, was seriously injured.

**The Question of Sunday Labour.**—The Electricity Committee of Hammersmith B.C. has decided that, in the case of all employés whose duty necessitates Sunday work, arrangements be made to give them one whole day's holiday per week. Also that the wages of employés be increased, fitters and turners in future to be paid at the rate of 9½ per hour, and labourers, fitters' mates, and blacksmiths' mates at the rate of 7d. per hour.

NOTES.

**A Forecast.**—Is it a fact, or have I dreamt it, that, by means of electricity, the world of matter has become a great nerve, vibrating thousands of miles in a breathless point of time.—Nathaniel Hawthorne—*The House of the Seven Gables.*

**Wanted—Six Hundred Pounds.**—Our readers are already aware that at the annual festival dinner Mr. E. G. Byng offered to give £100 to the funds of the Electrical Trades Benevolent Institution, if nine other firms or gentlemen would do the same within three months from April 16th. The £100 which Mr. Sutton had already given was to be counted as one of the nine; Mr. H. Hirst, through Mr. Sutton, promised a like amount; and Mr. Garcke's promise brings the total up to £400 out of the required £1,000.

It has been thought that some of our generously disposed readers would be willing to follow the splendid example set by these gentlemen and ensure that the conditional offers are fulfilled by making or influencing six other offers. We hope that in later issues it will be possible for us to fill names into the six spaces now standing vacant below:—

1	Mr. E. G. Byng	...	...	...	...	...	...	...	£100
2	Mr. G. Sutton	...	...	...	...	...	...	...	£100
3	Mr. H. Hirst	...	...	...	...	...	...	...	£100
4	Mr. E. Garcke	...	...	...	...	...	...	...	£100
5	"	...	...	...	...	...	...	...	
6	"	...	...	...	...	...	...	...	
7	"	...	...	...	...	...	...	...	
8	"	...	...	...	...	...	...	...	
9	"	...	...	...	...	...	...	...	
10	"	...	...	...	...	...	...	...	

**Discharging Electricity from Paper, &c.**—A recent patent granted to Messrs. Siemens Bros. & Co. (No. 1,554 of 1912) describes a method of discharging the static electricity evolved in spinning and weaving, or in paper manufacture, by ionising the atmosphere between the charged material and an earthed electrode, by means of ultra-violet rays, produced by an arc between iron electrodes or by a mercury-in-quartz lamp. The use of radio-active substances for producing the ionisation is also discussed (in Patent No. 1,555).

**Institution and Lecture Notes.**—INSTITUTION OF ELECTRICAL ENGINEERS.—The report of the Council for the year 1912-13 shows that at May 1st, 1913, the total membership numbered 7,084, a net increase during the year of 547, compared with an average of 137 for the preceding five years. In view of the change in the articles of association which took place during the year, it may be interesting to give in detail the changes in the list of members:—

	Hon. Mem.	Assoc. Mem.	Assoc. Grad.	Stu.	Totals		
Totals at May 1st, 1912	7	1,988	8,089	806	1,247	6,507	
Additions during year:—							
Elected	45	409	27	164	256	901	
Reinstated	1	3	5	—	27	36	
Transferred to	169	268	4	96	—	537	
Total additions for 1912-13	215	680	36	260	283	1,474	
Deductions during year:—							
Deceased	—	15	5	4	—	29	
Resigned	—	21	86	63	—	170	
Lapsed	—	18	49	10	—	194	
Transferred from	—	—	144	104	—	258	
Total deductions for 1912-13	—	54	284	171	—	468	
Totals at May 1st, 1913	7	1,549	8,655	671	260	1,062	7,084

During the session there were 14 general meetings and 61 meetings of Local Sections. Some 200 members took part in the summer meeting at Glasgow.

It is announced, in accordance with the statement which we have already published, that the *Journal* will be issued fortnightly from December to July, and will be of quarto size; in addition to the papers and discussions now published in the *Journal*, it will contain notices of meetings and other communications from the Council to the members.

Particulars are given of the facilities for experimental demonstrations which are now available in the lecture theatre, including gas, water, and various electrical supplies.

Arrangements have been made for the interchange of the privileges of membership with the American Institute of Electrical Engineers.

Provision has been made for the organisation of research to prevent overlapping and to promote research in selected subjects.

The Institution has joined with other British and American engineering societies in raising a sum of £1,650 for a memorial window to Lord Kelvin in Westminster Abbey, which will be completed by the end of June.

The Benevolent Fund at the end of December amounted to £4,612.

The accounts are presented in a new form, showing more clearly than before the margin to the good on the year's working, which last year amounted to £1,238, a decrease of £365 as compared with the previous year. The mortgages had been reduced by £652 from £36,274 to £35,622. The assets amounted to £110,368 against liabilities of £45,151, leaving a balance of £65,217, an improvement on last year of £2,813.

The formation of a lending library has been sanctioned by the Council, and progress is being made with the organisation of the museum.

**I.E.E. (STUDENTS' SECTION).**—The report of the Committee for the Session 1912-13 states that in London the average attendance at the 11 meetings has been about 36, the highest recorded being 51. At Manchester there were eight meetings, with 38 average attendances, and at Glasgow five meetings, with 15 average attendances. At Newcastle nine meetings were held. It was decided not to hold a summer tour last year. Arrangements are, however, being made to hold a tour this year from July 2nd until July 5th in Newcastle and the district.

**I.E.E. (YORKSHIRE LOCAL SECTION).**—At the annual meeting of the Section, held at Leeds on the 14th inst., the following officers were elected:—Chairman, Mr. W. B. Woodhouse; vice-chairmen, Mr. H. H. Wright and Dr. R. Pohl; hon. secretary, Mr. Jno. D. Bailie; for the four vacancies on the Committee, Messrs. W. M. Rogerson, H. A. Nevill, W. Lang, and F. J. Lowe were elected.

**I.E.E. (SCOTTISH LOCAL SECTION).**—This Section has arranged to hold its annual summer outing, on Tuesday, June 17th. The party will leave Central (Low Level) Station, at 11.9 a.m., and lunch will be provided at the Invernaid Hotel, at 2 p.m. On the return journey, the steamer will leave Invernaid at 6.45 p.m., a substantial tea being served on board. Members so desiring will be shown over the works of the Glasgow Corporation water department, at Loch Arklet.

**JUNIOR INSTITUTION OF ENGINEERS.**—On the twenty-ninth anniversary of the foundation of this Institution, on Monday, June 30th, at the Institution of Electrical Engineers, Victoria Embankment, the second Gustave Canet Lecture will be delivered by Dr. Dugald Clerk, F.R.S., who has chosen as his subject "The Working Fluid of Internal Combustion Engines." The late M. Gustave Canet (past president of the Institution of Civil Engineers of France) was president of the Junior Institution of Engineers in 1907-8, his death occurring at the close of his term of office. In accordance with a wish he had expressed, Madame Canet, MM. Paul and Albert Canet, and their families, presented a sum of money to the Institution to form a Gold Medal, in commemoration of his presidency. This Gold Medal is awarded quadrennially to an officer or Member of the Institution invited by the Council to deliver a lecture on the subject of importance to the engineering and scientific world. The first award was made in 1909, the lecture on "The Engineering of Ordnance" being delivered by Lieut. (now Sir) A. Trevor Dawson, R.N., M.Inst.C.E., M.I.Mech.E., president of the Institution 1912-13, who will preside on the occasion of Dr. Dugald Clerk's lecture.

**INSTITUTION OF MINING ENGINEERS.**—The general meeting will be held in London (Burlington House) on Thursday, June 6th. Among the papers to come under consideration is one by Mr. B. Welbourn on "Insulated and Bare Copper and Aluminium Cables for the Transmission of Electrical Energy, with Special Reference to Mining Work." Members are invited to attend the Mining Machinery Exhibition at the Agricultural Hall, Islington, after the general meeting. At night the Institution dinner will be held at the Waldorf Hotel. Friday will be devoted to an excursion to the Chingford Reservoir.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS (WEST OF SCOTLAND BRANCH).**—The annual business meeting of this Branch was held last Friday in the Royal Technical College, Glasgow. Mr. Matthew Brown, general manager of the Banknock Coal Co., presided. It was reported that the Branch was continuing to make gratifying progress both numerically and financially. Office-bearers were elected for the ensuing session, as follows:—President, Mr. Matthew Brown; vice-president, Mr. A. B. Muirhead, Lenzie; secretary, Mr. David Martin, 45, Hope Street, Glasgow; and treasurer, Mr. D. Landale Frew, Glasgow. It was announced that arrangements were being made for a joint excursion with the Scottish Branch of the National Association of Colliery Managers.

**AMERICAN SOCIETY OF MECHANICAL ENGINEERS.**—The spring meeting of this Society has been held at Baltimore this week, from May 20th to 23rd. Among the papers coming under attention were the following:—"Cost of Upkeep of Horse-drawn Vehicles against Electric Vehicles," by W. R. Metz; "Present Operation of Gas Engines using Blast Furnace Gas as Fuel," by C. C. Sampson.

**A Novel Shooting Match on the Life Target.**—On Monday last, a team composed of various members of the Electrical Press, was defeated at a shooting competition by a team of precision marksmen from Messrs. Siemens Bros. Yet the Press men were not altogether to blame, for it is the characteristic of the Press representative that he never sheds his journalistic instinct, and it was hardly to be expected that he should give his undivided attention to beads and barnacles and the like when it is explained that this shoot took place in the private range of Messrs. Life Targets, Ltd., at 12, Bow Street, W.C., the company that is handling the interesting kinematograph target that has already been described in these columns. This shoot was doubly interesting in that it constituted the first animated target competition that has been held as yet, and afforded a most interesting contrast between the methods and achievements of the peep-sight school of bull's-eye marksmen and the open-sight snap-shooting school. The shoot in question started with ordinary bull's-eye targets, the indicating or marking device only of the Life Target system being employed, and subsequently each man was confronted with an animated picture of a leaping springbok, at which he had to fire his dozen rounds from a Winchester repeater in under a minute. Modern warfare will undoubtedly call for quick, accurate sharp shooting, and the results of this shoot gave one furiously to think that trained men, who can do so well with a bull's-eye target, miss so

often at running game. For the benefit of our readers, and at the risk of repetition, we would explain that in the life-target system one fires at an animated picture, and at the instant of firing this stops dead, and one is able to see the result of one's effort, be it hit or miss, by virtue of a small point of light, which is caused by the bullet piercing the screen and allowing a strong light that is behind it to penetrate the hole. After about one-third of a second this hole is automatically closed, and the picture resumes motion ready for the next shot. Mr. D. G. M. Hume, A.M.I.E.E., who, on behalf of the company, placed the range at the disposal of the teams, and explained the technical workings of the system, told us that from his point of view the competition constituted a most interesting object lesson in support of the very claims and arguments the company are daily advancing as to the real necessity, as well as attractiveness, of life targets. Everybody went away full of the unusual and novel competition they had been privileged to take part in, not unconscious of the fact that they were the pioneers of inter-team shooting on the new target.

**The I.M.E.A. Meeting.**—The official programme of the convention to be held in London on June 17th, 18th, 19th, 20th and 21st, has now been issued, and follows closely the preliminary announcement given on page 565 of our issue of April 4th. At the Wednesday meeting, open to members and delegates only, the subjects for discussion are the "I.M.E.A. Bill," and "Heating and Cooking." On Thursday the special train to Kingston leaves at 9.30 a.m., and the meeting commences at 10.15, these times being earlier than originally announced.

We note with satisfaction that a demonstration of battery-driven vehicles will be given after this meeting, at which a paper on "Electric Vehicles" is being read. We also notice that the hoped-for visit to the Chingford pumping station, to see the Humphrey pumps installed there, has been arranged for, the time of departure from the I.E.E. being 9.30 a.m. All the London excursions start from the I.E.E., where also an exhibit of cooking, heating and other electrical appliances will be held during the Convention. Tickets for the various functions must be obtained *in advance* from the Secretary, 28, Bedford Square, W.C.

**For Sale.**—The L.C.C. invites tenders for the purchase of two 3,500-kw. steam alternators and two 150-kw. Belliss sets. See our advertisement pages in this issue.

**Fatality.**—A correspondent says that at Oakbank Oil-works, West Calder, Mr. Thomas Penhether, foreman plumber, was killed by coming in contact with a live electric wire.

**Copper.**—Mid-monthly returns (May 15th), as set forth in Messrs. H. R. Merton & Co.'s statistical circular, show increased activity in the market for this metal. That the visible supplies still stand at 30,243 tons, being a decrease of only 194 tons on the quantity for the end of April is apparently due to the increase in French stocks of 794 tons, English stocks having decreased by 588 tons, and the quantity afloat by 400 tons. Total European stocks, including Rotterdam, Hamburg, and Bremen, are less by 1,127 tons, and the estimate for other European ports reckons them as holding 400 tons less than for April 30th. European arrivals from North America are strong at 23,059 tons. England and France from Spain and Portugal receive only 308 tons, but from other countries well above the average quantity. Shipments from Chile show small, and Australia under the average. The total deliveries, at 30,052 tons for the half-month, are distinctly high. American stocks for the end of April were 12,822 tons less than for the end of March—a large reduction. The total visible supply, including Holland and Germany, stood at 77,556 tons for April 30th, a reduction of 14,068 tons for the month, a reduction not equalled, or approached, since May, 1912, during which month stocks were lowered 14,199 tons.

**Old Centralians.**—A lawn tennis match between the Old Centralians' Tennis Team and the City and Guilds (Engineering) College Lawn Tennis Club, was played on Saturday at the latter club's ground, North Ealing. The Old Students were beaten by 5-4. The score was as follows:—

Regnard (Capt.) and Saurback lost to R. Burton (Capt.) and H. T. M. Kent, 3-6, 7-5, 4-6; beat J. V. and P. V. Dupré, 2-6, 6-2, 6-4; beat A. P. Dicksee and R. A. Mack, 6-1, 6-1.

Harris and Moore beat Burton and Kent, 6-2, 7-5; lost to J. V. and P. V. Dupré, 1-6, 2-6; beat Dicksee and Mack, 6-1, 6-3.

Ryan and Mannel lost to Burton and Kent, 3-6, 1-6; lost to J. V. and P. V. Dupré, 0-6, 4-6; beat Dicksee and Mack, 6-2, 6-3.

A return match will be played on June 7th.

Old Students of the College who are good tennis players are requested to communicate with the Match Captain (Mr. Richard Burton, c/o Messrs. C. W. Burton Griffiths & Co., 1-3, Ludgate Square, Ludgate Hill, E.C.)

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—The Whitehaven T.C. on May 14th discussed a recommendation that instead of receiving an increased salary, the electrical engineer (MR. B. SANKEY) should be paid a bonus on the trade profits of the undertaking, the exact basis on which to calculate the bonus to be considered by a Sub-

Committee. Mr. W. Hinde said it would be an injustice to Mr. Sankey to pass the recommendation, as there could be no profit for a couple of years until the deficit of £1,598 was wiped out; he hoped that Mr. Sankey would have an increase before two years' time. Other members took the same view, and the matter was referred back to the Water and Lighting Committee for re-consideration.

The Watford U.D.C. has appointed MR. CHAS. E. D. GREENHALGH, of the Malvern U.D.C. electricity staff, as chief assistant electrical engineer.

The General Purposes Committee of Norwich T.C. has recommended that the salary of Mr. F. M. LONG, city electrical engineer, be increased from £600 to £700 a year.

MR. WILLIAM TRAVIS, having accepted another appointment, his resignation of the post of chief assistant electrical engineer has been accepted by the Hastings Corporation. The vacancy has been filled by the appointment of MR. A. J. RYAN (assistant electrical engineer at Gillingham). The salary is £150, rising by annual increments of £10 to £180 per annum.

MR. G. P. SHALLCROSS has been appointed Corporation electrical engineer at Birkenhead.

A Nottingham paper says that MR. F. H. COMFORT, who for the past ten years has been the mains superintendent of the Nottingham Corporation's electric lighting department, is going abroad permanently. Mr. Comfort, before serving under the Corporation, was for 22 years with the National Telephone Co., and for a time was their chief inspector.

MR. R. J. COULSON BRYANT has resigned his position at Portland Dockyard power station to take up the post of shift engineer at the Lowestoft Corporation electricity works.

The Worcester T.C. has promoted MR. II. H. SMITH to the position of works superintendent at the electricity works, at a salary of £150.

MR. FRANK TIMMS, of Newcastle, has been appointed installation engineer to the Tynemouth municipal undertaking.

At the fifth annual general meeting of the Barrow and District Association of Engineers, held on Monday last, MR. H. R. BURNETT, electrical engineer to the Barrow Corporation, was re-elected president.

**Tramway Officials.**—The tramway staff and employés at Croydon have presented an 18-carat gold hunter watch and a jewelled and gold stud to MR. H. B. HARRIS, who recently resigned the post of tramways engineer to the Corporation.

**General.**—The *Times* states that the President of the Local Government Board has appointed MR. H. H. LAW, M.Inst.C.E., as chief engineering inspector to the board, in succession to Mr. George Waller Wilcock, C.B., retired.

ALD. JAS. HENRY ASTON, chairman of the Borough Tramways Committee at Huddersfield, has been appointed a Justice of the Peace for the borough.

It is stated that DR. GISBERT KAPP will be President of Section G (Engineering) at this year's meeting of the B.A., Mr. Aspinall having had to withdraw owing to ill-health.

Congratulations to MR. J. C. DENISON DENISON-PENDER on his election to the House of Commons as the member for Newmarket. The new member is the son of Sir J. Denison-Pender and a grandson of the late Sir John Pender. He is only 31 years of age, but he goes to Westminster with a considerable knowledge of submarine telegraph matters. Not only is the name of Pender a household one in telegraph circles, but Mr. Denison-Pender has had personal and practical experience in submarine telegraph work, both in cable-laying operations and as a director of several well-known companies.

MR. F. R. BATTY has resigned his position as manager to Messrs. R. P. Hulton & Co., London, to take up a position in Manchester.

**Obituary.**—MR. HORATIO A. FOSTER.—We regret to read in the American *Electrical Review* of the death, which occurred suddenly one afternoon in April in a New York subway station, of Mr. H. A. Foster, who had been connected with electrical affairs in the States since 1884, having been associated with the Daft Electrical Co., the Thomson-Houston Electric Co., and the United States Census Office (electrical department). Twenty years ago he was editor of an American paper known as *Electrical Industries*, and he also became associated with Prof. George Forbes and the Niagara Falls Power Co. Later his power station and electric traction work brought him into close relation with L. B. Stillwell and B. J. Arnold, and in recent years he had devoted himself more to the valuation of public utilities and the study of traffic conditions. Many readers, doubtless, are familiar with Foster's *Electrical Engineer's Pocket Book*, of which he was the editor.

MR. J. G. FIEGEBEN.—The death occurred on May 11th, after several weeks' illness, of Mr. John George Fiegehen, founder and principal of the Bedford Engineering Co., crane makers, of Houghton Road, Bedford, a business he established about 26 years ago. He was 62 years of age.

PROF. HEINRICH WEBER.—The *Times* Berlin correspondent reports that Prof. Heinrich Weber, Ordinary Professor of Mathematics at Strassburg University since 1894, died on Saturday, aged 71 years.

MR. H. BROWN.—The death occurred on Sunday, after a brief illness, of Mr. Henry Brown, who was for many years on the staff at the Norwich Corporation electricity works. He was 65 years of age.

**Will.**—The late MR. W. M. MUSGRAVE, managing director of John Musgrave & Sons, Ltd., of Bolton, left £2,666 gross and £238 net personally.

## NEW COMPANIES REGISTERED.

**Nitrogen Products and Carbide Co., Ltd.** (128,982).—Registered May 15th, by A. Blackman, 194, Gresham House, Old Broad Street, E.C. Capital £500,000 in £1 shares. Objects: To acquire (1) from Nitrate Products, Ltd., the rights for the whole world where patents have been granted (except Rhineland and Westphalia) for the Ostwald Catalytic process for the production of nitric acid and nitrate of ammonia, together with works at Villeverde (Belgium) having a capacity of about 3,000 tons of nitrate ammonia per annum, and the business of that company as a going concern, with the benefit of subsisting contracts; (2) from Dettliff's Power Co., Ltd., the water-power in Iceland known as "Dettliff," and which, when harnessed up, should be capable of generating about 410,000 h.p.; (3) options for the purchase of three water-powers in Norway, known as Aura, Tøke and Ekenestad-Braatland, granted to yield, when harnessed up, about 600,000 h.p., and which options the company intend to exercise; and (4) the whole of the share capital of Nitrogen Fertilisers, Ltd. (£220,000), whose works at Adda (Norway) and Alby (Sweden) are at present producing (under licence granted in 1912) about 40,000 tons of cyanamide per annum, to adopt agreements with the said companies, to carry on the business of artificial fertilisers, manufacturers of and dealers in caustics, cyanamides, nitrogen, nitric acid, sulphuric acid, ammonia, sulphate and nitrate of ammoniac, cyanamides nitrolim (calcium cyanamide), sulphur, synthetic rubber and chemicals of all kinds, soaps, starches and other products, chemical manures and fertilising substances, electrical gas and mechanical engines, tool makers, foundries, generators of power by means of water, heat, light, electricity or otherwise, &c. The signatories (with one share each) are:—S. H. Boileau, Sutherland House, Surbiton, manager; T. A. Day, 3, Heather Road, Grove Park, Lee, S.E., clerk; A. H. Barnett, 99, Woodside Gardens, Bruce Grove, N., clerk; G. W. Parsons, Hill View, Oakleigh Road, New Southgate, N., clerk; H. C. Maclure, 99, The Drive, Fulham Park Gardens, S.W., manager; J. C. Harley, Norbury, Sidcup, solicitor; M. A. Carson, 31, Princes Avenue, Alexandra Park, N., accountant. Minimum cash subscription, seven shares. The first directors (no number not less than two or more than nine) are A. E. Barton, 28, Charles Street, Berkeley Square, W., chairman (chairman, Alby United Carbide Factories, Ltd.); Albert Vickers, 14, Cadogan Square, W. (chairman, Vickers, Ltd.); Sir Richard D. Awdry, K.C.B., 65, Victoria Road, Kensington, W. (director, Nobel Dynamite Trust Co., Ltd.); Sir Vincent Caillard, 42, Half Moon Street, Piccadilly, W. (director, Vickers, Ltd.); C. H. Maguac, 83, Old Broad Street, E.C. (director, Alby United Carbide Factories, Ltd.); Major C. H. Campbell, Highwood House, Leominster (director, Nitrogen Fertilisers, Ltd.); and Dr. A. Petersson, Adda, Norway (local director, Alby United Carbide Factories, Ltd.); qualification (except first directors), £500; remuneration, £250 each per annum (chairman, £1,250) and 2s. 6d. each per annum of the surplus net profits of the company after payment to the shareholders of a dividend of 10 per cent., divisible. Registered office, Winchester House, Old Broad Street, E.C.

**H. Langdon Down, Ltd.** (128,902).—This company was registered on May 9th, with a capital of £2,000 in £1 shares (1,000 "A" 7½ per cent. cumulative preference, 99 8/10 "B" 10 per cent. cumulative preference and 2 ordinary), to carry on the business of manufacturers of and dealers in gas and electric fittings and apparatus, and appliances for lighting, extinguishing and controlling at a distance gas, electric or other illuminants, &c. The subscribers (with one share each) are:—H. L. Down, 39, Astoria Place, Hendon, manager; T. B. Shilston, 46, Cameron Road, Ilford, engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. L. Down (chairman), and T. P. Shilston (both permanent). Registered office, 115-117, Cannon Street, E.C.

**Times Electric Co., Ltd.** (128,964).—This company was registered on May 14th, with a capital of £3,000 in £1 shares, to carry on the business of manufacturers and dealers in electrical appliances and machinery, electrical and general engineers and contractors, builders, suppliers of electricity, &c. The subscribers (with one share each) are:—C. H. Paterson, 19, Thornton Road, Barnet, Herts., clerk; L. E. Tucker, 5, Noel Road, North Acton, W., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; remuneration, one guinea each per meeting attended (chairman, 10s. 6d. extra). Registered by C. R. Enever, Broad Street House, E.C.

**Scientific Researches Co., Ltd.** (128,910).—This company was registered on May 9th, with a capital of £150 in £1 shares, to promote scientific research and turn the same to account commercially, &c. The subscribers (with one share each) are:—E. Martin Harvey, 83, Lee Park, Blackheath, S.E., merchant; A. Poultier, 19, Finabury Circus, E.C., company secretary. Private company. The number of directors is not to be more than five; the subscribers are to appoint the first. Registered office, 19, Finabury Circus, E.C.

**Kentish Town Motor and Electrical Engineering Co., Ltd.** (128,927).—This company was registered on May 10th, with a capital of £750 in £1 shares, to carry on the business of motor and electrical engineering (with one share each) are:—F. Rosser, 31, Prince of Wales Road, Kentish Town, N.W.; E. Jackson, 13, Hadley Street, Kentish Town, N.W., clerk. Private company. The first directors are F. Rosser and E. Jackson. Registered office, 114, Kentish Town Road, N.W.

**Cable Construction Syndicate, Ltd.** (128,872).—This company was registered on May 8th, with a capital of £100 in £1 shares, to carry on the business indicated by the title. The subscribers (with one share each) are:—J. Storrs, Fern Bank, Stalybridge, builder and contractor; W. Gornall, Ellesmere Street, Bolton, contractor; J. Dolan, Napier Street, Warrington, builder; T. A. Looan, 23, Strutt Street, Manchester, managing director of a company; C. Looan, 23, Strutt Street, Manchester, managing director of a company. Private company. The first directors are J. Storrs, W. Gornall, J. Dolan, T. A. Looan, G. Looan and F. Woods; secretary, T. A. Looan. Registered office, 23, Strutt Street, Manchester.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Coast Development Corporation, Ltd.**—Mortgage on electric lighting station at Walton-on-the-Naze, with plant and other fixtures used in connection therewith, beneficial interest and goodwill of business carried on thereat, electric lighting poles, cables, wires, &c., and benefit of Walton-on-the-Naze Electric Lighting Order, 1909, dated April 30th, 1913, to secure not more than £2,000, of which £1,500 is now advanced. Holders: Misses E. B., E. F., M. A., E. M. and G. B. Taylor, all of Grove Park, Bromley, Kent.

**Faringdon Electric Light and Power Co., Ltd.**—Particulars of £1,500 debts, created December 2nd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £100. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**Albert Green, Ltd.**—Particulars of £2,000 "B" debentures, created May 5th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**South London Electric Supply Corporation, Ltd.**—Issue on April 15th, of £1,600, and on May 6th, 1913, of £1,771 debentures, parts of a series of which particulars have already been filed.

**Transvaal Hydraulic Power Syndicate, Ltd.**—A memorandum of satisfaction in full on April 26th, 1913, of debentures dated October 27th, 1911, securing £3,000, has been filed.

**James Keith & Blackman Co., Ltd.**—Issue on May 5th, 1913, of £270 debentures, part of a series of which particulars have already been filed.

**Rawlins Bros., Ltd.**—Mortgage and Land Registry Charge on certain land and premises in Pembroke Mews, Helgrave Square, W., both dated May 10th, 1913, to secure £10,000. Holders: Alliance Assurance Co., Ltd., 1, Bartholomew Lane, E.C.

**Electrical Trades Supply, Ltd.**—Particulars of £1,250 debentures, created May 9th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees.

**Silent Electric Clock Co., Ltd.**—Particulars of £800 debentures, created May 5th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

## CITY NOTES.

## Sunderland District Electric Tramways, Ltd.

The annual meeting was held at Winchester House, E.C., on Tuesday.

MR. H. R. HOGG, in moving the adoption of the report (see ELECTRICAL REVIEW, page 822), congratulated the shareholders on the fact that the property was now under their own management, as it was handed over by the Receiver the day after the date of the accounts. The scheme of arrangement with the prior lien and first mortgage debenture-holders was of such a nature that, while settling the claims on an equitable basis, it reduced the fixed charges to a point which should be covered without difficulty by the annual income, and leave a balance in hand for the interests which successively followed after. The outgoings had been under the control of the late Receiver for two years and five months; but as he was unable to spend any of the income on the renewal of cars, most of them were taken over in a very bad state. To remedy this, an order for 10 cars was put in hand at once, and these had been delivered and were now running, and a further six cars had since been ordered. The accounts under review had to allow for full interest on three sets of debentures, and this, with the expenses of the Receivership, increased the old balance to the debit of profit and loss by the sum of £1,175. For some months in the early part of the year the receipts were affected by a strike of colliers, but in the latter half of the year they did fairly well, and at the end the accounts showed a growth of traffic receipts of £649, or over 7 per cent. increase on those of the previous 12 months. During the 26 weeks which had elapsed since the closing of the books, the traffic net receipts had increased by £1,857 over the corresponding period of the previous year. Of course, as he had said, the previous period was affected by the strike, and during the present period there had been the reduction in the charges, but still there had been a continuous increase in the receipts from year to year. The building of houses along the line of route had been steadily increasing, which meant probably that the increase would continue in normal times. He might remind them of their position when the board resumed the control of the property. The cash accumulated by the Receiver amounted to £26,417, but provision had to be made for the payment of the old prior lien bonds, and £10,500 worth of these at 105 and interest brought the total to £11,462. Other debts, amounting to £6,735, had to be paid, making in all £18,197. Thus from that and the sale of 20,000 new prior lien bonds, the board had for the necessary improvement of the rolling stock and line just about £26,000. This would enable them to provide the necessary equipment and make improvements for the better working of the line and the saving of expenses. The standing charges, i.e., the interests which had to be paid every half-year, were reduced to the interest on £140,000, as against the interest which previously had to be paid on £195,500. £40,000 of the first mortgage bonds and £20,000 second mortgage bonds, with the interest accrued during the receivership, had been replaced by bonds which only received interest if earned; but the prior lien bonds were increased by £9,500. He was sorry to say that the company from whom they obtained their power had been taken over by the debenture-holders and sold to another company, and thus they were obliged to make a new arrangement for the supply of current. They were not, perhaps, in such a good position for bargaining as they were at the beginning, but they would do their best to make a good bargain, because, if necessary, they could always erect their own generating station. The present balance-sheet was very complicated, because of the large amounts now standing to the debit of profit and loss, but by reducing the share capital and writing off these debit balances and other assets which were now only nominal ones, the whole thing could be simplified, and the board proposed to bring that before the shareholders at a later date.

MR. R. TAYLOR seconded the motion.

Answering MR. DE PAIVA, the CHAIRMAN said the debentures were reduced to 75 per cent., and 25 per cent. was given to the debenture-holders in income bonds, which would only receive interest if it was earned.

Mr. DE PAIVA said he understood there was some arrangement come to with the income-tax people. The debenture-holders were to have this 25 per cent. allocated to them, but then there was some deduction made by arrangement with Somerset House.

The CHAIRMAN said the matter had not been settled.

Mr. DE PAIVA said he was an income-tax commissioner, and had had to deal several times with appeals by people who had had shares allotted to them representing arrears of dividends, and for which they said there was no market at all. They allowed an appeal like that, and Somerset House was pressing the company for cash they should refuse to pay.

The CHAIRMAN said the board had not paid anything so far, but they were discussing the matter.

Mr. DE PAIVA said the company should say to Somerset House, "These shares are of no value. If you value them at anything, will you buy them?"

The report was then adopted.

### West Coast of America Telegraph Co., Ltd.

SIR J. DENISON-PENDER, K.C.M.G., presided on Tuesday at Electra House, E.C., over the sixteenth ordinary general meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, p. 823), the CHAIRMAN said that the gross receipts for 1912 were £53,738, against £53,891, showing a decrease of £153, but when he pointed out that for the eight months of the year ending December, 1912, they were working at a reduced rate of something like 33 per cent. on the old rate—that was to say, a reduction from 3s. 7d. a word to 2s. 9d.—he thought a decrease of only £150 was a very satisfactory item in the accounts. The working expenses for 1912 were practically the same as in 1911, showing a slight decrease of about £44. Salaries showed an increase of £1,090, rent and taxes an increase of £200, travelling expenses an increase of £265, and stationery an increase of £200. This was, of course, a considerable sum, but was counteracted by the cost of maintenance of cables and land lines, which in 1911 cost £14,300, and in 1912 only £12,162. Therefore, the £2,000 gained on this had gone towards the reduction of the general expenses. These had been carefully gone into, but it was impossible to work the company efficiently on less salaries, &c., which must increase with the increase of the traffic. The number of days on which the cable was down in 1912, when they lost traffic, was 23, as compared with 59 in 1911, which was also a satisfactory feature. A shareholder had written to him pointing out that the expenses of the company had nearly doubled in the last 15 years. This was perfectly true, but it was pretty much the same thing with every company, whether it was a cable or manufacturing company. The increase in expenses had been very large, because wages and the cost of materials had gone up, but at the same time they must not overlook the fact that the traffic during this period has also more than doubled. Another shareholder had written with regard to the future, and asked what difference the Panama Canal would make to them. That, of course, they could not say. At any rate, it would be made a new highway through Central America, and he could not see that it could do any harm to the West Coast of America. It certainly ought to develop that part, and, if anything, the company ought to benefit by the opening of the Canal. In conclusion, the Chairman proposed the adoption of the report, with the declaration of a dividend of 2½ per cent.

SIR ALBERT J. LEPPOC CAPPEL seconded the motion, and it was carried.

A hearty vote of thanks was accorded the board and staff.

### Eastern Extension, Australasian and China Telegraph Co., Ltd.

THE half-yearly meeting was held on Tuesday at Electra House, E.C., Sir J. Wolfe Barry presiding.

In proposing the adoption of the report (see ELECTRICAL REVIEW, p. 822), the CHAIRMAN said that the gross receipts for the half-year amounted to £379,000 against £359,000 in the corresponding six months of 1911; an increase of £20,000. Nearly £4,000 of that increase was derived from additional reserve fund investments, and the remainder (£16,000) was due to growth of traffic spread over the whole of the company's system. The working and other expenses amounted to £154,000, showing a decrease of £5,000, partly due to the expenses attending maintenance of cables having been nearly £2,000 less last year than in 1911, and partly to the general expenses of stations having been debited in 1911 with the cost of new relay and other apparatus, for which there was no corresponding item in the accounts for the past half-year. Comparing the figures for the whole year the following satisfactory results were seen:—The gross revenue for 1912 amounted to £747,000, against £689,000 for 1911, showing an increase of £58,000, whilst the gross expenditure for the past year was within a few hundred pounds of the expenditure for 1911. Since December last the depreciation of investments, unfortunately, had further increased by about £17,000, which would be dealt with during the current year. The cable which the Eastern Telegraph Co. had arranged to lay between Aden and Colombo to connect with their new cables would probably be completed towards the end of the current year, and their further sections between Penang and Hong Kong were expected to be laid and opened for traffic in the

early part of 1914. The cost of their new cables would amount to about £750,000, which would be charged against the general reserve fund. The revenue balance carried forward for 1912 amounted to £27,000, against £23,000 carried forward in 1911. The chairman then referred to the proposed new articles of association, and remarked that in addition to the necessary changes to bring them up to date, it was proposed to restrict the directors' borrowing powers, which at present were unlimited, to two-thirds of the nominal amount of the capital. Provision was also made for the appointment and payment of committees of the directors—such payment not to exceed £1,000 per annum without the previous sanction of a general meeting. The new articles also provided for the holding of annual instead of half yearly meetings.

Mr. F. A. BEVAN seconded the motion.

The CHAIRMAN, in reply to a shareholder, who suggested that in view of the flourishing condition of the company the directors might increase the dividend, said he believed their policy of putting their money to reserve was one which on the whole commended itself to the shareholders. By that means they had been able to maintain a steady dividend and to undertake very large extensions of their cables, thus giving the company stability and ability to meet the demands which were constantly being made upon them for lower rates, and a consequent increased volume of traffic passing over their cables. The directors still considered that policy to be the right one, and that it would be a great mistake, especially at the present time, to pay a higher dividend. With regard to wireless telegraphy, there had been nothing in the development of that system during the past year which in any way affected the question. Of course everybody knew that it was the intention of the Government to set up the system in various parts of the globe, but as to whether in view of wireless telegraphy the company was wise in extending its cables, the view of the board was that it would never do for them to be caught napping by finding themselves in the position of not having sufficient cables to do their work. They could not hold their hands and wait for the extension of wireless telegraphy, which might or might not compete with them for the traffic. It would be suicidal to pause in any way and let the traffic which they had fall behind for want of proper cable facilities.

The reported was adopted, and subsequently the new articles of association referred to by the chairman were approved.

### Prospectus.—Nitrogen Products and Carbide Co., Ltd.

—The list was to close on 21st inst. in an issue of 1,231,000 shares of £1 each, offered at par. The company has been formed to acquire the undertakings particularised in our "New Companies" section to-day. The principal objects of the company are to manufacture carbide, cyanamide, nitric acid, nitrate of ammonia, sodium cyanide, and other nitrogenous products. The company intends at once to proceed to harness up about 100,000 H.P., and to install plant, embodying furnaces of a type entirely different from those hitherto used at Odda, and capable of producing about 200,000 tons of cyanamide per annum. Of this quantity it is intended that 100,000 tons shall be utilised for conversion into about 50,400 tons of nitrate of ammonia at works to be erected adjoining the cyanamide factory, and that of the remaining 100,000 tons of cyanamide, part shall be used in the manufacture of sodium cyanide and the balance shipped to various parts of the world, where plants will be installed for converting it into nitric acid.

### Kalgoorlie Electric Power and Lighting Corporation, Ltd.

—The directors report that for the year to December 31st the decrease in the profit is chiefly due to the damage done to the plant and transmission lines by the violent cyclone which occurred in February of last year. The direct cost of rebuilding the damaged works, including new material, amounted to £2,436; the actual loss of revenue and the extra cost of operating during the reconstruction of the condensing plant amounted to about a further £2,500. The amount of power sold was larger than in any previous year. In accordance with the usual custom, £7,500 has been placed to reserve for depreciation and renewals, bringing that account up to £38,000. The balance to be carried forward is £992. The directors much regret that the financial position does not permit them to recommend the payment of a dividend on the ordinary shares. A new unit of plant has been sent to Kalgoorlie and is now being erected, and will be in operation during the latter half of this year. It consists of a 1,080-B.H.P. Parsons turbine and a 750-kw. alternator. The synchronous motors, referred to last year, have also been sent out. When these new items of plant are working, higher efficiency will be attained, resulting in a lower cost per unit of power.

### Traction and Power Securities, Ltd.—

—The directors report that the profit and loss account for the year 1912 shows a credit balance of £31,259, plus £9,996 brought forward, making £41,255 to be dealt with. The directors have transferred £30,000 to investment reserve account, leaving a balance of £11,255 to be carried forward. The investment reserve account now stands at £190,000. The *Financial News* says that the company's loan to the Clyde Valley Electrical Power Co. has, since the date of the balance-sheet, been repaid out of the proceeds of an issue of preference shares made by the Clyde Valley Co. In view of the liquidation of this loan, the directors have been approached by an influential body of shareholders with the request that a portion of the paid-up share capital be repaid. After full consideration, the board have resolved to recommend the repayment of £2 per share on the issued shares, the nominal value of such shares being at the same time reduced from £10 to £8 per share.

### Coventry Electric Tramways Co.

THE directors' report for 1912 stated that during the year the company received from the Coventry Corporation payment of the purchase price of the undertaking, in accordance with the arbitration award, so that the asset appearing in the last balance-sheet, under the head of construction and equipment account, does not appear upon the present balance-sheet. The amount received from the Corporation was £202,132, and sundry other receipts amounting to £87, stock reserve as per last balance-sheet £358, making total capital receipts of £202,578; deduct capital outlay as per last balance-sheet £201,186, leaving net surplus upon construction and equipment account of £1,392. Out of the funds received the company has paid off the liabilities appearing in the 1912 balance-sheet, including £34,000 on mortgage bonds, £21,470 new General Traction Co.'s account and sundry other creditors. The income received during the year under review amounts to £6,596. After deducting mortgage interest and other charges, there is left a profit of £5,440, to which is added £250 brought forward, making £5,689 available for distribution as dividend. The directors recommend that this amount be appropriated as follows:—£5,525 to the payment of a dividend at 8s. 6d. per share, and £164 carried forward. In January, 1913, the directors refunded to the shareholders by way of a return of capital £129,350, amounting to £9 19s. per share, in accordance with the resolution passed at the extraordinary general meeting held on November 8th, 1912. This still leaves a balance out of the purchase money which will in due course be distributed amongst the shareholders.

### Potteries Electric Traction Co., Ltd.

THE annual meeting was held on Monday, at the Electrical Federation Offices, Kingsway, W.C., Mr. G. F. M. Cornwallis-West presiding.

THE CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 818), congratulated the shareholders upon the result of the year's working, especially considering the serious effects of the coal strike at the commencement of the year, and the inclement weather of the whole of last summer. Dealing with the capital account, £2,558 had been spent, £1,551 being on account of the improvement and reconstruction of the permanent way. He did not want them to go away with the idea that all reconstruction work was paid for out of capital. Where they had to put down a heavier rail, which was a considerable item of expenditure, they had debited that amount—that was the difference between the original cost of the lighter rail and that of the new rail—to capital account. Under all other headings this expenditure had been debited to revenue or to renewals. The traffic showed a decrease which he considered small when they took into consideration the two adverse factors already alluded to. The total amount was only £505. As he informed them last year, the traffic receipts showed up to the commencement of the strike an increase of £790 over those for 1911. At the end of the strike that increase was turned into a decrease of over £2,500, so that, roughly speaking, they lost £3,500. These figures would give them some indication of the probable results of the year's working, but for the labour trouble. On the top of this absolute loss of £3,500, it must be remembered, in considering the revenue account, that an additional burden was thrown upon the staff in the maintenance of the service. Fuel had to be obtained at any price, and in addition to being costly, it was of a very inferior quality; it was even necessary to go to the length of obtaining coal from out-crops in the district, and the energies and resources of the staff during this trying period deserved the highest praise. The parcels receipts continued to show increase, and the advertising receipts remained at about the same figure as the year before. Under the heading of sundry receipts, there was an apparent decrease of some £1,900, but this was entirely accounted for by the different manner in which they were dealing with the sale of scrap material. In past years all cash so received was credited to sundry receipts; this year the value of the scrap sold was credited to the work in hand from which the scrap was taken, as shown in the balance-sheet, where the sum of £2,085 was credited to renewals account. Interest and dividends on their holding in the North Staffordshire Tramways remained the same as last year. On the other side of the revenue account, despite the difficulties under which they were working, their power, running, and parcels expenses, had not increased in total: in fact, they showed a small decrease of about £100, and administration expenses also remained at about the same figure as last year. Repairs and maintenance, after excluding the sum to which he had already referred as realised for the sale of scrap, showed a reduction of £1,464. He wished most emphatically to state that they might not look forward to any reduction in the future in this item of expenditure. In the year 1905 he went very fully into the details of a financial arrangement they were making for the renewal of the permanent way. In that year £2,500 was allocated to be set aside for renewal purposes. Year by year the contributions to that fund had been increased, viz., £3,500 in 1907, £5,409 in 1908, £7,090 in 1909, £7,525 in 1910, £12,000 in 1911, and this year £12,500. That meant they had set aside a sum of £50,000 during the last seven years for renewals. They were able to forecast within certain narrow limits the probable expenditure in the years to come, and in dealing with this point, he thought he should tell the shareholders that they were at present negotiating with the Corporation of Stoke for an extension of their tenure. As they all knew, under the present Act and Light Railway Orders, the tenure of the tramways expired in 1917, and of the light railways in 1932. Negotiations were proceeding, and they would readily

appreciate that they were of a somewhat delicate nature, so that until final terms, or otherwise, were arrived at, it was not advantageous to go more fully into the details. Directly the matter was settled one way or the other, all the shareholders would be apprised of the fact. He mentioned that now, because of its bearing on the amount they proposed to set aside to the renewals fund. If they were able to prolong the tenure, those amounts would be somewhat varied, but he would say this: that in all probability in the next eight or nine years, assuming they came to terms with the Corporation, there would for certainly three or four years be shown a balance carried forward on the debit side of the renewals fund, which would be more than made up a few years afterwards, when they would see a big amount on the credit side. Summarising the result of the year's working they might look upon it in this way: They were able to provide £500 more for renewals; place the same amount to reserve, pay the same dividend on the ordinary shares, and carry forward £136 less than was brought into the account. In other words, despite labour troubles and inclement weather, they were £365 better than in 1911, which was almost a record year for the company. With regard to the present year, the conditions were satisfactory, and there was a very substantial increase in the traffic receipts for this year, as compared with 1912, but they must bear in mind that the period they were dealing with compared with the period last year in which the strike occurred. Still, the receipts were close on £6,000 up, as compared with last year. That was very satisfactory.

MR. S. MEAR seconded the motion, and the report was adopted.

### Swiss Electrical Companies.

*The Akkumulatoren Fabrik Oerlikon, of Oerlikon, reports that the workshops were satisfactorily employed in 1912, and the turnover increased, particularly in heavy batteries. After placing £5,000 to the depreciation fund, as against £5,400 in 1911, the accounts show net profits of £12,700, as contrasted with £12,400 in the preceding year. The dividend is at the rate of 20 per cent. on a share capital of £48,000, the same as in 1911.*

*The Société Franco-Suisse pour l'Industrie Electrique, of Geneva, reports total receipts from interest, dividends on investments, &c., of £104,000 in 1912, as compared with £95,000 in the previous year. The payment of interest on the loans of £944,000 leaves net profits of £56,000, as against £47,000 in 1911. It is intended to distribute 5 per cent. on the share capital of £1,000,000, this rate contrasting with 4½ per cent. in the preceding year.*

*The Schweizerische Gesellschaft für Elektrische Industrie (Swiss Electrical Industry Co.), which is an investment trust closely associated with the Siemens & Halske Co., has an ordinary share capital of £800,000 and 4½ per cent. bonds of £1,200,000 and 5 per cent. bonds of £600,000, the last of which were issued in 1912. According to the report for 1912 the gross profits amounted to £136,000, as compared with £102,000 in the preceding year, and after deducting interest on bonds and defraying general expenses and taxes, the net profits are returned at £69,000, as against £50,000 in 1911. It is proposed to pay a dividend of 7 per cent., being the same rate as in the previous year.*

*The Motor A.G. für Angewandte Elektrizität, of Baden (Applied Electricity Co.), which is intimately connected with Brown, Boveri and Co., reports an extension of its sphere of activity in the working of, or investment in, electrical undertakings in 1912. The share capital was nominally increased by £400,000 to £1,200,000, the paid-up capital being £916,000, and a further loan of £200,000 at 4½ per cent. was issued, thus raising the loan capital to £1,000,000. As gross profits from the operation of works, installation business and investments, the accounts indicate the sum of £123,000, as compared with £95,000 in 1911. After meeting general expenses, interest on loans and depreciation, the net profits and balance forward total £68,000 as against £53,000 in the previous year. It is intended to pay a dividend of 7 per cent., as contrasted with 6½ per cent. in each of the two preceding years.*

*The report of the Elektrizitätsgesellschaft Alsthof, of Basle, most of whose share capital is held by Brown, Boveri & Co., of Baden, states that the specialisation of production and the division of work among the different works were carried out in 1912, and the way thereby paved towards the ultimate transfer of the Münchenstein shops to Brown-Boveri. The construction of new types of motors was commenced in the spring, and the erection of locomotives was added late in the autumn. During the second half of the year the company was very well employed, and a number of uncompleted orders were brought over into the new year. The realisation of the credit with the former representatives in Italy had been fully effected, and that in the case of the Spanish company had been almost entirely carried out, whilst the liquidation of business in France was proceeding along a normal course. As a result, it had been possible to redeem the whole of the banking credit of £60,000. In addition, the 4½ per cent. loan of £80,000 had been paid off, the Brown-Boveri Co. having made an advance for this purpose. The profits for 1912 amount to £18,900 as compared with £19,500 in 1911, and after allocating £7,000 to depreciation as against £6,800, the balance permits of the payment of a dividend of 4½ per cent. on the share capital of £240,000, being the same rate as in 1911.*

**Tramways and General Works Co., Ltd.**—The directors report for the year ended March 31st, a profit, including £151 brought forward, of £1,142. A dividend of 1s. per share is recommended carrying forward £142.

## Mexborough and Rawmarsh Construction Syndicate, Ltd.

THE annual meeting was held at 3, Laurence Pountney Hill, E.C., on Monday, Mr. L. B. Schlesinger presiding.

In moving the adoption of the report (see *ELEC. REV.*, page 819), and the declaration of a dividend at the rate of 2 per cent. per annum, the CHAIRMAN said that the expenses of working amounted to the small total of £13 15s., and the balance of £3,522 was £20 in excess of the dividend received from the Mexborough and Swinton Tramways Co. No charge had been made by the National Electric Construction Co. for the services of secretary, offices, and clerical staff. The directors had again waived their fees. The balance to the credit of profit and loss account was £3,695, compared with £4,517 for 1911, the difference being due to the reduced amount received from the Mexborough and Swinton Tramways Co. by way of dividend. Referring to the accounts of the Mexborough and Swinton Tramways Co., the chairman said that the traffic revenue showed a decrease of £506, which was wholly attributable to the coal strike. When he addressed them on April 15th last year, the traffic receipts at that date showed a decrease of about £400, as compared with the corresponding period of the previous year, and although he expressed the hope that they might make up this deficit by the end of the year, his hopes were not realised. The traffic receipts for the current year up to the 16th inst. showed an increase of £936 over the corresponding period of last year. There was a decrease of £128 in the profit derived from the tramways undertaking, which could be attributed solely to the decrease in revenue, as the working expenses were less than those for 1911. The results of the Rawmarsh electric lighting undertaking were unsatisfactory, as they showed a loss of £211, as compared with a profit of £138 in 1911. On the other hand, the Swinton undertaking showed a profit of £91, against £37 in 1911. Here again, however, the coal strike had hit them badly, as it had all supply undertakings throughout the country. In January of 1912 they were paying for coal 6s. 3d. per ton. In June this had risen to 8s. 6d. per ton, and in December to 9s. 6d. The total cost for fuel amounted to £1,901, as compared with £1,572 in 1911, an increase of £329, which was almost wholly due to the increased cost. During the year 1,069 8-c.p. lamps were connected to the mains, and at the present moment negotiations were in hand for several motors. They had also been requested by a colliery to quote terms for the supply of something like 800,000 or 900,000 units per annum, and this matter was having the attention of their engineers at the moment. If such a consumer could be obtained on reasonable terms, their accounts would show very differently indeed, as it would practically double their output. The plant extensions referred to in the report should be completed about the end of September, and they would effect substantial economies in working. If they got the Bill for which they were applying, it would enable them, at a comparatively small capital expenditure, to connect with the tramways the populous districts of Wath, Denaby and Conisborough. The additional population to be served would be about 30,000. These districts, although within a mile or so of their tramway system, had no connection with it; in fact, they had practically no travelling facilities at all, and it was originally anticipated, he thought with reason, that the tramways would be taken advantage of by the inhabitants of these districts, but this had not been the case, or at least, only to a very small extent, but with such a system in operation it should, in addition to earning a good profit, have a very beneficial effect on the revenue of the tramway undertaking, to which it would act as a feeder. The directors had no hesitation in saying that if the powers were granted, there should be an immediate increase in value of the shareholders' property. While they had had a set-back this year, owing to the coal strike, they had no reason to be discouraged. The report was adopted.

## Deutsch-Atlantische Telegraphen Gesellschaft.

THE report of the German Atlantic Telegraph Co. states that the Atlantic cable traffic experienced a further development in 1912, and that on the Vigo cable increased in one direction, and slightly declined in the other. During the year one of the company's Atlantic cables, as well as the Vigo cable, was interrupted for short periods. Nevertheless, it was possible to deal with the traffic on the other cable sections without much delay. The repairs were carried out promptly and comparatively quickly by the cable steamer *Grossherzog von Oldenburg*, notwithstanding the very unfavourable weather which prevailed. The Norddeutsche Seekabelwerke, in which the company holds an interest of £150,000, has been engaged on the manufacture of the Monrovia-Togo-Camerons cable for the German South American Telegraph Co., as well as on various telephone and telegraph cables for abroad, and the Seekabelwerke's dividend of 10 per cent. for 1912 will be brought into the accounts for 1913. The introduction of the Heurtly system, whereby a considerable increase in the speed of transmission on cables is rendered possible, was almost completed. In the case of the Vigo cable the result had been that the traffic, which would have necessitated a doubling of the cable in the near future, could now still be handled with the single cable. The general introduction of radiotelegraphy on ships had yielded a satisfactory volume of traffic to the cables through the coastal stations, and, instead of being a competitor, it had grown into a valuable feeder to the cables. Concerning the "L.C." private telegrams at half rates, which were brought into operation on January 1st, 1912, the report records a good development and a permanent increase, and it is also mentioned that the rates for Press messages were

reduced from 50 pfennigs to 35 pfennigs (6d. to 1½d.) on December 1st, 1912. A further extension of the system of the telegraphic transmission of money had taken place by the inclusion of the neighbouring countries of Luxemburg and Switzerland. It is also stated that the obligation to lay cables for the Portuguese Government in the Azores had been discharged by the establishment of wireless connections at a single cost of £10,000. The accounts show gross receipts of £288,000 for 1912, as compared with £267,000 in the previous year. After meeting general expenses and taxes, the cost of cable repairs, and placing £30,000 to the cable redemption fund, as against £29,700 in 1911, the net profits are returned at £139,700, as contrasted with £111,000 in the preceding year. It is proposed to pay a dividend of 7½ per cent. on the share capital of £1,200,000, being the same rate as in each of the two previous years.

## German Electrical Companies.

THE *Elektrotech. Fabrik Rheylt Max Schorch & Co.* records an increase of 60 per cent. in the turnover in 1912, although selling prices did not keep pace with the higher cost of raw materials. As net profits the accounts indicate the sum of £9,900, as against £9,800 in 1911, and the dividend at 8 per cent. is the same as in the previous year.

The *Elektrochemische Werke, of Berlin-Bitterfeld*, earned gross profits of £82,000 in 1912, as against £89,000 in the preceding year, the net profits being £60,000 as compared with £67,000 in 1911. It is intended to distribute 10 per cent., being at the same rate as in 1911. Most of the departments at Rheinfelden and Bitterfeld are leased to the Griesheim-Elektron Chemical Co., the company restricting its operations to the production of oxalic acid.

The financial statement of the *Sachswerk Licht und Kraft A.G., of Niedersiedlitz*, records gross profits of £39,000 for 1912, as contrasted with £27,800 in 1911. Depreciation absorbs £8,700, as compared with £6,500, and the net profits were £30,300, as against £21,300 in the previous year. It is proposed to pay a dividend of 6 per cent., as in 1911. The orders on hand on January 1st, 1913, were 30 per cent. in excess of the preceding year, and the increase in orders this year indicates favourable prospects.

The accounts of the *Norddeutsche Seekabelwerke, of Nordenham*, whose share capital is held in equal halves by the German Atlantic Telegraph Co. and the Felten & Guilleaume Co., show that the sum of £26,000 has been placed to depreciation in 1912, as compared with £33,000 in the preceding year. The amount placed to the reserve fund is £2,300, as against £16,000 in 1911, whilst the benevolent fund receives £1,500, as contrasted with £6,500. As net profits, the accounts indicate £51,000, as compared with £72,000 in 1911, and a dividend of 10 per cent. is proposed on the share capital of £300,000, being the same rate as in the previous year.

The report of the *Kabelwerk Duisburg, of Duisburg*, states that all departments were well employed in 1912. The selling prices for insulated wires and insulating tubes slightly advanced, and satisfactory prices were realised for lead cables, in which business was active, especially for State and communal authorities. The gross profits were £73,000, as against £60,000 in 1911, and the provision made for depreciation is £24,000, as compared with £16,000. Out of the net profits of £23,800, as contrasted with £23,400 in 1911, it is intended to pay 14 per cent. on the share capital of £112,500, being the same as in 1911. The share capital is now to be raised to £150,000 in order to provide for the extension of the works.

The *Deutsche Kabelwerke, of Berlin-Rummelsburg*, state that the volume of business transacted in 1912, was considerably greater than in the previous year. Including the balance brought forward, the gross profits reached £75,000, as compared with £60,000 in 1911. After deducting general expenses, taxes and interest charges, and apportioning £12,000 to depreciation, as against £5,800, the accounts show net profits of £31,000, as contrasted with £24,000 in 1911. The dividend in contemplation is at the rate of 8 per cent., this comparing with 7 per cent. in the preceding year. An abundance of orders had been brought over into the new financial year, and the turnover had so far shown an increase. It is mentioned that the subsidiary companies experienced a further favourable development in 1912. The Union Cable Co. of Dagenham, whose new factory was set in operation last autumn, is well employed at the present time.

The directors of *Voigt & Haefliger, of Frankfurt-on-Main*, report that a considerable increase in the turnover took place in 1912, the business extending to almost all countries. On the other hand, the cost of raw materials was greater, and larger expenses had to be incurred for wages. The disquiet produced by political events, and the dearth of money, did not have any disadvantageous effect upon the undertaking during the year, although it must be assumed that a continuance of these conditions will cause reserve in the allocation of orders. The orders brought over into the new year exceeded in value those of the previous year, but indications in the direction mentioned are already on hand. The gross profits amounted to £141,000, as compared with £100,000 in 1911, and after meeting general expenses and ordinary depreciation the accounts exhibit net profits of £72,000, as against £42,000. It is intended to distribute 10 per cent. for 1912, being the same rate as in each of the five preceding years, and the sum of £25,000 has been placed to extra depreciation, as contrasted with £5,500 in 1911.

The report of the *Aluminium Industrie Gesellschaft, of Neuhausen*, for 1912, states that the exceptionally low price of the metal had opened up many uses for aluminium, which had favourably influenced the development of the industry, and enabled the company to dispose of the whole of the production. In the meantime

a new agreement has been concluded between the aluminium works for the purpose of securing stability in prices and a constant extension of the markets. The company's subsidiary departments—those for the output of carbide and nitric acid—had yielded results in accordance with expectations. After placing the sum of £56,000 to depreciation in 1912, as compared with £45,000 in 1911, the accounts showed net profits of £148,000, as against £92,000, these being increased to £183,000 and £131,000 in the two years respectively by the inclusion of the balance brought forward. A dividend at the rate of 20 per cent. has been declared on the paid-up capital of £520,000 out of a total nominal capital of £1,040,000, this contrasting with 14 per cent. in each of the two preceding years. Out of the balance of net profits the amount of £24,000 has been allocated as a first instalment to a fund intended for the gradual payment of the unpaid ordinary shares of £520,000. The company has realised its investment of £50,000 in the electric steel works of R. Lindenberg, and devoted the proceeds mainly to depreciation in connection with the Marseilles and Goldschmied-Trotha subsidiary companies. At the recent meeting it was stated that the prospects for the current year were favourable, judging from the course of business during the first four months.

### Allmana Svenska Elektriska A. B.

THE annual report for 1912 of the Swedish General Electrical Co. has recently been published. The company has a capital of £333,333, which is equally divided between ordinary shares and preference shares. The dividends to be paid are 10 per cent. on the preference shares and 8 per cent. of the ordinary shares, as compared with 9 per cent. and 7½ per cent. in 1911. The net profits amounted to £35,877 in 1912, £28,555 in 1911, £24,833 in 1910, and to £16,333 in 1909. The gross profits for 1912 amounted to £50,666, as compared with £42,166 for 1911, £31,000 for 1910, and £22,666 for 1909.

The course of business is shown in the following table:—

	1908.	1909.	1910.	1911-12.
Turnover . . . . .	£670,000	£506,000	£333,333	£711,100
Value of exports . . . . .	88,338	68,777	117,444	174,777
Orders in hand, per December 31st, 1912 . . . . .	—	—	186,500	205,000
Engines and machines delivered . . . . .	9,760	8,345	5,566	6,011
1,000 kw. . . . .	140	105	230	220
Number of workmen . . . . .	2,167	2,384	2,462	2,527

The above table shows in all figures a distinct improvement and increase, as compared with the previous years. The only exception is to be found in 1909, which year, however, was quite exceptional on account of the large and prolonged strike. The increase of the export figures is especially remarkable, and the progress is even more striking if a comparison be made with the value for 1906, when it only amounted to £27,000. The exports have in the course of seven years thus increased at a ratio of nearly 1 : 8. The flourishing state of the export branch may, to a great extent be explained by the enormous requirements for electrical machinery of the Norwegian nitrate industry, which was the company's best customer. As regards the prices obtained, these are stated to have been rather low, but this has been more than outweighed by the increased volume of business. In regard to future prospects, it is stated that there is no indication of any slackening of the demand for electrical goods and machinery, at all events as far as 1913 is concerned. With the view of securing more business in future, it is the intention of the directors to enter into a closer connection with a financial institution, so as to enable the company to take an active part in the promotion and financing of enterprises.

### Belgian Electrical Companies.

THE *Société Générale Belge d'Entreprises Electriques, of Brussels*, which is an investment company, earned gross profits of £84,000 in 1912 as contrasted with £76,000 in the previous year. After making provision for general expenses, interest on loans, and making other appropriations, the accounts exhibit net profits of £62,000 as against £53,000 in 1911, the directors recommend a dividend of 10 per cent., this comparing with 9½ per cent. in 1911.

The report of the *Société Anonyme A.E.G.—Union Electrique* states that the general industrial development which was manifested at the beginning of 1912, enabled the company to again considerably extend its business. Whilst the augmentation which took place in 1911 was chiefly in connection with central stations and tramways, the increase in 1912 arose principally from the expansion in industrial transactions and in general sales. This result was due the decentralisation of the organisation which had been undertaken in recent years by the establishment of five offices at Antwerp, Ghent, Liège, Charleroi and Brussels. The extension of the business had necessitated an increase of 10 per cent. in the number of the personnel employed, which amounted to 722 workers, staff and engineers. The length of the working day had been reduced by 10 per cent., and the annual average wages of the workers and assistants advanced from £52 10s. in 1911, to £62 16s. last year. After making provision for depreciation of raw materials and manufacturers' and works' plant, the accounts show net profits of £15,800, or approximately the same as in 1911. It is proposed to pay a dividend of 6½ per cent. for 1912, being the same rate as in the preceding year, on an ordinary share capital of £140,000.

The directors of the *Ateliers de Constructions Electriques de Charleroi* report a considerable increase in the orders booked in 1912, all the departments being abundantly provided with work.

The value of the orders amounted to £771,000 as compared with £576,000 in 1911, and the company's customers were retained notwithstanding the efforts put forward by foreign competitors. Including the balance brought forward the accounts indicate profits amounting to £78,000, of which £39,900 has been devoted to depreciation, thus leaving a balance of £38,100. It is intended to pay a dividend of 14s. 10d. per share on the paid up capital. The share capital was increased to £500,000 in December 1912, and the premium of £80,000 realised on the issue has been applied to writing down the value of the works, so that the Charleroi-Marcinelle construction works, the Charleroi-la-Villette works, the iron and bronze foundry and the cable factory, wire drawing mills, and tube factory now stand at the value of one franc only in each case. The company gives employment to 2,500 persons. During the past year orders for electric motors for rolling mills have been executed for a number of the leading metallurgical concerns in Belgium, including the Cockerill Providence, Sambret-Moselle, Metallurgique du Hainaut Athus-Grivegnée, Esperance-Longdoz Clabecq, and Thy-le-Chateau Companies. An extensive business was done in electric winding engines and other electric plant for collieries, installations of this kind having been put down at the Marcinelle Nord, Bonne Fin, Shepy Braquegries, Andre-Dumont, &c. Electrically-operated mining pumps have also been supplied to the Grand Horon, Grand Conty, Reunis, and Ongree-Maribaye collieries. Considerable activity has also prevailed in the production of steam turbines and alternators, plants of this kind having been completed for the Société de Gaz et de l'Electricité de Hainaut, the Brussels Municipality, La Société de l'Electricité de l'Ouest de Belgique, La Société de l'Electricité du Brabant, La Compagnie Auxiliaire d'Electricité, La Société des Tramways de Tientsin (China), &c. In the electric cable department of the company the value of the orders secured was equal to three times that of those of the previous year, several important contracts for cables for from 15,000 to 18,000 volts having been completed, while the manufacture of 30,000-volt cables has been commenced. Among the orders recently completed or on hand, are cables for the Société des Tramways Bruxellois, the Ghent Tramways, the Ostend-Blankenberghe Electric Railway Co., La Société Auxiliaire de l'Electricité, La Société Bruzelloise de l'Electricité, &c.

### New General Traction Co., Ltd.

THE directors' report and accounts for the eight months ended March 31st, 1913, states that since July 31st, 1912, the date of the last balance-sheet, the liabilities of the company had been reduced out of the proceeds of the sale of the Coventry undertaking by the repayment of loans amounting to £40,700, by the redemption of the balance of £68,000 prior lien debentures, and by the repayment of £41,700 of 5 per cent. mortgage debentures, leaving £158,300 5 per cent. debentures still outstanding. The revenue received and accrued from the various sub-companies amounted to £19,013 for the period under review. The general expenses, including directors' fees and legal charges, amounted to £1,799. The accounts for the period show a profit of £10,288, to which is added £4,690 brought forward, making a total of £14,978 available for distribution. The directors recommend that this sum should be appropriated as follows: £10,480 to the payment of a 4 per cent. dividend, less income-tax, and that £4,498 be carried forward. The dividend received from the Coventry Electric Tramways Co. for the year ended December 31st, 1912, was 8s. 6d. per share. The accounts of the Norwich system show that there was an increase in the traffics for the year, and a decrease in the expenses. A dividend of 3 per cent. was received from that company for the year ended June 30th, 1912, as against 2 per cent. for the previous year. The Douglas Southern Electric Tramways, Ltd., paid 6 per cent. on its preference shares. The income received from the Philadelphia undertaking was in respect of the six months ended December 31st, 1912, and amounted to £6,965. The directors' reports and accounts of the Coventry Electric Tramways Co., the Norwich Electric Tramways Co., and the Douglas Southern Tramways, Ltd., are annexed to the report, and we publish them on other pages to-day.

**Anglo-American Telegraph Co., Ltd.**—An extraordinary general meeting of the shareholders of the above company was held on Monday at Winchester House, E.C., Mr. F. A. Bevan presiding, when the resolution which was passed at the extraordinary general meeting held on April 29th, providing new articles of association, was confirmed as a special resolution.

**Submarine Cables Trust, Ltd.**—At this company's meeting on Wednesday the chairman, Sir J. Denison-Pender, reported that the receipts for the year 1912 were £25,496 and the expenses £1,714. After adding the sum brought forward, the available balance was £23,850.

**Melbourne Electric Supply Co., Ltd.**—The directors have declared a dividend of 4 per cent. actual, free of income-tax, on the £300,000 consolidated ordinary stock, in respect of the half-year to February 28th. The *Financialist* says that should the earnings of the company continue to show the same satisfactory expansion as they have done hitherto, the directors anticipate that the dividend on the consolidated ordinary stock for the complete financial year ending August 31st will be 10 per cent.

### Calcutta Electric Supply Corporation, Ltd.

MR. PAGET V. LUKE, C.I.E. (chairman), presided on May 15th, at the office, Salisbury House, E.C., over the annual meeting.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 818), said the capital expenditure during the year was £127,509, largely on account of machinery and mains in connection with their new high-tension generating station at Cossipore. The total capital outlay up to December 31st amounted to £1,161,186. It was satisfactory to note that in letting the contracts for the work in connection with the high-tension station, there was a very considerable saving which went towards the cost of several additions to the original scheme, the demand for which arose as the work progressed. The revenue account showed on the debit side a normal increase in running costs due to a larger output. On the credit side there was a satisfactory increase in the sale of current, both for lighting and power purposes. Last year he expressed the hope that the supply of high-tension current from their new station would begin in July or August. As a matter of fact, the new machinery was in position in July, but owing to difficulties which not infrequently arose when starting new plant, it was found necessary as a precautionary measure, to keep some of the old stations running longer than was anticipated. But for this, there would have been a considerable saving in working expenses. The amount to the credit of depreciation and renewals was £79,310, and with the increase of £35,000, which it was proposed to add, it would amount to £114,310, which was a handsome figure, but none too large when they bore in mind the big additions to capital expenditure. It was also proposed to add to the reserve fund the sum of £5,000, and in future to credit to this fund the dividends on investments which amounted during last year to £1,987. Owing to the depreciation of some of the gilt-edged securities, the directors had decided to write £1,500 off their value to the debit of the revenue account. The most important feature of the year was the opening of the high-tension station at Cossipore. The initial difficulties connected therewith had been successfully got over, and they were now in a position to meet any demands for current likely to arise in the immediate future. The increasing demand for current in the Howrah district had culminated in a 20-years' contract for lighting the streets. Two heavy cables were successfully laid across the Hooghly River, and their old generating station at Howrah had been turned into a sub-station served from Cossipore. This laying of cables across a strong tidal river was a work of no small magnitude, and their staff had to be congratulated on its successful achievement. The estimated outlay in connection with the Howrah extension amounted to £18,400. A demand for current had arisen in the neighbourhood of Chetla, a district to the South of Calcutta, where rice-pulling mills were being erected. It had been decided to extend their mains to Chetla and to open a sub-station there. Although these outlays represented a very large expenditure, it was gratifying to see that the profits of the company continued satisfactory, and that there was no difficulty in maintaining the rate of dividend recently paid. The Calcutta improvement scheme had now entered on its second year, and they might soon see some of the proposed schemes put into force, the carrying out of which should tend to promote a demand for electric energy. There was every indication that the question of the economical use of electricity in place of steam had reached an acute stage, and the directors hoped, with the new high-tension plant now at their disposal, that the Corporation would be able to supply current at a price which would induce mill managers and other large consumers to come to them for the power they might require. The difficult matter of the rates to be charged for current was one which had the fullest attention from the directors and the consulting engineers. The supply of current at the cheapest possible rate must, however, be made consistent with a profit satisfactory to the shareholders and the building up of a sufficient reserve for contingencies. In December last one of the directors (Major-General Mahon) went to Calcutta to inspect the undertaking and report to the board. He went very thoroughly into the methods of working and accounts, and his visit and report had been of the greatest assistance, not only to the board, but to the agent in Calcutta, where arrangements had been made which, it was believed, would ensure economical and efficient management of the company's affairs, and prepare the way for carrying out the further extensions which must, in due course, become necessary. As regarded the transfer of the Capital to Delhi, the manager reported that, as expected, it had not affected the prosperity of the company to any extent. It was with much regret that he had to inform them of the retirement of their agent and manager, Mr. F. Rawson, C.M.G., who had so ably controlled their affairs in Calcutta for the past 5½ years. He had piloted the company's business through a difficult time with much tact and ability, and with great success, as the report in their hands testified. He was only leaving because he had no wish to remain another hot season in a tropical climate, and he would ask the shareholders to accord him a cordial vote of thanks for his services. Mr. R. E. Winkfield, M.I.E.E., who had been the chief engineer of the company, and had performed his duties to the satisfaction of the board, and who on several occasions had acted as agent and manager in the absence of Mr. Rawson, had been appointed agent and chief engineer. The board felt satisfied that in making this appointment they were consulting the best interests of the shareholders. The whole of the staff arrangements of the company had been reorganised, in consequence chiefly of the opening of the Cossipore station, and Mr. Winkfield would be assisted on the engineering side by a deputy, and also on the commercial side by the deputy agent. In making these new arrangements, General Mahon's report had been of much assistance to the board. The

chairman next alluded to the question of directors' extra remuneration. They were of opinion that the time had come when a maximum should be fixed to the extra remuneration, and accordingly, instead of proposing an alteration in the articles of association, they had passed a resolution to limit, for the present, the maximum sum to be divided amongst the directors in any one year to £2,500. The agent and the staff had passed through an arduous year of work consequent upon the entire change of the methods of generating and distributing electrical energy, and the satisfactory result of the year's working was in no small measure due to the excellent manner in which they had carried out their duties. The agent bore testimony to this good work of the staff in his annual report, and their services were well deserving of their appreciation. He was sure it would be the wish of the shareholders that the whole staff of the corporation should share in its prosperity. To this end the directors had in view a scheme for awarding a yearly bonus to the staff based upon the net annual profits.

COL. F. J. G. MURRAY seconded the motion.

MAJOR GENERAL R. H. MAHON spoke at some length on the condition of affairs in India, and the result of his visit as the representative of the board, and said that having carried out a good many similar inspections, he had seldom found more to praise and less to take exception to. Their thanks were due to Sir Alex. Kennedy and Mr. Jenkin for the admirable lay-out of the central generating station, and the dependent sub-stations, which were arranged so as to be capable of extension, to a practically unlimited extent at the minimum of cost. Their engineers in Calcutta were also deserving of thanks for the successful conclusion of their strenuous task of changing from the old system of supply to the new, without a moment's inconvenience to the public. As to the plant itself, they had had a few minor difficulties, but these had been surmounted, and the latest returns reported an economy of production which was the principal justification of the directors in sanctioning the large outlay. He had also inspected the whole office system which was inaugurated by Mr. Reeve, their secretary, when he visited India some years ago, and which had proved sound and durable. Gen. Mahon referred to the question of the rates to be charged for electricity, and said that as the result of prolonged consideration the board had announced special low rates for very large manufacturers. He was informed that there was in Calcutta approximately 60,000 H.P. in use and available for their enterprise, and so far they had only absorbed a comparatively small fraction.

COL FILGATE suggested that the board might when possible give a small bonus to the ordinary shareholders, which might afterwards crystallise into an increased dividend. He also referred in eulogistic terms to the services of Mr. Rawson, and pointed out that during that gentleman's term of office of five years the net profits had practically doubled whilst the capital had only increased by a third.

The CHAIRMAN expressed the hope that the time would come when the company could pay a bonus.

The report was adopted.

On the motion of COL. FILGATE, a resolution was passed regretting the retirement of Mr. Rawson, and expressing the appreciation of the shareholders of his services to the company.

The CHAIRMAN pointed out that whilst theirs was a commercial undertaking, yet they were engaged in a work which was of real benefit to the people. He was constantly told that the conditions of life in Calcutta had altogether changed since the introduction of electricity.

### Norwich Electric Tramways Co.

THE directors' report for the year ended June 30th, 1912, shows that the total receipts were £36,713, an increase of £1,069, and the total expenditure was £26,730, a decrease of £429. The net profit was £9,983, an increase of £1,498. The above amounts for expenditure include debenture interest, donations and London expenses. Adding £1,013 brought forward from last year (after paying the dividend and providing for the reserve), there is a total of £10,996 to be dealt with. The directors recommend that of this, £2,500 should be put to the reserve fund account, £7,920 to the payment of 3 per cent. dividend for the year ended June 30th, 1912, and £576 carried forward.

	1911.	1912.
Car-miles run . . . . .	1,099,985	1,050,458
Passengers carried . . . . .	8,490,019	8,817,963
Earnings per car-mile . . . . .	8.23	8.89
Expenses per car-mile . . . . .	5.65	5.50
Earnings per passenger . . . . .	0.99	0.97

### Atrincham Electric Supply, Ltd.

THE directors' report for the year ending December 31st, 1912, says that during the year 76 new installations have been connected to the mains, making an addition representing 10,449 30-watt lamps. After allowing for various disconnections and re-connections, there were, at December, 1912, 1,382 actual consumers and an equivalent of 87,631 30-watt lamps connected to the mains. Twenty-nine installations, comprising 655 30-watt lamps, were in progress. There has been an increase of nearly 88,000 units sold, and notwithstanding considerable additional expenses incurred during the coal strike, and certain repairs to the boilers, the total cost of generation has been only slightly in excess of that for the previous year. Further capital expenditure amounting to £5,777 has been made during the year. Of this amount £3,279 was for plant, and £1,526 for mains. The re-construction on

modern lines of the high-tension and low-tension switchboards at the generating station has been satisfactorily completed, and suitable extensions added to control the new plant. The company was granted a provisional order extending the authorised area of supply, which order received the Royal Assent on August 7th, 1912. The accounts show a profit for the period covered of £5,712, making with the balance of £78 brought forward £5,790, and this has been dealt with as follows:—Written off old stock, £200; general reserve for depreciation, £1,000; general reserve account, £3,500; leaving to be carried forward, £490. In view of the sum expended on capital account during the year, and the considerable sums shown to be due for loans and to the company's bankers, the directors much regret that they are unable to recommend the payment of a dividend. Mr. Henry Wolfenden and Mr. William Murray have retired from the directorate, and Mr. Charles Jermyn Ford has been elected a director and chairman of the company to fill the vacancy created by the retirement of the former.

The meeting was held on May 8th, at the offices in Queen Street, E.C.

Units generated—Gross	1,129,919
Pumps, &c., motors	66,893
Net	1,063,026
Units sold—By contract	190,765
By meter, private consumers	876,463
Total sold	667,228
Used on works	39,960
Total accounted for	707,188
Not accounted for	462,438
Total max. supply demanded, kw.	637

### Shanghai Electric Construction Co., Ltd.

The annual meeting of this company was held on Thursday last week at Basildon House, Moorgate Street, E.C., Sir Alfred Dent, K.C.M.G., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 819), said he referred last year to the considerable amount of vitality that was latent in their undertaking, and that statement he trusted they would consider was borne out by the accounts. The gross traffic receipts, after deducting £23,937 for loss in exchange, of £79,783, against £58,333 in 1911, and after the further deduction for operating expenses in Shanghai, showed a net profit of £27,727, as compared with £14,139 for the previous year. Including the amount brought forward, £3,301, the balance of profit and loss account amounted to £28,029, and that balance they proposed to deal with by transferring to reserve for renewals account £8,500, for reduction of preliminary expenses £1,554, to the payment of a dividend of 5 per cent. for the year £16,000 (less income-tax), leaving to be carried forward £1,974. The reserve for renewals, after charging the account with cost of renewing some of the trolley wire, would then amount to £17,883. The power expenses at £13,137 showed an increase of £1,887 owing to the increased mileage. The five-year agreement having now expired, negotiations for a revision of rates were in progress, and they hoped to get the full benefit of the reductions given to the general body of consumers. The expense ratio for the year was reduced to 66½ per cent., as compared with 71½. The statistics given at the end of the report showed the car-mileage as 2,747,088, or an increase of 505,975. The total number of passengers carried was 40,731,233, as against 27,257,250, or an increase of 13,475,983, and passengers per car-mile 14.83, as against 12.16 in 1911. The loss in exchange brought about by the excessive issue of copper currency by the native authorities amounted this year to £23,937, against £15,477, showing an increase of £8,459. This represented a loss of nearly 7½ per cent. on the capital, and was the most serious of the disadvantages which affected their profit and dividend. It was a feature that did not exist when the company was formed. The matter had been taken up by the China Association in the interest of the tramways and the trading community, and members of the Association would have noticed the correspondence with the Foreign Office on the subject. They seemed still to be a long way off a solution of the many difficult problems connected with currency reform, but there was some satisfaction in knowing that the Ministry of Finance had made a thorough investigation, and that as soon as a definite scheme had been drawn up, the defects of the present situation would gradually be removed. After providing for a substantial expenditure on capital account, the loan from the bankers on December 31st was reduced to £15,000—aa compared with £31,000—at the end of 1911. It had been further reduced since the account was made up, and now amounted to £12,000, but to meet their requirements, including the balance of cost of new motors and trailers, it would be again increased, in anticipation of the new issue of capital to which he referred last year—a matter which, in view of the increase in their receipts and the late repayments of the loan, they had left in abeyance until their financial position could be more readily defined than was possible at present. Taking the accounts as a whole, they showed a marked improvement over any that they had hitherto been able to present, and a particularly gratifying feature was that the profits permitted them to recommend a dividend for the year at the rate of 5 per cent. The fact of their having carried 40½ millions of passengers last year, showing an increase of about 50 per cent. on the preceding year, and the continued expansion of traffic and operating profits this year, indicated that the sections and scale of fares had now been adjusted to a point at which they fulfilled local requirements. It also proved the necessity for the additional motor-cars and trailers referred to last year. Reference was made in the report to the

proposed introduction of railless traction. This was a matter to which the general manager, Mr. McColl, directed his attention when he was home on leave during the latter part of last year. He inspected railless systems in England and on the Continent, and went very carefully into the question of operating expenses and the adaptation of existing types of railless vehicles to the special conditions of Shanghai, and reported in favour of the scheme. The development of the company's business in such a way as to secure a larger proportion of the total movement of Shanghai, had received their serious consideration, and of all the schemes which had been presented, railless traction offered by far the best prospects, and was more nearly akin to their tramway business than any of the others. The advantage of the railless car was that it could be operated in narrow thoroughfares which were unsuitable for the fixed rails of a tramway, and being dirigible it could, by means of a pivoted trolley arm, deviate widely from the line of the overhead trolley wire, and thus pass other traffic or an obstruction which would block a car running on a fixed rail. The cost of a car would be rather more than that of a tramcar, and the up-keep somewhat heavier on account of tire repairs, but the daily operating expense of a tramcar and a railless car of equal carrying capacity should be approximately the same. The great advantage of the railless system was that the heavy cost of laying down a permanent track was entirely saved, and that the relatively inexpensive equipment could be easily transferred if desired from one street to another at a small expense. It should, therefore, be the nearest approach to the motor-bus which was so steadily absorbing the traffic in many London streets, with the many obvious advantages of electricity over petrol as the driving power. The directors, having grounds for believing that railless traction might offer good prospects of increasing the company's earnings, and recognising the necessity for the company owing to their present concession, being first in the field should any new form of electric traction be sanctioned, authorised an application to be made to the Council in February for leave to introduce an experimental installation, which was estimated to cost about \$80,000 with a full equipment of cars. That application was granted, on condition that they paid the Council 5 per cent. of the gross earnings and a reasonable contribution towards road maintenance. It was intended originally that the trackless line should run through Horian Road, but Fohkien Road had lately been substituted, concerning which they waited further advice. If the experimental installation proved to be a success, an extension of the system would be brought about as funds permitted, and new districts opened up where tramlines were at present impracticable. Through running with the French Settlement was inaugurated about the middle of June on one route and on a second route in the middle of August. The results of the arrangement entered into with the French company had, in a measure, been satisfactory, and had demonstrated that a demand for through facilities existed. They did not consider that the demand would be adequately met until a larger service of cars was available, and through tickets, to which the French company had hitherto objected, had been arranged for. It was anticipated that the improvement in the company's position would continue as the year advanced and the additional motor-cars and trailers came into use, and they were confident that the final result of 1913 would show a good improvement on 1912. They had a record for the race week ended 7th inst., having carried 940,000 passengers, with effective receipts \$18,600—against 810,000 passengers and receipts \$16,000 in the corresponding race week of 1912. The wonder was how this was done with their existing rolling stock, but it showed that the staff in Shanghai, both foreign and native, were working as loyally and assiduously as ever in the interests of the company, and their thanks were due to them and to the local board for their efficient management of their affairs.

Mr. J. S. HASKELL seconded the motion, which was adopted.

### Vera Cruz Electric Light, Power and Traction Co., Ltd.

The sixth ordinary general meeting was held on May 14th, at Salisbury House, E.C., Mr. V. W. Yorke presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 777), expressed regret that the meeting had not been called at an earlier date. Two years ago he said he hoped they would always be able to hold the meeting before the end of March, and last year they were able to do this, but, unfortunately, owing to the disturbed conditions in Mexico during February and March, there had been difficulty in getting the accounts completed, and consequently they were later than usual. He was glad to be able to present that day a thoroughly satisfactory report and accounts, both sections of the company's business having shown a steady and regular increase during the year with corresponding increases in the net revenue. They had not received as much revenue at they had hoped under the contract with the Terminal Co., owing to a considerable falling off in import traffic, but with a revival of trade these receipts ought to show an increase. The contract with the Puebla Tramway, Light and Power Co., which had been arranged since the last general meeting, placed at their disposal a large supply of power, and would enable them to increase their business without incurring further capital expenditure. The Puebla Co. hoped that the supply of power would be available before the end of the year. As soon as they got it, the temporary steam plant in use would be dismantled, and they had made arrangements by which they hoped to dispose of this plant, which had served a useful purpose, at very small loss to the company.

They had transferred from the profits of the year £5,000 to depreciation and general reserve before arriving at the amount recommended as dividend. This amount added to that of last year brought the reserve up to £20,000, which was satisfactory considering that they had only reached the early stages of their history, and, as pointed out last year, the depreciation on an undertaking like this, where the property was fully maintained and kept in first-class condition, was not large. Therefore the provision they were making this year was, in their opinion, ample. As regarded the results of the current year, the earnings they had published showed an increase of \$13,000 for the first three months of the year, which was certainly satisfactory. He was glad to say that political conditions in Mexico showed distinct improvement to those prevailing in the earlier part of the year. They had their share of the troubles during the year, and Vera Cruz was occupied by General Felix Dias in February, and some fighting actually took place in the city. He was glad to say, however, that their business and property suffered only to a trifling extent from these disturbances, and as soon as the political conditions became settled again a real revival of business might be anticipated in which they would participate. He had to express on behalf of the board their appreciation of the zeal and energy shown by the general manager and the staff working under him in Mexico.

DR. S. MACKEW seconded the motion.

MR. WATKIN asked how the loan of £7,250 standing in last year's balance-sheet had been paid off; and also when they could expect a quotation of the shares?

The CHAIRMAN said the loan was paid off out of revenue. It was expected they would soon get a Stock Exchange quotation. The report was adopted.

### Douglas Southern Electric Tramways, Ltd.

THE directors' report for the year ending October 31st, 1912, says that the company's season consisted of 124 days, against 118 days last season; and the mileage run was 34,647.5, against 34,578.3 last season. The total traffic receipts for the season were £5,204, against £5,645, a decrease of £441, due to the cold and wet weather. The passengers carried were 212,528, a decrease of 18,125. The tolls payable to the Douglas Head Marine Drive, Ltd., amounted to £867 and a commission of £260. After deducting these amounts and adding sundry small receipts, there is a total of £4,082 net receipts, against £4,478 last year. The net profit for the year is £1,733, as against £2,125. Adding £152 brought forward, there is a disposable balance of £1,885, which enables the directors to recommend a dividend of 6 per cent. upon the preference shares, absorbing £1,558, leaving a balance of £327 to be carried forward. With the exception of £41 unclaimed dividends, there are no debts, debentures, mortgages or any other encumbrances whatever upon the company's property, and the buildings, rolling stock, boilers, engines, electrical equipment and permanent way have been maintained in a high state of efficiency out of revenue. No accident of any kind has happened to either passengers or property.

### Hong Kong Tramway Co., Ltd.

MR. E. C. MORGAN (chairman) presided on May 15th at the offices, 19, St. Swithin's Lane, E.C., over the ordinary general meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 812), the CHAIRMAN said the contents were of more than usual interest. Towards the end of last year the Government of Hong Kong approached them with a proposal that they should refuse to accept the Chinese subsidiary coinage in payment of fares upon the tramways, it being understood that the Government would support them in connection with the circumstances which might ensue from the adoption of so drastic a measure. The primary result of their action was rioting and boycott on the part of the Chinese, which soon caused the comparison of the receipts with those before the boycott took place to assume threatening proportions. After a time, however, the board were able to reassure the debenture and shareholders by the issue of a circular stating that the Hong Kong Government had obtained the consent of the Colonial Office to £30,000 in compensation up to December 31st, 1912, pending a settlement of the basis upon which the compensation might ultimately be paid. This circular was sent out on January 21st, 1913, when the full force of the boycott was beginning to abate, although it was still, and for some time afterwards detrimental to, their interests. Happily, however, the most recent traffic returns were satisfactory, and the manager advised them that the coinage and boycott question now affected the receipts very little. To fix the amount of loss sustained by the company in consequence of the boycott was a matter of great difficulty, owing to the alterations in surrounding circumstances. As an instance, he might mention that during the period with which they were now comparing, the traffic was abnormal, owing to the fact that the revolution in China had brought a number of refugees to Hong Kong, who, now that peace was restored, had presumably returned to their homes. However, the matter of compensation was still under discussion by the Government, and they were striving to obtain all they could properly claim, as their loss due to their compliance with the Government's request in the matter of the currency. In the abstracts attached to the report they would have noticed under the heading of maintenance and repairs an increase of about £4,000, consisting mainly of improvements in roadway and track, which

should reduce expenditure in the future. He thought it must be conceded that the popularity of the system was shown by the satisfactory figure of the receipts, which, in spite of the fact that the exchange on discount was still a heavy burden, showed a good margin as compared with the expenses. In any case, it appeared that the accounts must be considered satisfactory, and much was due to the tactful management of their manager and agent, and also to the exertions of their staff, during the difficult times they had gone through.

MR. W. J. C. CUTBELL seconded the motion, and the report was adopted without discussion.

On the motion of the CHAIRMAN, a final dividend of 10 per cent. was declared, making 7½ per cent. for the year.

The CHAIRMAN subsequently moved a hearty vote of thanks to the agents and manager and staff for the efficient way in which they had conducted the company's affairs in Hong Kong. He remarked that they had had troublous times, and brick-bats were not altogether absent from the proceedings at times.

MR. R. MILLER seconded the motion, and it was carried.

### Merthyr Electric Traction and Lighting Co., Ltd.

THE report for 1912 states that the capital expenditure now stands at £127,613. During the year a further issue was made of 2,000 ordinary shares of £5 each at par, upon which £3 per share has been paid up. The total revenue from all sources amounted to £21,205, as compared with £20,716 for the preceding year. The expenses amounted to £12,421, compared with £11,837 for 1911. The net revenue is £95 less than in 1911, a satisfactory result having regard to the restriction of trade in the district caused by the coal strike. After deducting all expenses chargeable to revenue (including £2,178 for debenture interest) and charging revenue account with £1,500 provision for renewals, there remains a surplus of £5,106 plus £852 brought forward. The directors propose to place to reserve £1,500, dividend on the preference shares £1,500, dividend at the rate of 6 per cent. per annum on the ordinary shares £2,029, carrying forward £929.

The results from the year's working of the electricity supply undertaking show continued progress. The gross receipts from the electric supply section of the undertaking amounted to £10,136, and the working expenses to £3,854. The receipts for 1912 exceeded those for 1911 by £940, whilst the working expenses increased by £340. The total number of units sold for lighting and power purposes was 688,793, which, compared with the previous year's figure of 568,173, shows an increase of over 12 per cent. The number of consumers at December 31st last, was 858, as compared with 758 at the corresponding date in the previous year, being an increase of over 13 per cent. The extension of the high-tension mains to enable a supply of electricity to be given in the towns of Merthyr Vale, Aberfan and Treharris, referred to in the last report, has been carried out during the year, and a supply was inaugurated on October 17th last, with satisfactory results.

The gross receipts derived from the working of the light railway undertaking amounted to £10,853, being a decrease of £593, and the working expenses amounted to £6,509, an increase of £55.

Since the close of the year an agreement has been entered into with the Merthyr Corporation under which the company has agreed to pave the whole of certain of the roadways in the lower part of the town with wood setts, and repair the same, and to construct an extension of the line to the Morning Sun in Cefn Coed; in consideration for which the Corporation have agreed to defer their option of purchase of both the light railway and electric supply undertakings from 1924 to 1934, being 10 years beyond the time specified in the Merthyr Tydfil Light Railway Order of 1899, and the Merthyr Tydfil Electric Lighting Order of 1899. It is intended to make an early application to the Board of Trade for amending orders with a view to obtaining the necessary statutory powers to enable the agreement to be carried out.

	1911.	1912.
Units generated .. .. .	1,266,234	1,423,938
Units sold—Public lamps .. .	150,060	153,605
To traction section .. .	385,365	396,512
Private consumers by meters ..	418,113	456,288
Total sold .. .. .	954,128	1,036,306
Used on works .. .. .	200,912	240,622
Quantity accounted for .. .. .	1,155,040	1,276,927
Not accounted for .. .. .	110,164	156,911
Total max. supply demanded—Traction	321 kw.	460 kw.
Lighting .. .. .	492 kw.	498 kw.

MR. G. J. SOMERVILLE (chairman) presided on Monday at the offices of the Electrical Federation, Kingsway, W.C., over the sixteenth ordinary general meeting.

In moving the adoption of the above report, the CHAIRMAN said that nearly the whole of the considerable increase of £11,128 in the capital expenditure was upon the electric supply undertaking. This was to provide an electric supply for the districts of Merthyr Vale, Aberfan and Treharris. The supply was only inaugurated on August 17th, so that the results of this expenditure did not fall into the revenue account for more than two and a half months. They were, however, satisfactory, and for the first quarter of this year they continued to be satisfactory, and the profit had been increased during this period of three months to the extent of £350. The traffic receipts on the light railways showed a considerable falling off during last year on account of the coal strike which affected Merthyr perhaps more than any other part of the country, and left the town very short of money for the remaining part of the year. The deficit in traffic alone amounted to over £500, but now that Merthyr had got into ordinary conditions again, the traffics had again shown a considerable increase, and during the first four months of this year they had more than made up the leeway—there being an increase in traffic receipts of £597 for the first four months of the present year. Altogether, taking into account

the adverse circumstances, the report of last year was quite as good as they could expect, and he could also say that this year promised a much better return than the previous year.

Mr. C. G. TEGEMEIER seconded the motion, and the report was adopted without discussion.

### Urban Electric Supply Co., Ltd.

THE directors' report for the year ended December 31st, 1912, states that the gross profits amount to £57,466, as compared with £50,876 a year ago, and after deducting the expenses shown in the profit and loss account, a balance of £54,265 is carried down to net profit and loss account. In the latter account the amounts required for interest and debenture stock redemption absorb £36,182, leaving an available balance, including £414 brought forward, of £18,496. Of this there is to be applied to reserve for depreciation £10,000, to dividend of 3 per cent. for the year on the preference shares £7,500, carrying forward £996. The balance of the 5 per cent. dividend on the preference shares will be satisfied by funded dividend certificates in accordance with the terms of the resolution passed and confirmed at the extraordinary general meetings held on February 2nd and 17th, 1912. Consequent on the reduction of capital sanctioned by the Court on March 12th, 1912, a capital reserve fund of £160,000 appears in the balance-sheet, off which has been written cost of plant dismantled and expenses relating to reduction of capital. The usual comparative statement, showing the profits earned at the various works, is appended. The following table shows the equivalent in 33-watt lamps connected and the gross profits at December 31st of each year:—

	1910.	1911.	1912.	1910.	1911.	1912.
Hawick .. .. .	57,681	65,599	70,251	£4,771	£4,840	£4,788
Stamford .. .. .	33,593	32,411	34,515	1,696	1,467	1,529
Weybridge and Walton ..	61,851	66,136	71,562	6,124	6,040	5,963
Godalming .. .. .	23,612	32,371	35,518	2,352	3,356	3,416
Twickenham .. .. .	103,371	118,068	128,466	10,150	10,959	11,012
Dartmouth .. .. .	23,794	24,543	25,274	2,607	2,637	2,440
Camborne and Redruth and Cornwall .. .. .	75,041	105,178	146,954	7,620	8,727	13,569
Newton Abbot .. .. .	18,570	20,719	22,761	1,467	1,695	2,003
Grantham .. .. .	37,286	33,209	40,336	2,493	2,648	3,132
Glossop .. .. .	47,598	28,782	33,125	2,641	2,983	2,898
Berwick .. .. .	19,821	21,683	23,831	1,466	1,665	1,615
Caterham .. .. .	14,813	16,563	48,426	1,142	1,635	1,927
Newbury .. .. .	22,369	23,575	24,926	2,158	2,259	2,673
Totals .. .. .	525,160	589,737	677,495	£47,254	£50,850	£57,496
	Lamps.		Gross profit.			

### Lisbon Electric Tramways, Ltd.

MR. LUDWIG BREITMEYER (chairman) presided on May 14th at the offices, 1, London Wall Buildings, E.C., over the fifteenth ordinary general meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 779), the CHAIRMAN said that during the year the tramways had suffered from two stoppages of the service owing to strikes. One was of short duration in January, but a much more serious one took place at the end of May, which lasted for over three weeks, when the whole of the service was suspended, the power house was shut down, and not a single car ran in the streets. The result of the first strike was a loss in receipts of about 8½ contos, and the 29 days' strike in May resulted in a loss of under 110 contos, making altogether 118 contos. Allowing also for the average increase of traffic during the time of stoppage, as shown over the rest of the year, this would bring the total loss in receipts to about 125 contos, or say, £25,000, which was a heavy sacrifice, but was a small burden for the shareholders to bear, considering the grave issues that were forced upon them, and which had to be resisted with the utmost determination and at any cost. Turning to the actual figures of the traffic movement, the passengers carried were 50,411,963, against 51,852,719 in 1911, a decrease of 1,440,756. The earnings amounted to 1,640,410'685 milreca, as against 1,676,302'658 milreca in 1911, a difference of only 35,892'607 milreca, or about £7,000 in English money. He might pass over the three days' strike in January, brought about through the intrigues of syndicalism, and in which their employes were not involved, being forced against their desire to stop work. The 29 days' strike from May 29th to June 24th was, however, a serious business. The management was faced with an absolutely clear issue—either to submit to its employes on an important question of discipline or to stand firm. The management, with the concurrence and, under the instructions, of the London board, refused to yield to the unreasonable demands of the men, and as the result of this firm attitude, the men returned to work on June 24th, and since then the general manager's relations with the employes had not been disturbed, and, of course, they had no other desire than that they should remain so. It was a critical time for the company, and their thanks were due to Mr. Giles, the general manager, and to Mr. Souza, the assistant manager, and all those of the staff who remained loyal to the company. From the accounts they would see that the balance of profit available was £107,212, from which the usual reserves, amounting to £40,000, had been deducted, and the preference dividend, amounting to £25,533, had been paid, and also the interim dividend of 3 per cent., amounting to £19,020. This left a balance of £22,658 to be dealt with, and the directors now recommended a final dividend of 3 per cent., making a total of 6 per cent. for the year, and absorbing £19,020. The balance of £3,637 it was proposed to carry forward. As the shareholders knew, they did not take any part in politics. They were simply a business undertaking,

but it was impossible to be indifferent to the course of public events in Lisbon, and the present state of unrest could not but continue to be a cause of anxiety. The gratifying feature was that their tramways business maintained the even tenor of its way, with increased development, in spite of the unrest which, unfortunately, still existed. Now that the contract with the Municipality of Lisbon for the reconstruction and electrification of the Nova Companhia dos Ascensores Mechanicos de Lisboa had been completed, the work was being pushed on with all speed, and when completed would be a further favourable factor in the development of the traffic.

Mr. J. B. TAYLOR seconded the motion, which was carried without discussion.

It was agreed that the remuneration of the directors for the year ending December 31st, 1912, be fixed at £2,500.

The CHAIRMAN expressed the hope that next year they would have a better balance-sheet, for it looked as if they would have no strikes, although one never knew what might happen.

### British Thomson-Houston Co., Ltd.

THE report of directors for 1912 reads as follows:—

*Works at Rugby.*—The buildings and machinery of the company have been maintained in first-class condition during the year. A number of extensions in progress were mentioned in the last annual report, the most important being a four-floor building to be used for railway work and other manufacturing purposes. This latter building is now completed. On the new tract of land mentioned in last year's report, a one-storey building is in course of erection, to be used for the manufacture of heavy apparatus, also another building for pattern storage which at present will be one storey high, but is so arranged that it can be easily converted into a three or four-storey building.

*Works at Coventry.*—These works are now in full operation.

*Works at Willesden, London.*—It was mentioned in the last annual report that we were erecting a factory at Willesden for the manufacture of Mazda lamps. Since then, however, improved methods of making these lamps have enabled us to very largely increase the output of the Rugby lamp factory, and on account of the rapid expansion of work in other departments, it has been decided to utilise the Willesden factory, which is admirably suited for the purpose, as a switchboard factory.

*Metallic-Filament Lamps.*—The business in Mazda drawn-wire lamps during the year has shown a further increase.

*Curtis Steam Turbines.*—The turbine business of the company continues to show satisfactory results, and the company had a larger number on order and in course of manufacture at December 31st last than ever before.

The company's operations were severely handicapped by the coal strike, which occurred at the beginning of 1912. Although ample coal reserves had been accumulated at the Rugby works, deliveries of raw material, such as iron, steel, &c., required in the manufacturing business of the company, were seriously affected, and the company's output very considerably restricted thereby.

*Debenture Redemption.*—Under the terms of the trust deed securing the issue of the company's debenture stock, the company has this year to pay to the trustees the sum of £4,452, to be applied by them in redeeming debenture stock at 105 per cent. by drawings. Since the closing of the books, debenture stock of the par value of £2,000 has been redeemed, making the total par value of stock retired to date £19,305, and a further £2,240 will be redeemed before the end of the year, making £21,545 in all.

The directors have followed their usual practice in making reserves to cover risks in connection with bad debts, depreciation of shares held by the company, and other contingencies.

The balance-sheet, after paying interest on debenture stock and loans, shows a profit of £31,000, and the directors recommend that this should be appropriated as shown in the profit and loss account—£20,000 to depreciation of plant account; £1,096 to depreciation of office furniture and store-room equipments; £6,270 to depreciation of apparatus, supplies, meters, &c.; £1,825 to special experimental expenses written off—leaving a balance of £1,209. This, together with the previous year's balance, makes a total amount to be carried forward of £8,590.

The meeting is to be held at 83, Cannon Street, E.C., on May 28th.

### Hastings and District Electric Tramways Co., Ltd.

THE directors' report for the year ended December, 1912, shows that there was a decrease in the traffic receipts of £2,433 due to the coal strike and to weather conditions during the holiday season. The expenditure side of the account, as compared with last year, shows a net increase of £1,120. This is chiefly due to the enhanced cost of fuel, and to abnormal expenditure on the permanent way, a part of which, amounting to £1,990, has been debited to depreciation account. The revenue account, after crediting receipts aggregating £17,491, and debiting administration expenses amounting to £1,431, shows a balance of £16,060 plus £2,177 brought forward, and deducting £10,387 for interest charges, there remains available £7,851. Out of this amount an interim dividend of 3 per cent. on the preference shares was distributed in October last, and it is now proposed to pay a final dividend of 3 per cent., making the full 6 per cent. for the year, and to carry forward the balance of £3,051.

"The attention of the Board of Trade having been called by the Hastings Corporation to the unsatisfactory results obtained from

the use of the Dolter surface contact system on the front line, the directors considered it necessary to promote a Bill in Parliament for the substitution of the overhead trolley system, by which all the other sections of the line are worked. They regret, however, to report that the Bill has been thrown out by the House of Lords' Committee. As the company has in the meantime been notified by the Board of Trade of its intention to call for the removal of the Dolter system, the board is carefully considering the alternative system to be adopted to meet the requirements of the public service, and, at the same time, to safeguard the interests of the shareholders."

Mr. E. C. Morgan, the chairman, relinquished that position last March owing to ill-health, and the directors appointed Mr. George Kitchen as his successor. Mr. Morgan continues as a member of the board.

The annual meeting was held on Tuesday at the offices, 1, Queen Victoria Street, E.C. MR. GEORGE KITCHIN, who presided, said that power expenses showed an increase of £369, due entirely to the increased cost of coal. Traffic expenses, on the other hand, showed a decrease of £859, owing to a decrease in the mileage run. Part of this decrease was compulsory; it became necessary to largely reduce the service during the coal strike; and part was voluntary, due to the suppression of unremunerative services. Consequent upon the continuance of the work of putting the track into first-class order, the greater part of the cost of which had come into the 1912 accounts, a sum of £12,980 had been spent upon maintenance and repairs. Of this sum £1,990 was in the nature of capital expenditure, and had been debited to depreciation account. The balance £10,990 had been debited to revenue, and showed an increase of £1,415 over last year, which again showed an increase of £1,143 over 1910. The effect of this heavy expenditure should be apparent in the improved conditions of running, and the reduction of maintenance costs to a more normal figure. General expenses showed an advance of £194, mainly due to an increase from £325 to £400 per mile of the charge made by the Corporation for the wayleave on the front line. The income and traffic showed a decrease of £2,433 due, first, to the coal strike; secondly, to the very unsettled weather conditions. The net result was an available balance of £7,850. From this they had already paid an interim dividend of 3 per cent. on the preference shares, and they now proposed to pay a further 3 per cent., making the full 6 per cent. for the year, and to carry forward £3,051. Proceeding to refer to the paragraph in the report dealing with the Bill which the directors considered it necessary to promote in Parliament for the substitution of the overhead trolley system on the front line for the surface contact system at present in use, the Chairman said he would like to remind them that there was a provision in their 1903 Act which compelled them to work the front line by self-propelled cars, or other system approved by the Corporation, other than the overhead system. After careful examination, the Dolter surface contact was installed in the year 1907, with the approval of the Corporation, as the best system that could be found to meet the case. From the outset it had caused them anxiety, but by sparing neither trouble nor expense, they had been able to work it with sufficient success to provide for the carrying of over 3,000,000 passengers annually on the front line. They were, however, quite aware of the various defects inherent in the system which developed in the working and became accentuated as time went on, and they quite anticipated that sooner or later this would result in a call for its discontinuance. It had been installed in Torquay and Mexborough, but in both places had been condemned and removed, while the company which owned the patents had abandoned them as useless. At the same time the directors were strongly of opinion that the only really satisfactory system which could be substituted for the Dolter was the overhead. All the other lines of the company had been successfully worked by this system, but before the substitution could be carried out, it was necessary to obtain the authorisation of Parliament, as not only was the company precluded from installing the overhead system, but by the Act of 1903 the Corporation was estopped from sanctioning its use. In 1911, finding that the Dolter system was deteriorating, they decided to apply to Parliament, but before depositing the Bill they approached the Corporation with a view to obtaining their assent, as they wished to work in co-operation with them, and, if possible, to avoid the heavy expense involved in a contested Bill. On receipt of their refusal they decided not to proceed with the Bill at that time. In April last year, however, the Corporation called upon the Board of Trade for a report upon the working of the Dolter system. The Board of Trade sent down Major Pringle, who inspected the line and furnished such a report, as, in the directors' opinion, confirmed the company in their contention that the defects existing in the system were inherent and of a nature beyond the control of the company. The report was to the effect that though satisfied that the company had done its best to work and maintain the system, the Board of Trade considered that the result had not proved satisfactory, and that it might be necessary at some future date to call for the discontinuance of the system in the interests of public safety. In the interests of the shareholders it became necessary to seek Parliamentary powers to substitute overhead for the surface contact system. They had used every endeavour, though unsuccessfully, to find some other system which would have been possible under their existing Acts, and which should be satisfactory to the public in its working, and to the shareholders in its results. They, therefore, again appealed to the Corporation not to oppose the Bill, and the directors travelled down to Hastings accompanied by Mr. Waller, their engineer, and had an interview with the Parliamentary Committee of the Corporation, in order to endeavour to induce them to modify their attitude, but they finally decided to oppose them. The frontagers also

raised a fund and briefed counsel to fight the Bill before the House of Lords' Committee, and, in the event that Committee decided that the Bill must not proceed. In the meantime, the Board of Trade had advised them that they proposed, at the expiration of six months from March 31st last, to issue an order requiring the company to cease the use of the Dolter system. They found themselves, therefore, in a difficult position, and they were now considering, with their consulting engineers, what was the best system to install—the overhead being forbidden and the Dolter condemned. They had to consider the interests both of the shareholders and the public; indeed, in his view, their interests were really identical. The company could not earn dividends unless it served the public well, and the public could not be well served by a company that could not earn dividends for its shareholders. As he told them last year, their Cooden extension promised to be remunerative soon, owing to the building, &c., going on under the auspices of Earl de la Warr, and lately, he was glad to say there were really some signs that Hastings and its Corporation were waking up, and were going at last to do something to bring their interesting, but sleepy, old town up to date. To that end this company would be glad to assist, and he could only hope that the Corporation would meet their efforts for the good of the town with a little more practical sympathy, and a little less of the spirit of the gentleman who insisted on his pound of flesh. Better relations between them would be for the good of the town, as well as of the people who had put up their money to provide Hastings with a really excellent service of tramways at so serious a financial loss to themselves up to the present. To establish these more friendly relations was the desire of the board, and to that end they would direct their efforts.

MR. E. C. MORGAN seconded the motion.

Replying to a shareholder, the CHAIRMAN said that the board had often wondered why the Corporation had taken up so hostile and so impossible an attitude towards the company, looking to the fact that the putting of the tramways in Hastings, which had been done with their shareholders' money, had been of considerable benefit to the town at large. They were endeavouring to introduce a better feeling between the company and the Corporation. There was no doubt that they both had the interests of the town at heart, and if the town was doing well the tramway company would be among the first to reap the benefits. If, therefore, they could in any way assist the Corporation to improve the town, they would do so, but they looked for a little more kindly feeling and a little more reasonable attitude than they had received in the past from the Corporation. They had for a considerable time been considering the question of petrol motors in connection with their cars, and only the previous day their consulting engineer witnessed some trials in the east end of a new petrol-electric tramcar, which the L.C.C. were proposing to install in the Hackney district, where they could not have the overhead system owing to the opposition of local authorities, and where they found the conduit system too expensive. Their difficulty was to find a system which would enable them to continue the through running between Bexhill and Hastings.

The report was adopted.

**Continental.**—FRANCE.—La Société de l'Electricité de Rheims is the name of a new company which has just been formed at Rheims, with a capital of £80,000.

A new company has lately been formed at Aigueville (Savoy), with a capital of £50,000, and the title La Société des Acieries Electriques d'Aigueville, to carry on a plant for the electrical production of steel.

RUSSIA.—La Société des Usines Electrotechniques Siemens et Halske, of St. Petersburg, reports a profit of 636,388 roubles for the last financial year; a dividend of 6 per cent. is again being declared.

## STOCKS AND SHARES.

Tuesday Evening.

APART from the rush to apply for the new Chinese loan, the principal feature in all the markets of the House is the absence of business. Like King Charles's head in Mr. Dick's book, the Balkans trouble crops up with a pertinacity worthy of a better cause. At least, the Stock Exchange says it is the Balkans affair which is acting as a drag upon clients' financial proclivities. Certainly there is little speculation going on; and, notwithstanding all the money which has been made in trade, the investment business of the Stock Exchange proceeds on very jogtrot lines.

See-sawing in fashion somewhat aimless, the Home Railway market this week has leaned to the dull side. There are apprehensions of difficulties on several of the steam lines, the Great Northern, in particular, being favoured with protests from some of its men that one of their number has been unjustly treated. Once more it becomes apparent that a lull in labour difficulties is not likely to be more than temporary; and so long as the market is subject to these spasms, all the increases in the world will not suffice to encourage substantial buying of the stocks. The soundness of this argument is underlined by the reaction that followed

upon a rally in Home Rails when the Great Northern's differences were composed.

Of the Undergrounds, Metropolitans hardened to 53½, but came back to 52½, and Districts, after going above 40, eased off again to 39½, leaving falls on the week. Underground Electric Railways shares fell 5s. to 4½. The Company's 1s. shares are quiet and steady, speculation in them having died out to a considerable extent. The special settlement took place this week in the new London and Suburban shares, and the Preference made up at 14s. 3d., the Ordinary at 8s. 3d., and the Debentures at 8s. These prices compared very favourably with those which were current about 10 days ago, when the Preference fell back to half-a-guinea and the Ordinary to 6s. 6d. The Company is proposing to exchange its own securities for the shares of the South Metropolitan Electric Tramways Company, offering £125 of Preference for £100 of the South Metropolitan Tramways Preference. The latter for a long time past have enjoyed no free market, whereas the London and Suburban have been readily dealt in since they first appeared, and this consideration will probably weigh with some of the South Metropolitan proprietors in inducing them to make the exchange. Thus another step is taken in the direction of fusing into one control the passenger traffic of the Metropolis. British Electric Traction issues rallied to some extent, in spite of the trouble which is being experienced in Birmingham in connection with the threatened tramway strike.

London Electricity shares are disposed to weaken a little. London Electric Ordinary shares went back to 30s.; Charing Cross Ordinary and Preference are easier, and Westminster's fell ½. The improvements in Edmondson's issues are maintained. The Urban report has not affected prices. An important issue of 5 per cent. Debenture stock is pending by the Midland Electric Corporation, and underwriting arrangements have been in progress this week. The money is required partly to pay off the existing 4½ per cent. Debenture stock, which becomes redeemable on June 30th next at 102½. Advance particulars show the stock to be admirably secured. Underwriters, we understand, receive a commission of 1½ per cent.

The Mexican news is again of a very mixed character, and proprietors of securities connected with Mexico are puzzled to know what they ought to do in the present situation. To the outside observer it would appear that affairs there will get straightened out in due time, although this has been a much longer process than anybody expected it would be. There can be no doubt that Mexico will go ahead strongly so soon as the revolutionary spirit is quenched, but in the meantime a good deal of patience is necessary. While the market in the common shares is somewhat dull, prices of the prior charge securities are also being lowered by way of precaution. There are falls this week in Mexican Electric Light 5 per cent. bonds, Pachuca bonds, Monteveys and one or two other similar issues. The market, as a whole, is subject to general influences, too, and there is the forthcoming issue of Brazilian Traction Preferred shares to give an added touch of depression to this department. Brazil Traction's themselves have gone up to 97½. It may be observed, incidentally, that things Brazilian are not in great favour at present, owing partly to the heavy fall in the price of raw rubber, which the alarmists declare may, if persevered in, have a pronounced effect upon the revenues of the Federal Government.

The telegraph market tends, if anything, to the lower side. Anglo-American Telegraph Preferred and Deferred continue to be depressed, and there still seems to be "deceased" stock floating about. The dullness is, no doubt, accentuated by the stagnation prevailing in American circles, the New York Stock Exchange apparently being worse off for business than London is. The question is revived as to whether the three classes of Anglo-American Telegraph stocks could not be unified. The difficulty, however, seems to lie in the off-chance of the relations between the Anglo-American Telegraph Company being dissolved from those of the Western Union, as might conceivably happen if the latter were to be adjudged a monopoly in restraint of trade under the United States laws, and, therefore, it seems necessary that the identity of the three Anglo issues should be separately preserved. Eastern Telegraphs are a little lower, but, on the other hand, Westerns rose 5s. to 13½, which placed them very much on the same level as Eastern Extensions shares and Eastern Telegraph stock. Great Northern's continue to improve, gaining 10s. Indo-Europeans are at £2 12s. 6d. dividend, allowing for which there is no net change in the quotation. Various other securities are quoted ex dividend. Marconis have receded still further. Since last we wrote, the price has been down to 4, from which it picked up to 4½, leaving ½ fall on the week. There is nothing much going on in National Telephone Deferred, the price keeping about 21. West Coast of America shares are unaffected by the issue of the report, the first since the expiration of the Portuguese guarantee. The carry-forward is reduced in consequence of this, otherwise there is not much change.

Reuters, old and new, lost ½, despite a good report and the maintenance of the dividend on both classes of shares. The banking business is to be separated from the other part, and this seems to be disliked in some quarters.

Copper merchants tell us that orders continue to come in at a rapid pace from their electrical manufacturing customers, but the activity in manufacturing circles which this suggests is not reflected in the share market. British Thomson-Houston Debenture is a point up, and this is practically the only quotable change. Babcock & Wilcox Preference are quoted ex the rights to apply for the issue of Second Preference shares, valued for Stock Exchange purposes at 1½ premium. Rubber shares relapsed after their brief bout of strength, and business in the market is of meagre proportions.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, May 21st.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
▲ Acid, Hydrochloric .. .. per cwt.	5/-	..
▲ " Nitric .. .. per lb.	22/-	..
▲ " Oxalic .. .. per lb.	23d.	..
▲ " Sulphuric .. .. per cwt.	5/6	..
▲ Ammoniac Sal .. ..	42/-	..
▲ Ammonia, Murate (large crystal) per ton	£29 10	..
▲ Bleaching powder .. ..	£6 5	..
▲ Bisulphide of Carbon .. ..	£18	..
▲ Borax .. ..	£17 10	..
▲ Copper Sulphate .. ..	£23 6	..
▲ Lead, Nitrate .. ..	£27	..
▲ " White Sugar .. ..	£25 5	..
▲ " Peroxide .. ..	£32	..
c Methylated Spirit .. .. per gal.	2/6	..
▲ Potassium, Bichromate, in casks per lb.	8½d.	..
▲ Potash, Caustic (88/90 %) .. per ton	£22 10	..
▲ " Chlorate .. .. per lb.	8½d.	..
▲ " Perchlorate .. ..	4½d.	..
▲ Potassium, Cyanide (98/100 %) .. (for mining purposes only)	7½d.	..
▲ Sbellac .. .. per cwt.	£2/6	2½/6 inc.
▲ Solphate of Magnesia .. .. per ton	£4 10	..
▲ Sulphur, Sublimed Flowers .. ..	£6 10	..
▲ " Recovered .. ..	£5 10	..
▲ " Lump .. ..	£5	..
▲ Soda, Caustic (white 70/72 %) ..	£10 5	..
▲ " Chlorate .. .. per lb.	8½d.	..
▲ " Crystals .. .. per ton	£8 5	..
▲ Sodium Bichromate, casks .. .. per lb.	8d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£95	..
b " Wire, in ton lots (1 to 14 s.v.g.) ..	£112	..
b " Sheet, in ton lots ..	£126	..
p Babbitt's metal, in ton lots ..	£50 to £221	..
c Brass (rolled metal 2" to 12" basis) per lb.	8½d.	½d. dec.
c " Tube (brazed) .. ..	10½d.	½d. inc.
c " " (solid drawn) .. ..	9½d.	½d. inc.
c " Wire, basis .. ..	8½d.	½d. dec.
c Copper Tubes (brazed) .. ..	11½d.	1½d. inc.
c " " (solid drawn) .. ..	11½d.	1½d. inc.
g " Bars (best selected) .. per ton	£85	..
g " Sheet .. ..	£85	..
g " Rod .. ..	£85	..
d " (Electrolytic) Bars .. ..	£73 15	£1 5 inc.
d " " Sheets .. ..	£90 15	£1 5 inc.
d " " Rods .. ..	£78 15	£1 5 inc.
d " " H.C. Wire per lb.	9½d.	½d. inc.
f Ebonite Rod .. ..	4/6	..
f " Sheet .. ..	1/0	..
n German Silver Wire .. ..	7/- to 8/-	..
b Gutta-percha, fine .. ..	8/10	8½d. inc.
h India-rubber, Para fine .. ..	6/7	..
i Iron Pig (Cleveland warrants) .. per ton	£79	..
l " Wire, galv. No. 8, P.O. qual.	£14	..
g Lead, English Pig .. ..	£19 5 to £19 10	£2 inc.
m Manganese Wire No. 28 .. .. per lb.	6/6	..
q Mercury .. .. per bot.	£7 10	..
e Mica (in original cases) small .. per lb.	6d. to 8s.	..
e " " medium .. ..	8/6 to 6/-	..
e " " large .. ..	7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. ..	8/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings ..	1/1 to 1/3½	..
p " " rolled bars & rods ..	1/3 to 1/2	..
p " " rolled strip & sheet ..	1/3 to 1/5½	..
o Platinum .. .. per oz.	185/-	..
d Silicon Bronze Wire .. .. per lb.	11d.	..
r Steel, Magnet, in bars .. .. per ton	£66	..
g Tin, Block (English) .. ..	£224 to £225	£8 dec.
n " Wire, Nos. 1 to 18 .. .. per lb.	9/9	..
p White Anti-friction Metals .. per ton	£50 to £228	..
k Zinc, Bh't (Viellet Montagne bnd.)	£29	..

Quotations supplied by—

- a G. Boor & Co.
- b The British Aluminium Co., Ltd.
- c Thos. Bolton & Sons, Ltd.
- d Frederick Smith & Co.
- e F. Wiggins & Sons.
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- b Edward Till & Co.
- / Bolling & Lowe.
- k Morris Ashby, Ltd.
- / Richard Johnson & Nephew, Ltd.
- m W. T. Glover & Co., Ltd.
- n P. Ormiston & Sons
- o Johnson, Matthey & Co., Ltd.
- p W. F. Dennis & Co.

West African Telegraph Co., Ltd.—The directors' report for the year ended December 31st, 1912, states that the revenue amounted to £46,603, from which is deducted £17,091 for the ordinary expenses, and £6,837 for expenditure relating to maintenance of cables and income-tax abroad, leaving £22,674, plus £987 brought forward, making £23,661. £1,323 has been provided for income-tax, £13,000 has been transferred to general reserve fund, and an interim dividend of 2 per cent. (free of income-tax), absorbing £4,622, was paid on December 1st. The directors recommend a final dividend of 2 per cent. (free of income-tax), on and after May 21st, making, with the interim distribution, 4 per cent. for the year, the balance of £94 being carried forward. The meeting is called for May 21st.

Cleveland and Durham County Electric Power Co. —A dividend of 3½ per cent. for the year to December 31st is announced, carrying forward £148.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations May 20th, Rise + or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations May 20th, Rise + or Fall, Present Yield p.c. Lists various companies like Bournemouth & Poole, Central Electric Supply, etc.

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations May 20th, Rise + or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations May 20th, Rise + or Fall, Present Yield p.c. Lists companies like Adelaide, Calcutta, Calgary Power, etc.

TELEGRAPH AND TELEPHONE COMPANIES.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations May 20th, Rise + or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations May 20th, Rise + or Fall, Present Yield p.c. Lists companies like Amazon Telegraph, American Telegraph, Anglo-American Telegraph, etc.

\*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for	Closing Quotations May 22th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations May 20th.	Rise or Fall	Present Yield p.c.
Bath Trams, Pref. Ord. . . . .	1	1911. 1912.	111 1/2	..	£ s. d.	Metropolitan Railway Consol. . . . .	100	1911. 1912.	52 1/2—62 1/2	- 1/2	8 1/2
Do. 5% Pref. . . . .	1	5 5	111 1/2	..	6 8 1	Do. Surplus Lands . . . . .	100	1911. 1912.	52—64	..	4 6 0
Do. 4 1/2% Deb. . . . .	100	4 4 1/2	72—77	..	5 17 0	Do. 8 1/2% Deb. . . . .	100	8 1/2	85—87	..	4 0 6
Brit. Elec. Trac., 6% Pref. . . . .	100	.. ..	84—10 1/2	..	..	Do. 8 1/2% Pref. . . . .	100	8 1/2	89—85	..	4 2 4
Do. Do. Deferred . . . . .	100	.. ..	4—6	+ 1/2	..	Do. 8 1/2% Con. Pref. . . . .	100	8 1/2	81—88	..	4 4 4
Do. Do. 5% Cum. Prf. . . . .	100	6 6	84—87	+ 1	6 18 0	Metropolitan District Ord. . . . .	100	Nil Nil	89—39 1/2	- 1/2	Nil
Do. Do. 7% Non-Cum. Prf. . . . .	100	.. ..	84—38	+ 2 1/2	5 8 8	Do. 6% Deb. . . . .	100	6 6	139—141	..	4 5 1
Do. Do. 6 1/2% Prp. Deb. . . . .	100	5 5	83—22	..	6 7 8	Do. 4% Deb. . . . .	100	4 4	94—96	..	4 8 4
Do. Do. 4 1/2% 2nd Deb. . . . .	100	4 4 1/2	73—77 1/2	..	6 17 0	Do. 4% Prior Lien . . . . .	100	4 4	87—99	..	4 0 10
Central London Railway, Ord. . . . .	100	8 8	82—84	..	15 5 8	Do. 4 1/2% First Lien . . . . .	100	4 1/2	85—87	..	5 1 2
Do. Pref. . . . .	100	4 4	84—86	..	13 9 0	Do. 8 1/2% Gtd. . . . .	100	8 1/2	75—77	..	4 10 11
Do. Def. . . . .	100	2 2	80—82	..	14 7 7	Metropolitan Elec. Trams, Ord. . . . .	1	6 6	53—54	..	6 13 7
Do. 4% Deb. . . . .	100	4 4	83—101	..	4 16 0	Do. 5% Pref. . . . .	100	5 5	92—93	..	6 8 1
City & S. London, 6% Pref., 1891	100	6 6	100—102	..	4 18 0	Do. 4 1/2% Deb. . . . .	100	4 1/2	87—91	..	4 15 11
Do. Do. 1896 . . . . .	100	6 6	100—102	..	4 18 0	Do. 5% Deb. . . . .	100	6 6	91 1/2—94 1/2	..	5 5 10
Do. Do. 1901 . . . . .	100	6 6	99—102	..	4 18 0	Potteries, Ord. . . . .	1	2 2	10—10 1/2	..	..
Do. Do. 1908 . . . . .	100	6 6	97—100	..	5 0 0	Do. 5% Pref. . . . .	1	5 5	10—10 1/2	..	8 19 0
Do. 4% Deb. . . . .	100	4 4	92—94	+ 1	4 5 1	Do. 4 1/2% Deb. . . . .	100	4 1/2	83—85 1/2	..	5 6 0
Great Northern & City, Pref. Ord	10	Nil Nil	24—24	..	7 7 8	South Metro. Trams, 6% Pref. . . . .	100	4 4	65—70	..	5 14 4
Hastings Trams, 6% Pref. . . . .	1	6 6	64—72	+ 1/2	6 5 0	Do. 4% Deb. . . . .	100	4 4	70—70	..	..
Do. 4 1/2% Deb. . . . .	100	4 1/2	67—72	+ 1/2	6 5 0	Underground Elec. Railways	10	.. ..	42—42	- 1/2	Nil
Do. 4% Deb. . . . .	100	4 4	75—80	..	6 0 0	Do. "A" . . . . .	1/2	.. ..	42—42	..	5 7 2
Lancashire United, 5% Deb. . . . .	100	5 5	73—80	..	6 5 0	Do. 6% First Cam. Inc. Deb. . . . .	100	.. ..	110—112	+ 1	6 10 11
London Elec. Railw., 4% Deb. . . . .	100	4 4	84—86	..	5 8 4	Do. 4 1/2% Bonds . . . . .	100	4 1/2	97—99	..	4 7 2
London United Trams, 5% Pref. . . . .	10	Nil Nil	42—5	..	6 1 3	Do. 5% Income . . . . .	1	5 5	92—93	+ 2	6 3 0
Do. 4% Deb. . . . .	100	4 4	62—66	..	..	Yorkshire (West Riding), Ord. . . . .	5	Nil Nil	1—3	..	Nil
						Do. 6% Pref. . . . .	5	8 8	2—3	..	3 17 5
						Do. 4 1/2% Deb. . . . .	100	4 1/2	81—85	..	5 6 0

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. . . . .	5	6 1/2	5 1/2	44 1/2—5 1/2	..	5 8 7	La Plata Elec. Trams, Ord. . . . .	1	Nil	.. ..	7—7 1/2	- 1/2	..
Do. 2nd Pref. . . . .	5	6 1/2	5 1/2	47—52 1/2	..	5 14 3	Do. Pref. . . . .	1	8	.. ..	10—10 1/2	..	5 16 6
Do. 4% Deb. . . . .	100	4 4	90 1/2—92 1/2	..	4 6 6	5 14 3	Lisbon Elec. Trams, Ord. . . . .	1	6 1/2	.. ..	100—100 1/2	..	4 8 8
Do. 4 1/2% Deb. . . . .	100	4 1/2	98 1/2—100 1/2	- 1/2	4 9 6	4 9 6	Do. 6% Pref. . . . .	1	6 6	.. ..	1—1 1/2	..	4 18 0
Do. 5% Deb. . . . .	100	5 5	99—101	..	4 19 0	4 19 0	Do. 5% Deb. . . . .	100	6 6	5 92—97	..	5 8 3	
Auckland Trams, 6% Deb. . . . .	100	5 5	101—103	..	4 17 1	4 17 1	Madras Elec. Tr. (1894), Deb. . . . .	100	5 5	103—105	..	4 15 1	
Bombay Elec. S. & Trams, Pref. . . . .	10	6 6	103—113	..	5 4 4	5 4 4	Manag. Trams & Lh., 1st Deb. . . . .	100	5 5	90—93	+ 2	6 3 0	
Do. 4 1/2% Deb. . . . .	100	4 1/2	95—98	..	4 11 0	4 11 0	Manila Elec. R. and Lgh., Bonds	100	6 6	97—100	..	5 0 0	
Do. 5% 2nd Deb. . . . .	100	5 5	97—99	..	5 1 0	5 1 0	Mexico Trams Con. . . . .	100	7 7	106—108	..	6 9 8	
Brazilian Traction Light and Power } \$100	..	6 1/2	96 1/2—98 1/2	+ 1/2	6 2 6	6 2 6	Do. Gen. Con. 5% Bonds . . . . .	100	6 6	91—93	..	5 7 6	
Brisbane Trams Invt., Ord. . . . .	5	8 8	7 1/2—7 1/2	..	5 5 0	5 5 0	Do. 5% Bonds . . . . .	100	8 8	87—89	- 1/2	6 1 8	
Do. 5% Pref. . . . .	100	5 5	100—103 1/2	..	4 15 3	4 15 3	Para Elec. Ry. & Lh., Ord. . . . .	5	10 10	6 1/2—7 1/2	..	8 15 7	
Do. 4 1/2% Deb. . . . .	100	4 1/2	100—103 1/2	..	4 7 5	4 7 5	Do. 6% Pref. . . . .	5	6 6	84—85	..	5 11 7	
S. Columbia Elec. Ry., Det. . . . .	100	8 8	130—133	- 1	6 0 4	6 0 4	Do. 5% 1st Deb. . . . .	100	5 5	98—100 1/2	..	5 0 0	
Do. Pref. Ord. . . . .	100	6 6	113—116	- 1	5 3 7	5 3 7	Perth (W.A.) Elec. Tr., Ord. . . . .	1	5 5	103—104 1/2	..	3 14 5	
Do. 5% Pref. . . . .	100	5 5	103—106	..	4 14 4	4 14 4	Do. 5% 1st Deb. . . . .	100	6 6	105—108	..	4 12 7	
Do. 4 1/2% 1st Mort. Deb. . . . .	40	4 1/2	100—103	..	4 7 5	4 7 5	Rangoon El. Tr. & Sup., Pref. . . . .	5	6 6	58—64	..	5 0 0	
Do. 4 1/2% Vancouver Deb. . . . .	100	4 1/2	100—102	..	4 8 3	4 8 3	Do. 4 1/2% 1st Deb. . . . .	100	4 1/2	103—103	..	4 10 11	
Do. 4 1/2% Con. Deb. . . . .	100	4 1/2	94 1/2—96 1/2	..	4 8 1	4 8 1	Rio de Janeiro Trams, 1st Mort. } 5% Bonds	100	6 6	101 1/2—102 1/2	- 1/2	4 17 4	
Calcutta Trams, Ord. . . . .	5	7 5 1/2	63—64 1/2	+ 1/2	5 12 0	5 12 0	Do. 5% Mort. Bonds . . . . .	100	6 6	95 1/2—96 1/2	..	6 3 8	
Do. 5% Pref. . . . .	5	6 5 5	41 1/2—6 1/2	..	4 17 7	4 17 7	Sao Paulo Tram, Lh. and P. } 5% 1st Deb.	500	5 5	101 1/2—103 1/2	..	4 16 7	
Do. 4 1/2% Deb. . . . .	100	4 1/2	97 1/2—100 1/2	..	4 9 7	4 9 7	Singapore Trams, 5% Deb. . . . .	100	5 5	83 1/2—87 1/2	..	5 14 8	
Cape Electric Trams . . . . .	1	2 1/2	.. ..	..	4 1 0	4 1 0	Southern El. Tr. B.A., 6% Deb. . . . .	100	6 6	96—98	..	6 10 3	
City Buenos Aires Trams (1904)	100	5 5	61—64 1/2	..	4 2 6	4 2 6	Un. Elec. Trams Monte Video . . . . .	5	7 6 1/2	5—5 1/2	..	6 2 0	
Do. 4% Deb. . . . .	100	4 4	93—97 1/2	- 2	4 6 6	4 6 6	Do. 6% Pref. . . . .	5	6 6	44—64	..	6 14 3	
Colombo Elec. Tr. & Lh., 5% Deb. . . . .	100	5 5	90 1/2—94 1/2	..	5 5 10	5 5 10	Do. 5% 1st Deb. . . . .	100	6 6	96 1/2—98 1/2	..	5 1 6	
Havana Elec. Ry., 5% Bonds } \$1000	5	8 8	97—101	..	4 19 0	4 19 0	Winnipeg Elec. Ry., 4 1/2% Deb. . . . .	100	4 1/2	99—102	..	4 8 8	
Kalgoorlie Elec. Trams . . . . .	1	Nil	.. ..	..	Nil	Nil							
Do. 5% A Deb. . . . .	100	6 6	83—88	..	6 18 8	6 18 8							
Do. 5% B Deb. . . . .	100	5 5	25—85	..	..	..							

MANUFACTURING COMPANIES.

Aron, Ord. . . . .	1	8	.. ..	..	8 0 0	Crompton & Co. . . . .	8	Nil	.. ..	4—8	..	Nil
Do. 5% Pref. . . . .	1	6 6	.. ..	..	7 2 2	Do. Deb. . . . .	100	5 5	55—57	..	9 16 6	
Babcock & Wilcox . . . . .	1	28 16	.. ..	..	5 2 6	Dick, Kerr . . . . .	1	6 Nil	.. ..	..	..	
Do. Pref. . . . .	1	6 6	12—13 1/2	..	4 7 3	Do. Pref. . . . .	1	6 6	.. ..	..	7 18 10	
British Aluminium, Ord. . . . .	1	Nil	.. ..	..	..	Edison & Swan, A, 28 paid	5	Nil	.. ..	..	..	
Do. 6% Cum. Pref. . . . .	1	Nil	.. ..	..	5 17 2	Do. fully paid . . . . .	5	Nil	.. ..	..	..	
Do. 5% Prior Lien Debts. . . . .	100	5 5	82—96	..	5 13 2	Do. 4% Deb. . . . .	100	4 4	60—64	..	6 5 0	
Do. Deb. Etc. . . . .	5	6 6	84—87	..	5 14 11	Do. 5% Second Deb. . . . .	100	5 5	70—73	..	6 17 0	
B.I. & Healey Cables . . . . .	6	10 10	7 1/2—8	..	6 5 0	Electric Construction . . . . .	2	2 1/2	82 1/2—1 1/2	..	5 14 4	
Do. Pref. . . . .	6	6 6	63—64	..	4 16 0	Do. Pref. . . . .	2	7 7	1 1/2—2	..	7 0 0	
Do. Deb. . . . .	100	4 1/2	102—104	..	4 6 7	Greenwood & Batley, Pref. . . . .	10	7 7	7 1/2—8	..	6 5 8	
Brush Thomson-Houston, Deb. . . . .	100	4 1/2	97—99 1/2	+ 1	4 11 0	Do. Deb. . . . .	100	5 5	99—103 1/2	..	5 11 7	
British Westinghouse, Pref. . . . .	8	Nil Nil	.. ..	..	5 17 8	General Electrico, 6% Pref. . . . .	10	6 6	120—103 1/2	..	4 6 0	
Do. Deb. . . . .	100	4 4	64—68	+ 1	6 18 10	Do. Deb. . . . .	100	4 4	88—93	..	5 16 5	
Do. 6% Prior Lien . . . . .	100	6 6	98—101	..	..	Henley's, Ord. . . . .	5	15 15	124—13	..	4 10 10	
Browett, Lindley, Ord. . . . .	1	.. ..	2 1/2—3 1/2	..	Nil	Do. Pref. . . . .	5	4 4	4 1/2—5	..	4 7 6	
Do. Pref. . . . .	1	.. ..	4 1/2—6 1/2	..	Nil	Do. Deb. . . . .	100	4 1/2	101—103	..	6 5 0	
Brush, 7% Pref. . . . .	2	Nil Nil	.. ..	..	6 8 2	India-Rubber, G. & T., . . . . .	10	6 6	11—12	..	6 6 0	
Do. 5% Prior Lien Deb. . . . .	100	5 5	73—78	..	10 9 4	Do. Pref. . . . .	10	6 6	90—98	..	6 6 2	
Do. 4 1/2% Deb. . . . .	100	4 1/2	88—43	..	16 3 4	Telegraph Construction . . . . .	12	17 20	36—88	..	4 0 10	
Do. 4 1/2% Second Deb. . . . .	100	4 1/2	25—29	..	4 7 7	Do. Deb. . . . .	100	4 4	86—99	..	..	
Callender's Cable . . . . .	5	15 15	11—11 1/2	..	6 7 8	Willans & Robinson . . . . .	1	Nil	.. ..	..	..	
Do. Pref. . . . .	5	6 6	42—6 1/2	..	4 7 7	Do. Pref. . . . .	5	Nil	.. ..	..	..	
Do. Deb. . . . .	100	4 1/2	98—101	..	4 9 1	Do. Deb. . . . .	100	4 4	57—59	..	6 16 7	
Caster-Kellner . . . . .	100	30 30	83—									

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING APRIL, 1913.

ALTHOUGH the April export figures fall very far short of the bumper total recorded in the previous month, the difference is to a large extent accounted for by the exceptional telegraphic export included during that month. The April exports amounted in value to £592,621 (as compared with £994,303 in March), while excluding telegraphic items, the total of £474,475 is some £10,000 less than recorded in March.

The month's exports included machinery to the value of over £210,000; cable, some £78,000 in value—showing a considerable decline; and over £70,000 worth of telephonic material—this also being much less than in March.

The imports, at £263,268, compared with £253,412 in March, showing an increase of nearly £10,000 in value, while the re-export totals were £23,349 and £23,723 respectively, for April and March.

Machinery imports were on a somewhat lower scale than in March, but increased values are recorded for cables, fittings and glow lamps.

An excellent all-round customer of this country was Argentina, while India, New South Wales and Canada also made comparatively heavy purchases. In the imports section, both the United States and Germany did an increased business with this country.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables, rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
Russia, Sweden, Norway and Denmark ...	1,646	426	67	196	655	152	6,992	100	24	...	19	493	10,770
Germany ...	3,364	1,358	35	110	469	...	6,186	415	22	31	52	1,742	16,781
Netherlands, Java and Dutch Indies ...	955	1,203	264	...	41	25	614	...	29	7	51	180	3,369
Belgium ...	1,783	290	151	149	374	29	3,852	311	87	207	1,402	298	8,969
France ...	977	13	3,934	47	12	48	794	30	...	145	187	57	6,214
Portugal ...	518	24	25	35	...	...	213	...	31	...	442	90	1,381
Spain and Canary Isles ...	1,579	1,351	74	...	...	719	5,534	...	1,553	...	1,505	966	13,281
Switzerland, Italy and Austria-Hungary ...	202	382	518	56	84	8	2,536	82	61	220	...	875	5,024
Greece, Roumania and Turkey ...	689	...	53	136	...	...	336	...	...	15	...	2,600	3,829
Channel Isles, Gibraltar, Malta and Cyprus...	720	368	14	...	...	33	184	...	...	...	15	348	1,682
U.S.A., Philippines and Cuba ...	200	...	49	40	...	55	2,840	...	...	13	...	500	3,697
Canada and Newfoundland ...	591	788	322	384	12	1,434	10,268	409	2,499	...	467	28,968	16,142
British West Indies and British Guiana ...	84	58	68	50	...	305	356	...	20	10	77	34	1,056
Mexico and Central America ...	13	...	...	10	29	...	90	...	...	...	87	262	491
Peru and Uruguay ...	743	22	145	171	68	74	1,160	56	16	...	60	171	2,716
Chile ...	584	1,556	470	187	170	2	4,543	2,175	77	29	152	4,416	11,361
Brazil ...	949	976	853	398	53	293	4,081	866	3,464	14	4,541	1,651	18,139
Argentina ...	4,360	14,150	1,624	1,346	229	554	21,656	5,204	1,432	166	10,969	7,333	69,023
Colombia, Venezuela and Bolivia ...	119	71	41	...	...	...	767	13	115	...	40	...	1,146
Egypt and Persia ...	502	1,071	108	196	13	198	943	296	2,351	...	835	4,505	11,018
British West Africa, Ascension & St. Helena	...	...	75	42	67	...	531	40	53	...	10	11,997	12,815
Rhodesia and Transvaal ...	2,291	2,529	494	2,174	...	9	11,587	32	1,709	21	79	126	21,051
Cape of Good Hope ...	1,629	3,868	231	341	31	1,251	4,793	269	314	74	242	1,884	14,927
Natal ...	1,227	5,414	376	12	63	132	7,610	93	513	...	91	132	15,663
Zanzibar, Brit. E. Africa, Mauritius & Aden	120	84	105	223	...	...	...	...	...	...	66	10,097	10,695
Azores, Madeira and Portuguese Africa ...	427	250	61	24	...	3	15,161	...	29	...	245	128	16,328
French African Colonies and Madagascar ...	5	...	...	...	190	...	15	35	...	...	...	15	260
China and Siam ...	707	5,108	319	1,097	113	2,210	4,791	103	35	174	...	620	15,277
Japan and Korea ...	685	20	1,097	...	...	991	12,444	2,672	237	21	3,836	4	22,007
India ...	6,012	15,771	3,246	3,069	198	2,251	18,985	3,667	4,691	187	1,301	2,312	61,690
Ceylon ...	118	173	246	39	...	...	2,222	306	132	...	141	147	3,524
Straits Settlements, Fed. Malay States and Sarawak ...	287	548	333	250	77	129	2,714	602	102	108	492	28,354	33,996
Hong Kong ...	511	31	303	671	...	163	359	60	875	...	11	255	3,239
West Australia ...	171	266	125	491	...	214	4,218	...	19	...	315	128	5,977
South Australia ...	1,000	1,382	100	427	...	894	617	...	28	28	3,949	98	8,523
Victoria ...	2,875	6,477	824	780	...	898	13,103	2	120	9	1,737	1,339	28,164
New South Wales ...	2,206	6,462	503	624	144	762	11,218	196	283	...	33,295	1,156	56,849
Queensland ...	244	54	229	123	...	94	3,855	...	...	...	232	62	4,393
Tasmania ...	...	99	...	100	...	39	70	...	13	...	...	...	321
New Zealand and Fiji Islands ...	1,353	2,322	750	396	...	572	3,331	1,024	302	54	3,873	3,803	17,750
Total, £	42,446	77,971	18,232	14,394	3,092	14,541	191,063	19,088	21,299	1,533	70,816	118,146	592,621

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Norway, Sweden and Denmark ...	53	32	15	47	37	35	3,422	334	718	46	6,472	11,211
Germany ...	9,583	29,069	3,765	13,368	7,223	2,657	75,642	1,097	1,711	7,155	4,381	155,651
Holland ...	...	...	...	506	520	...	171	...	28	...	36	1,261
Belgium ...	1,156	2,737	171	183	86	...	3,407	28	282	18	5,650	13,718
France ...	432	650	1,306	760	245	921	1,004	156	1,282	3,532	2,093	12,381
Switzerland ...	95	554	43	4	...	731	998	75	...	133	...	2,633
Italy ...	264	5,569	...	...	...	...	...	...	...	...	1,422	7,263
Austria-Hungary ...	...	865	...	523	173	...	435	...	248	262	55	2,561
Spain ...	...	...	...	...	...	...	13	...	...	...	537	550
United States ...	8,986	114	1,522	36	204	165	10,694	29,635	...	94	3,376	54,826
New South Wales ...	...	95	...	...	83	...	...	...	890	...	...	1,068
Canada ...	135	...	...	...	...	...	10	...	...	...	...	145
Total, £	20,704	39,685	6,822	15,427	8,571	4,509	95,804	31,325	5,131	11,805	23,455	263,268

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above ...	10,040	806	...	2,617	590	...	8,018	...	172	757	349	23,349
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TOTAL EXPORTS: £592,621.

TOTAL RE-EXPORTS: £23,349.

TOTAL IMPORTS: £263,268.

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

PROCEEDINGS OF INSTITUTIONS.

A New Form of Electrically-driven Two-high Continuous-running Reversing Mill.

By ANDREW LAMBERTON.

(Abstract of paper read before the IRON AND STEEL INSTITUTE, May, 1913.)

THE day has not yet arrived when it can be claimed that by the universal adoption of electricity as the motive power for driving rolling mills in iron and steel works, the highest economy in running costs can be attained. Speaking generally, where steelworks are associated with blast-furnaces, and perhaps also coking ovens, and an abundant supply of surplus gas is available for producing electric current at a low cost, electrical driving of such mills is clearly indicated. The greatest difficulty is met with in dealing with reversing mills of the two-high type, where the rolls have to be reversed at each pass, and when these mills are of large size the electrical plant is extremely costly, the reversing mill motors necessary being from 10,000 to 15,000 brake horse-power, due to their having to start from rest under full load at each reversal.

All engineers may be said to be in agreement that where rolling-mills can be driven by a constant-running motor associated with a heavy fly-wheel to take the peak loads of rolling, electrical driving

to rotate in the fixed frames or housings D. In order to make the turning of the gables easy, these are carried on broad revolving anti-friction rollers E, fig. 2, placed immediately under the gables, and carrying the weight of the same. These anti-friction rollers have

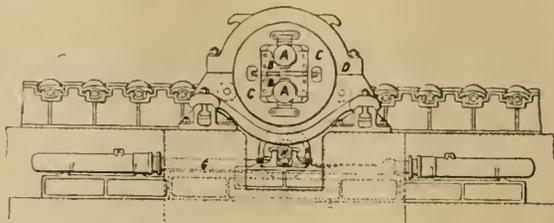


FIG. 1.

part of their breadth formed into a spur pinion F which gears with corresponding teeth in the rotating gables. By means of a hydraulically-operated ratchet G, gearing into the pinion on the bottom roller shaft H, the rotation of the gables is quickly effected, the time taken being only three to five seconds, and the stroke of the hydraulic rams is just sufficient to bring the rolls to their exact position at each reversal.

To provide for the alternate change in the position of the top and bottom roll, the driving spindles J, conveying the power from the mill pinions K to the rolls A, are disposed in the manner shown in fig. 2, and the weight of these spindles is borne by a balanced carrying gear, the weight of the descending spindle balancing that of the ascending spindle at each reversal. The mill pinions are placed side by side, and not superposed as is usual, as this side-by-side arrangement reduces the angle on the spindles during reversals.

The motor, driving gear, and fly-wheel, require no description. By the employment of a high-speed continuous-running motor, the size and cost of such motor is reduced to a minimum; and, as the fly-wheel takes the peaks of the rolling loads, the highest economy in operation results.

A rail-rolling mill plant on this new system, capable of an out-put of 5,000 tons per week, comprises three distinct mills:—A cogging-mill taking the ingot and reducing it to a bloom; a roughing-mill to reduce this bloom to a roughly formed rail; and a

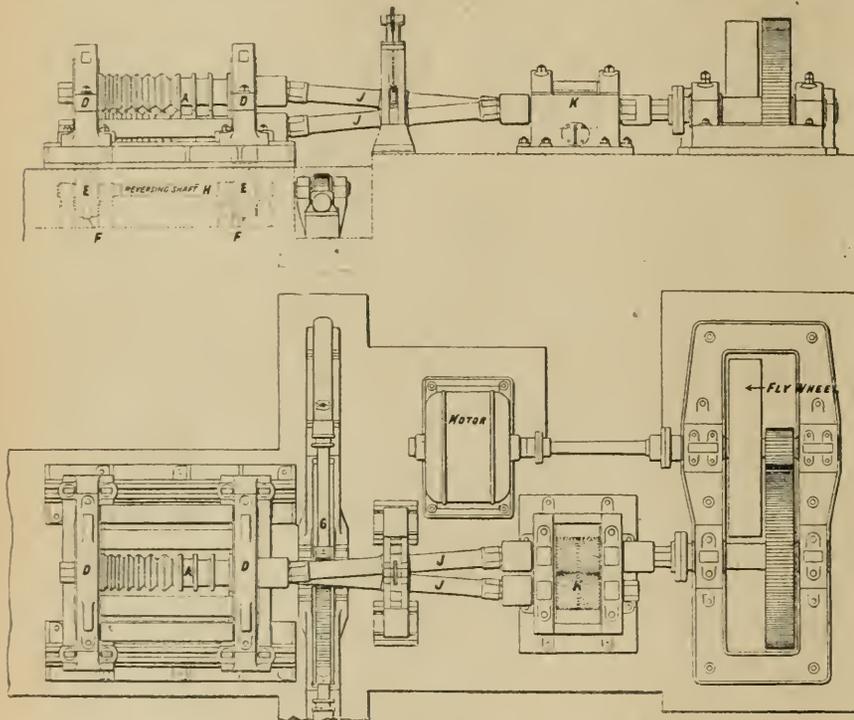


FIG. 2.

is to be preferred, provided, of course, that the cost of current be low enough. For small mills rolling light sections and bars, which can be fed to the mills by hand, the three-high continuous-running mill is practically universally adopted, and in such cases the driving of these mills by a continuous-running electric motor leaves nothing to be desired. For larger mills rolling bars and sections of heavier type which cannot be fed by hand, and where live roller feeding-tables and mechanical manipulators are therefore necessary, the three-high type of mill is not so popular in this country.

It occurred to the author that if two-high section rolling-mills could be designed so as to be capable of being driven by a continuous-running electric motor, and at the same time give the necessary reversals to the bar at each pass, this would go a long way to meet the difficulties, as the ease of setting the rolls in the two-high mill, and the simplicity of the roller tables being fixed instead of moving, would be conserved, and the large and very costly reversing motor rendered unnecessary. The following is a short description of the method by which this is accomplished:—

The root idea of the new system is that, if in a mill with two rolls, arrangements can be made to make the bottom roll the top roll, and vice versa, then at each reversal of the position of these rolls there will be a pass in the opposite direction. If then a pair of rolls be mounted in circular gables, which are free to rotate in fixed frames or housings, this will afford a continuous-running two-high mill, which gives reversals at each pass, on the gables being rotated through an angle of 180°—half a revolution.

Referring to fig. 1, the two rolls A are mounted in the usual form of chocks B contained in the circular gables C, which gables are free

finishing mill to finish the rail to the required section.

These mills are all of the same continuous-running reversing type. The live roller tables are all fixed tables of the simplest form, and the manipulation of the work is of the simplest character.

The first mill of this new type is now in course of construction, and will be put to work in a large steelworks in England in the early summer.

Power Supply on the Rand.

By A. E. HADLEY.

(Discussion on paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Manchester, March 11th, 1913. For abstract of paper see ELECTRICAL REVIEW, March 28th.)

DR. E. ROSENBERG said that there were some remarkable features which distinguished the Rand power supply from all others. First the incredibly high load factor, with a peak load of 88,000 kw., and sales averaging 1,350,000 units per day. This meant that the load for the 24 hours was equal to 15.3 times the peak load. These figures would be the envy of most central station engineers.

MR. B. WELBOURN said that in certain parts of the world, including South Africa, a good deal of trouble had been experienced in cables due to white ants. He asked if the author had experienced this on the system described in the paper. In carrying a cable network over a country of this character, there was in all

probability considerable surface subsidence which might lead to trouble; had expansion joints been found necessary? With regard to the disk insulators used to build up the suspension type insulator, in view of the very frequent dust storms, he asked whether the distribution of pressure over these insulators had been affected by the accumulation of dust especially on the 80,000-volt line. With regard to line protection he had come to the conclusion that any form of arrester that involved a spark was distinctly a thing to avoid.

Mr. G. D. SEATON said the efficiency reports commended themselves to him very much. A good deal of bad machinery was put into use in this country because it was cheap. Anything that brought out the merits of good machinery was to be encouraged, and the author was to be congratulated for his efforts in this direction. He would like to see such methods used by municipalities; if they were, he thought some astounding results would be seen.

Mr. LAMB asked the author for an idea of the size of the cooling pond for the condensation water. The quantity of circulating water seemed to be low for the size of the plant.

Mr. J. LUSTGARTEN asked if during the period of lightning, any insulators had been punctured. The question was an important one, because out of it arose whether an insulator existed to do this work. With regard to earthing the neutral, they had learnt that for all L.T. distribution circuits earthing the neutral was the best policy, but in Mr. Peck's recent paper the conclusions come to were that on H.T. circuits the neutral should not be earthed. The reason for that was that if working with an earthed neutral and flashing over took place on any of the lines, then if this flashing over persisted and the current was large enough, the circuit breakers would trip and interrupt the supply. Recent American practice had been to work with a non-earthed neutral and to use an arc suppressor.

Mr. COATES asked if the switches in the sub-stations were of similar breaking capacity to those in the main stations.

Mr. PARRY said it would be interesting to know how the cost of the 700 miles' scheme from Victoria Falls worked out in comparison with the present steam stations. Was there any reason why the power stations should not have been put down at the collieries and the power distributed from there?

Mr. W. BOLTON SHAW asked what was the drop in pressure at the most distant point on the air supply system? The very small loss of 3 per cent. on the pipe line spoke well for the way in which the line had been installed.

Mr. HADLEY, in reply, said they had not experienced any trouble on the cables through white ants. Owing to the very hard earth formation, subsidence was practically unknown on the reef, and therefore expansion joints were not used. There was no trouble in working overhead and underground cables together, but it had to be remembered that the 20,000-volt cables could only be connected to the 40,000-volt lines through coupling transformers. No trouble had been experienced with the suspension-type insulator due to dust. The Prat system of induced draught was one of the most interesting features of the installation; it also appealed on the question of saving freight, which was £10 per ton. Anything simplifying labour was also another great advantage. The system was so satisfactory that it had been applied on all the stations. The revision of price was entirely dependent on the cost of production and could take place every eight years. It was based on the average cost of the preceding three years. The size of the cooling pond depended on whether it was possible to discharge at one end and take in from the other. The amount of power used in the works at Rosherville depended on whether the pond was full, so that the natural gravity inlet was at the necessary height. On the whole,  $\frac{4}{3}$  to 5 per cent. was a fair figure, and included the supply to the houses of the staff and the recreation rooms, &c. The water was measured by Lea recorders. As to the puncturing of insulators, it was so seldom that the line itself was struck by lightning that he did not think they had any records of any value on this point. With regard to earthed neutral, with the Merz-Price system, when the station cut off a faulty line, it did not interrupt the supply, as the latter was in duplicate; this was the great merit of the system, and it had been found extremely valuable. In regard to a question whether there were any other protective devices than the Merz-Price system, there were also maximum overload cut-outs provided, but they were screwed up so that they could not work. The general tendency was to make the machines hang on as long as possible, and only take them out of service if it was found really necessary. With regard to switches in sub-stations, there were two sizes of switches smaller than in the power station, *i.e.*, three sizes of switches on the system; since the neutral was earthed, there had been considerably less trouble on the system. The transformers in the consumers' sub-stations were oil transformers, air cooled, but the transformers in the power stations and in the main central stations were water cooled. The compressed-air supply was far larger than anything tried elsewhere. They had never had a failure of the supply, but occasionally the pressure had gone down. The maximum pressure drop between the compressors and consumer was 6 lb.

Mr. Hadley's paper was also discussed at the meeting of the SCOTTISH LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS on April 15th.

The CHAIRMAN was sorry that Mr. Hadley had not given more details about protection from lightning. Tropical storms were terrible, and while the earthed guard wires served as a great protection, at the same time those wires did not protect from static discharges. In a case which was brought under his notice, the only

solution to periodical breakdowns in plant was a high resistance between the line and earth.

Mr. BUNTON expressed interest in the load dispatcher system, and wished Mr. Hadley had described the particular system adopted on the Rand.

Mr. SAM. MAYOR said that the generation and distribution of compressed air on so great a scale was a great piece of engineering. The most striking fact was the very small loss in transmission. The distance between the extreme mines supplied was about 14 miles, and the total run of pipe was 20 miles. The author said that the results of their tests showed that of the air units 95 per cent. had been recorded at consumers' meters and only 3 per cent. lost in transmission. The 3 per cent. loss in transmission must be taken as energy loss and not merely as pressure loss. He had had considerable experience of the use of the Venturi tube, and he had had many hundreds of careful observations made with it, and the results had all been satisfactorily consistent with each other, and he had not the slightest hesitation in saying that the measurements of accuracy claimed in the paper were well warranted. The efficiency of transmission was a testimonial to the type of joint, but he would like to ask how long it was anticipated that india-rubber rings would last? His experience had been that the low efficiency in the application of compressed air to mining was simply appalling. In the course of his investigations he had not found a single colliery where the loss in volume was less than 23 per cent. of the total volume of air compressed. When one compared that with the claims of the paper, the difference was enormous. Where the loss was 23 per cent. the pressure was only 30 lb.; with the higher pressure the loss would be very much greater. In some cases he found it as large as 40 per cent. Some of his tests had been made with up-to-date plant. In one of the largest Lancashire collieries, out of a total of 1,500 H.P., 400 to 500 represented leakage in volume alone. The paper was another illustration of the beneficent influence of the electrical engineer on any undertaking with which he associated himself. There had never been a satisfactory meter for metering compressed air, and, in view of the very considerable scale on which compressed air was used in this country for mining operations, it was not at all creditable to the compressed-air engineers that they had been all this time without a satisfactory meter. The electrical engineer had insisted on knowing what he was doing, and in the absence of a satisfactory meter he set about producing one. Compressed air was used for driving percussion drills. They were still in want of a satisfactory rock drill. The rock drill required a pressure of between 80 and 100 lb. Therein lay their present low efficiency, because the cylinder was filled with high-pressure compressed air at each stroke, and that was exhausted at very high pressure, and was thus thrown away in the exhaust. The power required for each drill was, approximately, 20 H.P., and the energy expended by the cutting of the bit was between 1 and  $1\frac{1}{2}$  H.P., so that the efficiency of the compressed air drill was only about 5 per cent.

Mr. W. L. SPENCE referred to the statement in the paper that the chimneys were all of the cold compressed-air ejector type. These could not of themselves be of a high efficiency, but they were thoroughly adapted to the conditions, because of the high cost of construction in Africa. The figures with regard to air distribution were open to suspicion, but if the figures were correct the scheme justified itself.

Mr. MACLEOD said that the system of induced fans could not be commended for general adoption, as it was open to objection that in certain circumstances the fans might fail the power house staff at a critical time. The confining of the pilot wires for operating the system with the telephone circuit in a lead-covered cable suspended overhead, seemed to him to be a tempting of Providence, because, in the event of a series transformer failing, it was more than likely that the telephone wire would be energised at any pressure up to 80,000 volts, and the operator who happened to be using the telephone at that time would have a very strenuous moment. Here they found there was endless trouble with suspended lead-covered cables through vibration causing cracking of the lead. In the Clyde Valley system they had used bare copper conductors for the protective gear, and also for the telephone system, and they had given uniform satisfaction.

Mr. ROBERTSON (Clyde Valley Co.) pointed out that the cost of current was said to be 525d., but there was no mention of the cost of coal delivered at the generating station. He would like to know the quality of the coal used. A 74 per cent. load factor was mentioned, and he took it that this was for both the electrical and compressed-air plant.

The CHAIRMAN admitted that it was very difficult to get an electric drill. With a solenoid the efficiency was very low, and they did not get the power they could get with an air compressor. There was a big field for anyone who could turn out a satisfactory electric drill to replace the air drills.

In the course of his reply, Mr. STARR (who read the paper in the author's absence) said the system dealt with in the paper was similar to that used at Newcastle and by the Clyde Valley Co. In the latter they had at their Motherwell power house a diagram of connections and the regulations were that no switch was to be closed or opened without communicating with the switchboard at Motherwell. Mr. Mayor had referred to loss in transmission, the figures were 6 lb. out of 131 lb., and that was about  $\frac{4}{3}$  per cent., the figure in the paper was 4 per cent. There was a certain number of units unaccounted for in every system. The jointing material for the pipe lines would not be pure rubber, it would be a compound of some sort. In reply to Mr. Spence, he did not see that the meter was so very complicated as compared with an ordinary electricity meter, and the latter recorded correctly. Induced draught had many disadvantages, and the comparison of natural with induced draught was a matter for controversy. Very often the local conditions

decided in favour of the one or the other. There was no good quality of coal on the Rand. The penalty for shutting down supply was 60 per cent. more than the price the consumer paid the company. That was, the consumer paid 525 per unit, but for a shut down the company paid the consumer a sum equal to the units he should have got at a price of 84 per unit. They had no stringent Board of Trade regulations on the Rand, and he took it that compressed air was used not only for the drills but for ventilation as well.

## STANDARDISATION RULES FOR ELECTRICAL MACHINERY.

(Excluding Railway and Tramway Motors).

The following code of rules was provisionally adopted on April 17th by the Council of the BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

Other sections dealing with short-circuit tests, commutation, pressure regulation, parallel operation, efficiency, and tolerances, are at present under the consideration of the Standards Committee of the Association.

### SECTION I.—STANDARD PRESSURES AND FREQUENCIES.

1. The standard frequencies for alternating-current work are:—50 cycles per second, and 25 cycles per second.

2. The standard high-pressure systems for alternating-current work are:—2,000, 3,000, 6,000, 10,000 and 20,000 volts.

3. The standard generator pressures are:—

For direct-current generators.	For alternating-current generators.
115 volts	440 volts
230 "	550 "
460 "	2,200 "
525 "	3,300 "
	6,600 "
	11,000 "

Standard low pressures measured at consumers' terminals:—

Direct-current.	Alternating-current.
110 volts	100 volts
220 "	200 "
440 "	400 "
500 "	500 "

(Motors are to be capable of operating without injury at their rated outputs and overloads on any pressures not exceeding 5 per cent. above or below their standard voltages. See Clause 6, Sec. IV.)

5. Transformers.—The normal rated pressure of the low-tension side of a transformer is to be the same as that of the consumer's supply, according to Clause 5.

It is recommended that the standard transformer ratios should be such as to transform between the standard pressures above-named.

### SECTION II.—HIGH-PRESSURE TESTS AND INSULATION RESISTANCE.

(a) High pressure tests—(1) commercial high pressure tests are to be made on the completed apparatus while it is in good condition and before it is put into service. In the case of apparatus which has been in service reduced tests only are to be applied.

Unless otherwise specified, the high-pressure tests are to be made at the makers' works.

The test is to be made with a pressure of approximately sine wave form, preferably at the rated frequency of the apparatus, but in general any frequency between 25 and 100 is satisfactory.

Prolonged tests at high pressure are undesirable, since they permanently weaken the insulation.

2. The following tests are to be applied for one minute between the windings and the frame and core when the apparatus is at normal working temperature:—

Rated terminal pressure of circuit.	Test pressure.
Not more than 333 volts.	1,000 volts.
Above 333, but not more than 1,500 volts.	3 times rated pressure with a minimum of 1,500 volts.
Above 1,500, but not more than 2,250 volts.	4,500 volts.
Above 2,250 volts.	twice rated pressure.

Note.—In the case of machines driven by water-wheels and exposed to runaway conditions or otherwise exposed to possible excess pressure, it is recommended that pressure-limiting devices shall be provided, otherwise the test must be based on the highest pressure to which the windings may be subjected.

3. High-pressure tests on field windings are to be based on the excitation pressure. Field windings of synchronous machines intended to be started from the A.C. side are to be tested at a pressure of 5,000 volts unless the field windings are provided with a "break-up" switch, or will always be short-circuited at starting.

4. Transformers are to have the same test between high-pressure winding and core as between high-pressure winding and low-pressure winding. In making such tests the low-pressure winding should be connected to the core.

5. In general, constant current apparatus, and apparatus used for series operation, is to have the test pressure rating corresponding to the maximum pressure which may be impressed upon the apparatus.

(b) Insulation resistance.—(6) Very high insulation resistance (megohm test) should not be specified on electrical machinery, since in order to obtain it, long baking at high temperatures may be required, which may permanently damage the insulating material.

Insulation resistance tests are of value in showing the condition of the insulation, with special reference to moisture and dirt, and it is usually advisable to measure the insulation resistance before making high-pressure tests.

7. In general, an insulation resistance of 1 megohm for windings above 350 volts, or 0.25 megohm for low-pressure windings, is sufficient evidence that the windings are in condition to receive the high-pressure test.

### SECTION III.—TYPES OF MACHINES.

The following classification of rotating machines is recognised: (1) open; (2) protected; (3) enclosed-ventilated; (4) (a) pipe-ventilated, (b) pipe-ventilated, with "forced draught"; (5) drip-proof; (6) totally enclosed; (7) flame-proof.

1. Requires no definition.

2. A "protected" machine is one in which the armature, field coils, and other live parts, are protected mechanically from accidental or careless contact, while free ventilation is not materially obstructed.

3. An "enclosed-ventilated" machine is one in which the ventilating openings in the frame are covered with

(a) Expanded metal or wire gauze of not less than  $\frac{1}{4}$ -in. mesh, so as not to obstruct free ventilation.

(b) Wire gauze, less than  $\frac{1}{4}$ -in., but not less than  $\frac{3}{32}$ -in. mesh, or with perforated metal having not less than  $\frac{1}{16}$ -in. holes.

(c) Machines having ventilating openings covered with screens having smaller openings than those specified in 3 (b) are to be treated as "totally-enclosed" machines as regards temperature rise and overloads.

4. A "pipe-ventilated" machine is one in which the frame is so arranged that the ventilating air may be conveyed to it through a pipe attached to the frame.

If the heated air expelled from the machine is to be conveyed away through a second pipe attached to the machine, this should be so stated.

It is understood that a pipe-ventilated machine propels its own ventilating air unless it is distinctly stated that the air supply is to be maintained by an independent fan external to the machine, in which case it becomes a "forced-draught" machine.

5. A "drip-proof" machine is one having a frame provided with ventilated openings, so protected as to exclude falling moisture or dirt.

6. A "totally-enclosed" machine is one in which the enclosing case does not allow a circulation of air between the inside and outside of the case, and is dust-proof, both as regards case and bearings.

7. A "flame-proof" machine is one in which the enclosing case can withstand, without injury, any explosion of gas that may occur within it, and will not transmit the explosion to any inflammable gas outside it.

An induction motor in which the slip rings and brushes alone are included within a flame-proof case should not be described as a "flame-proof" machine, but as a machine "with flame-proof slip-ring enclosure."

### SECTION IV.—RATING.

1. Two classes of rating are recognised—continuous rating and short-time rating (for intermittent working).

2. The continuous rating is the output which a machine or a transformer will give for a period sufficiently long to attain practically constant temperature rise, and otherwise comply with these regulations.

Unless otherwise specified, any machine rated to operate between two limits of pressure shall have its ampere rating determined upon the higher pressure.

3. The short-time rating is the output which a machine or transformer will give for one hour, one half-hour, or other specified period, and comply with these regulations.

These ratings are called one-hour rating, one half-hour rating, or other specified rating respectively.

4. Machines with two or more fixed speeds are to have a definite rating for each speed.

5. Variable speed machines. These are of two classes:—

(a) Machines rated to give the same output throughout the entire range of operating speed. In such machines, the heating tests should be made at the lower limit of speed, and commutation tests at the upper limit of speed.

(b) Machines which are not rated to give the same output at all speeds. These machines should have ratings specified for both minimum and maximum speeds.

6. Test rating and pressure variation. Guarantees as to heating, efficiency and other characteristics are to be taken as applying to tests at the pressure marked on the nameplates, but motors must be capable of operating without injury at their rated outputs and overloads on any pressures not exceeding 5 per cent. above or below their standard pressures.

It should be noted, however, that the "pull out" torque or maximum torque available will vary approximately as the square of the terminal pressure.

## SECTION V.—OVERLOADS.

1. (a) Machines with continuous rating having limits of full load temperature rise in accordance with Sec. VI. (a) are to be capable of withstanding 25 per cent. overload beyond the continuous rating for the following periods:—

100-KW. or H.P. and above	... ..	Two hours.
Below 100 KW. or H.P. not below 25 KW.	... ..	One hour.
or H.P. ... ..	... ..	One half-hour.
Below 25 KW. or H.P., not below 2 KW. or H.P.	... ..	Five minutes.
Below 2 KW. or H.P. ... ..	... ..	

(b) Machines with continuous rating having limits of full load temperature rise in accordance with Sec. VI. (b) are to be capable of withstanding 15 per cent. overload beyond the continuous rating for the periods shown above.

(c) Machines with continuous rating, of the "totally-enclosed" class, having limits of full load temperature rise in accordance with Sec. VI. (c) have no overload ratings except the momentary overloads required in connection with commutation tests.

The above overloads are to be measured in kilowatts, kilovolt-amperes, or horse-power according to the name-plate, except in the case of series or compound motors for which the overloads should be measured in amperes of input.

2. With machines having two or more fixed speeds the above overload ratings are to apply at each speed.

With variable speed machines having ratings at minimum and maximum speeds, the above overload ratings are to apply at each speed.

With machines having a speed range exceeding 2 to 1 and the same ratings at all speeds, the above overload ratings apply at any speed from the minimum to 75 per cent. of the maximum speed.

3. Motors with short-time rating are to be capable of carrying an overload of 100 per cent. torque for 30 seconds.

4. Transformers are to be capable of withstanding overloads of 25 per cent. for two hours, and 100 per cent. for 30 seconds.

## SECTION VI.—HEATING.

1. Determination of temperature rise.—The temperature rise of electrical machinery, both rotating and static, is to be taken as the difference between the cooling air temperature as defined in Clause 6 and the temperature of the machines after giving their normal rated output for the following periods:

(a) For machines with continuous rating. Until the temperature rise is practically constant; that is, until the rate of increase of temperature rise does not exceed 1° C. per hour.

(This condition will usually be reached in less than six hours, except in the case of oil immersed transformers.)

(b) For machines with short-time rating.—After working continuously for the period defined by the rating.

2. Permissible temperature rise.—For machines with continuous or with short-time rating and designed to operate under ordinary conditions of cooling, i.e., designed for an air temperature of 25° C. (77° F.), the following temperature rises are the highest permissible at the normal full load:—

## (a) MACHINES HAVING UNOBSTRUCTED VENTILATION.

(Section III, Classes 1, 2, 3a, 4a, 4b.)

Rise by thermometer.

All windings ... ..	40° C. (72° F.)
Cores in which windings are embedded ... ..	40° C. (72° F.)
Commutators and slip rings ... ..	55° C. (99° F.)

In general the temperature rise by increase of resistance should not exceed 55° C. (99° F.) for alternator field coils, or 60° C. (108° F.) for shunt field coils of direct-current machines in this class.

## (b) MACHINES HAVING PARTIALLY OBSTRUCTED VENTILATION.

(Section III, Classes 3b, 4a, 5.)

Rise by thermometer.

All windings ... ..	47° C. (85° F.)
Cores in which windings are embedded ... ..	47° C. (85° F.)
Commutators and slip rings ... ..	55° C. (99° F.)

In general the temperature rise by increase of resistance should not exceed 65° C. (117° F.) for shunt field coils of direct-current machines in this class.

## (c) MACHINES OF THE "TOTALLY-ENCLOSED" CLASS.

(Section III, Classes 3c, 6 and 7.)

Rise by thermometer.

All windings ... ..	55° C. (99° F.)
Cores in which windings are embedded ... ..	55° C. (99° F.)
Commutators and slip-rings ... ..	55° C. (99° F.)

In general the temperature rise by increase of resistance should not exceed 70° C. (126° F.) for shunt field coils of direct-current machines in this class.

3. Transformers.—The temperature rise of transformers is to be measured at their rated full-load output, under the conditions specified in Clause 1. It is permissible, however, to reduce the time of test by running for a time on an overload in current and pressure, then reducing the pressure to normal, and maintaining at this until the required standard rate of temperature rise is attained.

The limit of permissible temperature rise at the rated full load is as follows:—Oil-cooled, by resistance or by thermometer, 50° C. oil, 50° C.; air-cooled, by resistance or by thermometer, 50° C.

4. Machines for Tropical Conditions.—For tropical conditions or other cases where the cooling air temperature is in excess of 35° C., the permissible temperature rises shown in the preceding clauses are to be reduced by 20 per cent.

This does not apply to machines insulated with special heat-resisting materials in accordance with Clause 5.

5. Special Heat Resisting Materials.—The limits of temperature rise shown in Clauses 2, 3 and 4 above, apply to windings whose insulation consists wholly, or in important part, of cotton, paper, varnished cloth or similar materials.

Higher temperature rises are permissible in the case of windings where asbestos, mica or preparations of these materials are solely relied upon for insulation.

6. Measurement of Cooling Air Temperature.—The air temperature is to be taken as the mean of the temperatures measured at regular intervals during the last quarter of the test period.

When the machine under test is provided with pipe ventilation or forced draught, the air temperature is to be measured by a thermometer placed in the current of incoming air.

In the case of machines other than those referred to in the preceding paragraph, the air temperature is to be taken as the mean of the readings of two or more thermometers placed not more than 6 ft. from the machine, and on a level with its centre on opposite sides. So far as possible, these thermometers should be placed so as to measure the current of air flowing towards the machine, but they must not be exposed to radiation or stray draughts.

7. Correction for Altitude.—When a machine is intended for service at high altitude, the permissible temperature rise, if tested near sea-level, is to be reduced 2½ per cent. for each 1,000 ft.

## UNIVERSITY OF HONG KONG.

## ADDITIONAL EQUIPMENT.

WE have received a second list of experimental apparatus and machines presented to the newly-established University of Hong Kong. We are glad to notice that upwards of 80 firms have promised assistance, and there is no doubt that there will be, in the greatest distributing centre of China, a permanent exhibit of British engineering appliances. At the same time we regret to notice that electrical firms have not responded to the appeal from this British Colony as well as we should wish. A number of electrical firms have shown practical sympathy, and we sincerely trust that makers of electrical machinery will also send help. The Asiatic Petroleum Co., Ltd., have offered to supply the necessary oil fuel for the engines and boilers, which will be oil-fired. We gave a list of many of the gifts in our issue of January 31st, page 194. The shipping companies have offered to send freight free all the presentations to the University, and intending donors should communicate with Messrs. Matheson & Co., 3, Lombard Street, London, who have kindly taken charge of these arrangements.

We may mention that Prof. C. A. M. Smith will be in London in June, and letters addressed to him at the Royal Colonial Institute, Northumberland Avenue, W.C., will receive immediate attention. Among the electrical apparatus urgently needed we notice the following:—

One 5-KW. D.C. generator, 110 volts, shunt regulation, speed about 750 R.P.M.

One motor converter, speed about 1,450 R.P.M., and consisting of:—(a) One 20-H.P. single-phase induction motor, 110 volts, 75 cycles, with starter; (b) one 15-KW. D.C. generator, 110 volts, shunt regulation.

One booster, with potentiometer rheostat on fields, current capacity 50 amperes, voltage range 0-50, with 4-H.P. 110-volt D.C. driving motor.

A 16-panel switchboard for 110 volts.

Telegraphic apparatus.

Telephonic apparatus.

A balancer set consisting of two 7-KW. D.C. generators upon the same bedplate, each generating 110 volts and running at 1,500 R.P.M.

A single-phase four-pole alternator of 10-KW. capacity, frequency 50, and running at 1,500 R.P.M. on the same bedplate as (1). Voltage 110 D.C.

A booster, capacity 100 amperes, and giving any voltage 0-50, with potentiometer regulator and series resistance. Speed about 1,500 R.P.M.

A rotary converter, 7-KW. capacity. D.C. side 220 volts. A.C. side provided with two-phase and three-phase slip rings. Four-pole, speed 1,500 R.P.M. Frequency 50 with field rheostat. To be arranged for separate driving when required.

A 10-KW. three-phaser with separate windings giving 110 volts per phase, capacity speed 1,500 R.P.M., frequency 50, four poles, with field rheostat.

A 12-KW. D.C. motor wound for 110 volts, running at 1,500 R.P.M., mounted on the same bedplate as (5) with starter.

A 220-volt 10-KW. D.C. generator complete with static balancer and field rheostat.

A 15-H.P. D.C. motor 110-volt on the same bedplate as (9), and running at the same speed with starter.

A three-phase induction motor, frequency 50, speed 1,500 R.P.M., 10 H.P., with wound rotor and starting resistance and short circuiting gear.

A 7-kw. 110-volt D.C. generator running at 1,500 R.P.M. and mounted on the same bedplate as (11) with field rheostat and starter for use as motor.

A 3-H.P. two-phase induction motor, 150 volts, frequency 50, squirrel-cage rotor.

Switchboard, 21 panels + 3 spare.

## THE ELECTRICAL INDUSTRY IN FRANCE.

By GEORGES DARY.

(Continued from page 797.)

For some time past Paris, too confined by the surrounding fortifications, has been spreading out in all directions; new houses, streets and avenues having come into existence as far as Versailles to the west; to Champigny on the east; and to Saint Denis and Enghien on the north—a radius of over 12½ miles from the walls of the city. The result of this crowding of inhabitants, and the want of space in the centre of Paris, is that, just as in London, business men, employés and commercials have begun to make for the suburbs in order to secure more space, larger houses, the long-desired gardens, and, above all, to secure a reduction in rent, which, in Paris, has become far beyond the means of ordinary purses. This daily emigration from the city of quite an army of persons cannot be carried out except by a frequent and rapid means of transportation. This is the reason that has rendered necessary within the last five or six years the doubling of the means of transport, which are already insufficient to meet the needs of the steadily increasing number of passengers. Within Paris itself the Metropolitan underground electric railways have proved a solution to a part of the question, but as to the traffic outside Paris, the increase of the number of trains on the suburban lines to the practical maximum has proved insufficient.

The only available means of dealing with the problem was that of the electrification of all the lines running out of Paris in all directions and up to a pre-determined distance. In this way a minimum of congestion in the departure stations in Paris and a maximum of speed and frequency can be obtained. The chief companies have decided on this course, and the programme of the electrification of the Paris suburban railways will be carried out from year to year until the scheme has been completely realised. In 1908 we drew attention to the electric railway between Paris-Invalides and Versailles, and to that from Paris-Quai d'Orsay to Juvisy. The first-named line forms part of the State's Western system, while the second belongs to the Orleans Railway Co. On the present occasion we must mention the very important scheme for the electrification of all the suburban lines running out of the Gare St. Lazare, Paris, and which also form part of the State's Western system.

The St. Lazare station is peculiarly situated; the 27 lines running into it have, owing to the Batignolles tunnel, after reaching Paris, to be reduced to eight tracks, there being absolutely no land available for expansion. On these eight tracks no less than 1,200 trains per day have to be run in both directions without counting the shunting of about 200 locomotives. We believe that the conditions are unique, and find no parallel in any part of the world. As a result of this "bottle-necking," quite a number of complications have to be dealt with—unexpected stops, delays, blockages, . . . and accidents, which are steadily increasing in number. It was, therefore, necessary to alter the whole conditions, and it was consequently resolved:—(1) To demolish the Batignolles tunnel and the numerous houses built above it and to replace it by an open cutting covered by steel bridge work to give communication between the two sides. In this way it will be possible to increase the number of tracks by two; (2) to construct an underground railway with five tracks, and a second arrival station provided with platforms 490 ft. long, reserved for the suburban lines, which are to be electrified.

The electrification scheme which received the official sanction on May 9th, 1912, will consequently comprise the following lines:—

Paris (St. Lazare) to Auteuil and Champ de Mars, 13½ miles, double track.

Paris (St. Lazare) to Versailles (right bank) and to St. Nom la Bretèche, 21½ miles, double track.

Paris (St. Lazare) to Saint Germain-en-Laye, 15 miles, double track.

Paris (St. Lazare) to Mantes and Pontoise, *via* Maisons-Laffitte and Argenteuil, 37½ miles, double track.

With the exception of the Versailles and Argenteuil lines the departure platforms of which will be in the upper station, the others will, on entering Paris, be underground lines as far as St. Lazare.

The work is being carried out in three sections, commencing with the lines that are the most blocked—those to Auteuil and Versailles. It is hoped that the first section will be completed in 1914 or by the commencement of 1915. The total cost of the work is estimated at no less than £5,560,000. In the original project, the supply of the current necessary for the working of these lines was to have been carried out by the State, which owns the system. A generating station was to have been erected on land purchased for the purpose at Bezons Bridge, and the electricity station at Mouligneux was to have been extended so as to have an output of 25,000 kw. Eventually it was decided to procure the necessary electrical energy from private companies in place of establishing a Government plant, and tenders were invited for the contract, conditions coupled therewith being that the contractor should take over the Mouligneux generating station—which supplies the current to the Paris (Invalides)-Versailles line—and the land acquired by the State at Bezons Bridge. Provision was also made for supplying energy by transmission lines from generating stations outside Paris (the Rhone transmission line or that from the Nord). In the latter case, the steam-driven stations established in Paris for the supply of current to the railway system, must be kept with steam up in readiness for use at any time in case of breakdown of the main supply. The power available at the Mouligneux station will be 25,000 kw., and at the Bezons Bridge plant 40,000 kw. The contract is for a term of 30 years, and the contracting company will be required to deposit a sum of £60,000 by way of guarantee.

The trains will be supplied with continuous current at from 600 to 650 volts, and by means of a third rail lateral to the track. The electrical energy, generated at the power stations in the form of three-phase current at a pressure of 15,000 volts, will be transmitted by underground cables to transformer sub-stations erected along the lines.

The trains will comprise new four-axle double-bogie motor carriages, the trials of which have just been carried out on the Invalides-Versailles line. The vehicles, which have a length of 73½ ft., comprise a luggage compartment and two first and second-class compartments. Their large dimensions will enable a single vehicle to form a train during the quiet hours of the day. The underframe is provided with two 250-H.P. motors, by means of which a speed of 50 miles per hour can be attained on the level and 31½ miles per hour on slight gradients. The control is arranged on the multiple-unit system, with controllers at both front and rear of the vehicles. The carriages are lighted and heated electrically, and have seats for 64 persons and standing room for 36 others, or a total of 100 passengers per vehicle. The ordinary buffer connection between the carriages is replaced by an automatic central-coupling attachment. All these characteristics will enable lighter and less lengthy trains than at present to be built up at the busy hours, and will form a true solution of the crowding at the large stations in Paris which are invaded in the mornings and evenings, at midday and at 1 o'clock—that is, four times each day—by suburban passengers and traffic.

Before leaving Paris and its suburbs, we should mention the complete electrification of the tramway system of the Compagnie Générale des Omnibus, an extensive project, part of which has already been carried out, while the remainder will be pushed through as rapidly as possible until the whole scheme is complete. The Compagnie Générale des Omnibus commenced its operations on March 1st, 1855, with 435 horse-drawn buses, which served 25 routes of a total length of 93 miles in Paris, and 28 routes, extending to 122 miles,

in the suburbs. After having constructed several lines of tramway on its own account, it was only in 1903 that the Compagnie des Omnibus took over the municipal tramway system, the concession for which up till then was held by the Paris Municipality. This system to-day comprises 39 routes, having a total length of 183 miles. Up to 1900, it may be said that the methods of tramway traction in Paris included every known system, and formed what may be termed a living museum of all the different types of motors that had been invented, possible and imaginary—compressed-air motors, hot-air motors, steam engines, in fact, motors of all kinds; Serpollet steam generators, Purry steam boilers . . . electric motors with accumulators, with overhead conductors, with surface contact collectors and underground conduits—and all of these working on the different lines! To-day it is proposed to suppress these different systems and to work the whole tramway system electrically on the overhead principle in the outskirts and on the conduit system in the interior of Paris.

The necessary electrical energy will be supplied from three generating stations, situated respectively at Saint Denis, Vitry-sur-Seine and at Billancourt. The three-phase current generated at a pressure of 12,000 volts at these stations, will be distributed by high-tension feeders to eight sub-stations, where it will be transformed to continuous current at 600 volts, and, as such, transmitted to the lines. The sub-stations will be connected one with the other in such a way that, in case of a stoppage at any one of the central stations, they may be fed from the two others. The feeder system will consist of three-core armoured lead-covered cables; the hoop-iron armour is separated from the lead casing of the cables by two sheets of coated paper, a band of cotton and two layers of tarred rope in order to protect the cables from any chemical phenomena which may be experienced in the earth. For the 300, 400 and 600 sq. mm. conductors, aluminium has been substituted for copper.

The underground conduit, which will be adopted for the central part of the system, and which will extend to an additional distance of about  $37\frac{1}{2}$  miles, has been constructed by the Compagnie Thomson-Houston, and is of the central type already installed on two lines in Paris (three other lines, Etoile-Bastille, Chatelet and Reanmur, are of the lateral conduit type). It is built up of cast-iron chairs weighing 352 lb. each, and set at distances apart of about 4 ft. 3 in.; the extremities of the chairs support the running rails, while the slotted rail is fixed to the centre. The lines worked on the overhead-conductor system extend to a distance of about 144 miles. As regards the rolling stock, the company has decided to suppress the usual double-deck vehicles, on account of their causing delays owing to passengers having to mount

with a motor for driving purposes, while the other axle, which is fitted with smaller diameter wheels, is intended for steering (fig. 2). The point of support of the car body on the frame has been arranged as close as possible to the driving axle in order to increase the load on the latter. These cars are intended for use on the routes on which there is a heavy traffic combined with only moderate gradients. (2) For routes comprising steep hills, and on which cars with trailers are employed, a motor tramcar with two axles and a large wheel base—11 ft. 9 in.—has been adopted; to facilitate running round curves a certain amount of play is left in the axle boxes to permit of convergence in the axles, this arrangement having been adopted with success in connection with the tramways in Vienna. (3) Finally, for the routes on which there is only a relatively light traffic, a smaller type of car with end platforms, and with a wheel base of 10 ft. 8 in., has been adopted.

The electrical equipment will comprise two motors per car, of from 50 to 60 h.p., and of the auxiliary or commutator pole type. The addition of the auxiliary poles has enabled the problem of commutation to be solved. The controllers are of the series-paralled type with magnetic blow-outs and are sectionised, so that in case of accident it is possible to cut out a part of the equipment, and to run at a slower speed with the remaining portion. A small combined motor and compressor produces the compressed air necessary for the working of the automatic brake; it comprises an electric motor of from 3 to 4 h.p., working continuously, but able to develop double that power when used intermittently, a compressor and an electric pressure regulator.

According to a report presented to the Société des Ingenieurs Civils de France by M. Mariage, manager of the Compagnie des Omnibus, the estimates for the acquisition of 1,100 tramcars amount to £960,000. As for other costs in connection with the scheme, they comprise £100,000 for high-tension feeders, £156,000 for sub-stations, and £192,000 for continuous-current feeders.

In addition, the cost of organising and equipping 13 dépôts for the storage of the cars and a central repairing establishment—jointly used for the motor-buses and tramways of the company—is estimated at £140,000.

To summarise or even enumerate the new electricity-distributing installations that have been established in provincial France during the last five or six years is practically impossible, and even if attempted, would consist mainly of a wearily long list of names of towns. Therefore, before passing to the Pyrenees, where at present several interesting installations are being carried out, we will content ourselves by drawing attention to the activity which prevails in all parts of France and the object of which, as we pointed out at the commencement of this article, is to provide the different districts with a supply of electrical energy, either by utilising available water-power or by establishing generating stations directly connected with collieries with the view of securing low costs of production.

To give an example, we may draw particular attention to the plant of the Compagnie Electrique du Nord, which is destined to become the main artery of a large system supplying current for lighting and power purposes to the majority of the industrial centres in the Nord and Pas de Calais Departments, if not later on to the suburbs of Paris, as we have previously indicated. Already the supply mains of the company extend to a distance of over 37 miles, supplying the current required for haulage purposes by the Societe de Halage Electrique, which works the canals in the district of Douai.

The generating station, which is situated at Pont-a-Vendin, belongs to the Société des Mines de Lens; it produces 50-period three-phase current, at 45,000 volts pressure. The high-tension mains—three in number—convey the current to five sub-stations, located at Bavrin, La Batterie, Douai, Arleux and Hem-Leuglet. Special care has been devoted to the arrangements for the protection of the overhead lines where they cross roads and railways.

The details of the installation need not now be gone into; we have only referred to it because of the future extensions, which will reach to all parts of the Nord Department, and

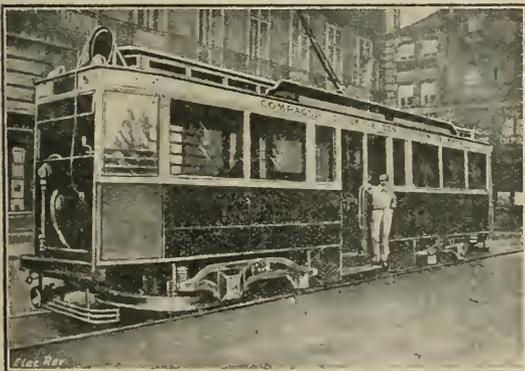


Fig. 2.

up to, and descend from, the top. With the view, however, of meeting all requirements, and in order that the cars, notwithstanding their great length, may easily pass round sharp curves, possess perfect underframe rigidity, and sufficient adhesion, the company has been led to adopt three types of car, according to the lines on which they are to be used:—(1) A car with bogies, one axle of which is provided

because of the important character it will assume in the near future. Similarly, we will only mention, in choosing at random from a long list of similar undertakings, the names of the Société de l'Energie Electrique du Centre, La Compagnie Electrique du Jura, La Compagnie Générale Electrique de la Marne, La Compagnie Lorraine d'Electricité, La Société Hydro-Electrique des Basses Pyrenées, La Société de l'Energie Electrique du Sud-Ouest, La Société des Forces Motrices du Refrain (Doubs), and La Société Force et Lumière du Val d'Arly. This short list will be sufficient to prove the truth of our assertions at the beginning of this article, and for us to state that the number of electricity supply companies established in France has more than doubled since 1908.

We may now devote attention to the new installations which have been established, and also to those in course of construction in the Pyrenées, which will complete our endeavours to demonstrate to the readers of the REVIEW, the present prosperous condition of the electrical industry in France and the immense progress which the industry has made within the short space of five years.

To begin with the work which has been commenced by the Midi Railway Co. in connection with the adoption of

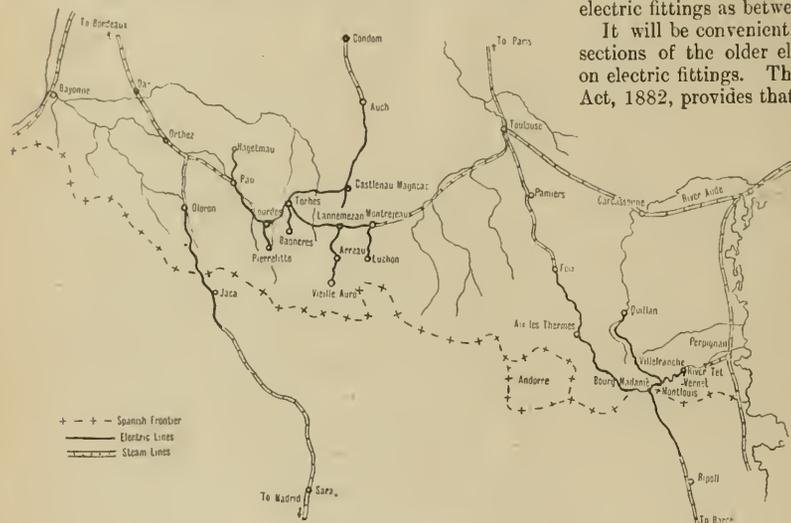


FIG. 3.—MAP OF ELECTRIC RAILWAYS IN THE PYRENEES.

electric traction, it may be stated that this company has decided to electrify practically all the lines comprised in its Pyrenées and trans-Pyrenées system, these being as shown in the accompanying map (fig. 3):—

1. The Villefranche de Confient-Bourg-Madame (Spanish frontier) line, a distance of 35½ miles, with branches from Villefranche to Vernet, and from Bourg-Madame to La Tour de Carol.

2. The Foix-Ax-les-Thermes line (25½ miles) and its extension from Ax-les-Thermes to Ripoll (Spain) *via* Bourg-Madame, 25½ miles. This line places Toulouse in direct communication with Barcelona.

3. The Montrejeau-Pau section, 70 miles, with branches from Montrejeau to Luchon (22 miles), and from Lannemezan to Arreau (15½ miles), from Tarbes to Bagnères de Bigorre (13¾ miles), from Lourdes to Pierrefitte (12¾ miles), and from Pau to Oloron and Laruns (33¾ miles).

4. The Auch-Lannemezan line (43½ miles), with a branch from Castelnaud-Magnoac to Tarbes (25 miles of 39-in. narrow-gauge line).

5. The Arreau-Vielle-Aure (French frontier) line (7 miles).

6. The Pau-Hagetmau line (32¾ miles).

7. The line from Oloron to the Spanish frontier (32½ miles), giving direct connection between the Southern line and Saragosa, Spain, and

8. The line from Quillan to Montlouis and Belesta.

The majority of these lines comprise gradients which are too steep for steam traction; the others have to bear a very

heavy traffic, which is more easily dealt with electrically, and it is for these reasons that the Midi Railway Co. has decided to adopt electric traction on practically the whole of its system in the Pyrenées.

(To be continued.)

## ELECTRICAL FITTINGS AND THE LAW.

[FROM A LEGAL CONTRIBUTOR.]

To judge from the legal queries addressed from time to time to the ELECTRICAL REVIEW, it would seem that the supply, hire, and use of electrical fittings, are matters which frequently give rise to questions of legal difficulty. It is probable that few householders in a town have a very clear notion as to how their premises came to be wired for electricity. Again, the consumer's mind is frequently in a nebulous state as to what his rights are in relation to electric fittings as between himself and his landlord.

It will be convenient, in the first place, to consider some sections of the older electric lighting Acts in their bearing on electric fittings. Thus, Sec. 24 of the Electric Lighting Act, 1882, provides that any officer appointed by the undertakers may at all reasonable times enter any premises to which electricity is, or has been, supplied by the undertakers, in order to inspect the electric lines, meters, accumulators, fittings, works, and apparatus, for the supply of electricity belonging to the undertakers, and for the purpose of ascertaining the quantity of electricity consumed or supplied, or where the undertakers are authorised to take away and cut off the supply of electricity from any premises, for the purpose of removing any electric lines, accumulators, fittings, works, or apparatus belonging to the undertakers, repairing all damage caused by such entry, inspection or

removal. The powers conferred by this section must not, however, be arbitrarily exercised. Due notice of an intended visit should be given, for it was decided in *Brompton, &c., Electric Supply Co. v. Shadforth* (ELECTRICAL REVIEW, July 24th, 1903) that where a consumer refused to allow inspectors to come into her house unless she received previous notice of their visit, an injunction ought not to be granted to restrain her.

Electric fittings are also protected from distress from rent. Thus, by Sec. 25 of the Electric Lighting Act, 1882, where any electric lines, meters, accumulators, fittings or works or apparatus, belonging to the undertakers—*i.e.*, the local authority or company supplying electricity—are placed upon any premises for the purpose of supplying electricity, they shall not be subject to distress, or to the landlord's remedy for rent of the premises where the same may be, nor be taken in execution under any process of a court of law. In the ordinary way, they might be seized by the landlord whose rent was in arrear. This affords considerable protection to the undertakers. Very often, when a tenant does flit, the only articles of *vertu* left on the premises are the electrical fittings, which the landlord would be glad to sell in order to satisfy some part of his claim for rent outstanding.

But what are "fittings" within the meaning of the section? Wires and pipes through which wires are laid naturally come under this heading, but there are other things not so easy to classify. It was decided under Sec. 14 of the Gas Works Clauses Act, 1871, which is similar to the above, that a gas stove let for hire is a "fitting for the gas" within the meaning of that section, and is, therefore, not subject to distress for rent (see *Gas Light and Coke Co.*

*v. Hardy*, 1886, 17 Q.B.D. 619). It would seem to follow from this that electric stoves, kettles, fans and electric irons, if hired out by the local authority to the consumer, would not be subject to distress by the landlord.

As to whether electric fittings let on hire by the supply authority vest in the trustee in bankruptcy of the consumer, it is difficult to speak with certainty. The law of bankruptcy provides that goods which are in the order and disposition of the bankrupt, with the consent of the true owner, at the date of his bankruptcy, shall vest in the trustee for the benefit of creditors. And this is right; for credit is naturally given to a man upon the strength of the goods which he has upon the premises. But where it is well known that certain classes of goods are customarily lent on hire, the presumption that they belong to the bankrupt does not arise. For instance, the custom of hotel keepers to hire furniture is so well known that such furniture does not vest in the trustee in bankruptcy of the hotel proprietor.

Questions arise from time to time as to the power of local authorities supplying electricity to deal in fittings. It is common to find in the Acts of local authorities a special clause to enable them to sell, let, hire, but not to manufacture, lamps, meters, electric fittings, &c. The terms of these clauses vary somewhat. In the Nottingham Corporation Act, 1889, Sec. 4, the power conferred is to provide and let, &c., but not to manufacture, "lamps, meters, electric lines, fittings, apparatus, and things, for lighting and motor power, and for all other purposes for which electric energy can or may be used, or otherwise necessary or proper for the supply, distribution, consumption or use of electrical energy." The Manchester Corporation (General Powers) Act, 1898, after the usual wide powers, contains these words: "Electrical motors, and apparatus for the use of electricity for motive power and other purposes."

The Halifax Corporation Act, 1898, is even wider in its terms. It authorises the Corporation to "purchase, hire, sell, let on hire, or otherwise deal with dynamos, electric motors, accumulators, meters, burners, arc and other lamps, fittings, wires, plant, engines, conductors, machinery, apparatus and appliances for and in relation to the production, supply, distribution or utilisation of electricity, or required or used for or in connection with their electrical works and undertaking."

The new Electric Lighting Act of 1909 gives a further protection to electric fittings. It is there provided by Sec. 16 that "all electric lines, fittings, apparatus and appliances let by any undertakers on hire or belonging to any undertakers, but being in or upon the premises of which the undertakers are not in possession shall, whether they be or be not fixed or fastened to any part of any premises in or upon which they may be situate, or to the soil under any such premises, at all times continue to be the property of, and removable by, the undertakers, and Secs. 24 and 25 of the Act of 1882 shall extend and apply to all such electric lines, fittings, apparatus and appliances: Provided that such electric lines, fittings, apparatus or appliances have upon them respectively a distinguishing metal plate affixed to a conspicuous part thereof, or a distinguishing brand or other mark conspicuously impressed or made thereon, sufficiently indicating the undertakers as the actual owners thereof. For the purposes of this section, electric fittings, &c., disposed of on the terms of payment by instalments are deemed to be electric fittings, &c., let on hire by the undertakers. This section does not affect the amount of the assessment for rating of any premises upon which any electric lines, fittings, apparatus or appliances are or shall be fixed."

Electric lines, fittings or other apparatus may be so affixed to a house as to become part of the land for "*quicquid plantatur solo, solo cedit*." In that case they would pass by a conveyance of the law, or become the subject of an existing mortgage, although they were merely hired by the owner or lessee of the land under a hiring agreement, or agreed to be purchased under a hire-purchase agreement and not yet paid for. (*Holland v. Hodgson* (1872) L.R. 7 C.P. 328.) The owners of lines, fittings or apparatus has, however, by virtue of the hiring or hire-purchase agreement, if in the latter case they are to remain his property till paid for, an equitable interest in the land under which he may

remove his lines, fittings or apparatus (*re Samuel Allen and Sons, Ltd.* (1907) 1 Ch. 575).

It has, of course, been decided that the Electric Lighting Acts do not authorise undertakers to supply electric fittings and apparatus other than meters.

## CONSULAR NOTES.

**South Africa.**—The Austrian Consul at Cape Town reports that British cables, which are recommended by engineers in South Africa, have recently strengthened their hold on the market. German cables, which are favoured by German importers, have shown a tendency to fall off, and Italian cables have for the first time appeared in the market. The future will show whether this is just a temporary appearance due to one delivery, or whether Italy will continue to prove a factor in the competition. The Cape Province is, however, rather unimportant as a market for cables, when considered relatively with the Transvaal. In order to secure trade in this line, it is almost essential that firms should be represented.

**Japan.**—The American Consul at Yokohama reports that the sale of American electrical machinery and supplies to Japan during 1912 was the largest in the history of this line of business in that country. The total sales of electrical supplies aggregated about £1,000,000, the bulk of the imported products coming from America. The importation of all kinds of machinery into Japan increased by about £300,000 in 1912, the total imports in round numbers being £2,850,000. The principal business during 1912 consisted of the extension of the existing light, power, and railway stations. The Tokio Municipal Railway, for instance, purchased £60,000 worth of apparatus for transforming high-tension current in their various sub-stations throughout the city, to the trolley line voltage.

The machinery ordered about a year ago at Tokio for various large water-power electric companies has been arriving during the past few months and the plants are being completed. The principal ones are as follows:—

**Tokio Electric Light Co.**—An extension of about 40,000 kw. to their first water-power electric plant which amounted, when it was installed, to approximately 20,000 kw. This extension is now about finished.

**The Kinugawa Hydro-electric Co.**—Approximately 40,000 kw. This plant is now about completed and some current is already being transmitted to Tokio from its power stations.

**Katsurugawa Hydro-electric Power Co.**—This equipment complete was supplied from Schenectady, N.Y., the aggregate capacity being about 40,000 kw. All of the machinery has arrived and the work will probably be finished within the next few months, so that a large amount of power from that source will shortly be brought down to Tokio.

**The Inawashiro Hydro-electric Power Co.**—The order for this apparatus, amounting to about 40,000 kw., was placed about one-half with an English firm (Dick, Kerr & Co.), and the other half in America (Westinghouse). This apparatus had not been shipped at the time of writing, and the company will, therefore, not be ready for operation until after the end of this year.

At Yokohama a 3,000-kw. steam-turbine generator was installed to further increase the capacity of the existing lighting plant.

At Osaka there have been many additions to the existing electric railway plants, and some small suburban roads have been put into operation in the last four or five months. Osaka is a very active centre for the electrical business in Japan, and many suburban roads have been successfully put into operation there. On account of the large manufacturing interest developed, electric power will be largely used there in the future, and as there is a large water-power company, the Ujigawa, which is now nearing completion, and which will bring into Osaka 30,000 to 40,000 kw. of current, the prospects are favourable for low cost of light and power in that city in the future.

The Kyushin Electric Railway added during 1912 a 3,000-kw. turbo-generator set, and at Nagasaki two 500-kw. turbo-generator sets were installed as an extension to the existing lighting plant. The coal mines in Kyushin have also been active in purchasing electrical apparatus.

The greater part of the sales reported have been made through the General Electric Co., of America. In addition to the extensive business of selling American electrical machinery, the General Electric Co. is a leading factor in the electric lamp trade in Japan. It has developed a very large lamp manufacturing plant in Tokio, which now supplies the great bulk of the incandescent lamps used in the country. This plant is operated through a Japanese company under American control. It is managed entirely by Japanese, however, and the operatives are largely Japanese girls. It has been very successful both financially and in supplying the demands of the country. In fact, this is a new industry created in Japan within the last three or four years.

The General Electric Co. also owns a considerable interest in the Shibaura Engineering Works at Tokio, which is controlled by the financially powerful Mitsui Co. The Shibaura works manufacture electrical apparatus up to 2,000 kw., and the business for the past six months was so satisfactory that the company has decided to

increase its capital from the present £200,000 to £400,000 to take care of the demands of the market. There is close co-operation between this company and the parent General Electric Co., of Schenectady, N. Y., and "there is apparently no reason why this Japanese electrical manufacturing concern should not become very strong and prosperous." All of its products are manufactured in accordance with the American designs of the General Electric Co.

Large quantities of the smaller electrical supplies are imported into Japan, and in this business American manufacturers and importers participate very satisfactorily. It is evident, however, that the Japanese will be able, particularly through foreign associates, to manufacture the greater part of the smaller electrical supplies, including telephones and telephone equipment. The manufacture of this class of smaller electrical products in Japan is growing steadily and rapidly.

There are in Japan several British manufacturers who have a fairly large electrical business, but the Allgemeine Co. and the Siemens Schuckert Co. are the two important competitors of the American manufacturers of heavy electrical machinery and supplies.

**Persia.**—The British Consul at Ispahan reports that a telephone service, first established in that town in 1910-11, now numbers nearly 100 subscribers, and wires have been carried as far as the villages of Sehah (about 16 miles) and Najafabad (about 20 miles), west of the town.

- 11,013. "Electric current-distributing systems." P. V. HUNTER, J. R. BEARD, and ELECTRICAL IMPROVEMENTS, LTD. May 9th.  
 11,017. "Treatment of metals or alloys to render them ductile and malleable." WESTINGHOUSE METALLURGICAL GLÜHLAMPENFABRIK G.m.b.H. (Addition to 19,869, 1912. Convention date, May 13th, 1912, Austria.) May 9th. (Complete.)  
 11,088. "Telegraph, telephone and like cables." A. J. STUBBS, May 10th.  
 11,067. "Electrical time-switches." H. F. J. THOMPSON and J. H. BOWDEN, May 10th.  
 11,069. "Means for operating direction switches and resistance in electro-motor-driven controllers." ELECTROMOTOR EQUIPMENT CO., LTD., and A. J. BARLOW, May 10th. (Complete.)  
 11,090. "Meter-testing apparatus." R. L. DEZENDORF, May 10th.  
 11,106. "Wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and C. P. RYAN, May 10th.  
 11,115. "Means for controlling electric circuits." H. LEITNER, May 10th.  
 11,128. "Anodes for the electrolysis of aqueous solutions." P. C. C. ISHERWOOD, May 10th.  
 11,131. "Electric relays." A. N. HOOLAND, May 10th. (Complete.)  
 11,135. "Apparatus for automatically starting and braking electromotors." H. DELVENNE, May 10th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

ADVERTISING DEVICES AND THE LIKE. H. K. HARRIS, 27,798. February 10th, 1912. (February 10th, 1912. Patent of Addition not granted.)

1912.

- SYSTEMS FOR STARTING ENGINES. C. F. Kettering, 1,424. January 15th. (June 19th, 1911.)  
 ELECTRIC TIME SWITCHES. F. T. Reid, 1,693. January 22nd. (August 22nd, 1912.)  
 DEVICE FOR DISINFECTING TELEPHONE MOUTHPIECES AND OTHER SIMILAR INSTRUMENTS. S. B. Dewhurst, 9,388. April 20th.  
 SYSTEM OF ELECTRIC GENERATION AND TRANSMISSION FOR MOTOR-DRIVEN VEHICLES, LOCOMOTIVES OR TRAINS. H. Leitner, 9,416. April 20th.  
 MEANS FOR REGULATING THE TEMPERATURE OF ELECTRICAL HEATING AND COOKING APPARATUS. J. C. P. Kirkwood, 9,518. April 22nd.  
 ELECTRIC CEILING ROSES AND THE LIKE OUTLET BOXES. S. TROOD and J. H. Dale, 9,910. April 26th.  
 FIRE-ALARM SYSTEMS. G. Porter and H. ISSACS, 10,278. April 30th.  
 ELECTRICAL SWITCHES. A. Wynne, 13,415. June 8th.  
 STARTING SWITCHES FOR ELECTRIC MOTORS. J. M. S. Fontects, 13,761. June 12th.  
 ELECTRODES FOR ARC LAMPS. A. Blondel, 14,741. June 24th.  
 MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES. J. Y. Johnson, (F.I.A.T., Fabbrica Italiana Automobili Torino), 15,669. June 27th.  
 METHOD OF MOISTURE-PROOFING CORD CONDUCTORS. Western Electric Co. (Western Electric Co.) 16,162. July 10th.  
 TYPE-PRINTING TELEGRAPHS AND CIRCUIT-SELECTING APPARATUS. H. O. A. Jensen, 18,955. August 19th.  
 ELECTRIC FUSES. G. W. Christiansp., 19,533. August 26th. (December 27th, 1911.)  
 SUPPLY OF FILTERED AIR TO DYNAMO-ELECTRIC MACHINES. G. A. Mower and K. O. Hale, 19,792. August 25th.  
 ELECTRICALLY-OPERATED SECTION CLEANERS FOR THE EXTRACTION OF DUST AND THE LIKE. Anglo-Indo-Port Manufacturing Co., W. C. Jeary and J. P. Annacker, 20,269. September 5th.  
 PROTECTIVE DEVICES FOR ELECTRIC CIRCUITS. British Thomson-Houston Co. Ltd. (General Electric Co.) 20,663. September 16th. (Divided application No. 16,703 of 1912, July 17th.)  
 COMPUTATORS FOR ELECTRIC MOTORS. W. H. Scott, 20,628. September 12th.  
 CONTROLLING APPARATUS FOR TELEPHONE SYSTEMS USING AUTOMATIC SELECTOR SWITCHES. E. C. Molina, 21,008. September 14th. (September 14th, 1911.)  
 BRUSH ROCKING APPARATUS FOR DYNAMO-ELECTRIC MACHINES. Pintsch's Electric Manufacturing Co., Ltd., and C. H. Vidal, 21,438. September 20th.  
 IGNITION SYSTEMS FOR MOTOR VEHICLES. A. L. Riker, 22,197. September 30th. (September 30th, 1911.)  
 DEVICES FOR AUTOMATICALLY ADJUSTING THE TIME OF IGNITION IN INTERNAL-COMBUSTION ENGINES. Firm of Robert Bosch, 24,665. October 28th. (December 6th, 1911.)  
 ELECTRIC HEATING OF HOUSES. H. LÖFQUIST, 25,101. November 1st.  
 METAL FILAMENTS FOR ELECTRIC INCANDESCENT LAMPS. Westinghouse Metallurgen Glühlampenfabrik Ges. 26,269. November 15th. (November 20th, 1911.)  
 JOINT BOXES FOR ELECTRICAL CABLES. W. T. Henley's Telegraph Works Co. and W. H. Nichols, 28,694. December 6th.  
 ELECTRIC ARC LIGHTS. General Composing Co. Ges. 28,503. December 10th. (December 11th, 1911.)

1913.

- MANUFACTURE OF QUARTZ ARTICLES. British Thomson-Houston Co. (General Electric Co.) 415. January 6th.  
 APPARATUS FOR PRODUCING PERFORATED STRIP FOR TELEGRAPHICALLY TRANSMITTING SIGNALS. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 942. January 13th. (Addition to No. 8,013 of 1908.)  
 MEANS FOR THE CONTROL OF ELECTRIC PRESSURE AND CURRENT REGULATORS. W. J. Poole, 1,755. January 22nd.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 10,500. "Electric soldering irons." A. H. RAILING and A. J. D. KRAUSE, May 5th.  
 10,512. "Electrolytic electricity meters." SCOTT & GEN. (Addition to 14,288 of 1909. Convention date, June 10th, 1912, Germany.) May 6th. (Complete.)  
 10,514. "Reversing and controlling gear for electric motors, specially applicable to electric motors for operating lifts." ETCHELLS, COXDEN and MEIR, LTD., and F. MEIR, May 5th. (Complete.)  
 10,519. "Electric motors applicable for driving kinetographs." I. KITSEZ, (Divided application on 14,480 of June 26th, 1912.) May 5th. (Complete.)  
 10,535. "Electric motors." M. J. RAILING and J. COLE, May 5th.  
 10,539. "Means for automatically regulating the admission of air to electrical machines." G. A. MOWER, K. O. HALE and J. CHRISTIE, May 5th.  
 10,556. "Telephone fixtures." W. C. UDE. (Convention date, May 3rd, 1912, United States.) May 5th. (Complete.)  
 10,559. "Timing devices for operating electric switches and other apparatus." S. CHORF, May 5th. (Complete.)  
 10,579. "Electrically-heated apparatus." E. C. R. MARBS. (Landers, Frary & Clark, United States.) May 5th. (Complete.)  
 10,608. "Windings of dynamo-electric machines and other electrical apparatus." ALGEMEINE ELEKTRICITÄTS GES. (Convention date, May 3rd, 1912, Germany.) May 5th. (Complete.)  
 10,609. "Device for the automatic maintenance of phase equality of the currents of parallel-connected alternating-current machines." ALGEMEINE ELEKTRICITÄTS GES. (Convention date, May 3rd, 1912, Germany.) May 5th. (Complete.)  
 10,616. "Electric light lamp stands and pendants fitted with copper silver-plated shades." A. H. B. SHARPE and G. BOOLE, May 6th.  
 10,631. "Time element or retarding devices for automatic circuit-breakers and the like." W. BURTON, May 6th.  
 10,685. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT.-GES. (Convention date, May 6th, 1912, Germany.) May 6th. (Complete.)  
 10,717. "Switch-operating mechanism and the like for causing the actuation of signals on moving objects." E. J. PAGE and O. E. KELLUM, May 6th. (Complete.)  
 10,732. "Means for, and methods of, changing the frequency of alternating electric currents." A. M. TAYLOR, May 7th. (Addition to 8,853, 11.)  
 10,770. "Rheostats for starting and controlling electric motors driving the blowing apparatus of organs or the like musical instruments." L. B. COLEMAN, May 7th.  
 10,803. "Electric railway signalling systems." J. B. MOYEN.—(Convention date, May 8th, 1912, France.) May 7th. (Complete.)  
 10,840. "Electric accumulators, means of protecting against excessive discharge." D. ECCLES, May 8th.  
 10,841. "Method of operating rotary converters and other alternating-current machinery." A. H. RAILING and C. C. GARRARD, May 8th.  
 10,883. "Electro-deposition of alloys." S. O. COWPER-COLES, May 8th.  
 10,864. "Telephone exchange system." M. L. JOHNSON, May 8th. (Complete.)  
 10,873. "Apparatus for electro-osmotic extraction of water from substances." GES. FÜR ELEKTRO-OSMOSE M. R. H. and GRAF BOTHO SCHWERIN. (Addition to 23,545, 1912.) May 8th.  
 10,892. "Means for improving the illuminating effect of electric and gas lamps." W. J. BRYLLIE, May 8th.  
 10,900. "Automatic electric alarm signals and the like." P. DUNNE, May 8th. (Complete.)  
 10,901. "Arrangement for the regulation of machines for multiple wire-drawing and the like." SOC. ANON. DES FORGES ET ACIERIES DE HUTA BANKOWA. (Convention date, May 11th, 1912, France.) May 8th. (Complete.)  
 10,917. "Incandescent electric lamps." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 8th. (Complete.)  
 10,918. "Incandescent electric lamps." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 8th. (Complete.)  
 10,919. "Windings for dynamo-electric machines." BRITISH THOMPSON-HOUSTON CO., LTD., and H. W. TAYLOR, May 8th. (Complete.)  
 10,920. "Systems for supplying from high-pressure mains continuous current at a lower pressure." E. A. GRAHAM and W. J. RICEITS, May 8th. (Complete.)  
 10,977. "Device for recording telephone calls and the like." P. H. JONES, May 9th.  
 10,987. "Device for dealing with electrical currents in the earth." E. RYAN and H. W. BROWN, May 9th.  
 11,007. "Fly-wheel storage arrangements such as used in the electrical driving of hauling or winding machinery." SIEMENS-SCHUCKERTWERKE G.m.s.H. (Convention date, May 10th, 1912, Germany.) May 9th. (Complete.)

# THE ELECTRICAL REVIEW.

Vol. LXXII.

MAY 30, 1913.

No. 1,853.

## ELECTRICAL REVIEW.

## NEW BOARD OF TRADE REGU- LATIONS.

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The subject of regulations for overhead wires in this country is one which has always been of very great interest to electrical engineers, and its importance is constantly growing. The new regulations just issued, and reproduced elsewhere in our pages, will therefore claim the close attention of our readers. Any concessions that tend towards facilitating the employment of overhead lines will naturally receive a heartfelt welcome.

The new high-pressure code embodies some noteworthy changes, and alterations have been made also in the memorandum for the guidance of persons applying for leave to use overhead wires. General consent is not given; each case is considered on its merits, and the regulations are drawn up to correspond with the actual circumstances, but it will be found that an attempt has been made to separate the variable from the constant terms of the problem, embodying the latter in a definite code and deriving the former from the applicant.

An important change is the reduction of the wind pressure from 30 to 25 lb. per sq. ft., which, moreover, is the maximum allowance, without regard to snow or ice; in this respect the regulation is more lenient than those in force on the Continent. Our climate in winter is certainly less rigorous than that of Germany or France, and while we may occasionally experience a blizzard, it would be unreasonable to legislate for so exceptional an event, imposing a perpetual burden upon the industry on account of a remote possibility.

An interesting addition to the high-pressure code is the requirement that precautions shall be taken to prevent contact between high-pressure lines and trees. This appears to be due to the difficulty in obtaining wayleaves in this country. It would be better to clear away the trees alongside of a transmission line, as is done in other countries, but the attempt to do so here would, in many cases, result in a blank refusal to grant the wayleave.

Another new regulation in general forbids the erection of high-pressure wires across the premises of a consumer. Permission may be given to do this under special conditions, but such wires might be regarded by the Home Office as service wires, not coming under the Factory Regulations, and in the case of an accident, the supply company would be held responsible. The code, in fact, is intended only to apply to cross-country work.

One of the regulations contains an additional provision regarding the earthing of the ironwork on each pole as an alternative to the use of a continuous earth wire.

The failure of the wire cradle to give satisfaction at crossings is recognised in Regulation 24, which le

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

## 1913 EDITION.

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the applicant to submit proposals as to the safeguards to be used. Improved methods of insulating and supporting the conductors, by duplication and similar devices, have come into use of late, and it stands to reason that it is much better to render breakage practically impossible than to provide against its consequences.

It will be seen that while the changes are not of fundamental importance, their tendency is, on the whole, towards leniency. The main question, however, is the facility of obtaining consents, and we have been pleased to see that in recent years the number of these has very greatly increased.

#### The Post Office and Telephone Subscribers.

THE man who is compelled to patronise that Government monopoly—the telephone—generally pays what is demanded of him without making a fuss. Life is not long enough to justify the expenditure of time in disputing over small sums—possibly 1s. or 6d.—which may appear to be an overcharge. It would seem, however, that those in charge of the Post Office Telephone system do sometimes make mistakes—like the rest of us; and if a protest is made, it may turn out that the charge cannot be justified. A singular case occurred last week in the Westminster County Court which illustrates this point. A subscriber was sued by the Post Office, the claim being for £7 4s. 9d. alleged to be due for telephone rental and fees, including an item of 4s. 9d. for trunk calls. Owing to his not having paid, he had been deprived of the telephone. From a brief report which appeared in a daily paper, the defendant appeared to admit the £7, but denied that he had had any trunk calls.

It appears that a Post Office witness said that the trunk fees were for postal facilities. In reply to the Judge, who asked for proof, he said that he could produce the books, and that subscribers agreed to take the book records as their accounts. Judge Bray said that might be so, but that did not make the books evidence before a court of law. The nature of the charges must be proved in the ordinary way, and, in the absence of such proof, he disallowed the claim for 4s. 9d. This decision appears to have given rise to an impression that there was some difficulty about the Post Office recovering trunk calls. At any rate, the Post Office appears to have attached importance to it, for, on the following day, the case was again mentioned to the Court, when the Judge pointed out that “he had not decided that the Post Office books were not evidence to prove trunk calls. If the books were produced, he would then have to decide whether they were or were not evidence against the defendant. He now understood that the charges were for Post Office telegrams, and the Post Office were at liberty to prove that fact if they liked.” This puts a very different complexion on the previous decision: but the fact remains that, like every other litigant, the Postmaster-General must be prepared to prove his case if he brings an action at law. It is reasonably clear that, in the absence of agreement, the books or records kept at the exchange are not in themselves evidence against a subscriber for any purpose. Suppose it were alleged against a subscriber who had paid his £6 10s. a year, that there was an additional sum of 19s. 4d. due for extra calls. If his defence was: “I deny that I have had more than 360 calls,” the Postmaster-General would have to prove that each additional call was made. For that purpose he would be bound to summon as witnesses every exchange clerk who recorded any call from that particular number. The exchange clerk, no doubt, would be entitled to refresh his memory by referring to any memorandum made at the time, and his evidence, so fortified, would be difficult to displace; but the fact remains that the burden of proof would have to be discharged. It will be noticed that in the case above mentioned those representing the Post Office relied upon an

agreement by subscribers “to take the book records as their accounts.” Judge Bray stated the law with perfect accuracy when he said that such an agreement was valid *inter partes*, but was not binding on a Court of Law.

We know of no express decision on the point; but it may be that, by agreeing to accept the entries in the Post Office books, a subscriber becomes (as the lawyers say), estopped from disputing their accuracy. In any case of real doubt, however, a subscriber would be well advised to insist on witnesses being called, because he would be entitled to have it proved in Court that the entries were actually made by those in the employment of the Post Office.

#### Electric Lighting for Motor-Cars.

FOR many years those associated with the electrical industry in the United States have set a commendable example in the interest they have taken in everything appertaining to the motor-car. The excellent results that have attended the efforts of the Electrical Vehicle Association in developing the use of electric motor vehicles in the United States have often been referred to in our pages. Now that electricity bids fair to become practically the only medium for the lighting of automobiles, and is also playing an important part in the starting devices which have been introduced to render the usual petrol engine starting handle a thing of the past, it is interesting to find that electrical engineers are working together with the view of seeing that these new departures are developed along proper lines. Thus, the American Society of Automobile Engineers has recently appointed an electrical equipment division, or sub-Committee, which is at present engaged on a discussion as to whether, for car electric lighting installations, the double-wiring system, or the single wiring with earthed return, should be recommended by the Society. Although there is a majority in favour of the latter, it was resolved at the last meeting to postpone the final decision. As a matter of fact, the only direct opposition to the standardisation of the single-wire system came from a single manufacturer of electric lighting and engine-starting systems, who contended that the earthing method had been the cause of many difficulties, and that whereas several “earths” might exist on a two-wire system without putting it out of action, one “earth” might suffice to throw out a single-wire system; furthermore, that fuses would not protect the latter from the losses due to slow leaks. On the other hand, one large firm of motor-car manufacturers stated that they had had no troubles along the lines indicated, and that they intended to adhere to the single-wire system. The representatives of several lamp manufacturing concerns stated that they had no preference for either of the systems, but as it was estimated that at least 7,000,000 lamps would be sold this year for replacement purposes alone, they were anxious to see one or other of the two systems standardised, so that the question of supplying them could be simplified.

Another subject which is being dealt with by the Society is that of accumulators for car electric lighting and starting systems, a proposal to adopt standards for battery ratings and also for the external dimensions of battery containers being under consideration. The representative of an accumulator factory stated that his firm had to keep a stock of no fewer than 128 styles, sizes, and capacities of accumulators, owing mainly to needless divergencies in the location of the same on the car. It was also decided to draw up a standard set of instructions for the charging and care of batteries: these will probably be engraved on a metal plate, to be fixed to the dashboard of the car.

Other points relating to the electrical equipment of petrol cars are being dealt with by the Society, but those we have mentioned will more than suffice to demonstrate the practical interest taken in the matter, this being, as we stated at the outset, an example which might well be followed by the electrical trade in this country.

**Imperial Communications.**

THE Dominion House of Commons "Hansard" of May 5th, and Bill No. 188, introducing "An Act to provide for more advantageous telegraphic communication between Canada, the United Kingdom, and other parts of the British Empire," and containing a Schedule giving the terms of an agreement for Radio-Telegraphic communication between Great Britain, Canada, Australia and New Zealand, enables us to understand the exact attitude now taken up by the Dominion Government with regard to cable, telephonic, wireless, and any other means of telegraphic communication. The Act is cited as "The Ocean Telegraph Act," and by this it would seem that it is still the inward belief that the ocean, and not the ether, will have much to do with the future of telegraphy. The Act provides regulations for issuing licences for the landing of cables; for the construction and operation of all telegraphic stations; for their control and management, as well as their inspection; for harmonious working, and for making effective international conventions and treaties.

The debate in the Canadian House brought out a great deal of information which has not appeared in the Press, but we do not think the benefits derived from cable communication by the two countries, Canada and Great Britain, received full recognition. No loss would follow a tribute of this nature, and it does not appear to be large statesmanship to say that a country has been for years in the hands of the cable companies, when the remedy is in the hands of the Governments. If this had been applied many years ago, when the question became active, it is probable that the cost of any necessary undertaking would by now have been paid off, instead of which experimental purposes are to delay further what is agreed to be a vital necessity. The debate when it reached technicality became more involved, especially when a speed of 400 letters per minute (or 100 per cent. more than by cable) was stated to have been guaranteed by wireless. The Pacific Cable project was brought into the discussion, and statements of opinion as to its financial results are very interesting as being the expressions of one at least of the partners in the concern. They agree with statements which have been made by us for many years. Notwithstanding the large capital cost of that undertaking (£2,175,000), it was stated that the venture was profitable, and that if its revenues were not used partly as a sinking fund they would far exceed its expenditure.

The new wireless system is not to be allowed to compete with this cable, but at present this appears to be a harmless provision. It was also said that it might soon be necessary to duplicate the Pacific cable, as it was fully loaded. If this be the case no delay for experimental purposes, however cheap they may appear, should be allowed to interfere with the aim of placing and maintaining the State telegraphic system in a fully remunerative and satisfactory condition, in accordance with the policy which has secured the success of private cable companies.

**The Manchester Steam Users' Association.**

THE annual report of the Management Committee Association for 1912 has been issued. This must not be confused with the technical report of the chief engineer, though it is interesting in its own way.

The Association, founded in 1854, now has 10,051 boilers on its books, and during the year succeeded in making total or thorough inspections of fully 92 per cent. in the ordinary way, and over 3½ per cent. specially, in addition to partial examinations, such as internal parts or flues only. Thus, in the year over 98 per cent. of the Association's boilers were probably examined at rest, in addition to over 13,000 visits paid for external or working examination, such visits, of course, including from 1 to 40 or more boilers in one visit. The ten thousand boilers belong to 2,153 owners, or nearly

five boilers to the average owner, and an average of very closely 20 boilers to each 10 works, and a little over two works to each member. The income averages a little over £2 per boiler, and the Association, which gives a pecuniary guarantee with its inspections, possesses a reserve fund of nearly £17,000, including furniture, &c. It is stated as evidence of the care of the Association that no life has yet been lost by the explosion of any boiler inspected and guaranteed. The guarantee is a good feature of the Association's method. If members do not follow the advice tendered them they are not put out in the cold to be a danger to the community, but the guarantee is withheld as a solemn warning, for it would be a very grave matter if, after the guarantee were withheld, a boiler should fail, and the owner would possibly find himself in a serious position.

Compared with America this country is very safe in respect of its boilers. In the United States in October there were 54 explosions and 20 deaths, and we believe that the Hartford Boiler Insurance Co. tries hard to bring practice nearer to English lines, in respect of construction and of pressures. There is certainly too much liberality with stresses in America, and there are, of course, many boilers in distant corners.

In the United Kingdom during the year there were 68 explosions and 31 deaths. Only 17 were boiler explosions proper, the rest being other things, such as pipes, keirs, ovens, &c.

We may, perhaps, assume that the boilers in the United States now outnumber those in this country, but, in any case, the degrees of safety differ very widely.

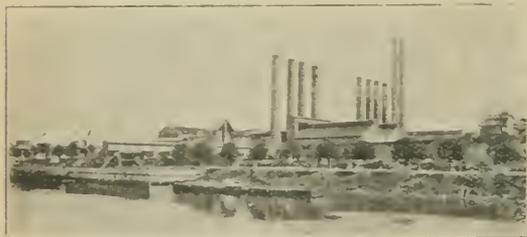
The Association has had in hand for some time experiments on the fatigue of metals, and some of the results are shortly to be published. It has also surveyed the present condition of knowledge on the strength of flat plates, and on the elasticity of steam bends, both matters of considerable interest to engineers.

**State Co-operation with Private Enterprise.**

THE growing practice of co-operation between private enterprise and municipal or communal authorities in lighting and tramway undertakings in Germany is now proposed to be extended by the conversion of the Hamburg electricity works into a concern to be jointly owned by the existing company and the State of Hamburg. At present the company, which has a share capital of £1,100,000, does not possess an exclusive monopoly of the supply business, and it is not intended to confer such a privilege upon it in the future, but permission is to be granted for an extension of the supply throughout the whole of the area of the State, thus bringing within the scope of the works a number of suburbs which are not now furnished with light and power from this undertaking. The Hamburg Senate proposes to subscribe for £500,000 in preference shares, in order to assist in the development of the supply system and to have a large interest in the company. According to the existing agreement between the Senate and the company, the former receives a share of 15½ per cent. of the gross receipts, in addition to one-fourth of the surplus after 6 per cent. has been paid on the ordinary shares, and one-half of the surplus remaining after the dividend amounts to 8 per cent. In future the State is first to receive 5 per cent. on the preference shares, and one-half of the surplus after the dividend on the ordinary shares is 6 per cent., whilst the other half is to be distributed as a super-dividend on the whole of the capital. The amount of the latter devolving upon the preference shares, as well as the fees payable to the three representatives of the State on the board of directors, is to be used for the formation of a fund for the purchase of ordinary shares. The present right of expropriation of the company as from the end of 1913, on giving one year's notice, is to be continued until 1923; if it is not exercised by that time it will lapse under the terms of the new agreement, but this is not the case under the present contract.

## THE INSTITUTION OF ELECTRICAL ENGINEERS IN PARIS.

THE Société Internationale des Electriciens is to be congratulated either upon its singularly good fortune or upon its remarkable control over the weather, for, although Paris had "enjoyed" a spell of disagreeable weather right up to the day on which the British party crossed the Channel, the spell was broken on our arrival. Perhaps Commandant Ferrié and his expert staff, by reversing the ordinary course of events and dispatching thunderbolts into the upper air via the Eiffel Tower from their mysterious caves in the Champ de Mars, had something to do with it. For is not M. Ferrié the world's timekeeper, and does not he distribute the finest possible *temps* to all the world?



SAINT DENIS ELECTRICITY WORKS.

Whatever the cause, the result was charming weather throughout the visit, improving in quality with time, and being at its very best for the excursions to Chantilly and Versailles. The visit officially ended on Saturday, but many members of the party remained for the week-end, and Sunday was a perfect summer's day.

But, of course, our confrères' solicitude was not confined to the elements; they are masters of organisation and foresight, and made admirable arrangements to ensure that the visit should be a success in every

which was more or less known to the electrical world, though doubtless much of it was new to many of the audience—for each of the two nations concerned is of necessity unable to keep closely in touch with the progress of the other, and no man can claim to maintain an intimate acquaintance with all branches of the ever-expanding tree of science known as electrical technology. The excursions, on the other hand, were full of varied and individual interest; the natural beauties of Versailles and Chantilly, and the priceless works of art with which those palaces are so richly stored, contrasted sharply with the magnificence as a masterpiece of engineering of the great works at St. Denis, and the delicate perfection of the porcelain of Sèvres with the no less perfect but wholly dissimilar symmetry and grandeur of the Eiffel Tower; and Paris herself, the mother of all these works of art, provided unlimited food for interest and admiration.

It only needed the efforts of our hospitable friends to co-ordinate all these attractions, and, with the collaboration of the clerk of the weather, to render the visit a success without a flaw. We think we voice the feelings of the whole of the British visitors when we say that all the conditions were fulfilled, and that the "joint meeting" of 1913 will long be remembered by those who took part in it as one of the most pleasant and agreeable experiences of their lives. Where all were courteous, amiable, and genial, it may seem invidious to praise a few; but it is only just to refer with special emphasis to the indefatigable labours of M. Berthelot, President of the Société; M. Grosselin, Past President; M. Bureau, Member of Council; and M. Joly, the Secretary, all of whom exerted every effort to secure the comfort and happiness of their guests and to ensure the orderly conduct of the programme of each day's doings.

Amongst the British engineers who took part in the visit were Mr. W. Duddell, President of the Institution of Electrical Engineers; Messrs. W. Judd and J. F. C. Snell, Vice-presidents; Prof. Carey-Foster, Past-president; Mr. Robt. Hammond, Hon. Treasurer; Messrs.



*Cléche du Vitrscope Richard.*

THE PARTY ARRIVING AT CHANTILLY.

way. The proceedings in this instance partook more of the nature of a congress than of a round of visits to engineering works, as on previous occasions, and it cannot be said that the papers or discussions as a whole brought forward any new developments of notable importance; the former were mainly statements or résumés of work already accomplished, or in progress,

J. S. Highfield and Roger T. Smith, Members of Council; Mr. P. F. Rowell, Secretary, and Mr. R. Tree, Chief Clerk; and Messrs. J. Christie, T. Harding Churton, C. B. Clay, W. R. Cooper, K. Edgcombe, F. Espir, G. Hooghwinkel, J. P. Hooper, F. Hope-Jones, A. Jacob, F. H. Nalder, C. C. Paterson, R. W. Paul, Ll. Preece, T. F. Purves, J. W. Record, W. Slingo

(Engineer-in-Chief to the Post Office), G. Stoney, A. A. C. Swinton, H. L. Webb, A. P. Wood, and H. E. Yerbury. The party numbered about 150 in all, including more than 40 ladies. During the visit Mr. J. H. Rider, *en route* from South Africa to England, spent some time in Paris and was cordially greeted by his friends.

The journey to Paris was accomplished without noteworthy incidents; the party assembled at Victoria, and proceeded to Dover by special train. The sea was like a lake, and afforded no excuse for *malaise*. At Calais an excellent lunch was provided, which was partaken of at leisure, and fortified the party for their journey by special train to Paris. At the Gare du Nord the President of the Société with a number of his colleagues welcomed the visitors, who then dispersed to their various hotels.

On Wednesday morning, at 9 o'clock, the visitors with their French colleagues assembled at the Conservatoire des Arts et Métiers; the President of the Société Internationale occupied the chair, and inaugurated the proceedings in due form, addressing a hearty welcome to the visitors and explaining the order of procedure and the programme for the week. A large party of the members, including most of the ladies, then proceeded on a tour of inspection of the exhibits in the Conservatoire, while the remainder settled down to the consideration of a formidable array of papers relating to electric traction on railways. Fortunately, these were not read *in extenso*; all the members having received copies in advance, the Secretary, M. Joly, read a brief *résumé* of each as a preliminary to the discussion.

M. L. Gratzmuller outlined the history of high-tension continuous-current traction, and reviewed the various elements of the problem from the generator to the motor, with particulars of recent installations, pointing out that the pressure had been raised by stages from 500 to 2,400 volts, and not by any abrupt transition. M. Marius Latour's paper dealt with single-phase traction, in the development of which he has played so distinguished a part. He referred especially to the characteristics of the various types of motors available, comparing their respective advantages. M. Jullian described the conditions under which the concession for the railway from Villefranche to Bourg-Madame, in the Western Pyrenees, and other new railways, was accepted by the Compagnie des Chemins de Fer du Midi, providing that the State should bear the cost of a considerable proportion of the hydro-electric works and of the transmission lines, as well as the cost of constructing the railways, a comprehensive scheme was eventually decided upon, embracing the electrification of 622 km. of existing and projected lines. The conversion of the existing lines, about half the total, will be completed in July next. The conditions prevailing are exceptionally favourable to the use of electric traction, which is being effected with single-phase alternating current. The equipment of the line is described in the paper; the voltage adopted for the transmission line is 60,000 volts at 16 cycles, and the generating stations will have an output of nearly 50,000 h.p. Elaborate experiments have been made to determine the best type of motor, resulting in the adoption of the series type.

Mr. A. N. Mazen described the traffic conditions obtaining on the State railways which formerly formed the railway system of the Compagnie de l'Ouest; the traffic has grown to such an extent that it cannot be satisfactorily handled by the present equipment, and the only possible solution to the problem is the adoption of electric traction. It has been decided to adopt continuous current at 650 volts, and to construct 400 to 500 motor-coaches; about 50 km. of line will be electrified. M. H. Parodi contributed a study of the railway electrification problem as it was met with in the United States, broadly considering the subject with the aid of a mass of statistics, the paper constituting a valuable summary of the position.

M. J. B. G. Damoiseau dealt with the subject of petrol-electric motor-vehicles, and described the designs adopted by the leading manufacturers in Europe and the United States. He arrived at the con-

clusion that the petrol-electric vehicle was the best type of independent motor vehicle before the public, and that its use would tend to increase.

Messrs. Mazen, Roger Smith, Hammond, and Bochet took part in the discussion which followed. In the course of his remarks, Mr. Smith expressed the view that in this country electric traction would be economically possible only for two purposes—the working of suburban railways, and of mineral traffic in hilly districts—and stated that the North-Eastern Railway Company was going to lead the way in the latter connection, and a d.c. railway at 3,500 volts would shortly be put in operation in this country. The great obstacle to the extended use of large electric locomotives in Great Britain was the enormous number of traders' wagons—about half a million—which could not stand a draw-bar pull exceeding 12 tons.

In the afternoon a large party, including most of the ladies, proceeded by special steamer to St. Cloud, and visited the celebrated porcelain works of the French



Cliché du Vésicope Richard.

LEAVING THE HÔTEL DU GRAND CONDÉ, CHANTILLY.

Government at Sèvres, where they were entertained at tea before returning, the trip down the river and back being most enjoyable, in addition to the artistic delights of the factory. The more technically bent were taken in motor 'buses' to the electrical generating station of the Electricité de Paris at St. Denis, one of the finest installations—if not, perhaps, the finest—in Europe, comprising turbine plant of 120,000 h.p. output. We published a description of the works in our issue of Jan. 11th, 1907, and therefore we need not here dwell upon details. Most of the generating plant was supplied by the Compagnie Electro-Mécanique, and is of the Brown, Boveri-Parsons type, but some of the generators were built by the Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont. The boilers are of the Babcock and Wilcox marine type.

The most striking characteristic of this splendid example of a modern generating station is the unity of design which has made of it one huge machine. From the barges which bring the coal to the station, to the feeders which convey the energy to the consumers, the fullest use is made of mechanical operation and control, and there are very few men to be seen about the plant. It is interesting to note that Scotch coal is largely used at the station—washed nuts; the bunkers have a capacity of 32,000 tons. While natural draft is mainly employed, two of the ten chimney shafts being 90 m. (295 ft.) in height, the draft of the first four shafts can be increased 50 per cent. with the aid of ejectors on the Prat system, and of additional steam blowers. There are four generating sets of 5,000-6,000 kw. capacity at 10,250 volts, 25 cycles, 3-phase, for the supply of power to the Ch. de Fer Métropolitain; two turbines of the same size driving each two alternators

in tandem, one similar to the former and the other a two-phase machine working at 12,300 volts,  $41\frac{2}{3}$  cycles, 6,000-7,200 kw.; four sets of 5,000-6,000 kw., 12,300 volts,  $41\frac{2}{3}$  cycles; and one set of 11,000-15,000 kw., 10,250 volts—all of the Parsons type. The two-phase supply is for lighting and power in Paris; the three-phase for the railway and for tramways.

The works include a factory capable of turning out 50,000 bricks a day, made from the ashes. The first turbine was set to work in August, 1905, and the plant has been continuously extended since that date.

From St. Denis the party proceeded to the works of the "Triphasé" at Asnières; this station is of longer growth than the former, and includes some fine examples of the low-speed alternator, driven by horizontal engines, as well as two interesting, because now rarely met with, external armature machines of the Siemens type, the outer bars of the winding forming the commutator.

The newer plant in the station consists of Rateau turbines driving three-phase generators. Here also the coal-handling arrangements were very elaborate and complete, including a long conveyor-bridge over a road,



*G. Eiffel*

THE EIFFEL TOWER IN A STORM.

from the Seine to the works. The huge screens employed, five or six in series, for preventing the ingress of undesirable matter from the Seine with the circulating water, were also found very interesting. At each of these stations the visitors were entertained by the respective companies with light refreshments. They afterwards drove back to Paris, and prepared for the banquet to which they were bidden by the Société Internationale at the Palais d'Orsay.

M. Berthelot presided, and the guests numbered some 360. During the dinner, which was characterised by lavish hospitality, a musical programme was performed by the band of the Chemin de Fer du Nord. M. Berthelot gave the toast of the King, and Mr. Duddell that of the President. Later, M. Berthelot, in the course of a brief speech, proffered a cordial welcome to the British visitors, referring to the achievements of the more distinguished among them. He also expressed the gratitude of the Société to the respective persons and firms who had assisted in providing entertainment and instruction for their guests.

Mr. Duddell, in responding, referred to this as the first reunion of the two societies, and expressed his appreciation of the genial welcome and unstinted hospitality of the Société, and of the persons named by M. Berthelot. He concluded by proposing the toast of

"The Société," which was accorded musical honours by the visitors.

The company then adjourned to a concert room, where an excellent entertainment was provided by artistes from the Opéra and the Comédie Française. The most interesting feature, however, of the evening was a series of kinematograph demonstrations by M. Gaumont, in which the moving picture was accompanied by sounds produced by the gramophone, in accurate synchronism with the picture. An orator delivering a speech, a cock crowing, and an artist performing a humorous item on the banjo were reproduced with lifelike fidelity, though, of course, the defects inherent to the gramophone could not be completely concealed. Another very telling series showed the decomposition of movements, apparently effected by taking a succession of photographs at a rapid rate and projecting the views on the screen very much more slowly. Thus, a man jumping off a table slowly rose into the air, as if gravitation had been neutralised, descended to the ground like a feather, and slowly crouched on his haunches. The movements of the human body in walking, skipping, etc., when thus portrayed become not only surprising but also very amusing.

On Thursday morning, the Congress was resumed at the Conservatoire, but a number of alternatives were provided, parties being formed to visit some of the places of interest in which Paris abounds; one party in particular spent the morning at the Aerodynamical Laboratory of M. Eiffel at Auteuil, under the genial guidance of the founder himself.

The meeting at the Conservatoire, under the chairmanship of M. Berthelot, was devoted to the subject of long-distance transmission of electrical energy. Mr. J. S. Highfield read a paper on the continuous-current Thury system, describing the results which he has obtained with this system in the Western area of the Metropolitan Electric Supply Co. A discussion followed, in which Messrs. Thury, J. F. C. Snell, Edgumbe, Raphael, Roger Smith, Jenkin, and another took part. Mr. Snell doubted whether the saving effected by transmitting electrical energy, for instance, from coalfields to London, would be sufficient to cover the cost of the wayleaves necessary for the transmission line. Mr. Smith pointed out the impossibility of finding sufficient space alongside of the railway tracks near London for a three-phase overhead line, and said that for that reason the Thury system offered exceptional advantages for the operation of railway sub-stations; 1,200 kw. was just the size required to run one railway section carrying two trains simultaneously. He had no fears as to the effect of the return by earth upon railway signals. Mr. Jenkin, also referring to the question of railway electrification, said that the facility for extension resulting from the uniform section of the cable was a strong point in favour of the system, and the difficulty of constructing switchgear capable of dealing with three-phase power supply on a large scale, contrasted with the simplicity of the switchgear on the Thury system, afforded a further advantage when the latter was employed.

M. Maurice Leblanc then read a paper on "Three-phase Currents," which occupied the remainder of the session.

In the afternoon, a party visited the electricity works of the Nord-Sud Railway, and the central repair dépôt of the Compagnie Générale des Omnibus de Paris, where the rolling stock of the tramways and the motor buses are repaired, employing 2,000 hands. The works are laid out on the most modern lines and on a very extensive scale, occupying an area of about 96,000 sq. metres. The machinery is, of course, electrically-driven, with a power plant of 300 kw.

The *pièce de résistance* of the afternoon, however, was a reception by M. Eiffel on the topmost platform of the Eiffel Tower, followed by an inspection of the wireless installation of the military authorities in the Champ de Mars. This was an extremely popular event, appealing to all sorts and conditions, and a very large number took part in the visit to the Tower; M.

Eiffel, in the most kindly way, patiently signed scores of the brochures which he presented to the visitors, containing the reprint of a lecture on the famous Tower delivered by M. Ch.-Ed. Guilleaume, at the Fête du Soleil last year, and we reproduce from this an illustration showing the tower struck by lightning—a common event—together with M. Eiffel's signature. We do not propose to describe the Tower, but may remark that its graceful design and majestic proportions were the subject of many admiring comments. The visitors were privileged to ascend beyond the third platform into regions inaccessible to the general public, including M. Eiffel's private rooms, and were entertained with light refreshments. Many of them, undaunted by the vertical ladders inside the central tube, attained to the foot of the flagstaff itself, where there is only room for six people to stand.

(To be continued.)

(Abstracts of Papers discussed in Paris at the Joint Meeting of the INSTITUTION OF ELECTRICAL ENGINEERS and the SOCIÉTÉ INTERNATIONALE DES ELECTRICIENS, 21st-24th May, 1913.)

**High-Tension Continuous-Current Traction.**

By MONSIEUR GRATZMULLER.

THE object of this paper is to consider the high-tension continuous-current system of traction and its possibilities of development. Its weak point is the lack of a static transformer; this has been the cause of continuous current being set aside. Can this disadvantage be compensated by certain advantages?

When the power station is at a considerable distance from the track (this will always be the case for traction over very long distances) three-phase generators will obviously be employed.

The rotary converter for a frequency of 25 periods and a pressure of 600 volts is to-day giving every satisfaction, and the increase of the continuous-current pressure to 1,200 volts is agreed to universally.

The three-phase rotary converter operates well even at 50 periods, but I think that in this case the continuous-current pressure could not be raised to more than 600 to 750 volts. Continuous-current pressures above 1,200 volts in the case of 25 periods, or 750 volts in the case of 50 periods, should be obtained by putting the converters in series.

When there is no need to generate at a very high pressure, the mechanical power produced by a hydraulic turbine is transformed directly into continuous-current power. Up to 1,500 volts a dynamo with a single commutator will operate satisfactorily. The pressure could be increased up to 3,000 volts by installing a machine with two windings and two commutators, or by putting two machines in series. When the mechanical power is generated by a steam turbine in the neighbourhood of the track it appears to me to be desirable to transform A.C. into D.C. by means of a rotary converter at the most favourable point for feeding the continuous current into the conductor. The mercury converter allows the alternating current to be rectified with a constant fall of pressure. It is being perfected; apparatus of a capacity up to 300 kw. already exist, and for high pressures its efficiency is nearly unity. Hence, electric power in the form of continuous-current power may, in the future, perhaps prove the most economical.

As regards the collecting of current, a pressure of 3,000 volts D.C. promises to be the safe limit for some time to come. A current of 500 amperes at this pressure supplies a power of 1,500 kw. It thus appears that powerful locomotives can only be utilised where a third rail is installed, which alone will provide the necessary surface and contact pressure. Currents up to 150 amperes can be transmitted by means of overhead conductors which are more economical at low speeds with the type of suspension ordinarily employed at pressures of 600 volts, but with double insulation.

An advantage in favour of continuous current is that for the same amount of current there is a smaller loss in the return circuit; on the other hand, there is the question of electrolysis to be considered. Also high-tension continuous current does not cause disturbances in neighbouring telegraph and telephone lines.

Without entering into a detailed examination, it may reasonably be inferred that with (1) the same internal diameter, (2) the same length of iron, and (3) the same weight of copper for the windings, it will be possible to obtain the same torque in normal working whether the motor be wound for continuous current or be a three-phase induction motor.

The commutator segments and the brushes in the case of the high-tension machine will be heavier than collecting rings and their brushes, but the laminations of induction motors have to be held in the frame. Thus I think that the difference in weight for a given peripheral speed will not be of such a nature as to make the continuous-current motor compare unfavourably with the three-phase motor.

The single-phase motor is clearly heavier, but especially for low frequencies the difference is not so great as might be expected. The mean power in an alternating-current machine will differ by only 15 per cent. from the power in a continuous-current machine, and not by  $1/\sqrt{2}$  of this power.

The continuous-current motor and the three-phase motor in normal working are thus approximately equal as regards weight for the same copper or iron losses.

In the series motor the torque increases more rapidly than the current. Another advantage is that the losses diminish rapidly with the load in the series motor. The commutation is very good, because (1) the air gap can be increased so as to reduce the cross flux due to the ampere-turns of the armature reaction, and (2) the self-induction of the coils undergoing commutation decreases automatically with the load owing to the saturation of the teeth in the path of the field flux.

It is useless to attempt to make high-tension continuous-current traction practicable at a pressure exceeding 750 volts unless the commutation is perfect. There is no special technical difficulty, and it seems to me that the pressure of 1,200 volts per motor should be easily reached when multiple units are employed, and 1,500 volts when the motor is placed inside a locomotive. A locomotive of 2,000 h.p. at 3,000 volts could thus be constructed with two motors in series or motors having two commutators. The current required would then be approximately 500 amperes.

Nowadays the capacity of a motor is limited rather by heating than by difficulties of commutation. The use of aluminium seems very suitable for the rotors. The increase of electrical resistance can be largely compensated by the increase in the peripheral speed for the same centrifugal force. The improvement in the cutting of gears has been very great, and we need not be afraid of using reduction gear, which a few years ago could not have been thought of. The working of the Citroën gear for the electric locomotives of Lötschberg is so perfect that the noise of the brushes on the commutator is alone audible. Since the capacity is limited by the heating, it is important to cool the motors by ventilation. The increase of peripheral speeds on the one hand, and of ventilation on the other, will allow the weight of the motors to be reduced by about 50 per cent.

The series-parallel method of regulating the speed is exclusively employed if each motor is so constructed as to be able to withstand the total pressure. When each motor is designed for only half the total pressure (Westinghouse), series-parallel working is used with two groups of motors, each group consisting of two motors in series. With the latter method, it is to be feared that slipping may cause an undue pressure to come on one motor. Protecting relays can easily be designed, but practice has shown their uselessness, as they cannot withstand such abnormal rushes of current as are easily withstood by the motors themselves.

Regenerative working can be obtained on gradients by exciting the field magnets of the motor by means of an auxiliary exciter forming part of a small independent motor-generator.

Where starting and stopping are frequent, the energy dissipated in the resistance, or lost as heat in the brakes, may be considerable. But regulation at all speeds, and also braking, can be obtained under really quite simple conditions by making use of the increase of peripheral velocity and of the ventilation which this can be made to give. An apparently simple solution is the use of boosters on one or more cars. If the voltage of the booster can be supposed to vary from  $-V$  to  $+V$ ,  $V$  being the voltage of the line, the possibility of obtaining all speeds without wasteful losses of energy other than the normal losses of the set, can immediately be seen. Great peripheral speeds and artificial cooling make this solution the one to be adopted.

The Compagnie Générale d'Electricité de Creil has the rights in France and its colonies of the Siemens-Schuckert system, and in 1912 it had constructed, or had in course of construction, apparatus for 14 installations with motors working at from 1,000 to 1,200 volts. Two important installations have been in service since 1906. At Maizières-Sainte-Marie are three 55-ton locomotives, each fitted with four motors grouped in pairs in series across 2,000 volts. Each motor is of 160 h.p., and the weight of the trains is from 200 to 300 tons.

The Westinghouse Electric Manufacturing Company, of Pittsburgh, has installed a number of high-tension continuous-current installations, and in particular several locomotives in America.

Two motors are always connected in series across 1,200 to 1,500 volts, so that each motor is subjected to only half that pressure.

The Compagnie Française Thomson-Houston and the General Electric Company of America have specially developed high-tension continuous-current traction. Four installations in Italy, designed for 1,200 volts and motors of 45 h.p., and 17 in America with motors of from 50 to 300 h.p., may be mentioned. About two-thirds of the installations are more than 60 kilometres long. In the greater number of cases the motors are coupled in pairs in series across 1,200 volts, the pressure per motor thus being 600 volts.

The Brown-Boveri Company has carried out various installations, and in particular it has made controllers for use at high pressures.

Heavy traffic is a favourable factor for high-tension continuous-current traction. The advantages of continuous current are principally the large starting torque, the quality of the commutation (which is shown by the small wear of the commutator and the brushes), and the light coaches. On the other hand, there are the drawbacks of the use of an exposed high-tension rotating part—particularly dangerous in damp localities—the use of a commutator, and the control of the large currents necessary when a large amount of power is required.

All traction, whether on a large or small scale, is tending undoubtedly and rapidly towards electrical working, the weight of the apparatus and the cost of the lines being capable of further marked diminution.

(To be continued.)

## LEGAL.

GIRLING v. FELL.

In the King's Bench Division on May 23rd, Mr. Justice Pickford heard this action, in which Mr. Harry Percy Girling, an electrical engineer, of Maldon, claimed from Mrs. Fell, a lady residing at Maldon Hall, £134 in respect of work done in connection with electric lighting and heating. The lady disputed the claim on the ground that the installation was not satisfactory in its results.

MR. GIRLING gave evidence in support of his claim, stating that, having heard that Mrs. Fell was about to take the Hall, he approached her with a view to inducing her to have the house electrically fitted instead of using gas, which the landlord had agreed to lay in free of charge. She agreed to use electricity if her landlord would undertake the expense for the installation. The landlord consented, and Messrs. Sadd & Sons, Ltd., agreed to bring the mains to the house free of charge. Messrs. Sadd & Sons, he said, were timber merchants having a great deal of wood refuse, which they used for a large gas-producing plant for the supply of electricity to the inhabitants of the locality. He (plaintiff) did their local work, and he had an arrangement by which he was paid a small salary, in return for which he put in work on advantageous terms, involving a certain percentage on materials and labour. The mains were installed to the house by Messrs. Sadd under the arrangement, and he wired the house. He had had many interviews with the defendant as to what she would like in regard to appliances.

His LORDSHIP: Where did the mains come to?

PLAINTIFF said they came across private grounds, were fixed to a chimney of the house, and then passed down to a meter where Messrs. Sadd's work ended and his work began. He explained to the lady that the main would not be sufficient to supply all the heating apparatus she required, and that Messrs. Sadd would supply a booster, which would make up for any deficiency. The booster would cost about £17, but an additional main to produce the same result would run into three figures in pounds. The question of the capacity of the main, however, had nothing to do with his contract. Messrs. Sadd had the hooster ready at their works, but would not put it in as the defendant had not paid her bill for the energy supplied during the previous quarter.

MR. HERBERT EUSTACE SADD, director of Sadd & Co., Ltd., said that his company produced electricity as a by-product. The main was put in in this case at a cost of £80, and the company looked for payment by the current supplied.

For the defence, Mr. Herbert Dudley Barlow, electrical engineer, put in a report which he had made as the result of an inspection of the work, the effect of which was that he had no fault to find with the wiring, although the supply was insufficient for both heating and lighting.

The defendant herself did not appear to give evidence.

His LORDSHIP, without calling upon counsel for the plaintiff to reply, gave judgment. He said that an electrical installation must always depend upon the facts of the particular case, and might be anything, from the setting up of generators to the mere wiring. In this case the contract was for work necessary after passing the meter for lighting and heating with plugs and switching, and the plaintiff had nothing to do with the mains. The work of providing the mains, fixing the meters, and supplying the current was with Messrs. Sadd & Co., and the plaintiff was right when he told the defendant what was necessary to secure proper heating power with lighting at the same time. Messrs. Sadd were perfectly willing to do everything necessary to give the proper voltage, but they did not do it because the lady would not pay their bill, and the defendant's refusal to pay the plaintiff for the work he had done did not appear to be on account of defective work. Judgment must, therefore, be for the plaintiff for the amount claimed with costs.

Judgment was entered accordingly.

OSRAM LAMP WORKS, LTD., v. LOUIS SCHLOSS &amp; CO.

This infringement action came before Mr. Justice Neville in the Chancery Division on Friday, May 23rd, on a motion for judgment in default of defence.

MR. J. HUNTER GRAY, representing the plaintiffs, said that they sued in respect of two patents, one of 1904 and the other, No. 13,622 of 1906. In the particulars of breaches, it was alleged that on January 7th, 1913, the defendants sold 150 lamps which were constructed in accordance with the plaintiffs' patents. There was no defence, and he asked for the usual order—for an injunction to refrain infringement, for delivery up of the infringing articles, for an inquiry as to damages, and for the costs of the action as between solicitor and client. The costs of the inquiry would be reserved.

His LORDSHIP: Why solicitor and client costs?

MR. GRAY said that an action had been originally tried, and the plaintiffs had been granted a certificate of validity of their patent by Mr. Justice Warrington. According to the rules, therefore, the plaintiffs were entitled to solicitor and client costs.

The defendants did not appear, and his LORDSHIP made the order as asked.

OSRAM LAMP WORKS, LTD., v. APPLE.

In the Chancery Division on May 27th inst., before Mr. Justice Warrington, Mr. J. H. Gray moved for judgment in default of defence in this action.

His LORDSHIP: The only question I want to be satisfied about is the form of the order for costs. What is the section of the Act?

MR. GRAY: Section 35.

MR. CALVERT: I appear for the defendant, and I have an affidavit showing that there has been an agreement between the parties that a certain sum should be paid for damages and costs.

MR. GRAY: I did not know my friend was going to appear.

MR. CALVERT: We submit to a perpetual injunction and £10 10s. for costs and damages, if any.

His LORDSHIP said the defendant did not submit to an injunction at first. He must deal with the matter strictly. He had got the statement of claim and the certificate as to validity, and that was not denied, the plaintiffs were entitled to the relief they asked. His Lordship then gave judgment for a perpetual injunction, inquiry as to damages, the payment of damages after certificate, and payment of costs according to the Act, the costs of the inquiry being reserved.

GRIFFIN v. THE A.E.G. ELECTRICAL CO. OF SOUTH AFRICA.

In the King's Bench Division, before Mr. Justice Scrutton, this case was mentioned for settlement.

MR. SYLVAIN MAYER, who was with Mr. H. E. Duke, K.C. (for the plaintiff), said his Lordship had reserved this action to be tried on Monday week, but now the Court would not be troubled with it. The parties had entered into an arrangement, and he thought the proper order would be that the action should be stayed on the terms agreed. There would be a Judge's order, if necessary.

MR. CROOM JOHNSTONE (for the defendants): That will include the payment out to the defendants of £57 14s. 1d. paid into Court.

His LORDSHIP agreed.

X.L. ELECTRIC CO., LTD.

In the Chancery Division on May 23rd, Mr. Justice Warrington, on the motion of the plaintiff in the debenture-holder's action of Wiener v. X.L. Electric Co., Ltd., appointed a receiver and manager of the company. Mr. Arthur Sims, for the plaintiff, said there were six debentures issued to the plaintiff by the company. They were not part of a series, but were issued successively, and each stood by itself. The principal moneys amounted to £4,000. No interest had been paid by the company to the plaintiff. According to the conditions contained in the debentures when the interest on any of the debentures was in arrear for a month, the principal money became payable. The company were manufacturers of electric clocks, the motive power being electricity. It was important that various contracts entered into should be carried out.

MR. JENNINGS, for the company, consented to judgment in the action.

His LORDSHIP thereupon granted the usual judgment in a debenture-holder's action. As to the receiver and manager, he limited his management to October 20th.

TRAMWAY COMPANY SUEDE FOR £1,000.

AN action has been raised in the Court of Session by a Remton dealer, who sues the Dumbarton Burgh and County Tramways Co., Ltd. for £1,000 damages in respect of personal injuries. Pursuer alleges that one of the wheels of a float he was driving caught against the side of one of the tram rails. The rim was wrenched off and the wheel collapsed, with the result that pursuer was thrown from the top of the float and seriously injured. He alleges that at the point where the accident happened, the sets had become sunken below the level of the rails. Defenders deny that the roadway was defective.

In re THE ADAMS MANUFACTURING CO., LTD.

APPLICATION was made to Mr. Justice Neville, in the Chancery Division, at the sitting of the Court, on Tuesday, May 27th, with reference to the sale of certain property to which the sanction of the judge was required. Counsel stated that a summons was taken out in a debenture-holders' action returnable on May 23rd, but there was then not sufficient expert evidence to enable the Master to deal with the matter. It came again before him on May 26th, and was adjourned by his Lordship. It was necessary that the matter should be speedily dealt with, or the proposed contract might go off.

His LORDSHIP said he would deal with the summons that afternoon in Chambers, after the company winding-up business was disposed of.

**Holidays.**—We have received a copy of a most attractively got-up little book of between 60 and 70 pages, entitled, "To the Continent." It is issued by the Great Eastern Railway Co. and by means of admirable facsimile water colour pictures interests the reader in the company's Harwich route to the Continent. A postcard to the Continental manager at Liverpool Street Station, London, E.C., will bring a copy to any of our readers.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### The "Mego-Meter" Insulation Testing Set.

THIS instrument, which is supplied by the ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., of 111, New Oxford Street, W.C., has been remodelled and improved. It is designed to meet the demand for a strong reliable insulation testing set that is sufficiently accurate for everyday testing work. In principle it is very similar to other well-known testing sets on the market.

It contains a direct-current generator, supplying current at either 240 or 480 volts. This generator is used in connection with a moving-coil indicating system, the dial of which is calibrated direct in megohms, and also has a volt scale.

The construction of the instrument is simple and strong, and, its weight being only 11 lb., it can readily be carried about.

The standard 240-volt set is arranged so that tests can be made at either 120 or 240 volts, and the 480-volt instrument so that tests at 480 and 240 volts can be made.

As a volt scale as well as a megohm scale is provided, the instrument can be used as a testing voltmeter, provided the voltage to be measured is within the range of the instrument; it is suitable



FIG. 1.—THE "MEGO-METER."

for direct-current voltage only. Also, when testing the insulation resistance of an installation that is carrying current, the voltage of the installation itself can be used for testing purposes instead of the generator voltage.

The complete instrument is mounted in a polished walnut case, complete with carrying strap. The generator operating handle is detachable, and is fitted inside the instrument when not in use.

If desired, extra terminals can be fitted, and with the use of separate shunts, current measurements can be made, using the indicating part of the testing set as an amperemeter.

### A New Pulley.

MESSRS. JOHN JARDINE, of Nottingham, have just introduced a new cast-iron pulley, shown in fig. 2, the peculiar design of which is the outcome of considerable study, with a view to overcoming the well-known defects of the ordinary cast pulley. It will

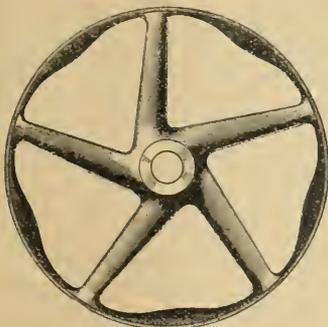


FIG. 2.—THE JARDINE PULLEY.

be noticed that the arms, odd in number, are on the tangent principle, giving better facilities for contraction when cooling after casting; the rim is of light section, but is strengthened by a web

between the arms. The pulley is both light and strong, costs no more than other cast pulleys, and has been successfully used by the makers for some time.

### Siemens Lamp Obscure.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Tyssen Street, Dalston, London, N.E., have sent us particulars of the new lamp obscurer which they have recently placed on the market. The Siemens obscurer is a fluid which etches the glass, leaving an even matt surface. Its application is extremely simple, the acid being simply poured into a container sufficiently large to take the lamp or any other article it is desired to obscure. The surface of the glass should, in the first place, be cleaned to ensure that it is free from dirt and grease; the article is then immersed in the acid for a period of from 4 to 10 seconds. It has then only to drain for about a minute, and afterwards to be thoroughly washed to remove all traces of milky film from the glass. It can then be dried off with a clean cloth and the operation is complete. Heating is not at all necessary, either in the case of the article to be obscured or of the obscurer; neither is it necessary to place the lamps on circuit during the operation.

We have before us a piece of glass which has been obscured by this process, and certainly the surface obtained appears to be of excellent quality. The obscurer is supplied in strong sealed kegs, but owing to the demand experienced, arrangements have been made also to supply it in specially prepared earthenware jars.

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"CYCLE" writes:—"One of our friends some short time ago installed the electric light in a house tenanted by him from the landlord. He paid for the complete installation, and did not, as we believe is sometimes done, ask the landlord to bear the expense of the wiring only, himself providing the necessary drops and fittings.

"He now wishes to leave the house, and has been in communication with the landlord as to what he will allow him for the electrical equipment just as it stands. The landlord, however, offers only a very low figure, which the tenant does not at present see his way to accept. He now proposes to remove the lamps and all the special fittings up to the ceiling rose, which, we believe, is usually done, but we should be extremely obliged if you would inform us how he stands regarding the wiring up to the ceiling rose. Can he legally remove the wires from the casing and take down the casings, thus rendering the installation practically useless?"

"\* It would seem that the tenant is very much in the hands of the landlord. A tenant is entitled to movables, but not to fixtures, the maxim *quicquid plantatur solo, solo cedit* applying to vest in the landlord everything which has become affixed to the premises. In the matter of electrical fittings, the line seems to be drawn between those parts of an installation which are necessarily of a permanent character and those parts which may be altered to suit the fancy of a particular tenant. Regard must also be had to the extent to which any particular article is annexed to the freehold. For instance, wires embedded in the plaster of a wall could not, by any stretch of imagination, be regarded as a fixture which a tenant was entitled to remove. On the other hand, to go to the other extreme it is clear that a mere incandescent lamp could not possibly be looked up as the property of the landlord. The following views were expressed in the ELECTRICAL REVIEW October 11th, 1912, at p. 593—(a) Wires and wire-casing vest in the landlord; (b) switches and distribution boards, being articles of a permanent character, vest in the landlord; (c) lamp-brackets, often being fanciful in design and capable of being moved without doing damage, are the property of the tenant; (d) a transformer would be tenant's property; (e) ceiling roses are very much on the border line. As they are generally ornamental objects, they should be treated as tenant's fixtures; (f) wall-sockets would be tenant's fixtures inasmuch as they can be easily removed and replaced by a permanent connection to a wall or bracket lamp.

With regard to wires enclosed in casing, it will be seen from the foregoing that these would not be regarded as tenant's fixtures.

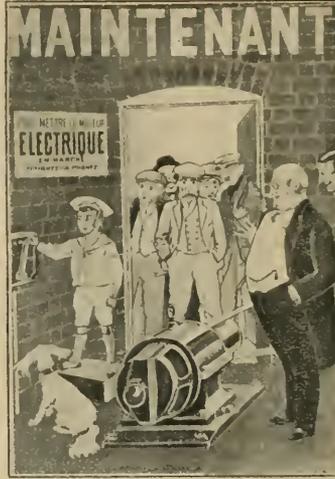
**Bradford Strike.**—The electricians' strike at Bradford has not yet terminated, though it has been in progress for the past seven or eight months. The men came out for an advance in wages to 9d. an hour. This the masters refused to grant, and the city was flooded with non-Union men, who were engaged at 8½d. per hour. The Union men offered to go back at this figure, but the masters would not dispose of the services of the non-Union men whom they had taken on when the strike commenced. The Trades and Labour Council, at a meeting last week, passed a resolution protesting against the action of the Electrical Contractors' Association in paying 8½d. per hour to non-Union men and refusing to pay the same rate of wages to Union men.

## BUSINESS NOTES.

**Advertising Electric Power.**—The Union des Exploitations Electriques en Belgique has recently issued a couple of striking posters, with the object of drawing attention to the advantages of electric power. They are entitled "Autrefois" and "Maintenant" ("Then" and "Now"). The first shows the whole staff of a small works tugging round a fly-wheel in an unsuccessful



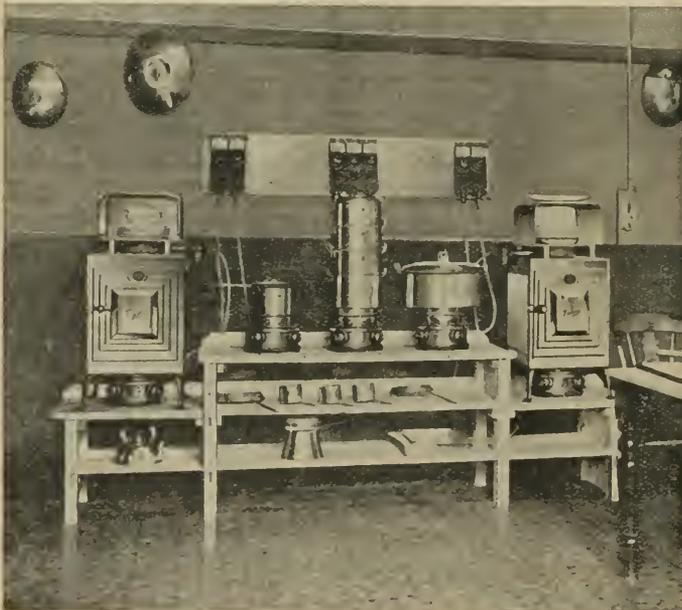
THEN.



NOW.

attempt to start the gas engine. In the second picture the gas engine is replaced by an electric motor, above which is a notice to the effect that it is only necessary to move the switch to put it in motion.

**"Tricity" Kitchen at Barrow-in-Furness.**—In the accompanying illustration we show the "Tricity" equipment which has been installed at the house of Ald. J. P. Smith, Barrow-in-Furness. In addition to the apparatus here shown there are



"TRICITY" KITCHEN AT BARROW.

two more single cookers which can be used on a table placed in front of the kitchen range, controlled by two panels similar to those shown in the illustration. These are for either heating an urn or for grilling operations. The hot water supply of the house is taken care of by an independent coke stove which has been fixed near the

kitchen range. The installation has only recently been completed, but we understand that the average consumption for cooking for a household of five adults, is eight units per day. During the second week in May a series of lectures and demonstrations was given by the BRITISH ELECTRIC TRANSFORMER CO., and the Corporation has decided to hire "Tricity" cookers to its consumers.

**Consular Notes.**—Peru.—The British Consul at Iquitos, in a recent report, states that the first telegraph communication there with Lima was established in 1908, with five wireless and 11 telegraphic relays between Iquitos and Lima. Early in June last direct communication was established between the new tower erected at Iquitos and that on the Cerro San Cristobel, near Lima. The tower at Iquitos is 100 metres high, and is constructed of trussed steel balanced on an insulated point. The power is 25 kW., and the wave length 1,000 to 4,000 metres. The system used is the Telefunken singing spark. On June 15th last, the new system was inaugurated and public messages were accepted for transmission; since then an excellent service has been maintained. Between Iquitos and Lima the cost per word for messages in Spanish for a minimum of 10 words is 24 cents (6d.), and this is doubled for messages in a foreign language or in code. Iquitos has been from time to time in direct communication with Manao, Para, and other stations outside Peru, but so far commercial messages have not been received for transmission, although private telegrams have been dispatched by special request. It is to be hoped that some arrangement will be made between the Peruvian and Brazilian Governments to permit direct intercommunication between Iquitos and Manao on a commercial basis. The tower formerly in use in Iquitos was recently dismantled, and has since been erected at El Encanto, in the Putumayo region. Experimental messages have already been received from the new station at El Encanto.

**Cape Verde Islands.**—The British Consul reports that the concessions for the electric lighting of Mindello and Praya have not yet been granted. This installation is likely to be one of the first of many prospective improvements.

**Norway.**—Probably more small towns and hamlets in Norway use electricity than in any other country, owing to the abundance of water power. An American Consul states that in the country districts not only are there plants for each collection of five or six houses, but in many cases even small farms have their own generating plants. In Christiania the electrical plant Kristiania Elektricitetsverk is owned and managed by the city. The plant was built in 1891 by a German firm and cost about £450,000, of which about £275,000 has already been paid off out of profits. The plant was originally fitted completely with German machinery, but the unit recently added was made in Norway. All current consumed in Christiania is sent out from the city plant, but only about one-third of it is generated there. The city purchases 6,500 kW. of alternating current from the Kykkelsrud Co., which generates electricity from the waterfalls at Kykkelsrud, 40 miles from Christiania: 1,950 kW. of alternating current is obtained from the city's plant at the Hammer waterfall, in the Maridalsvand or Maridals Lake district, seven miles from the city; and about 4,000 kW. is generated at the city plant by steam. Of the 4,000 kW., 2,400 is alternating and 1,600 D.C., but it is all transformed to direct. The direct current is used in the centre of the city, and the alternating, which is 50 cycles per second, in the less congested parts and in the suburbs. The voltage used is 230 volts. Both currents are supplied night and day. The total power used in this same year, 1911, was about 10,000 kW., of which 3,859 was D.C. and the balance alternating. Of the latter, 1,346 kW. was furnished to the street-car companies. Notwithstanding the large profit made by the city, energy is furnished to consumers at very low prices. For lighting purposes the rates per kW.-hour, during the last 10 years, have been as follows: 1902 and 1903, 6½d.; 1904, 5½d.; 1905 to 1910, 4d.; 1911, 3½d. For trade purposes the rate has always

been the present one, 2½d. per kW.-hour. On contracts the prices are even lower. Thus the lighting rate is 22s. 4d. per 100 watts per year, and rates for trade uses are about £5 per H.P. up to 15, and £4 per H.P. if more than 15 H.P. is used.

In other cities and in the country districts the rates are also very

low. Alternating current generated from water power is mostly used. The machinery is generally of German manufacture, as also are the lamps, transmission lines, cut-outs, meters, &c. Some of the plants are owned by the communities and others are privately owned.

**Panama.**—According to a report of the Isthmian Canal Commission, survey began early in December for the location of towers to carry the electric transmission line, which will follow the re-located line of the Panama Railroad from Cristobal to Balboa, connecting terminal sub-stations at these points. The line will be fed mainly from the Gatun hydro-electric station, and will be teed into the permanent steam generating station at Miraflores. Energy will be transmitted along this line at a potential of 44,000 volts in delta connection, and reduced at centres of distribution to the requisite potentials for the operation of machinery and for lighting. Each tower is to have a track-span bridge consisting of two side frames connected by a cross-bridge, all of skeleton steel construction. The bridge is to support duplicate three-phase lines, one on either side of the track, a ground wire strung from the top of each side frame, messengers and cables for duplicate telephone trunks and for track signal circuits, and the necessary messengers and wires for a catenary trolley construction should the Panama Railroad be electrified.

The track-span bridges will be located from 200 to 300 ft. apart, according to the curvature of the tracks. Under the specifications being prepared preliminary to advertising for bids on furnishing materials for the line, 725 single-track and 100 double-track bridges will be required, with 2,000,000 ft. of copper wire, No. 00, B. & S. gauge, 6,500 three-unit suspension insulators, and 1,000 ground plates. Inasmuch as the Commission has secured poor deliveries upon recent requirements of structural steel work, in connection with unfavourable prices of both steel and copper in the United States market, foreign manufacturers will be invited to compete for furnishing materials for the transmission line.

**Private Arrangements.**—THE ADAMS MANUFACTURING CO., LTD., automobile and electrical engineers, Balfour House, Finsbury Pavement, E.C., and at Bedford. The following are creditors herein:—

Acme Electrical Co. . . . .	£130	Hopper, J., & Co., Ltd. . . . .	£105
Ashwell & Nisbet . . . . .	159	Hart, J. T., & Sons . . . . .	230
Auto-Car . . . . .	208	Lookwood, J., & Co., Ltd. . . . .	119
Platt's Advertising Agency . . . . .	307	Imperial Motor Industries, Ltd. . . . .	22
Commercial Motor . . . . .	171	Maudslayi Bros. . . . .	226
Concordia Elec. Wiring Co. . . . .	132	Matthews, E., & Co. . . . .	145
Continental Tyre & Rubber Co. . . . .	112	Motor, The . . . . .	144
Cutler Hammer Mfg. Co. . . . .	1,181	Nettlefold & Sons . . . . .	230
Elec. Ordnance Accos. Co. . . . .	200	Cutler, P.R. Works . . . . .	149
Electrical Times . . . . .	174	Rochdale Electric Co. . . . .	280
Electrical Review . . . . .	113	J. Smith & Sons (Norwood), Ltd. . . . .	250
Elec. Mechanical Contract Co. . . . .	116	Clark, B., & Co. . . . .	113
Dunlop Rubber Co. . . . .	250	Barry Magneto Co. . . . .	130
Smith's Timber Co. . . . .	122		
T.R.T. Copper Works . . . . .	149		
Thomas Green & Co. . . . .	268		

**France.**—LA SOCIÉTÉ DE CONSTRUCTIONS MÉCANIQUES ET ÉLECTRIQUES (Ascenseur Système Houplain & Elluin) is the name of a new company which has lately been formed in Paris (40, Rue Bargeue), with a capital of £20,520.

**More Lamp Stories.**—All sorts of stories reach us every few days regarding what severe and unexpected ordeals are imposed upon tungsten lamps. No doubt the reader is beginning to find such reports monotonous, and to anticipate the result before he reaches the end of the paragraph. The latest account to reach us relates to a Mazda 60-watt, 230-volt lamp installed at the Palace Theatre, West Hartlepool. This lamp cast itself down from a giddy height of 12 ft. on to a stone pavement below. With it it carried a gallery and heavy bead shade, but when put into the holder again it responded in the usual brilliant fashion, absolutely indifferent to the folly of its fall or the consequences thereof. We also learn that when several cases of Mazda lamps underwent the terrors of shipwreck, and subsequently had to suffer the severe tortures of salvage operations, only 1 per cent. were damaged. Yet again are we told of a stage lighting batten of 100 Mazdas, which fell 5 ft. without one single lamp having grazed its skin or fractured its filament.

**Diploma.**—THE BRITISH THOMSON-HOUSTON CO., LTD., have been awarded a diploma of honour for their exhibit at the International Kinematograph Exhibition, which we described some weeks ago. The main feature of the exhibit was their "Eye-Rest" system of indirect lighting.

**Oils for Electrical Work.**—THE STERN SONNEBORN OIL CO., LTD., of Royal London House, Finsbury Square, London, E.C., announce that recent improvements have enabled them to place on the market transformer oils which vary in colour from almost to absolutely water white. These oils are claimed to give remarkable results as to dielectric strength and specific resistance, and they are being used by leading transformer manufacturers, and light and power installations. Another speciality is their special Sternal white turbine oil.

**Motor-Car Lighting.**—MESSRS. C. A. VANDERVELL AND CO., manufacturers of the well-known C.A.V. car lighting system, were adjudged first on all counts in the competitive trials for lighting sets organised in connection with the Turin Motor Exhibition.

**Patent Applications.**—THE WESTERN ELECTRIC CO., LTD., have applied for leave to amend patent No. 1,950 of 1908, granted to J. E. Kingsbury, for "Improvements in gravity switches as applied to telephones and the like."

THE NATIONAL TELEWRITER CO., LTD., are applying for an extension of term of patent No. 21,918 of 1899, granted to Foster Ritchie, for "Improvements in teleautograph apparatus."

**Scottish Depression.**—According to the *Times*, "two of the works in Glasgow connected with the Malleable Iron Combination closed down on Saturday owing to the dearth of orders, and 500 men were rendered idle. Men were also paid off at several other works." A later paragraph from the *Times* Edinburgh correspondent says that the combine has "been very badly hit, having already closed down four of its 15 works. The depression is the direct result of speculation on the part of local makers, who declined to accept orders during the boom except at higher prices than were then quoted by American and Belgian makers. The result was that orders for fully 100,000 tons of material went abroad."

**Russia.**—THE GESELLSCHAFT FÜR ELEKTRISCHE AKKUMULATOREN "REX" is the name of a new company, which has lately been formed in St. Petersburg, with a capital of 400,000 roubles, to carry on the manufacture of accumulators.

**Liverpool Exhibition.**—This Exhibition is now open, the ceremony having been performed by the Lord Mayor, Sir Chas. Petrie

**Church Lighting.**—St. Cuthbert's Church, York, has been recently lighted by means of Osram lamps. Every effort has been made to ensure that the general arrangement of the lighting is in entire harmony with the general scheme of architecture.

**Small Loans at 2 Per Cent.**—Under the bequest of the late Samuel Wilson, loans of from £10 to £300 are advanced to *bona-fide* tradesmen and manufacturers carrying on business in the City of London, or within five miles thereof. The loans bear interest at £2 per cent. The grantee must be under 40 years of age, and have been set up in business at least one year, and not more than three years. Further reference is made to the matter in our advertisement pages.

**Catalogues and Lists.**—MESSRS. J. C. FULLER & SON, LTD., Woodland Works, Wick Lane, Old Ford Road, Bow, London, E.—New catalogue (20 pages) containing full illustrated particulars and prices of their patent Block type accumulators for telegraph, train lighting, house lighting and power, motor-car ignition, hand-lamp, wireless and other service. A number of accumulator sundries, motor-car lamps, ignition coils, fans, &c., are also particularised. The firm are so busy with these accumulators that they have had to open a new factory for their special manufacture.

THE POWER PLANT CO., LTD., West Drayton, Middlesex.—12-page illustrated pamphlet (No. 6), containing descriptions of combined driving, starting and roll turning gear for electrically operated cold rolls, &c., with line diagrams and notes on the method of operation.

MESSRS. BOVING & CO., LTD., 9½, Union Court, Old Broad Street, London, E.C.—New catalogue (40 pages art paper) dealing fully with the "Victoria" turbo pumps and giving many half-tone illustrations of typical plants. Low lift, medium pressure, vertical sinking, high-pressure, turbo-fed, and fire and booster pumps, are covered in the list. Test curves are given in a number of cases. We learn that the total H.P. employed in driving Boving pumps is now well over 20,000 H.P.

THE UNION ELECTRIC CO., LTD., of Park Street, Southwark, S.E., have again issued to their friends one of their little celluloid vest pocket calendar cases containing a supply of sticking plaster.

MESSRS. MANLEY & SANDY, LTD., Caledonia Street, King's Cross, London.—Eight-page pamphlet, illustrating the M. & S. miners' safety lamps, fitted with detector and direct-reading percentage gas indicator within glass, or with detector which can be proportioned to any desired percentage of gas; also showing D.C. generators, A.C. motors, and other lamp cabin equipments.

MESSRS. VERITYS, LTD., 31, King Street, Covent Garden, London, W.C.—Leaflet No. 739, giving illustrated particulars and prices of "Typhoon" D.C. fans and "Delhi" A.C. fans—desk and bracket patterns.

THE POLYSTAT ELECTRIC CO., 222, Marsland Road, Sale, Manchester.—Leaflet "D," describing and stating prices of their wire-length measuring apparatus, for measuring wires, cables, &c. Also illustrated list "C," describing their "Handy" commutator and slip-ring grinder.

MESSRS. SCHOLEY & CO., LTD., 151, Queen Victoria Street, London, E.C.—Four-page supplementary list of electric fans for the current season, including desk and table, oscillating, and portable fans, also four-blade ceiling fans, and the "Mars" special tropical ceiling fan. Particulars of weights, speeds, prices, &c., are tabulated.

**Lamp Economy.**—THE BRITISH THOMSON-HOUSTON CO., LTD., has issued a new piece of publicity matter in the form of a cheque to the value of £40,000, purporting to be drawn in favour of the "World's Electric Light Users," on account of "Mazda—the original drawn-wire tungsten lamp."

The amount mentioned is estimated to represent the daily saving effected by the 20 million Mazdas in use to-day as compared with carbon lamps, reckoning a charge of 4d. per unit, and one hour's service per day.

**Book Notices.**—"Beyond the Atom." By John Cox. "Wireless Telegraphy." By C. L. Fortescue. London: Cambridge University Press, 1913. Price 1s. net each.

"The Uses of Electricity." Three pamphlets. "Electric Lighting," "Electric Cooking and Heating and other Domestic Uses," "Works Driving." London: Kilowatt Publishing Co., Ltd.

"Journal of the Western Society of Engineers." Vol. XVIII, Nos. 3 and 4. March and April, 1913. Chicago: The Society. Price 50 c.

"The Physical Review." Vol. I, No. 5. May, 1913. Lancaster, Pa.: The American Physical Society.

"Boletín de la Sociedad de Fomento Fabril." Vol. XXX, No. 4. April, 1913. Santiago, Chile: The Society.

"Telefunken Zeitung." April, 1913. London: Siemens Bros. and Co., Ltd. (Publication Department).

"Researches on Irritability of Plants." By J. C. Bose. 1913. London: Longmans, Green & Co. Price 7s. 6d. net.

"Fire Protection in Buildings." By Harold G. Holt. 1913. London: Crosby Lockwood & Son. Price 8s. 6d. net.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXII, No. 5. May, 1913. New York: The Institute. Price \$1.

"Transactions of the Illuminating Engineering Society." Vol. VIII, No. 4. April, 1913. New York: The Society. Price 75c.

**Bankruptcy Proceedings.**—J. G. M. HILTON, electrical engineer, Birmingham.—First meeting, June 4th; public examination, June 25th, both at Birmingham.

**Trade Announcements.**—THE ELECTRICAL PRESS, LTD., have removed from the Strand, to 13-16, Fisher Street, near Kingsway, London, W.C.

**Dissolutions and Liquidations.**—COLONIAL RAIL AND TRAMWAY SYNDICATE, LTD.—This company is winding up voluntarily with Mr. E. H. Burton, 16, St. Helen's Place, E.C., as liquidator.

ELECTRIC LAMP REGENERATORS, LTD.—This company has resolved upon reconstruction. Mr. F. W. Beard, 480, Salisbury House, E.C., the secretary, is liquidator, and he has authority for the registration of a new company, Electric Lamp Regenerators, Ltd., with a capital of £20,000 in 5s. shares. A meeting of creditors is called for June 5th.

BROWN & PABSONS, LTD., The Parade, Leamington.—A meeting of creditors is called for to-morrow, May 31st, at the offices of the company. Liquidator, Mr. G. H. Butterworth.

BECK FLAME LAMP, LTD.—A meeting is called for June 30th, at 21, Ironmonger Lane, E.C., to hear an account of the winding-up, from Messrs. H. J. Page and G. E. Corfield, the liquidators.

## LIGHTING and POWER NOTES.

**Accrington.**—A report has been issued, showing the financial position of the electricity department. The gross income for the year ended March 31st last was £23,716 and the gross expenditure 214,345, leaving a surplus of £9,371, which represents a profit of 773 per cent. on the capital outlay. After meeting various charges for interest and so forth, there was left £2,823, of which £1,150 has been handed over for rate relief. The capital outlay since the electricity works were opened in November, 1900, has been £121,178, £28,834 having been expended in extensions during the past year. The number of units supplied during the year aggregated over 4,800,000, an increase of over 1,500,000.

**Aysgarth.**—At a meeting of the B. of G. on May 20th, it was reported that inquiries had been made with respect to the electric light installations at two small workhouses mentioned by the L.G.B. Inspector, and it had been found that the light had proved a great boon, not only in the way of improved light but also in cleanliness. In one case where oil lamps were formerly used there had been a saving of 25 per cent. The Board has decided to ascertain the cost of an installation.

**Barnes.**—A sub-committee has been appointed to consider what, if any, steps should be taken to increase the output of the Council's electricity undertaking. The electrical engineer reports very poor replies to a letter he had sent to tradesmen explaining the system of hire-purchase of lamps approved of by the Council, and stated that business of this class would go elsewhere unless the Council possessed the powers to undertake the business throughout.

**Beckenham.**—The B. of T. has granted the U.D.C. a prov. order for electric light in the parish of West Wickham, and has inserted a clause revoking the powers of the West Kent Electric Co. for that district.

**Bexhill.**—The Council has instructed the engineer to report on the cost of replacing the whole of the arc lamps of the borough with high-power metal-filament lamps.

**Birkenhead.**—An inquiry has been held by the L.G.B. relative to the Council's application for sanction to borrow £32,600 for purposes connected with the electricity undertaking. Of this amount £18,400 is required for mains and services for three years, and £14,200 for extensions to plant—for two 750-kw. generators.

The Inspector (Mr. H. R. Hooper) expressed a strong opinion in regard to municipal electrical undertakings paying money towards the relief of the rates instead of building up an adequate reserve fund. He felt that no municipal authority could afford to pay a penny to the relief of local rates in the present position of the electrical industry, as it was increasing by leaps and bounds. Therefore, it was all the more necessary to provide a sufficient reserve fund to meet the larger and more up-to-date generating plant which would be required to cope with the ever-increasing requirements. The chairman of the Electricity Committee (Mr. D. J. Clarke), said, after his experience, he quite agreed with the remarks of the Inspector.

**Birmingham.**—It is stated that the city authorities are experimenting with electric lanterns with a view ultimately to equipping the whole of the police force with them.

**Blackpool.**—An annual saving of £550 in the cost of the street lighting was foreshadowed in the electrical engineer's estimates, submitted on May 22nd to the Street Lighting Committee. The electricity department has reduced charges for street electric lighting from 3d. per unit for the first 250,000 units to a flat rate of 2½d. for all consumption.

**Bolton.**—It was reported last week that the total profit of the electricity department, together with the amount brought forward last year, was £31,566. After making allowance for depreciation, interest, &c, there was £1,787 available for distribution, and it was decided by the Electricity Committee to allocate £1,500 of this in relief of the rates. In 1912 the amount voted for this purpose was £3,250, and in 1911 it was £6,500.

**Bootle.**—Mr. H. R. Hooper, L.G.B. Inspector, has held an inquiry into an application by the Corporation to borrow the sum of £3,980 for the purchase of land in Linacre Lane, and £3,750 for purposes of the electricity undertaking. The town clerk explained that the expenditure of the latter sum was necessitated by the development required for the provision of an additional electricity supply to districts which they served, and for a duplicate supply to certain large consumers. Councillor F. W. King (chairman of the Electric Power and Lighting Committee) stated that they wished to proceed with the scheme as soon as possible, because they wanted to make provision for supplying Messrs. Harland & Wolff, the cold stores, and other firms. There was no opposition to the application.

**Bristol.**—It is intended to convert 1,517 street gas lamps for electric lighting, the saving in expense being estimated at 20 per cent.

**Burgess Hill.**—On the proposition of Lady Ruth Pelham, the Burgess Hill group of school managers has decided to recommend the East Sussex Education Committee to take steps to discontinue using gas as an illuminant at London Road schools, as it is considered electric light is more healthy.

**Bury.**—The Electricity Committee has appointed a sub-committee to consider the question of inter-connection being made with the mains of the Lancashire Electric Power Co., so that in case of a breakdown at either works a supply could be obtained from the other works. According to the Manchester papers this is part of a general scheme to interconnect the different generating stations in the neighbourhood of Manchester, with a view to safeguarding the supply.

**Colwyn Bay.**—At a meeting of the Lighting Committee, a statement of the financial results of the past year, which was submitted, showed gross profits of £4,011, and net profits of £1,319. The Committee considered the results very satisfactory. It was decided that the price of current used for public lighting and U.D.C. departments should be reduced from 4d. to 3d. per unit.

**Continental Notes.**—GERMANY.—The new Franken power station, which has a capacity of 6,200 H.P. of the Franke Ueberland Zentral, of Nuremberg, has just been completed and put in operation. It is supplying current to no less than 160 small towns and villages, the mains having a length of about 320 miles.

SICILY.—Good progress is being made with the adoption of electrical energy for lighting and power purposes on the Island of Sicily. The Société d'Electricité de la Sicile Orientale is now supplying current to 106,808 incandescent and 402 arc lamps, as well as to 758 electric motors belonging to private consumers, and 3,449 incandescent and 827 arc lamps used for public lighting, and the power for the tramways in the town of Catania. Current is supplied altogether to 11 small towns having a total of 504,000 inhabitants.

**Coventry.**—The annual report of the Corporation electricity undertaking has been issued, and shows that the department has had a successful year's working. It states:—The total borrowing powers of the undertaking amount to £275,570, the whole of which have been exercised. The sinking fund amounts to £72,130. During the year the number of consumers increased from 1,962 to 2,517, an increase for the year of 555, as compared with an increase for the previous year of 372, and by far the largest increase recorded since the commencement of the undertaking. The number of units sold increased from 10,473,339 to 13,337,482, an increase of 2,864,143 units, of which the power load accounted for 2,684,266. The revenue from sale of current, motor rents, &c., amounted to £60,521, compared with £60,682 in the previous year, notwithstanding the further reduction in the charge for power which was made last year. The working expenses amounted to £24,765, against £17,370 in the previous year, the increase in the price of coal accounting for a considerable portion

of this increase. The gross profit was £35,766. Capital charges amounted to £19,510, against £17,138 in 1912, the result being a net profit for the year of £16,245. To this has to be added the amount of £48 brought forward, making the available surplus £16,293. The Committee makes the following recommendations as to the disposal of the surplus of £16,293:— (1) That £4,500 be paid over to the general district fund in aid of the rates; (2) That £11,600 be paid to the reserve fund, and transferred from that fund to capital account, such sum to be applied for the replacement of superseded plant and other purposes stated below, in lieu of raising a loan for the same, viz., £1,800 for transformers and sub-station equipment, £2,000 for house services, £4,000 for new machinery and replacement of plant, £3,800 for the plant to be provided in connection with the supply of energy to the tramways department; (3) That the balance of £193 be carried forward to the next account.

**Creswell.**—At a meeting of parishioners last week, an electric light scheme submitted by Mr. J. P. Houghton, managing director of the Beloevo Colliery Co. was accepted. Mr. Houghton offers to supply four lights and do the wiring work at a charge of 13s. per house per year to cover interest on capital, upkeep, and cost of repairs and renewals to fittings. The cost of current will be 3½d. per unit.

**Darlington.**—Reporting to the Electricity Committee, the electrical engineer, Mr. Lunn, stated that the units generated for lighting and power in April amounted to 401,483, as against 186,080 in April, 1912, an increase of 116 per cent. From the profits of the past year, £5,000 has been allocated to the relief of the rates. It was decided to submit a tender for the electric lighting of those streets in the borough where cables are laid, in view of the saving over gas lighting.

**Darwen.**—A L.G.B. inquiry was held last week regarding the application of the Corporation to borrow £6,400 for extensions at the electricity works and various sums for other purposes. The town clerk explained that owing to the success of the electricity undertaking it was proposed to obtain new plant. There was no opposition to the application in so far as it related to the money for extensions at the electricity works.

**Egypt.**—According to the *Board of Trade Journal*, the Egyptian Government is considering the development on a large scale of the power at present wasted at the Assuan dam. A large amount of power could be obtained and utilised in the manufacture of chemical manure—calcium cyanamide probably—but a small plant will be provided in the first instance.

**Elland.**—The electricity department receipts have increased from £2,173 to £2,918 last year, whilst the expenditure was £1,968, as against £1,617 in the previous year. The credit balance on the year's working has been increased from £556 to £950, notwithstanding extra expenditure on coal, amounting to £115, as compared with a year ago.

**Epsom.**—The chairman of the U.D.C. electricity undertaking has just issued his annual memorandum. It states that after paying all charges, including capital costs, a profit is shown of £137, which is £54 in excess of the estimate. The total sum borrowed since the undertaking was established was £43,811, of which £15,335 had been repaid. The total income was £6,519, as against £6,681, a decrease of £161; and the total expenditure £3,630, as against £3,622, leaving a gross profit of £2,885, as against £3,059.

**Exeter.**—The results of the year's working of the electricity undertaking, according to the annual report of Mr. Munro, the engineer, are: Receipts, £18,211; working expenses, £9,840; gross surplus, £8,370. The interest, sinking fund and income-tax charges amounted to £6,997, leaving a net surplus for the year of £1,373. The lighting, heating and power output increased by over 60,000 units, but the tramway demand was less by 21,000 units. Although the charges for power and lighting have been twice reduced recently, the loss of revenue from this source is already balanced by the increasing demand. The Committee has decided to carry the surplus of £1,373 to the reserve and renewals account, increasing the credit balance to that fund to £11,785. The Finance Committee has been asked to consider the salaries of the electrical engineer and the members of his department.

**Hanwell.**—The District Council proposes to obtain estimates from the Gas and Electric Light Co. for the lighting and maintenance of the lamps in a portion of Greenford Avenue.

**Hebden Bridge.**—It is proposed to extend the electricity works, at an estimated cost of £3,250. The chief item in the extension proposals is the provision of a Diesel engine for power purposes.

**Herne Bay.**—The U.D.C. has decided to have the electric light installed at the new King's Hall, current to be supplied from the works of Messrs. Hunt at 3d. per unit. This firm will also undertake the installation work.

**Hornsey.**—A special rate of 3d. per unit is to be charged during the summer months for current supplied for garden lighting. At the last meeting of the Council, Councillor Moritz, speaking upon a report of the Electricity Committee with regard to the interference by a workman employed by a local tradesman with a box and fuse belonging to the Council, said that cases of the sort mentioned were becoming too frequent, and the Committee had decided to take drastic steps in the next case.

**Hull.**—The T.C., having received applications for current from residents at Sutton, has applied to the Southcoates R.D.C. for permission to undertake the supply, and for support to an application to the B. of T. for the necessary order. The Town Clerk intimated that his Council intended in the near future to apply for a prov. order for E.L. in the parish of Sutton generally. The R.D.C. has deferred the matter for further consideration.

**Hkley.**—The U.D.C. is proceeding with its electric lighting scheme, and intends to make early application to the L.G.B. for sanction to borrow £18,000 to carry out the work.

**Knottingley (Yorks.).**—The U.D.C. has appointed a Committee to consider the question of applying for a prov. order for E.L.

**Limerick.**—At a meeting of the Electric Lighting Committee, held on the 16th inst., it was decided to again recommend the Council to apply for a full loan for renewals at the power house, including £6,100 for the purchase of a Diesel oil engine.

**Liverpool.**—The existence of the much-debated Electrical Sub-Committee is again threatened. After being dissolved and re-established within a month, a motion to rescind the resolution reappointing it was down for discussion on Friday last.

**London.**—SOUTHWARK.—The L.C.C. is to be asked to sanction a loan of £29,464 to meet the cost of the additional plant required for the extension of the electric light station.

HAMMERSMITH.—The Electricity Committee recommends that sanction to a further loan of £9,500, for mains extensions, services, sub-station transformers, &c., be obtained from the L.C.C.

BATTERSEA.—The L.C.C. has sanctioned the borrowing of £3,275 for the provision of additional plant.

**Luton.**—The borough engineer has submitted to the T.C. a scheme for extending the refuse destructor, at an estimated cost of £7,000.

**Middlesbrough.**—The annual report of the Electricity Committee of the Corporation, shows that during the past year the revenue had increased by £3,533 to £24,448, whilst the total costs £13,365 represented a decrease of '07d. per unit. The gross profit was £11,113, an increase of £837, and the net profit of £3,369 represented an increase of £450. The profit was allocated to the reserve fund and the special redemption fund. The engineer's (Mr. H. M. Taylor's) salary was increased from £425 to £450 per annum, and that of the mains superintendent (Mr. R. Sistrin) from £180 to £200.

**Morecambe.**—Terms have been approved by the T.C. for the supply of electricity to Messrs. Ward's shipbreaking yard, viz., a standing charge of £90 per annum, plus 1d. per unit for every unit supplied, with a guaranteed consumption of 50,000 units per annum, and Messrs. Ward to guarantee to take the supply for a period of five years. The Corporation is protected in the matter of peak load supply and cost of fuel.

**Norwich.**—At the last sitting of the T.C., Mr. Alderman Wild presented a report from the Electricity Committee, as to the sum required for plant during the next five years. He said an estimate prepared by the electricity engineer (Mr. F. M. Long) amounted to £25,000. The increase of business during the last two years had amounted to more than the whole sales when the business was taken over by the T.C. The expenditure proposed was large, but the amount would only be raised as it was required. The report was adopted.

**Oldham.**—At a meeting of the Electricity Committee on May 21st, a summary of the past year's working of the electricity department was given. The expenditure on capital account was £11,668, making the total capital expenditure of the undertaking £318,414. The gross revenue for the year amounted to £46,646, and the gross expenditure to £25,451, leaving a balance to be carried to net revenue of £21,195. Interest and sinking fund charges amounted to £18,618, expenditure on meters to £1,533, leaving a net profit for the year of £1,043. The credit balance brought forward from previous year was £664, which leaves a credit balance to carry forward to next year's account of £1,708. The number of units sold (exclusive of traction) was 3,028,203, as compared with 2,451,116 in the previous year, or an increase of 577,087, or 23½ per cent. The number of units sold for traction during the year was 3,435,213, as against 3,541,360 in 1912, a decrease of 106,147, or 2'99 per cent. The amount standing to credit of the reserve fund is £5,726. The number of lamps connected was 241,258, as against 206,048, an increase of 35,210, or 17'09 per cent. The generating capacity of the Greenhill station has been increased by the addition of a turbine, and now amounts to 8,600 H.P. The works costs amounted to 0'712d. per unit sold, the total revenue costs to 0'914d., as against 0'669d. and 0'924d. per unit in 1912, respectively. The increase in costs is solely due to the expenditure on coal. The total number of units sold during the year was 6,463,416, as against 5,922,476 in the previous year.

**Peterborough.**—The accounts of the city electricity department for the past year show a surplus on the revenue account of £4,353, but after paying £1,635 for interest on loans, £2,151 for re-payments, and £711 for capital expenditure out of revenue, there is a net deficit of £145, which is met by the reserve fund. Last month (April) the works earned a surplus of £322. The Great Northern Railway Co. has applied for a supply of power for its cranes, which matter is under consideration.

**China.**—To meet the increasing demand for current for lighting and power purposes, two new 2,000-H.P. steam engines and a 1,000-H.P. transformer have been installed at the central generating station at Tientsin.

**Plymouth.**—The electrical engineer has recommended the Council that a turbo-generator of 1,000-kw. capacity be installed, together with the necessary auxiliaries; also switchgear of greater capacity and additional distributor and interconnector cables. Estimated cost £5,500.

**Runcorn.**—The Mersey Power Co. has applied to the B. of T. for consent to the placing of electric lines above ground for purposes of supply under the Runcorn Urban and Runcorn Rural Electric Lighting Order, 1910.

**Southend-on-Sea.**—The T.C. has received the sanction of the L.G.B. to a loan of £3,700 for the provision of an additional 500-kw. steam generator and accessories.

**Stafford.**—The annual statement in connection with the electricity undertaking shows that for the past year the total revenue from all sources amounted to £6,182, and the total expenditure to £3,708, leaving a gross profit of £2,480, compared with £2,809 in the previous year. It has been decided to pay bonuses, as usual, to the employees on the profits of the year's working.

**Tottenham.**—The Council, at its meeting this week, will consider a recommendation from the General Purposes Committee advising the acceptance of the quotation of the Tottenham and Edmonton Gas Co. for lighting the district for a period of 10 years. Competitive prices were obtained from the North Metropolitan Electric Power Supply Co. Reporting on the two offers received, the Council's engineer states that the Electric Light Co. already supplies current to 140 arc lamps in the district, and under an agreement the contract cannot be terminated until January, 1918. The company's tender just received is for the completion of electric lighting in West Green Road and Lordship Lane, and for the installation of electric light in several other streets and portions of streets.

**Walsall.**—The report of Mr. E. M. Lacey on the Corporation electricity undertaking has been issued. He condemns the present generating station site and plant; finds that it has been inefficiently maintained and staffed; that the proposed expenditure of £5,000 on repairs and additions to plant is essential; and that the charges for d.c. supply should be increased, so as to secure an average return of 4.75d. per unit sold for lighting purposes, and of 1.68d. per unit for traction supply. Mr. Lacey goes on to recommend the provision of a modern 3,000-kw. power station, capable of extension to 10,000-12,000 kw., to meet the needs of the area. He finds that responsibility for the present state of affairs rests to some extent with the chief engineer, who, however, has not had the time to give close attention to everything. Mr. A. S. Barnard (borough electrical engineer), in replying to this criticism, points out that he has repeatedly drawn the attention of the Committee to the necessity of appointing a chief assistant engineer, and blames the Committee for ignoring his advice. The General Purposes Committee, after approving the report, said it considered that the borough electrical engineer cannot be freed from responsibility, and after considering whether his services should be retained, it recommended that the matter be decided on the result of the year's working; but that the Council may at any time determine the engagement of the engineer. While agreeing with the consulting engineer as to the unsuitability of the present generating plant, the Committee, in view of the extensions, has deferred consideration of a new station.

**West Ham.**—Application is to be made to the L.G.B. for sanction to a further loan of £21,500, made up as follows:—Transformers, sub-stations, switchgear and accessories, £9,000; general mains extensions, £8,500; services and accessories, £4,000. The electrical engineer has been instructed to report on the use of current for domestic heating and cooking purposes, with a suggested tariff of charges in connection therewith.

**Wigan.**—At a meeting of the Electric Lighting Committee last week, it was decided that tradesmen be granted (on application to the electrical engineer) the loan of festoons and lamps, with free light, for illuminated decorations on the night of their Majesties' visit to the town, subject to their paying the cost of fixing such decorations.

**Willesden.**—The clerk has been instructed to negotiate for the advance, by instalments, of £14,000 sanctioned by the L.G.B. for the purposes of the undertaking. From a special report prepared by the engineer, the Electricity Committee states that the undertaking continues to make steady progress. A communication has been received from the Home Office as to the renewal of the high and low-tension switchboards, which is estimated to cost £2,000, and in accordance with the suggestion of the engineer the work is to be carried out by allocating the sum of £500 per annum for the purpose, until the whole of the work is complete. The latest type of flame arc lamp is to be substituted for the present open arcs, which are now practically worn out, and for which £500 per annum is also to be put aside. During the first year 25 lamps in the High Road, Kilburn, and Shoot Up Hill, are being renewed at an estimated cost of £275. The electrical engineer has submitted to his Committee a report with regard to the supply of current in bulk to the Willesden Infirmary and the extension of cables to meet additional demands in the Park Royal area. In this report the engineer states that in October last he offered to meet the requirements of the Guardians for a fixed sum

of £35 per annum, being 10 per cent. upon the capital cost, and 2d. per unit for all energy used for lighting and power, which was accepted. The cost of this extension to the Infirmary, with provision for meeting any further demand in Park Royal, is as follows: High-tension cables, £708; transformer with switchgear, £100; switch panels, £29; total, £837. In addition to this, at least one 25-H.P. motor will be required to be let on hire for driving the laundry. The greater portion of this expenditure is for the future development of the district.

**York.**—The Corporation having decided to extend its electricity works, a L.G.B. inquiry was held on May 26th into the proposal to borrow £30,000 for that purpose.

It was stated that the works for some time lost money, totalling £8,400. Latterly, however, profits had been made aggregating £8,633, of which sum £2,400 had been paid to the relief of the rates. The units sold during the year ended March 31st last were 6,007,800 compared with 3,610,950 units in 1911-12, an increase of nearly 2,400,000. The loan sought was to meet the expenditure necessary to meet the estimated increased demand for next year. Mr. J. W. Hame, the electrical engineer, said the increased sale was largely due to the increase in the power supply. The amounts required were:—Generating plant, £10,100; two water-tube boilers, £4,300; cables, £5,250; batteries, £3,900; building, £890; total, £24,440. This reduction from the amount it was originally intended to borrow was due to the fact that the estimate for the 3,500-kw. generating plant was £14,257. The accepted tender, however, was only £9,967, the highest tender being £15,000. The preliminary estimate was based on a slower-speed turbine, but it was now possible to use machines of a higher speed, which enabled them to be made more cheaply, and they also occupied a smaller space. There was no opposition.

## TRAMWAY and RAILWAY NOTES.

**Australia.**—According to the *Mining and Engineering Review*, Messrs. Griffiths & Co., contractors, of London, are reported to be negotiating with the N.S.W. Government in regard to the financing and construction of the Sydney underground railway system.

**Barnoldswick.**—The Light Railway Commissioners conducted an inquiry on May 23rd into the expediency of establishing a light railway between Gisburn and Barnoldswick. The proposed railway will be 4½ miles in length. It is designed to commence near the highway, and will join the Lancashire and Yorkshire railway system at Gisburn, thus connecting an important centre of the cotton industry with the Manchester markets. It was stated at the hearing that terms had been arranged with the Lancashire and Yorkshire Co. who were present to support the scheme. The estimated cost was something over £44,000, and it was proposed to raise £45,000 capital.

**Birmingham.**—The City Council has approved of a recommendation of the Tramways Committee to purchase 75 new cars, 40 for the Warwick Road, Hockley Road, and Stafford Road routes, and 35 extra cars. The cars will cost about £83,000.

**Cardiff.**—Mr. Arthur Ellis, the tramways engineer and manager, states that he has included an electrical-petrol car with the trackless trolley and the motor-bus for use in the outlying districts of Cardiff in a recommendation to the Tramways Committee, which has asked the Parliamentary Committee to include these types of vehicles in the Bill which is being prepared in connection with the extension of the city boundaries. The Tramways Committee proposed to take advantage of the Bill to obtain powers to include the running of a service of vehicles to the outlying districts in different directions of the types of one or other of the three referred to. It did not recommend them for city use.

**Conisborough.**—The Parish Council at its last meeting gave consideration to the proposals of the Mexboro' and Swinton Railless Tramway Co.'s Parliamentary Bill and decided to give its support to the latter, the chairman and the clerk being appointed to give evidence in support of the Bill.

**Continental Notes.**—AUSTRIA.—It is reported from Vienna that the Government proposes to carry out the conversion of the Vienna City Railway to electric traction, which has been under consideration for a period of several years, for the account of the State, at an estimated expenditure of £1,250,000. On the other hand, the construction of the proposed new underground railways is to be undertaken by the city of Vienna with the participation of the leading electrical companies and of French capital, if a portion of the money is raised in the French market. The outlay on the lines is computed at from £6,000,000 to £10,000,000, although the work is not to be begun before the completion of the transformation of the existing city railway.

**Dundee.**—The Corporation Tramways Committee, in an effort to beautify the car routes, recommends that flower baskets be attached to a number of the standards.

**East Ham.**—With reference to the last portion of the paragraph inserted under "Ilford" in last week's issue the continuation of that Council's agreement with East Ham Corporation for the lease of the Ilford Hill track, the engineer and manager to East Ham has been directed to negotiate for reduced terms.

**East Kent.**—The East Kent Light Railways Co. are applying to the Light Railway Commissioners for power to construct additional lines of railways in the new colliery district. The lines will run through the parishes of Woodnesborough, Goodnestone, Nonington, Little and Great Mongeham, Sholden, Deal, Wickhambreux, Littlebourne, Fordwich, Hackington, Canterbury, Coldred, Lydden, Temple Ewell, Alkham, West Hougham, Northbourne, Wingham, and Stonar.

**Exeter.**—In his statement for the year ending March 31st, Mr. H. C. Bartlett (manager of the tramways) says that the total receipts were £16,748, being £512 less than the previous year, which was a record year. The total profit is £2,012, being £224 less than in 1912, the weather during the summer months being very bad for tramway business. The energy consumption has been reduced to a minimum; and although 3,600 more miles have been run this year, the energy has cost £143 less than last year, due to the use of car meters.

**Holcombe Brook.**—The overhead equipment in connection with the electrification of this branch railway has now been fixed, and current, which is supplied by the Lancashire Electric Power Co. was switched on for the first time last Friday.

**Keighley.**—The Tramways Committee has decided to purchase two railless trolley vehicles from Messrs. Trackless Trolley, Ltd., for £1,420, provided the installation of the railless trolley system between Ingrow and Leea is satisfactory. The Committee has also decided to request the B. of T. to grant a further extension of time for the construction of tramways from Dale Street to Stockbridge, and for the commencement and completion of the tramways authorised by the Keighley Corporation Tramways Order, 1909.

A deputation from Brighton visited the town on Wednesday, the 21st inst., in order to inspect the railless trolley system.

**Leith.**—The receipts from the tramways for the year just ended are more than £900 over last year's figures, the total amount from all sources reaching, approximately, £35,500.

**Little Hulton.**—The South Lincs. Tramways Co. is making exceptionally rapid progress in constructing the new tramways through Little Hulton. Connections with the company's existing system will be made at the Ellesmere Memorial, Walkden, and at Buckley Lane, Farnworth.

**Luton.**—The T.C. has decided, subject to the consent of the B. of T., to lease for a further term of 10 years the electric tramways to Balfour, Beatty & Co., Ltd.

**Manchester.**—A general reduction of car fares on all the routes in the city has been adopted by the Tramways Committee. As an experiment, cheaper fares have been in operation on three routes, and Mr. J. M. McElroy (general manager) declares that the result of the experiment is such that the Committee would not be justified in withholding the proposed reduction of the fares on the remaining routes. The experiment referred to covered a period of three months. The passengers carried numbered 13,710,673, against 12,039,136 in the corresponding period a year ago. The receipts amounted to £60,610, against £60,276 in the same period a year ago. Referring to the general all-round reduction, Mr. McElroy states that although there may be some diminution of the net earnings, it will not be of such a substantial nature as seriously to affect the financial position of the department.

The annual report of the tramways undertaking was before the Tramways Committee on Tuesday. There is an increasing revenue, and profits are well maintained in spite of higher labour, power, and other costs. The length of track was 188 miles 651 yd., an increase of 3 miles 687 yd. over the previous year. The traffic revenue increased from £845,460 (in 1911-12) to £876,022. Working expenses increased from £530,068 to £557,737, and the gross profit increased from £326,720 to £329,909. A slight decrease in the revenue per car-mile is due to reductions in fares, and an increase in the traffic expenses is accounted for by increased scale of wages adopted for nearly all grades of labour chargeable to this account. An increase in power expenses is due to the increased price per unit paid to the Electricity Committee consequent upon the higher price of coal. The consumption of electrical energy per car-mile shows a further decrease, notwithstanding the increased number of cars fitted with top covers. The units consumed were 30,514,278 (against 29,890,427 in 1912), and the units consumed per car-mile were 1,625 (against 1,653). Of 629 cars at work, 407 have covered tops, 38 having been fitted during the year. The car-mileage was 18,768,259 (as compared with 18,076,999 in the previous year), the passengers carried, 187,675,183 (against 174,424,237), and the amount paid in relief of rates was £100,000 against £86,000. The profits of the parcels department had risen steadily, and last year were £3,568. The average traffic revenue per mile was 11'20d. The car-miles per day per car averaged 97'2, and the average fare per passenger 1'12d.

**Rotherham.**—The Corporation has under consideration a proposal to substitute a tramways system for the present railless traction system between Rotherham and Maltby.

**Southend-on-Sea.**—The net profits of the Corporation electricity and tramways undertakings for the last financial year amounted to £8,056, of which it is proposed to contribute £4,700 to the rates.

**Swansea.**—At a meeting of the Finance Committee, the hon. treasurer reported that in the original agreement with the Tramways Co. was a clause that in the event of the company paying a dividend of over 6 per cent., there would be an annual payment to the Corporation of £968. Seeing, however, that it was doubtful whether circumstances might arise making such a payment necessary, the chairman said he had substituted a clause by which the company should annually pay the Corporation 2 per cent. on its gross profits. The advantage of this change had already been seen in the payment to the Corporation of the sum of £576 for the last year.

**West Sussex.**—A company is applying to the Light Railway Commissioners for power to construct a light railway between Hunston, West Wittering, West Itchenor and Chichester and Selsey, and to acquire the undertaking of the Hundred of Munhood and Selsey Tramway Co., Ltd.

## TELEGRAPH and TELEPHONE NOTES.

**American Marconi Shares.**—An action has been brought by Mr. O. Locker-Lampeon, M.P., and Mr. P. Wright against the directors of Marconi's Wireless Telegraph Co., Ltd., and others, claiming, as shareholders, a sum of upwards of one million sterling in respect of 500,000 American Marconi shares which were put on the market on April 19th last year. The case is not likely to be heard before the Long Vacation.

**Anglo-Dutch Telephone.**—A Bill has been introduced by the Dutch Government for the establishment of telephonic communication between Holland and Great Britain. The length of the proposed cable will be 165 km., and the cost, which is estimated at £62,000, will be equally shared by the British and Dutch Post Offices. It is proposed to run the cable from Westkapelle (island of Walcheren) to Orford Ness (Suffolk), and it will be laid before September, 1913.

**Australia.**—The Commonwealth Government has obtained a stay of proceedings under the order granted by the Full Court, authorising the Marconi Co. to inspect the wireless installations of the Government. The latter is applying to the Privy Council for special leave to appeal against the decision of the Full Court.

**Australia and New Zealand.**—Experiments have been carried out recently between the high-power stations at Pennant Hills, near Sydney, N.S.W., and Awani, New Zealand, a distance of 1,400 nautical miles, between 11 a.m. and 1 p.m. Communication was successfully maintained without difficulty, during daylight hours. Messages have been received at night at distances up to 4,800 miles.

**Franco-British Telephone.**—The French Chamber has adopted the Bill approving an Agreement for the regulation of telephonic communication between the two countries. The loaded telephone cable has enabled the Electrophone to be used for hearing in London a performance of "Faust" at the Opera in Paris.

**Imperial Wireless System.**—The Select Committee on the Marconi Contract met on Wednesday to consider the draft report of the chairman on the accusations against Ministers. The *Times* states that it is understood that the report, while referring to errors of judgment on the part of Sir Rufus Isaacs and Mr. Lloyd George, exonerates them from any charge of corruption. It is stated that the report finds favour with neither party on the Committee.

**Libel Action.**—The action brought by Mr. Godfrey Isaacs against Mr. Cecil Chesterton (the editor of the *New Witness*) for criminal libel was opened on Tuesday, Sir E. Carson appearing for the plaintiff. The alleged libels imputed corruption to two Ministers as well as to Mr. Godfrey Isaacs. Evidence was given by Mr. H. Samuel regarding the negotiations between the Post Office and the company, and his examination was continued on Wednesday.

**Poulsen Contracts.**—It is reported that as the result of exhaustive comparative tests, the United States Government has placed a contract with the Federal Telegraph Co. for a high-power station at Colon on the Poulsen system, with a range of 3,000 miles by day or night. The Marconi Co. has instituted legal proceedings against the Federal Co. to prevent the execution of the contract, on the ground that it would involve the infringement of 11 Marconi patents.

**The Siemens Quenched-Spark Wireless Telegraph System.**—Messrs. Siemens Bros. & Co., Ltd., have issued a new pamphlet (A. 550) which contains a good deal of interesting data in connection with modern wireless telegraph stations for all classes of mercantile vessels. Messrs. Siemens first took up the manufacture at Woolwich of quenched-spark apparatus in 1910, and since that time they have successfully carried out a large number of installations upon both British and foreign vessels, a particularly large order which has just been completed being for

the equipment of the following vessels owned by Messrs. A. Holt and Co.:—*ss. Keenum, Oanfa, Teucar, Bellerophon, Antiochus, Cyclops, Talithybius, Protesilaus, Izion, Titan, Ajax*. Another large contract recently placed with Messrs. Siemens is for the equipment of the following vessels of the Tank Storage and Carriage Co.'s fleet:—*ss. Cuyahoga, Saranac, Cadillac, Seminole, Kennebec, Tuscarora, Dakotah, Winniebag, Schuykill, Seneca, Uncas, Treumsh, Shaboner, Winamac, Tascabuso, Tamaha, Tahchee*. In addition to orders for the Mercantile Marine, Messrs. Siemens have supplied several foreign Governments with wireless telegraph installations of long range and special design suitable for naval purposes. Besides marine installations, important contracts for large land stations have been, or are being, carried out. We are informed that the system has given exceptionally good results in tropical countries, and has been adopted by the British North Borneo Co. for commercial stations at Lahad Datu, Jesselton, Sandakan and Silimpon; and by the African Direct Telegraph Co., at Freetown and Lagos. From some interesting statistics which are given, it is shown that of the total number of wireless stations throughout the world more than 50 per cent. are equipped on the "Quenched-spark" system, in which an efficiency of 50-75 per cent. is obtained in transforming the primary electrical energy into useful radiated energy. This high efficiency has led to the classification of the standard types of station according to the energy in the antenna, and not according to the primary energy, which is misleading. For example, a 15-kw. installation of the usual open spark type, with an efficiency of about 30-35 per cent., is said to have only the same radiative power as a quenched-spark 5-kw. installation. Other advantages of this system are also pointed out, such as the harmonic nature and high pitch of the propagated waves, which enable atmospheric disturbances to be largely eliminated; and the absence of noise which, with the ordinary spark-gap, necessitates a specially constructed sound-proof cabin occupying a considerable amount of space, sometimes a serious matter on board ship. The latter half of this pamphlet give descriptions of standard types of ship stations which have been designed to embody great compactness of apparatus. One station, which has been specially designed to meet the requirements of the recent American Shipping Acts, and has a guaranteed range of 100 miles by day, is totally enclosed in a roll-front case, of which the dimensions are only 4 ft. 8 in. x 2 ft. 2 in. x 2 ft. 4 in. Several pages of the pamphlet are devoted to records compiled from operator's reports, showing that the ranges guaranteed are greatly exceeded in practice, distances of more than twice the guaranteed range being frequently bridged when engaged upon ordinary commercial traffic. The pamphlet contains a large number of illustrations of apparatus and ships which have been equipped.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Atherton.**—June 10th. Two 150-kw. single-phase transformers, for the U.D.C. See "Official Notices" to-day.

**Australia.**—VICTORIA.—June 2nd. 20,000-volt H.T. switchgear and L.T. switchgear and accessories, for the Melbourne Suburban Railways. See "Official Notices" May 2nd.

June 11th.—Switchgear and instruments, for the Melbourne City Council. See "Official Notices" April 25th.

June 24th.—H.D. copper wire, telephone parts and telephones, for the P.M.G. See "Official Notices" May 23rd.

July 1st. Telephone instruments and submarine cable, for the P.M.G. See "Official Notices" May 23rd.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

July 8th.—Rubber-covered wire, batteries, telephone switchboards, measuring instruments and telephone instruments, for the P.M.G. See "Official Notices" to-day.

TASMANIA.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" May 23rd.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 9th and 30th and August 6th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

June 11th. Metal-filament lamps, for the P.M.G. See "Official Notices" May 23rd.

July 23rd.—Telegraph and telephone instruments, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telephone switchboards and parts, for the P.M.G. See "Official Notices" to-day.

July 30th.—Cable, switchboard, for the P.M.G. See "Official Notices" to-day.

SOUTH AUSTRALIA.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

NEW SOUTH WALES.—July 9th. Switchboards, for the P.M.G. See "Official Notices" to-day.

**Bedford.**—June 20th. About 10,870 tons of hard or soft coal, for the Corporation electricity works. Mr. Charles Stimson, town clerk.

**Belgium.**—The municipal authorities of Liège are about to invite tenders for armoured cables for electricity supply service. Particulars from the Service Communal du Gaz et de l'Electricité, 22, Place St. Jean, Liège.

The municipal authorities of Hody (province of Liège) have just invited tenders for the concession for the supply of electric lighting and power purposes in the town.

**Brazil.**—The contract arranged between the Brazilian Government and a private company for the erection of a telephone line between Rio de Janeiro and Sao Paulo having been annulled, fresh tenders are invited by the Brazilian Ministry of Public Works.

**Devonport.**—June 2nd. Cables, wires and meters for 12 months for the Corporation. See "Official Notices" May 23rd.

**Dewsbury.**—June 2nd. Twelve months' supply (about 4,500 tons) of steam coal for the Electricity Works. Specification, &c., from Mr. R. H. Campion, borough electrical engineer.

**Dundee.**—May 30th. Steam and feed piping, steam feed pumps and hot-well tank, &c., for the Corporation Electricity Department. See "Official Notices" May 16th.

**Germany.**—The municipal authorities of Altheessen are at present inviting tenders for the supply of a 500-kw. transformer for the central electric lighting station.

**Halifax.**—June 6th. One natural draught chimney type water cooling tower, for the Electricity Department. See "Official Notices" May 23rd.

**London.**—L.C.C.—June 3rd. High and low-tension cables for Tramways Department. See "Official Notices" May 23rd.

METROPOLITAN ASYLUMS BOARD.—June 4th. Extension of internal telephone system and installation of signal bells at the Western Fever Hospital, Fulham, S.W. See "Official Notices" May 16th.

ST. PANCRAS.—June 9th. Welsh and other steam coal for the Electricity Department, 57, Pratt Street, N.W.

STEPNEY.—The Electricity Committee is about to invite tenders for arc lamp carbons and coal.

**Manchester.**—The Corporation Tramways Committee invites tenders for the supply and delivery of (a) Tramcar trucks, and (b) Tramcar wheel centres. Mr. J. M. McElroy, general manager.

Providing and fixing electric light fittings at the Grange Street Municipal School, Bradford, Manchester. Education Offices, Deansgate, Manchester.

Offers are invited by the Corporation Tramways Committee for scrap metals and materials. Mr. J. McElroy, general manager.

June 7th.—The Electricity Committee invites tenders for the supply of stores required during the 12 months ended June 30th, 1914. Particulars and forms of tender from Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

**Mexborough.**—May 30th. Lancashire boiler, for the U.D.C. Electricity Department. See "Official Notices" April 25th.

**Oldham.**—May 31st. Extra-high-tension switchboard for the Corporation. See "Official Notices" May 23rd.

**Portsmouth.**—June 11th. Wiring for electric light installation at Workhouse Infirmary extensions, &c., Milton. See "Official Notices" May 16th.

**Rawtenstall.**—June 10th. One 1,500-kw. turbo-alternator complete with condenser, for the Corporation. See "Official Notices" May 23rd.

**Salford.**—June 2nd. 1,000 tons of steel tramway rails. General manager, Corporation Tramways, 22, Blackfriars Street.

**Servia.**—Common-battery wall and portable telephones, table telephones, &c., for the Directorate of the Servian Telephones. Particulars from the B. of T. Commercial Intelligence Department, Basinghall Street, E.C.

**Southampton.**—June 19th. Electric lighting of the old pavilions at the Infirmary, Shirley Warren. See "Official Notices" to-day.

**Spain.**—MADRID.—June 16th. Tenders are invited for a concession to establish an electric tramway service between Rens and Tarragona. Provisional deposit 10,427 pesetas. Particulars, Ministerio de Fomento, Madrid.

**Swansea.**—June 6th. Installation of electric light and bells at the new training college, Glamor, for the Education Committee. See "Official Notices" May 23rd.

**West Hartlepool.**—June 14th. Two 300-kw. rotary converters, complete with transformers, switchgear, &c., for the Corporation. See "Official Notices" to-day.

### CLOSED.

**Belgium.**—Only one tender, that of the Société d'Electricité de l'Est de Belgique was submitted to the municipal authorities of Wakenraedt (province of Liège) for the concession for the electric lighting of the town.

Five concerns submitted tenders to the Belgian Telegraph authorities last week for the supply and erection in the basement of the telegraph station at the Royal Palace at Laeken, of two rotary transformers with accessories, the lowest offer being that of the Société Internationale de l'Electricité de Liège.

**Bennis Contracts.**—The following contracts have been placed with Messrs. E. Bennis & Co., Ltd. :—

Barnsley Corporation electricity works.—Six "Bennis" mechanical stokers and self-cleaning compressed-air furnaces for Lancashire boilers. Repeat order.

Narrow-in-Furness Corporation electricity works.—"Bennis" coal conveyor, &c.

Morcambe Corporation electricity undertaking.—Two "Bennis" stokers and self-cleaning compressed-air furnaces. Repeat order.

**Blackpool.**—A Baths sub-Committee has recommended the tender of Mr. Geo. Morrison, for an electric light installation, for acceptance.

**Buenos Ayres.**—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract for the supply of 12,000 "Wotan" lamps for use on the Buenos Ayres Great Southern Railway.

**Carlisle.**—The T.C. has accepted the following tenders :—

Browett, Lindley & Co.—Engine and dynamo set, £2,708.  
Siring Boiler Co.—Water-tube boiler, superheater, mechanical stokers, &c., £1,810.

Korting Bros.—Multi-jet ejector condenser, £285.

**Cleckheaton.**—The U.D.C. has accepted the tender of Messrs. F. W. Birkett & Son for installing the electric light at the Baths; and those of the Cleckheaton Colliery Co. and Messrs. Wm. Bennett & Sons for coal for the electricity works.

**Dover.**—The Works Committee has under consideration a letter received from Messrs. Dick, Kerr & Co., Ltd., stating that they were not prepared to carry out their tender for the construction of the tramway only in connection with the Council's pier scheme. The Town Clerk reports having been in communication with the next lowest tenderers, viz., Messrs. G. P. Trentham, Ltd., whose price was £3,289, and who were prepared to carry out the work at the price quoted, and Messrs. Paramors, who, as their tender for the road construction had been accepted, were prepared to undertake the contracts for both works for the sum of £15,062, making their price for the tramway the same as that quoted by Messrs. Dick, Kerr & Co.

**East Ham.**—The following tenders have been accepted by the T.C. :—

Ray Electric Co.—Installation of electric light at sewage works, £67.  
Dick, Kerr & Co., Ltd.—Supply of permanent way material required in connection with the reconstruction and duplication of the tramway track in High Street North, £776 (quotations were also received from the Titan Trackwork Co., and Hadfield's steel Foundry Co.); 50 tons of 90-lb. girder tram rails, £8 16s. per ton.

**France.**—The French Post and Telegraph authorities in Paris have placed a contract with La Société des Ateliers de Constructions Electrique du Nord for 200 km. rubber and fireproof cotton-covered copper cables, and one with the Société des Trefileries du Havre for 100 km. ditto.

**Grimsbey.**—The Lighting Committee of the T.C. on Monday accepted the following tenders :—

British Westinghouse Co., Ltd.—Condensing plant, £550.  
Blake & Co.—Cooling tower, £129.  
Key Engineering Co.—Conduits, £124.  
Bertram Thomas.—Switchboard, £302.  
Hipkin, Grimsby.—Foundations, £454.  
J. Brown & Co.—Pitch.

**Keighley.**—The Electricity Committee has accepted the following tenders :—

British Thomson-Houston Co., Ltd.—Turbo-alternator plant, £700.  
Herbert Morris, Ltd.—Supply and fixing runways, £112.  
Hird Bros. & Co.—Reinforced concrete water tower, £388.  
J. A. Mullen.—Painting and decorating and repairs to roof at electricity works, £58.

The Tramways Committee has accepted the tender of Trackless Trolley, Ltd., for two trolley vehicles, at £1,420.

**London.**—STEPNEY.—The tender of the B.I. and Helsby Cables, Ltd., to supply 24 street boxes for £129, six for £61 10s., and that of the Universal Electrical Manufacturing Co. for six street boxes for £62 5s., have been accepted by the B.C.

**Mexborough.**—The U.D.C. has accepted the tender of Messrs. Galloways, Ltd., for a Lancashire boiler for the electricity works, at £723.

**Norwich.**—The T.C. has accepted the following tenders for coal for the electricity works :—

W. Cory & Son, Ltd.—4,000 tons Scotch washed peas, 15s. per ton, f.o.b. Bo'ness or other port; 1,000 tons of Newdigate peas, at 16s. 8d. per ton, f.o.r. Norwich; and 1,000 tons of Arley peas, at 16s. 10d. per ton, f.o.r. Norwich.

E. Collier & Sons, Ltd.—2,000 tons of Newstead nutty slack delivered into bunkers at the works, at 17s. 1d. per ton.

**South Africa.**—Messrs. Siemens Bros. Dynamo Works, Ltd., have obtained a contract for 3,500 "Wotan" drawn-tungsten wire lamps for the Union of South Africa.

**Southend-on-Sea.**—The T.C. has accepted the following tenders :—

Korlund Anti-Vibration Co.—Two anti-vibrators under the concrete foundation for the two 500-h.w. steam generators, £144.  
Edward Bennis, Ltd.—500 ton capacity coal-conveying plant, £2,000.  
Chloride Electrical Co.—Four cells for storage-battery, £88.

**Stalybridge.**—The Joint Tramways and Electricity Board has accepted the tender of Messrs. Tinkers, Ltd., for boilers.

**Taunton.**—The T.C. has accepted the tender of Messrs. Warner & Co. for a steam-driven feed pump for the electricity works, at £74.

**Walsall.**—The T.C. has accepted the tender of Callender's Cable & Construction Co., Ltd., for cable, at £601, and that of the British Westinghouse Co., Ltd., for sub-station equipment, at £167.

**West Ham.**—Mr. H. R. Mansfield has received an order from the Corporation for a 12 months' supply of stoneware ducts, at £27 3s. 9d. per 1,000 delivered.

**West Kirby (near Birkenhead).**—The Electric Supply Committee of the U.D.C. has decided to purchase a 400-kw. steam alternator and engine (£2,491) and condensing plant (£1,749), the successful firms being Messrs. Siemens Bros., Messrs. Belliss and Morcom, and Messrs. Ledward & Beckett, respectively.

**Woolwich.**—The B.C. has accepted the tender of the British Electric Transformer Co., Ltd., for a supply of transformers on the following basis prices for the respective sizes :—45 k.v.a., £199; 40 k.v.a., £138; 5 k.v.a., £41 5s.; 90 k.v.a., £316. The tender of the Yorkshire Copper Works, Ltd., has also been accepted for a supply of tubes for re-tubing the second large condenser at the Plumstead works, at 10d. per lb.

### FORTHCOMING EVENTS.

**Institution of Electrical Engineers.**—Friday, May 30th. At 8 p.m. London Annual General Meeting. Paper on "Practical Application of Telephone Transmission Calculations," by Mr. A. J. Aldridge.

**Physical Society.**—Friday, May 30th. At the Imperial College of Science, South Kensington, 8.W. Paper on "Electro-Thermal Phenomena at the Contact of two Conductors with a Theory of a Class of Radio-Telegraph Detectors," by Dr. W. H. Eccles.

**Royal Institution of Great Britain.**—Saturday, May 31st. At 8 p.m. Lecture on "Radioactivity; the Origin of the Beta and Gamma Rays and the Connection Between Them," by Prof. I. E. Rutherford.

Thursday, June 5th.—At 8 p.m. Lecture on "Recent Chemical Advances; The Structure of Crystals," by Prof. W. J. Pope.

Saturday, June 7th.—At 8 p.m. Lecture on "Radioactivity; The Radioactive State of the Earth and Atmosphere," by Prof. E. Rutherford.

**Illuminating Engineering Society.**—Tuesday, June 3rd. At 8.30 p.m. At the Royal Society of Arts, Adelphi, W.C. Annual general meeting.

**Institution of Mining Engineers.**—Thursday, June 5th. At 11 a.m. At Ethington House, Ely. General meeting. Paper on "Insulated and Bare Copper and Aluminium Cables for the Transmission of Electrical Energy, with Special Reference to Mining Work," by Mr. B. Welbourn. Followed by visit to the Mining Machinery Exhibition, at the Royal Agricultural Hall, N.

Friday, June 6th.—At 10.5 a.m. Excursion to Chingford Reservoir of the M.W.B.

### THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, June 2nd.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 6th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.

Tuesday, June 3rd.—"B" Company. Ditto.

Thursday, June 5th.—"C" Company. Ditto.

Friday, June 6th.—"D" Company. Ditto.

Saturday, June 7th.—Headquarters will be opened for regimental business from 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.  
For Officer commanding L.E.E.

**Strike Trouble at Manchester.**—A correspondent writes: "The overhead wiremen forming the night shift on the Manchester Corporation Tramways decided to come out on strike, and at midnight on Monday the men on duty ceased work. The men allege that after concessions had been granted, the management stultified them by appointing a number of time-expired men from the Navy who, it is said, were paid less than the usual rate. It was understood that the Tramways Committee should receive a deputation from the Electrical Trades Union on Thursday.

**Inquiries.**—A reader asks for advice as to the best metal to use for handling juices containing acetic acid; another urgently requires armature stampings up to 7 in.

## NOTES.

**A Contributor Thanked.**—For several weeks we have been asking for £600 for the E.T.B.I. To-day we are asked to advise the contributor at Wimbledon who sent the sum of five shillings to Mr. P. A. Lundberg, a member of the Committee, on behalf of the Fund, and omitted to send his name, that his donation has been received.

**Electrical Machinery, &c., Imported into India.**—The India Office has issued a volume of tables dealing with the trade of India during the years 1907-8, 1908-9, 1909-10, 1910-11 and 1911-12, which show that the United Kingdom continues to hold a big lead over other countries in regard to the electrical machinery she exports to that country. In 1911-12 the United Kingdom sent electrical machinery to the value of £193,231, as compared with £182,014, £177,773, £204,682 and £153,674 respectively in the four preceding years. Germany's total in 1911-12 was £30,007, as against £50,496, £7,133, £4,584 and £15,990 in the four preceding years. The United States sent machinery to the value of £26,223, and Italy to the value of £12,842. Under the heading of "Electrical instruments, apparatus and appliances, and parts thereof," the value of the goods sent from the United Kingdom was, in 1911-12, £390,662, as compared with £294,344, £263,593, £282,809 and £295,559 in the preceding four years respectively. In the last recorded year Germany sent such goods of the value of £35,266, and the United States of the value of £5,401.

**Experiments on Tungsten Lamps.**—The Engineering Standards Committee has issued Parts Nos. 1 and 2 of the Report of Experiments on Tungsten Filament Glow Lamps (No. 60). The experiments were undertaken by the National Physical Laboratory to assist the Sub-Committee on Physical Standards of the Engineering Standards Committee in dealing with the question of tungsten filament lamps from the point of view of standardisation. Although the number of lamps tested for useful life was not large, the lamps dealt with were representative, and a very large number were tested for candle-power rating, being lent for that purpose by several large users. The diagrams accompanying the report form a separate volume in order that the text and the diagrams may be more easily compared and studied. A careful perusal of the report affords a large amount of useful and interesting data as to the uniformity in individual batches of tungsten lamps as made in this country and, although the makers of the lamps are referred to under a letter of the alphabet and not the actual name, the report generally should prove of considerable advantage to all large buyers and of real interest to the industry at large.

**The Metric System.**—The annual report of the Decimal Association states that all measures and weights in the new British Pharmacopœia will be in the metric system. In view of the adoption of the metric carat of 200 mgm. in the United States, the London jewellers are doing their best to have its use made compulsory throughout the trade. The Government of the Union of South Africa introduced a Bill last year adopting the metric system, but pressure of other business prevented its passage. The Dominions Royal Commission, which was appointed last year to inquire into the trade of the British Empire, has been urged by the Congress of Chambers of Commerce of the Empire to press the adoption of uniform weights and measures, the metric system being recommended. The system will be adopted in Malta on July 1st next year. Siam and China have taken definite steps towards the introduction of the metric system, which has also received the official approval of the Russian Government, embodied in legislation extending its permissive use, and preparing for its obligatory adoption.

When Russia has completed this process, the only great nations continuing to muddle along with a hedge-podge of heterogeneous and chaotic units will be the two which pride themselves on being the leaders of civilisation—the United States and the United Kingdom (not the British Empire, for by that time the Dominions will have made the change).

**When a High-Voltage Wire Breaks.**—What happens when a high-pressure electric wire breaks is shown in the accompanying photograph of a cement sidewalk in a California city. The wire fell upon it and writhed about, emitting sparks and flames until the current was shut off. After the danger was over and the



MARKS OF FUSION ON CEMENT.

wire removed, it was found that the electricity had fused the cement where it had come in contact with it, burning little depressions about half an inch deep and an inch or more wide, which were glazed like china ware. This gives an idea of the exceedingly high temperature, for cement is by no means easy to fuse.

**Distinctive Street Lights.**—San Bernardino, California, is planning to install a distinctive form of lamp post in the shape of an arrowhead, the significance of this design being a natural landmark on one of the near-by mountains, a huge arrowhead, several acres in extent, which forms a bare place on the slope, and which was regarded by the Indians as the sign of the Great Spirit. As the "City of the Arrowhead," San Bernardino has



A SYMBOLIC LAMP-POST.

sought to emphasise its symbol, and to that end street lights of that design have been installed. Two forms have been displayed on the city streets, and the people will decide which is better adapted to the purpose, after which all the city lights will take that form. One of them is mounted upright on an ordinary standard, the outline of the arrowhead, point downward, carrying four large globes with bulbs. The illustration leads us to speculate on the possible results of applying the idea in this country; what, for instance, would be the devices adopted by Burton-on-Trent or Coventry, or Yarmouth?

**Cable Discounts.**—Under the above title, in our issue of August 30th last year, there appeared a series of formulae designed to facilitate the working out of net prices of cable from the list prices. The recent alteration in the discounts necessitates a new set of formulae; and they are given hereunder. "L" of course, is the list price per mile, expressed in pounds and decimals thereof.

$$\begin{aligned} \text{C.M.A. } \text{£ per mile} &= 10L \times \frac{1}{2} \times \frac{1}{2} - \frac{1}{1000} \text{ of the result.} \\ \text{s. per coil} &= 100L \times \frac{1}{2} \times \frac{1}{2} - \frac{1}{100} \text{ of the result.} \\ \text{d. per yard} &= 10L \times \frac{1}{2} \times \frac{1}{2} - \frac{1}{100} \text{ of the result.} \\ \text{"Non." } \text{£ per mile} &= L/2 - L/90 + \frac{1}{1000} \text{ of the result.} \\ \text{s. per coil} &= L/2 + L/9 + \frac{1}{100} \text{ of the result.} \\ \text{d. per yard} &= L/10 \times \frac{1}{2} + \frac{1}{1000} \text{ of the result.} \end{aligned}$$

In each case the terms in roman type give an approximation only, sufficiently close, however, for all practical purposes. If greater accuracy is desired, the inclusion of the final term—that in italics—will give results correct to five figures. As an example, take "non-association" cable of a list price of £100 a mile. The price per yard, according to the last formula above, would be 6'6666 . . . pence, as a first approximation; or 6'6733 . . . pence, as corrected by the inclusion of the final term. The exact figure, worked out by the usual lengthy process, is 6'6732954 pence. The discrepancy of '0000378 pence per yard is not likely to disturb the equanimity of the most conscientious of contractors.—H. R. T.

**Electric Cooking Demonstrations.**—For several days last week, one of the larger rooms at the Town Hall, Stratford, was given over to the very useful purpose of initiating those members of the public who were sufficiently interested to attend in response to an invitation from the Corporation Electricity Department, into the mysteries and the economies and manifold other advantages of electric cooking. The msgician, lecturer, demonstrator and cook, all rolled into one—though we ought to explain that he repeatedly, and with emphasis, asseverates that he is no cook at all, but only an engineer—was the peripatetic, ubiquitous, irrepresible Mr. Grogan. With all that he said in the course of an hour's rapid and effective conversational, but none the less convincing, lecture, punctuated here and there with the pungent odours of grilling bacon, display of the artistic pattern on electric toast, and so on, we need not deal, but it undoubtedly admirably answered the purpose for which it was designed. Did it not set the fair sex looking at each other in astonishment as the "Tricity" advocate got his points home? And did it not set them asking all sorts of searching questions when the lecturer had got home on that question of shrinkage, and had at last shut down? Did it not send the representative of the gas company away speechless—yet bursting with indignation? Two audiences per day gathered; sometimes they were larger than at other times, but

we are sure that this sort of thing can only do good to the electrical cause, bring grist to the mill of the "Tricity" apparatus makers and sellers, and cooking and heating load to the West Ham Corporation electricity supply department. In the main, of course, it was for this last-named purpose that the demonstrations were organised by Messrs. Gillespie & Beales, the sole wholesale selling agents for "Tricity" cookers. Mr. Grogan advocates hiring out apparatus, and tells stories of what happens to a borough electrical engineer away in the "wilds of Cumberland," whom housewives will give no rest because all this year's allowance have been hired out and there are none left for them. The electric supply department at West Ham established its new cooking and heating department last autumn, with Mr. Sellars, formerly of Newcastle, in charge thereof, and between then and now a 250-kw. load of this class has been connected. Those who do not know the salubrious neighbourhood of Stratford and West Ham might not at first place it in the same category as Marylebone or Brompton and Kensington, Tunbridge Wells or Harrogate from the residential cooking load point of view, but we have no doubt that the West Ham department, if it continues to run on its present aggressive lines under the control of Mr. J. W. Beauchamp and Mr. Farndon, the sales manager, and introduces those reduced charges for the cooking directly, will show that anybody anywhere is only too glad to get something for nothing, with something else thrown in.

**Electricity Supply Rifle League.**—On Saturday last (Empire Day) there was a representative gathering from the various clubs composing the above League, on the range of the Hackney Electric Rifle Club, at Millfields Road, Clapton. The object of the meeting was a friendly tussle amongst the 37 competitors for the prizes offered for the best shots at 25, 50 and 100 yards, with a handicap competition at 25 and 50 yards as an inducement for the less experienced shots. Amongst those present to witness the shooting were the president, Sir Alexander Kennedy, F.R.S., Mr. L. L. Robinson (borough electrical engineer, Hackney), and Mr. A. H. Shaw (electrical engineer to the Ilford U.D.C.).

The 25 yards competitions were decided first, and included a scratch competition, handicap competition, and a rapid-firing competition (10 rounds in 90 seconds). A "possible" was recorded by Mr. F. Winchcombe, of the Westminster Electric Club, and secured first prize. For the second place there was a tie at 98 between Mr. Weekes, of Shoreditch, and Mr. Neville, of Westminster, and the re-shoot ended in favour of the former. The handicap competition drew 36 entries, with the following results:—

1st.—Mr. J. K. Wells (Central), 98 plus handicap 1'14	...	99'14
2nd.—Mr. A. J. Randall (Poplar), 93	"	6
3rd.—Mr. W. H. Dice (Ilford), 93	"	5'68
		...
		99'00
		98'68

In the rapid-firing series Mr. Weekes, of Shoreditch, took first prize with a score of 95, whilst Messrs. Harvey (Central) and Hilling (Hackney) tied for second place with 93, and in the re-shoot the former was successful.

In the 50 yards scratch competition, Messrs. Wells (Central) and Weekes (Shoreditch) each scored 96 and had to re-shoot to decide the winner; the result was a win for the Shoreditch crack.

The handicap competition again drew the largest number of entries, and resulted as follows:—

1st.—Mr. G. Horley (Westminster), 98 plus handicap 1	...	99'00
2nd.—Mr. A. J. Randall (Poplar), 88	"	10'28
3rd.—Mr. A. G. Hilling (Hackney), 95	"	3'12
		...
		98'28
		98'12

There were 19 entries for the 100 yards scratch competition, which resulted in Mr. W. J. D. Partridge (Westminster), with a score of 95, securing first place, whilst there was a tie for second between Mr. Weekes (Shoreditch) and Mr. Hilling (Hackney), who scored 94 each, but in the re-shoot the former was an easy winner.

The championship of the meeting, carrying a gold medal, was decided upon the aggregate of the three scratch events, and resulted in a win for Mr. Weekes, of Shoreditch, with a total of 288, the next highest being Mr. F. Winchcombe, of Westminster, with a total of 284.

After the ties had been decided, the president presented the prizes to the successful competitors, and the proceedings terminated with the usual votes of thanks to all concerned.

**Fatalities.**—Frank Stafford (36), of Gorton, Manchester, met with a fatal accident at the electricity sub-station on the L. & Y. Railway at Holcombe Brook, near Bury, on Friday. He was working in the station where machinery was being completed in preparation for a trial run of the experimental electrical railway from Bury to Holcombe Brook, and he fell from a plank a distance of 20 ft., alighting on his head.

Edmund Sheard (37), tramcar conductor, of Atherton, died last week. On April 23rd he was the conductor of a South Lancashire Tramway Co.'s car, which got out of control whilst descending a hill. Two passengers, fearing a collision with another car, rushed out and accidentally knocked the conductor off the platform. Sheard was found to be suffering from concussion of the brain, and he died last week from his injuries.

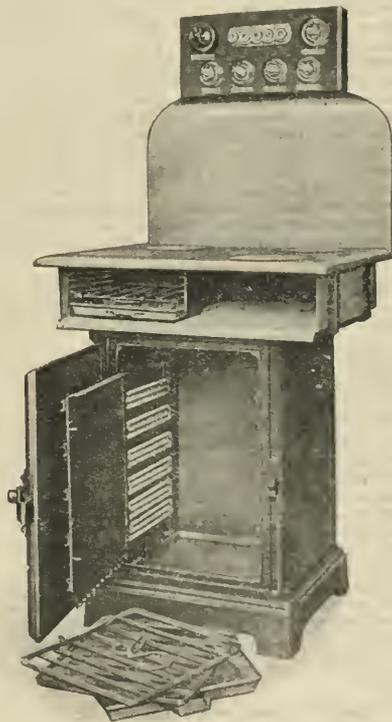
The *Glasgow Evening Times* reports that a miner named Joseph Davia was killed while working in Kenmuirhill Colliery, Carmyle. It is supposed that Davia in some unaccountable way came in contact with the electric cable, but nothing was known of the accident till his comrades discovered him lying dead. Deceased was 28 years of age.

A lady was killed last week in a bath at St. Cloud by pressing the bell-push, which had somehow become connected with a high-voltage circuit. Death was instantaneous.

**Illicit Commissions.**—At the West London Police Court, a few days ago, Henry Hart, a motor agent, was fined £15, with £5 ss. costs, by Mr. Fordham who, fortunately for him, took the view that he had acted as a fool rather than as a knave; and, therefore, did not send him to prison. That the first half of Mr. Fordham's estimate of his conduct was about right seems clear from the fact that he made his corrupt offer in a letter to a buyer of motor lorries in the service of Messrs. Lever Bros., of Port Sunlight, Mr. Arthur Davies, who took the proper course of showing the letter at once to his principals. The case was taken up by the Secret Commissions and Bribery Prevention League; and we are pleased to report their success in dealing with it. We trust that the good example shown by the buyer and his principals will be followed by others in similar circumstances, and that advantage will be taken of the League's organisation whenever occasion arises. It is a public duty to stamp out bribery and blackmail without respect of persons.

**Turbine Steamer Driven by Electricity.**—It is reported from Sweden that the Steamship Co. Svea has recently placed an order with the Lindholmen Shipbuilding Yard, in Sweden, for two turbine steamers, one of which is going to be delivered in the course of the autumn, while the second will be completed in the course of the spring next year. Both steamers are cargo ships, and will be employed for the coasting service. Their loading capacity will be about 1,200 tons each, and they are to be constructed for a speed of 11 knots, and supplied with engines capable of developing 1,000 I.H.P. The ships will be constructed as sister ships, but, as far as the machinery is concerned, one will represent quite a new departure from the ordinary types, as it is going to be fitted with turbines, and will be run by means of electricity. These turbines will be supplied by the Aktiebolaget Ljungströms Aangturbiner (steam turbine).

**The Belling Electric Cooker.**—Messrs. Belling & Co., of Enfield, N., are introducing the electric cooking stove shown herewith, with a view to meeting the undoubted demand for this class of apparatus at the present time. It will be seen that it includes a lagged oven 15 in. sq. and 21 in. high, with heating elements (the firm's standard fire-bar elements) on the two sides, in connection with which three different temperatures can be obtained. Above the oven is a grill with three-heat control and plate warmer, and over these a top plate with three three-heat boiling rings. The total electrical loading is:—Three boiling rings, 1,500 watts



THE BELLING COOKER, SHOWING OVEN HEATERS.

each; griller, 1,750 watts; oven, 2,500 watts. The crown plate over the oven, and the splash plate at the back are white vitreous enamelled, and over the latter are mounted the control switches; the boiling rings have no mica in their construction, and are guaranteed for a year. There is not a single joint or electrical connection inside the oven, and the makers claim that cold water, grease or dirt can be thrown on to the Belling fire-bar elements without causing the slightest injury.

**Institution and Lecture Notes.**—**INSTITUTION OF ELECTRICAL ENGINEERS.**—The fifteenth annual meeting of contributors to the Benevolent Fund will be held at the Institution offices to-night (Friday) at 7.45 p.m., to receive the report of the Committee of management and the accounts for the year ended December, 1912. The income and expenditure account shows, that with £605 brought forward, the income amounts to £893. Out of this grants have been made to the tune of £31, and there is transferred to capital £642, that is the whole of the amount brought forward and £37 beside. The balance carried to the balance-sheet is £217. The capital is £4,642 invested in 3, 3½ and 4 per cent. stocks, and the year's dividends therefrom amounted to £136. The donations of under £5 received during the year totalled £10 11s. 6d., £5 and over, £71 5s., and annual subscriptions £65 12s.

**JUNIOR INSTITUTION OF ENGINEERS.**—A paper was recently read before the above Institution by Mr. Archibald Alison, on "Heat Accumulators and their Use in Exhaust Steam Turbine Plants."

**ASSOCIATION OF ELECTRICAL STATION ENGINEERS.**—A general meeting of the London Section was held at Salisbury House, on May 22nd. A set of rules for the Association was put before the meeting for their approval, a number of additions and amendments were made, and the rules were finally agreed to. They are to be submitted to the branches for approval before being finally ratified by the London conference of delegates. A proposal was made that a junior section be formed to include pupils, apprentices, &c., and that the annual subscription for this Section should be 5s., with an entrance fee of 1s.; this was agreed to unanimously. On a report being given on the circumstances leading to the resignations and subsequent withdrawal of some of the Life Power Co's running staff, the meeting unanimously passed a resolution that the Committee be empowered to take any action at its own discretion. In the meantime, the Committee has decided to have printed in leaflet form details of this case and others, and to circulate them widely amongst station engineers, to show the absolute necessity for the organisation of electrical station engineers.

The Manchester branch recently held a meeting at the Crown Hotel, when a paper was read by Mr. J. W. Thomas, on "The Status of Electrical Station Engineers and the Need of an Association," which was followed by a lively discussion. The latter part of the meeting took the form of a social evening, and a few musical items were rendered.

The above paper is to be read at an extraordinary general meeting of the Association in London next month. This meeting will be arranged to be coincident with the conference of delegates from all the principal centres of the United Kingdom, and the delegates will be asked to report on the progress and views expressed by the various branches concerned. The date and fuller details will be announced shortly.

**THE CONCRETE INSTITUTE.**—The report of the Council for the past session shows that on May 8th there were 947 members, and the total membership was 1,006, an increase of 98. It is proposed to form classes of Associate Members and Associates. The income for the year was £1,043, and the expenditure £951, leaving a surplus of £92. The assets were valued at £475. The third annual dinner of the Institute was held at the Connaught Rooms on May 22nd, Mr. E. P. Wells, the president, being in the chair.

**ASSOCIATION OF MINING ELECTRICAL ENGINEERS.**—A lecture on "The Manufacture of Electric Cables" was given by Mr. F. F. Unwin, Birmingham, to a meeting of the Association at Cardiff, on Saturday, May 17th.

**The Thames Ironworks.**—It is reported that Messrs. Vickers have purchased the Thames Ironworks at Greenwich as a joint concern. The Canning Town property has been taken over by the Great Eastern Railway Co. Another newspaper report says that the plant and machinery still remaining on Wednesday morning had been sold to Mr. W. Defries, of Defries, Ltd., ironfounders and engineers, Antelope Foundry, Deptford.

**Appointments Vacant.**—Assistant engineers (21-24) in Engineer-in-Chief's Department, G.P.O.; shift engineer for Stockton-on-Tees (32s.); commercial assistant, for the Birmingham Electricity Department (£100); chief assistant electrical engineer, for the Corporation Electricity Department, Gillingham (£150); junior engineer, for the Morley Corporation Electricity Department; visiting teacher of electric wiring, for the L.C.C. School of Engineering and Navigation, Poplar (10s. 6d. per evening); sub-station shift engineer, for the Electricity Department, Bristol (35s.); switchboard attendant, for Portsmouth Corporation (25s.); switchboard attendant, for Salford Corporation (26s.). See our advertisement pages to-day.

**Strike.**—It is reported that 4,000 men employed by Messrs. Stewarts & Lloyds, Ltd., at Halesowen, came out on strike on Wednesday.

**The "Times" Time.**—We have noticed with interest that for some days the clock over the doorway of our honoured contemporary, the *Times*, has been deprived of its hands. This may be a drastic punishment for past errors, but from personal experience extending over many years we can vouch for its justice. This particular clock is—or rather has been—one of the most persistently mendacious "time-keepers" (save the mark) with which we are acquainted, and its face ought to be as crimson as a blush rose. We trust that its present forlorn condition is a sign of coming reform. But the *Times* does not stand alone; the condition of the public clocks of London is a scandal which reflects the greatest discredit upon the capital of our Empire. The constantly varying discrepancy between the said clock and that of Messrs. Spicers & Pond close by has amused us, at the same time that it has

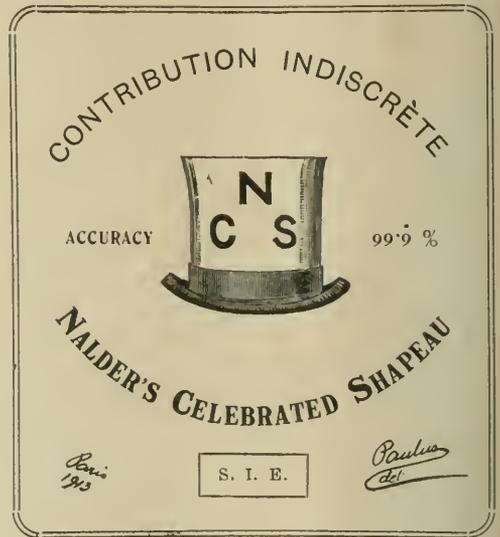
emphasised the need of strong measures. London is dotted all over with clocks showing false time, many of them under the control of professional watch and clock makers.

Some clockmakers, however, have condescended to introduce Greenwich time—which is now so cheap that they all ought to employ it. We are glad to be able to add that we have never known the clock of St. Paul's Cathedral to be wrong, though from our position on Ludgate Hill we have it constantly under observation, and Messrs. Benson's clock close by affords a reliable standard with which to check it.

**The Leicester Strike.**—A Leicester paper records that "the dispute in the electrical trade has ended, and the operatives are to return to work forthwith." According to the new agreement, the experienced wiremen are to get 9d. an hour in August, and the others a minimum of not less than 8½d.

**Stealing.**—At the Lambeth Police Court on Tuesday a labourer, named Randall, was sentenced to six weeks in the second division for stealing electric fittings, the property of the Southwark Borough Council.

**A Noted Tile.**—We have been asked to insert the accompanying device as an interesting souvenir of the I.E.E. visit to Paris. The allusions will be appreciated by those who were present at the meeting and who will recognise a familiar landmark,



the subject of many facetious comments, which were received by the wearer with unflinching good humour. The design was elaborated by a self-appointed committee, and formally submitted to the President and the gentleman most closely concerned for approval.

**Failure of the Telephone Service.**—A fire at a lace factory near Nottingham, says the *Times*, caused damage to the extent of more than £20,000 on Saturday last; the fire broke out at the top of a seven-storey building, and attempts were made to call the fire brigade from Nottingham, which is less than three miles away, but for half an hour it was impossible to get through on the telephone. Eventually a call was put through on a private wire, and the motor fire engines arrived in a few minutes, after which they quickly brought the fire under control, and saved the greater part of the factory. Had it been possible to effect communication directly the fire was discovered, obviously the loss would have been comparatively trivial.

This is another glaring example of the inefficiency of the telephone service under the Post Office régime; the fact that complaints have been frequent since the Government assumed control is notorious, but, as we pointed out a year ago, it was hardly fair to criticise the Post Office severely in the early days of its rule. Now, however, 17 months have elapsed since the Department acquired the telephone system, and it cannot be denied that the service is in a parlous condition. Thousands of would-be subscribers are awaiting connection, but whether they are worse off than those who have been unlucky enough to get telephones installed is open to question. Wrong numbers, premature disconnection, noises in the receiver, and delays are only a few of the faults within our own experience which characterise the service under its present managers. Before the transfer we warned the public that they would regret its consequences, and our prophecy has been abundantly verified.

**Balfour v. Tillett and others.**—For several days this week, Mr. Justice Darling and a special jury have been occupied with an action by Mr. Balfour, of Messrs. Balfour, Beatty & Co., against Ben Tillett and the *Glasgow Daily Record*, for damages in respect of a libel telephoned and published during the Parliamentary election at Govan, Glasgow, when plaintiff was the Unionist candidate. Yesterday it was announced that the action had been settled, the *Daily Record* paying £1,000 damages.

## THE ELECTRICAL INDUSTRY IN FRANCE.

BY GEORGES DARY

*(Concluded from page 874.)*

THE first of these lines which has been in regular operation for over a year is that from Villefranche de Conflent to Bourg-Madame, *viâ* Montlouis; it includes gradients of 1 in 20 and even 1 in 15, and curves of 262 ft. radius. The track has a gauge of 3 ft. 3 in. The line forms an extension of the railway from Perpignan to Prades and Villefranche, which is still operated by steam locomotives. The station at Villefranche is located at an altitude of 1,426 ft. above sea level. From that point the line rises to a height of 5,277 ft. at Montlouis, whence it falls, until on the southern side, at Bourg-Madame, the altitude is 3,608 ft.

There was a good deal of very difficult engineering work on the line, which the engineers of the Midi Co. succeeded in overcoming. The Fonpedrouse viaduct and the Gisclar bridge may, amongst others, be mentioned as architectural triumphs, which mark the line as one of the most curious and noteworthy in France. Its construction once more demonstrates the truth of the old saying that the word "impossible" is not French, and that with the aid of science and perseverance even the most daring project can be accomplished.

The necessary electrical energy is produced at a power

River Têt is confined in the reservoir by means of a dam 1,312 ft. long established at La Bouillonne. A canal,  $3\frac{1}{2}$  miles in length, conveys the water to the power station, two reserve reservoirs along the route being also provided. Sluice gates are also provided to enable the water to be turned into one or other of these reserve reservoirs according to the season and the requirements. The head of water is 1,394 ft.

The generating sets are four in number (fig. 4); they comprise 1,500-h.p. Pelton type turbines and direct-coupled double-current dynamos with fixed fields and rotating armatures. The normal output of the generators is 650 kw., a temporary overload capacity of 60 per cent. being possible. Each dynamo can supply its total output, either as continuous current at 850 volts or as six-phase alternating current at 600 volts and 25 periods. The four transformers are each directly connected to their respective generating sets, and

convert the six-phase 600-volt current to three-phase 20,000-volt current.

The overhead high-tension line, which starts at the power station, supplies the current to five sub-stations, situated at Villefranche de Conflent, Thuès, Odeillo, Err and Bourg-Madame. The line, which runs alongside the railway track, is composed between Bourg-Madame and the power station, of six cables of siliceous bronze with a section of 10 sq. mm., supported by triple-bell porcelain insulators. The three conductors of each line are separately grouped on cross arms on the poles, in the form of a triangle

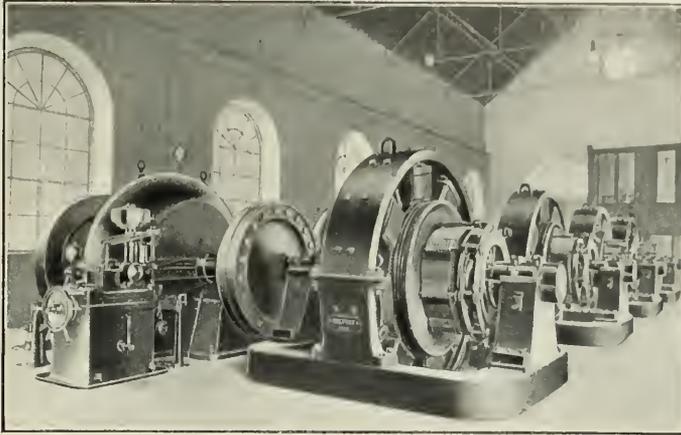


FIG. 4.—HYDRO-ELECTRIC PLANT AT LA CASSAGNE STATION.



FIG. 5.—POWER STATION AT LA CASSAGNE.

station situated on the banks of the River Têt, near the village of La Cassagne (fig. 5); it comprises a basement and a ground floor. Located in a part of the basement are the water-control gates and the turbine regulators; in another part are installed the step-up transformers. Above, on the ground floor, is the engine room and the low-tension switchboard. The high-tension control gear is situated on a gallery. The turbines are supplied with water from a reservoir having a capacity of about 47,700,000 cb. ft., built at the foot of Mont Carlitt, at an altitude of 6,724 ft. The water of the

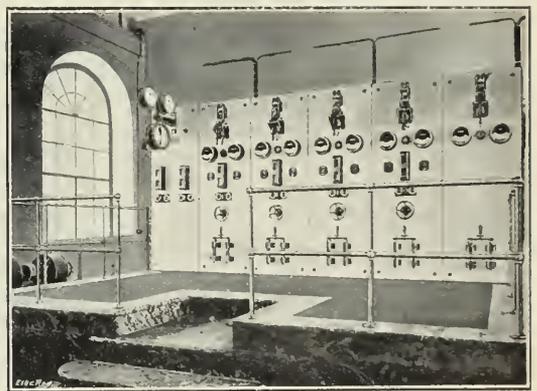


FIG. 6.—SWITCHBOARD, LA CASSAGNE STATION.

having sides measuring  $27\frac{1}{2}$  in. The poles are set at an average distance apart of 114 ft.

Between the power station and Villefranche, the line consists of three aluminium cables of a section of 70 sq. mm., and of three aluminium cables of 30 sq. mm. section. In this case masts of armoured cement have been employed in place of wooden poles. At the power station and near the sub-stations the lines pass into overhead sectioning boxes containing disconnecting switches operated by means of a winch. By this arrangement, it is possible to cut out the three cables of one line on one or more sections.

The five sub-stations above mentioned, and the power station, supply continuous current at 800 volts pressure to the rails. The plant at the sub-stations is identical, and consists of two groups, each comprising a step-down transformer and a rotary converter arranged in a single room. A brickwork extension supports the high-tension apparatus, distribution panels being also attached to the brickwork. The transformers have a normal capacity of 600 kw., or 750 kw. for a period of two hours. For the brief space of five minutes they are also able to withstand an overload of 100 per cent. They receive three-phase current at 20,000 volts, and give out six-phase current at 600 volts.

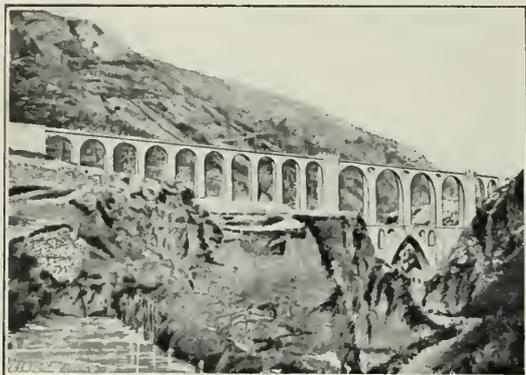


FIG. 7.—VIADUCT ON THE VILLEFRANCHE BOURG-MADAME LINE.

The rotaries, which are of the fixed field type, produce continuous current at 800 volts and run at a speed of 250 R.P.M. Each machine has mounted on one of its bearings a relay actuated by a centrifugal device keyed on the end of the shaft and intended to break the circuit by means of a cut-out should the machine exceed a speed of 300 R.P.M., or should it, on the other hand, endeavour to run in the reverse direction. Starting is effected by passing through the armature the current from the third rail of the track, the machine then running as a continuous-current motor.

The power rails are of the double flange type and weigh 79.2 lb. per yard, their length being 36 ft. The ohmic resistance is 0.027 ohm per kilometre (0.0432 ohm per mile). The rails are supported every 9 ft. 10 in. on glazed stoneware insulators laid on blocks of creosoted wood, the latter in turn being secured to the sleepers. At level crossings the rail is interrupted and replaced by an armoured cable buried in the ground; at the stations it is protected by fibrocement casings. The running rails are of the Vignoles pattern, and weigh about 71 lb. per yard; they are connected up in parallel every 328 ft. by a transverse copper connection, in order to ensure communication in case of fracture or replacement of a rail. A similar connection is provided at the points.

The motor vehicles are of two types for passenger and goods service. The first measure 47½ ft. between the buffers, and contain seats for eight first-class and 36 second-class passengers, a luggage compartment and driver's compartments at both front and rear. The goods vehicles have a length of 35½ ft., and have only one driver's compartment. The electrical equipment of the vehicles comprises four series-motors each of 50 H.P., mounted in pairs on each bogie. The control system adopted is of the Sprague multiple-unit type, with certain interesting modifications.

At the present time, the rolling stock comprises 20 motor vehicles and 14 trailer carriages for passenger trains, 65

special cars for the transport of minerals, 29 wagons for cattle and goods, and 52 platform wagons.

In view of the altitude to which the line ascends, and as a consequence of the frequent falls of snow and deposits of hoar frost on the rails, it has been necessary to make special provision to ensure a regular service in all weathers. In ordinary weather, that is, during the fine season, the current is picked up from the conductor rail by each motor vehicle by means of four contact blocks, arranged two on each side, the third rail being sometimes on the left, and sometimes on the right of the track. The contact blocks consist of steel shoes suspended from two small arms, and making contact with the rail by reason of their own weight. In the bad season this system alone would not be efficient; it has, therefore, been replaced by special contact blocks known as "brises-glace" (ice-breakers), consisting of four small steel plates resting on their edge on the conductor-rail, and bolted to the end of a pivoted support, the vertical movement of which is controlled by a piston working within a cylinder under the action of compressed air. The degree of contact of the blocks with the rail is regulated by the driver of the train.

In the second place, having regard to the gradients, which reach as much as from 1 in 20 to 1 in 16, it was necessary to provide the vehicle with powerful and reliable brakes. For this reason each train is provided with no less than four systems of brakes—a Westinghouse, an electro-magnetic brake, a rheostatic brake, and a hand brake. The electro-magnetic brake-shoes with which the motor vehicles are provided are four in number, and consist of electro-magnets suspended from the bogies by spiral springs. The cores of the electro-magnets are expanded at their ends, which are held between the wheels, a slight distance above the running rails, which act as armatures. The coils are actuated by a current from a battery of 12 Tudor cells having a capacity of 125 ampere-hours at a 10-hours' discharge rate; a spare battery is also carried. To operate the brake shoes a current of 80 amperes at 20 volts is required. In the tests which were carried out a motor passenger carriage, weighing 26½ tons, descended a gradient of 1 in 16 at a speed of 8½ miles per hour, and was pulled up in 15 seconds within a distance of 57 yards. For the Westinghouse brake an electric compressor of the Olivier type provides the necessary power; it is driven by an 850-volt series motor, which can be put in operation without the use of a starting resistance. It starts either by switching in by hand, or automatically. The air pump is

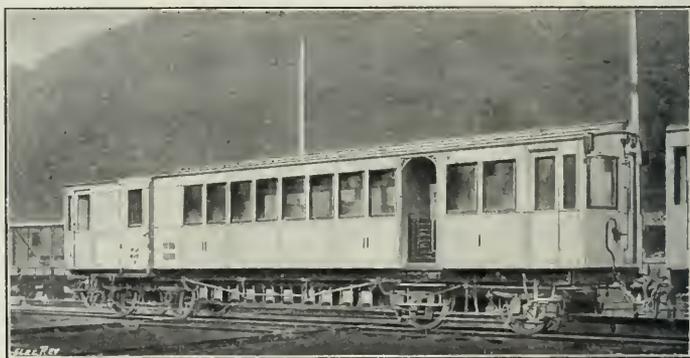
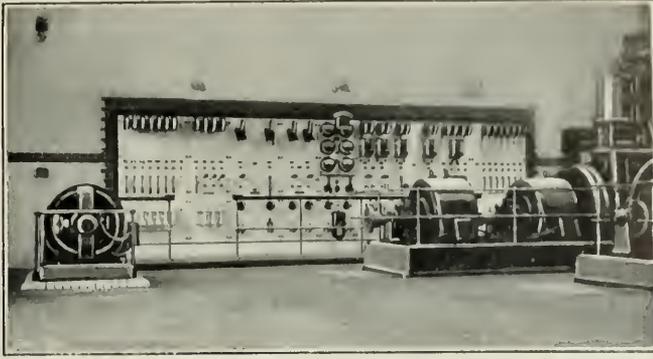


FIG. 8.—MOTOR COACH, VILLEFRANCHE BOURG-MADAME RAILWAY.

of the twin-cylinder, parallel spindle type, driven by single gearing off the electric motor.

Each train, when running, is in charge of a driver-electrician, a guard, and an electrical assistant, the latter being located in the rearmost motor vehicle. If the train includes three motor vehicles, two of the latter are placed at the rear. The maximum weight of the trains has been fixed at 120 tons. As for the maximum speeds authorised, they have been fixed in accordance with the gradients, both ascending and descending, as follows:—From zero to 1 in 30, 31½ miles per hour; from 1 in 30 to 1 in 22, 21½



THE MAIN SWITCHBOARD, SEVERALLS ASYLUM, COLCHESTER.

miles per hour; from 1 in 18 to 1 in 16½, 14½ miles per hour.

The consumption of electrical energy is 80-watt hours per ton kilometre. The whole of the electrical installation of the line was carried out by the Société Alsacienne de Constructions Mecaniques, of Belfort, who have thus shown that the employment of double-current machines provides a rational and economical solution of the problem of electric traction.

In a subsequent article, we shall show how the company has introduced modifications in the material for the new electric lines that are projected, or are in course of execution.

### AN ESSEX ASYLUM INSTALLATION.

THERE has recently been opened near Colchester, Severalls Asylum, a large institution to accommodate 2,000 inmates and to serve the northern portion of the county of Essex.

The buildings, which have been erected to the designs and under the supervision of Mr. Frank Whitmore, County Architect, and Mr. W. N. Town, architect, of Colchester, cover a considerable area and comprise a central main group, including in addition to the numerous wards, a

bakery, kitchens, stores, laundries, recreation hall, power station, workshops, &c., connected by covered corridors and several isolated buildings, the total cost of the work carried out amounting to nearly half a million pounds.

The heating and hot water supply of the Asylum is furnished by a calorifier installation fed by steam from five Paxman tubular boilers, designed for a working pressure of 120 lb. per sq. in. Steam is supplied direct to the calorifiers through reducing valves at a pressure of 5 lb. per sq. in.; five calorifiers, together with double-acting Mumford pumps, which circulate the water at a temperature of up to 180° F., through the pipe system, are installed.

The electrical generating plant is

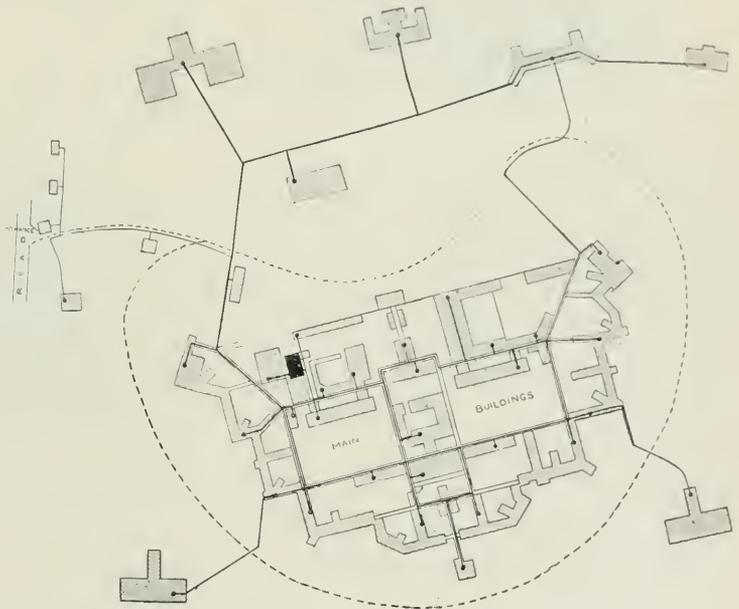


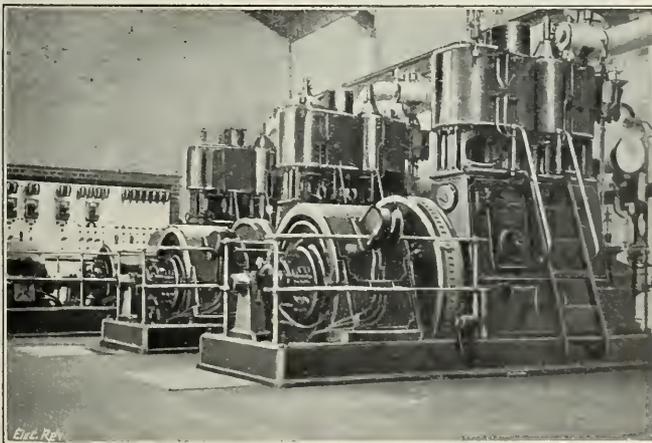
DIAGRAM SHOWING THE GENERAL LAY-OUT OF THE ELECTRICAL DISTRIBUTION, SEVERALLS ASYLUM, COLCHESTER.

Power station shown black, general lighting and power mains in full lines and main road lighting mains in dotted lines.

supplied with steam through a main tapped on to the main steam-pipe system, and the exhaust steam which leaves the engines at a pressure of about 5 lb. per sq. in. is returned to the calorifiers, to augment the direct supply from the boilers, but we gather that once the heating system is working, it can be kept going on the exhaust steam only.

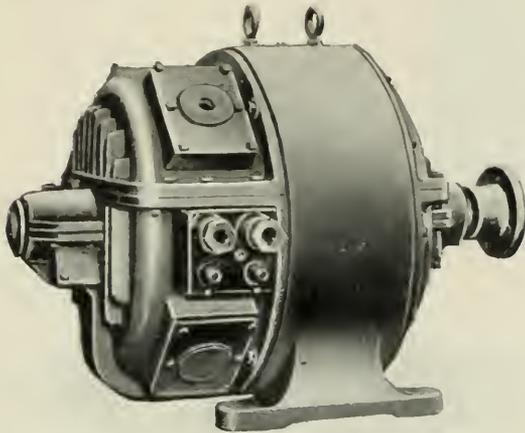
In this case the electricity is a sort of heating bye-product obtained at the expense of about 3 per cent. of the initial heat contained in the steam, and the very small fuel cost which can be credited to its account, will reduce the actual cost of the electricity used in the Asylum to an unusually low figure.

The generating plant is housed in a white glazed brick lined building, 51 ft. long and 36 ft. wide; it consists of compound high-speed enclosed engines



DAVEY, PAXMAN-B.T.H. (GENERATING PLANT, SEVERALLS ASYLUM.

by Davey, Paxman & Co., direct coupled to dynamos by the British Thomson-Houston Co. Two of these are of 100 kw. size, and a third unit consists of a similar engine coupled to two dynamos, each of 50 kw. size to form a steam balancer.

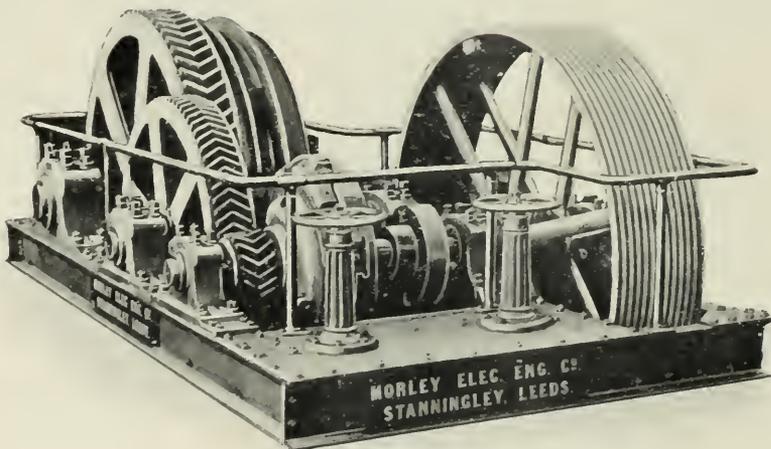


A 60-H.P. FLAME-PROOF MOTOR, MORLEY ELECTRICAL ENGINEERING CO. (see p. 901).

The larger dynamos are compounded and all run at a speed of 450 R.P.M., the larger ones giving 213 amperes at 470 volts, and the smaller ones giving 213 amperes at 235 volts. In addition to the above plant there is a motor balancer by the B.T.H. Co., consisting of two machines each of 15 kw. size.

No battery is at present installed, but room has been provided for one, and the dynamos have been designed so as to work in conjunction with a battery, if one should be put in at some future date.

The main switchboard is placed at the end of the engine room and consists of a number of grey marble panels mounted on an iron frame let in flush with the end wall. Access to the back of the board is obtained by a door leading into a room from which all the circuits are carried. The switchboard is provided with all necessary switches, circuit-breakers, cut-outs, regulating gear and instruments together with meters for measuring the output of each machine, and the lighting and power circuits. Seven positive and seven negative lighting, and four power as well as the machine circuits are provided for.



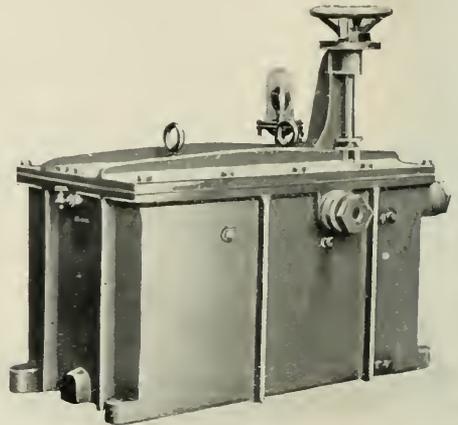
A 200-H.P. ENDLESS ROPE HAULAGE GEAR (see p. 901).

An overhead travelling crane of Herbert, Morris and Bastert's make is provided in the engine room.

The contract for the plant, switchboard and travelling crane has been carried out by the British Thomson-Houston Co.,

and that for the steam, exhaust and drain pipes and valves, by Messrs. Aiton & Co. of Derby.

The wiring system is very compact; the Asylum buildings are constructed round a large rectangle with several spur wings; a pipe and cable subway about 8 ft. wide and 6 ft. 6 in. high runs round the whole of the rectangular portion with creepways under the wings. The switchboard lighting feeders are carried to a triple-concentric lead-covered ring main running the whole length, about 760 yards, of the subway, and supported in wooden cleats bolted to the walls. The ring main is divided into eight sections by disconnecting fuse boxes, for the purpose of isolating faulty sections, and is tapped at intervals by service cables leading to the various blocks, the larger ones being connected as three-wire, and the smaller ones as two-wire, services on alternative sides of the three-wire 230-460-volt system. A second or subsidiary ring main tapped on to the other one, supplies various detached buildings, viz., the private patients' and idiots' blocks and consumptive hospital, while branch feeders run to the acute male and female patients'



100-H.P. DIRECT-CURRENT OIL-IMMERSED STARTER, BY THE MORLEY ELECTRICAL ENGINEERING CO. (see p. 901).

hospitals, isolation hospital, medical superintendent's house, &c.

A separate service, sectioned by means of disconnecting fuse-boxes, is run for the covered ways connecting the various blocks, and special concentric lead-covered mains from the switchboard, running by way of the subways, supply power to the laundries, bakery, &c. Each of the covered ways is lighted from two distinct services for purposes of safety, and the same principle is applied to the recreation hall and some of the other blocks.

A handsome recreation hall, 120 ft. x 60 ft., is provided, the auditorium being lighted by 10 fire-light polished brass electroliers and side brackets.

Four of the electrolier lights in each case are run off one circuit controlled from the stage, while the odd (pilot) lamps and bracket lighting, on another circuit, are controlled from the hall. The stage lighting is also distinct, and its equipment of vari-coloured batten lighting with liquid dimmers was supplied by the General Electric Co., through the main contractors.

The general wiring of the Asylum is carried out in wood casings run on the surface, the casing with the covers forming a segment of a circle in section so as to avoid all chance of the lodgment of dust. The casings are painted to correspond with the decorations, and the special form used makes them very inconspicuous.

Single and twin lead-covered wires are used for lighting the covered ways, subways, engine and boiler houses, laundries, workshops and similar places.

Two-way switching is employed throughout the corridors and wards for obvious reasons; Ediswan extra flat switches are employed in ordinary situations, and Ediswan key switches in places where they might be tampered with, and in all cases locking rings are fitted to prevent the covers from being removed by mischievous persons. In the case of lead-covered wires, Ediswan water-tight switches have been used, with sweated joints to wiring.

For controlling the various distributing circuits to the wards, and, in fact, throughout the Asylum, Berry-Skinner "fool-proof" switches with detachable handles have been used, a standard arrangement being one of these switches with a glass-fronted distributing board, containing fuses and flat switches, mounted above it.

In the case of two-storey buildings, the upper and lower floors are balanced on either side of the three-wire system.

The fittings are plain throughout, with few exceptions strict economy being studied as far as possible; pendants are largely employed in the main buildings, with a specially-designed bulkhead fitting for the single rooms, and batterholders in the covered ways and subways.

The power circuits supply the following motors, the contract for which was placed with Messrs. Mawdsley's, Ltd.:—In the pump room, two 28-H.P. motors driving three-throw Pearn fire pumps; bakery, an 8-H.P. motor for kneading and mixing machines, &c.; laundries, a 20-H.P. motor for general wash-house and finishing room machinery, a 7-H.P. motor for blower in general drying closet, which, it may be noted, extracts warm air from the pipe and cable subway, a 12-H.P. motor for foul wash-house machinery, and a 12-H.P. motor for staff wash-house and finishing room machinery.

Other motors will be provided for the deep well, 524 ft. deep, in connection with which two 35-H.P., electrically-driven Brotherhood compressors are being installed to deliver 120 cb. ft. of air per minute at 100-lb. pressure.

These lift the well water into a 12,000-gallon tank in a water tower, which also houses large rain water, hot water, feed and fire tanks—the latter holding 40,000 gallons, being at the top of the building.

It may be mentioned that the whole of the rain water from the many roofs in the Asylum is collected in two subterranean tanks holding 120,000 and 100,000 gallons respectively.

The pump room, in addition to containing the fire pumps mentioned above, will house the compressors; it also contains three Mumford boiler feed pumps and the hot well, into which the condensed steam from the heating system and elsewhere is led for re-use.

The complete lighting of the Asylum comprises about 2,500 points in the main block and 1,200 points in detached buildings, while the motors are expected to reach 200 H.P. in all.

In addition to the electric lighting and power circuits, a complete system of the Sterling Co.'s telephones has been installed, connecting all parts of the Asylum with a central exchange in the porter's room. The telephone exchange is on the central battery system, metallic circuits of twisted pairs of conductors being employed. The switchboard, which is arranged for 100 circuits, is provided with lamp signalling apparatus, hand generator, power ringer worked from the lighting mains, and all necessary apparatus.

A complete system of fire alarms and bells is also provided, in connection with a 35-line indicator fixed in the porter's room.

The insertion of an ordinary door key, as carried by the attendants (an arrangement due to Mr. Beeching, the resident engineer of the Asylum), sets the alarm bells ringing at all the stations throughout the Asylum, as well as starting the steam hooter at the boiler house; the various bells are stopped by means of a hand release operated

by the attendants in the vicinity; some 70 stations are provided in all.

A time recording system with stations in the wards and other parts of the buildings, operating a recorder placed in the medical superintendent's office in the main block, completes the electrical system, except for a number of bells at entrances to wards, &c.

The whole of the wiring in connection with bells, telephones, fire alarms and time recorders is run in wood casing in a similar manner to the lighting system, and the contract for the whole of this work and the electric lighting and power systems has been carried out by Messrs. H. J. Cash and Co., of Westminster.

In conclusion, we are indebted to Mr. W. C. C. Hawtayne, the consulting engineer for the electrical work at the Asylum, for offering facilities for a visit to the latter and to his chief assistant, Mr. A. G. Dixon, for so ably piloting us through this huge institution. To Mr. H. J. Beeching, the resident engineer, who acted as clerk of the works during the carrying out of the various engineering contracts, our thanks are also due for courteously explaining many matters of engineering and general interest.

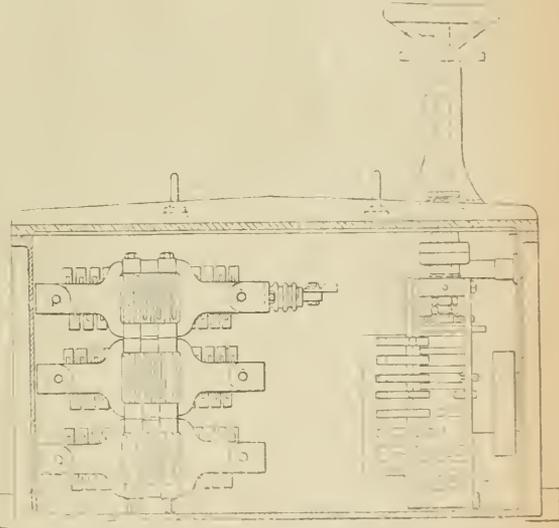
### SOME "MORLEY" MINING SPECIALITIES.

RECENTLY, through the courtesy of the Morley Electrical Engineering Co., Ltd., of Stanningley, we were enabled to inspect one of their oil-immersed direct-current flame-proof starters and controllers, combined with resistance. Much discussion has taken place on the subject of direct-current oil-immersed switchgear, and it is, therefore, interesting to note that this firm has had considerable success in this direction, having supplied such switches for up to 120 H.P., which have been working day and night in collieries for the last four or five years.

We illustrate on this and the following page a 100-H.P. starter of this type for use with an endless rope haulage gear.

The cables are brought in at one side through a special joint box; armoured glands are provided, and a screw-down cover in place of bolts.

The resistance, built up of sectional iron grids, can be lifted out



SECTIONAL VIEW, 100-H.P. DIRECT-CURRENT OIL-IMMERSED STARTER.

in one piece. The controller consists of two drums, with all metal and mica insulation, chain-gear and driven from a hand wheel.

When dismantling the controllers, these drums which are hinged at the top, can be swung out of the oil for examination, and by a system of plug connections the latter can be speedily remade. An indicating lamp shows when the resistance is in circuit, as it is primarily intended for starting purposes only.

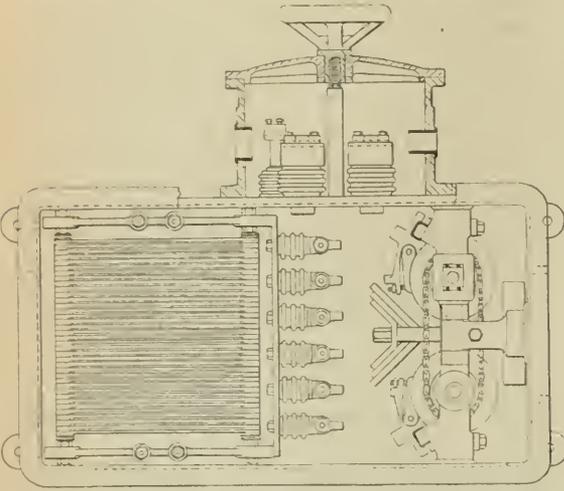
The company makes a speciality of colliery plant, including flame-proof motors, haulages, mining switchgear, coal cutters of the chain type, &c., and supplies a special sand-filled mining fuse.

We also illustrate a 200-H.P. endless rope haulage gear, arranged for rope driving from a 500-volt interpole motor, running at 500 R.P.M. The drive is through a friction clutch on the first motion shaft—an arrangement found very satisfactory—and double helical gearing.

The surge wheel is 6 ft. in diameter, and the gear, as a whole, is carried on a bed built up of rolled sections. Brake and clutch hand wheels are provided mounted on pillars.

The company builds a special flame-proof mining motor, having a cast-steel magnet frame, with pole pieces cast on, which are fitted with laminated pole shoes. Commutating poles are provided, and end shields, split across above the centre, with wide machined joints.

Large hand holes are provided in the end shield at the commu-



PLAN OF DIRECT-CURRENT OIL-IMMERSED STARTER, SHOWING ARMOURED GLANDS, &C.

tator end, the upper ones being fitted with glass inspection holes.

The removal of the covers allows of free access to the machine, the cables to which are lead into a junction box at the side, provided with a special type of armoured gland, which facilitates earthing and disconnecting. While the company's attention is mainly devoted to mining plant, a good deal of special and repair work passes through the shops.

## NEW COMPANIES REGISTERED.

**Atlas Electrical Co., Ltd.** (128,987).—This company was registered on May 16th, with a capital of £100 in £1 shares, to carry on the business of manufacturers of and dealers in electrical accessories, fittings and devices, arc and other lamps, globes and shades, generators, electric and other wires, insulating and other materials, &c. The subscribers (with one share each) are:—W. H. Clegg, 75, Deodar Road, Putney, S.W., civil engineer; Mrs. A. E. Clegg, 75, Deodar Road, Putney, S.W.; P. D. Clegg, 75, Deodar Road, Putney, S.W., secretary. Private company. The number of directors is not to be less than two or more than three; the first are W. H. Clegg, Mrs. A. E. Clegg and P. D. Clegg (all permanent); qualification, £1; remuneration, £100 per annum, divisible. Registered office, 33, Tothill Street, Westminster, S.W.

**Electric Ignition Co. (1913), Ltd.** (129,088).—This company was registered on May 21st, with a capital of £7,000 in £1 shares, to take over as from September 29th, 1912, the business of a manufacturer of, and dealer in, all kinds of appliances relating to the electric ignition of internal combustion engines and all accessories connected therewith, carried on at Royal Wellington Works, Sampson Road North, Birmingham, by the Electric Ignition Co., Ltd., and to adopt agreements with R. A. Felton and A. Cox. The subscribers (with one share each) are:—H. Lewis, Athol Lodge, Acocke Green, manufacturer; A. Rose, Kineton Road, Olton, Warwickshire, manufacturer. Private company. The number of directors is not to be less than two or more than five; the first are H. Lewis, A. Cox and A. Rose (all permanent, subject to holding £1,000 shares); qualification, 100 shares; remuneration of H. Lewis and A. Cox, £50 per annum; of A. Rose, £25 per annum; of other directors as fixed by the company; solicitor, W. A. Gibb, 23, Colmore Row, Birmingham. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

**Best's Safety Lamps, Ltd.** (129,034).—This company was registered on May 19th, with a capital of £5,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, miners' safety lamps, lighting appliances, lamp cleaning machines, electric lighting and other apparatus, and to adopt an agreement with W. Best, A. E. Best, J. C. Best, R. O. Best and M. Best. The subscribers (with 200 shares each) are:—W. Best, Providence House, New Park Street, Morley, safety lamp manufacturer; A. E. Best, 9, Westfield Road, Morley, safety lamp manufacturer; B. O. Best, 3, Marshall Street, Morley, safety lamp manufacturer; M. Best, 41, Worrall Street, Morley, safety lamp manufacturer. Private company. The number of directors is not to be less than four or more than nine; the first are W. Best, A. E. Best, R. O. Best and M. Best (all permanent, subject to holding 200 shares), and A. H. Welham, J. R. Spanton, H. Upton, W. Farrar and C. M. Rowbotham who may retain office for seven years, subject to holding one share; remuneration, £50 per annum; solicitor, T. B. Kitson, 72, Abchurch Lane, Leeds. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

**Scottish Light Railways and Development Syndicate, Ltd.** (129,143).—This company was registered on May 23rd, with a capital of £1,000 in £1 shares, to construct, equip, maintain and work any light railways in Aberdeenshire or elsewhere in the United Kingdom. The subscribers (with one share each) are:—Viscount Selby, 18, Brunswick Square, Hove; Sir James Howe, 28, Cranley Gardens, S.W. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. Registered by Lumley & Lumley, 87, Conduit Street, W.

**Turbine Engine and Pump Co., Ltd.** (129,044).—Registered May 19th, by W. T. Hick, Broad Street House, E.C. Capital £75,000 in £1 shares. Objects: To acquire, manufacture, sell, let on hire, grant licences in respect of, and deal in, turbine motors, engines and pumps, motor and other cycles, ships, launches, flying machines and vehicles of all kinds, engineers, electricians, &c., and to adopt an agreement with the H.D. and B. Syndicate, Ltd. The signatories (with one share each) are:—F. Sidney, Broad Street House, E.C., law clerk; C. A. Frith, 55, Harrington Road, Crouch End, N., secretary; F. King, 26, Dorset Street, W., clerk; F. J. Barnett, Broad Street House, E.C., solicitor; E. Knight, 12, Alexandra Road, N., electrical engineer; A. R. Newman, 65, Lewisham Hill, S.E., engineer; M. Schopkovski, 32, Tremaine Road, Anley, S.E., gentleman. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than five) are not named; qualification £250; remuneration (except managing director), £100 each per annum and £50 extra for the chairman. (Note.—The H.D. and B. Syndicate, Ltd., mentioned above, was registered on April 25th last, with capital £100 in 1s. shares, to carry on financial, underwriting, promotion and similar business. The signatories are F. Sidney and F. Barnett, two of the clerks named above. No list of directors and no notice of situation of registered office appear on the file to May 22nd.)

**Carlton Split Ball Bearing Co., Ltd.** (129,106).—This company was registered on May 22nd, with a capital of £2,000 in £1 shares, to acquire a patent for an invention relating to improvements in ball bearings for axles, to adopt an agreement with B. Lumb, A. Schofield, H. Coates and D. C. L. Welch, and to carry on the business of founders, mechanical and electrical engineers, manufacturers of machinery, ball bearings, axles, shafts and pulleys, &c. The subscribers (with one share each) are:—B. Lumb, 80, Carlton Street, Bolton, spindle maker; A. Schofield, 60, Carlton Street, Bolton, spindle maker; H. Coates, 58, St. George's Road, Withington, Manchester, engineer; D. C. L. Welch, 191, Lloyd Street, Manchester, engineer. Private company. The number of directors is not to be less than two or more than four; the first are B. Lumb, A. Schofield, H. Coates and D. C. L. Welch. Solicitor, J. H. Hall, 20, Acrefield, Bolton. Registered office, 30, Examiner Buildings, Cross Street, Manchester.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**O. C. Hawkes, Ltd.** (49,661).—Return dated April 2nd, 1913. Capital £200,000 in 25 shares (20,000 pref.), 17,000 ord. and 17,000 pref. shares taken up; £5 per share called up on 21,019 shares; £105,095 paid; £64,905 considered as paid up on 12,981 shares. Mortgages and charges: £1,000.

**Newcastle and District Electric Lighting Co., Ltd.** (23,022c).—Return dated March 7th, 1913. Capital £900,000 in £10 shares. All shares taken up; £10 per share called up; £297,400 paid, leaving £2,600 in arrears. Mortgages and charges: £296,040.

**Newcastle-upon-Tyne Electric Supply Co., Ltd.** (27,997).—Return dated April 2nd, 1913. Capital £1,500,000 in 25 shares (150,000 pref.); 137,500 ord. and 137,500 pref. shares taken up; £5 per share called up on 129,529 ord. and 126,741 pref.; £1,281,350 paid; £93,650 considered as paid on 7,971 ord. and 10,759 pref. Mortgages and charges: £388,225 14s.

**Madras Electric Tramways (1904), Ltd.** (80,361).—Return dated March 27th, 1913. Capital £200,000 in 25 shares (25,000 pref. and 15,000 ord.); 18,339 pref. and 11,452 ord. shares taken up; £5 per share called up on 11,339 pref.; £69,195 paid; £89,760 considered as paid on 6,500 pref. and 11,452 ord. Mortgages and charges: £61,180. A further 852 pref. shares were allotted for cash on April 2nd.

**Marsh, Son & Co., Ltd.** (74,746).—Return dated May 10th, 1913. Capital £20,000, in 21 shares; 18,608 shares taken up; £6,503 paid; £12,000 considered as paid. Mortgages and charges: £9,200.

**Mather & Platt, Ltd.** (60,387).—Return dated March 3rd, 1913. Capital £1,000,000, in 40,000 pref. shares of £10 each and 600,000 ord. shares of £1 each. All shares taken up; £10 per share called up on 29,200 pref. and £1 per share on 25,000 ord.; £317,000 paid; £683,000 considered as paid on 10,800 pref. and 675,000 ord. Mortgages and charges: Nil.

**Burgess Hill and District Electric Supply Co., Ltd.** (85,694).—Return dated March 18th, 1913. Capital £6,000 in £1 shares (3,000 pref., 3,000 ord., and 2,600 pref. shares taken up; £1 per share called up on 3,000 ord. and 2,600 pref.; £5,450 paid; £100 considered as paid on 100 pref. Mortgages and charges: £1,200.

**Midland Electric Wire Co., Ltd.** (104,571).—Return dated March 28th, 1913. Capital, £5,000 in 21 shares; all shares taken up; £5,000 paid. Mortgages and charges: Nil.

**Glantawe Electric Supply Co., Ltd.** (112,615).—Return dated March 18th, 1913. Capital, £10,000 in £10 shares; 940 shares taken up; £9,400 paid. Mortgages and charges: Nil.

**Executors of Thomas Atkinson, Ltd.**—Particulars of £300 debentures, created April 26th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future. No trustees.

**Fors Accumulator Foreign Patents, Ltd.**—Debenture dated May 6th, 1913, to secure £125, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. Weir, Dumbarton, Malford Green, Snaresbrook.

**South London Electric Supply Corporation, Ltd.**—Issue on May 20th, 1913, of £900 debentures, part of a series of which particulars have already been filed.

**No Cell, Ltd.**—Debenture dated May 16th, 1913, to secure £1,000, charged on the company's patents, rights, undertaking and property, present and future. Holder: J. F. Greenwood, 12 and 14, Arthur Street, E.C.

**The "Point Fives."**—A meeting was held on Friday last, when it was decided that the June meeting, during the I.M.E.A. Convention, should take place on June 17th at 7 p.m. sharp, at the "Delico" Restaurant, Barrett Street, W.; tickets 3s. 6d., morning dress. At 8.30 the chairman will deliver an address, and a general discussion will follow on the extension of the use of electricity for domestic purposes, including the subjects of tariffs, apparatus, selling methods, &c. Mr. Friederichs, of West Hartlepool, and Mr. Purse, of Carlisle, were elected members of the Point Fives.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—At the New Inn Hotel, Pontypridd, on 13th inst., a gold watch was presented to Mr. W. W. COOKE, on his departure to Canada to take up an engagement. Mr. Cooke has been for the last eight years acting as cable jointer under the South Wales Power Co. The proceedings closed with a smoking concert.

Mr. C. CULMER HODGES has been appointed secretary to the Dawlish Electric Light and Power Co., Ltd., in addition to his present post as engineer and manager, in succession to Mr. E. R. Callender, resigned.

Mr. A. E. FIRTH has resigned his position as shift engineer at the Stockton-on-Tees Electricity Works, in order to take up a similar position with the Fife Electric Power Co.

The Colwyn Bay Council has confirmed a recommendation that the salary of the electrical engineer should be increased from £230 to £255 per annum.

The Horsham U.D.C. has granted the electrical engineer, Mr. MORGAN, permission to supervise the carrying out of the electricity undertaking at Basingstoke.

The Hackney B.C. Electricity Committee recommends that in future the minimum salary for the office of assistant distributing engineer be £120, rising by £7 10s. per annum to £150; Mr. A. HILLING is appointed to that office at £120 per annum. The minimum for the office of technical inquiry clerk is to be £90, rising to £120, and Mr. A. GWYN holds that office at £105 per annum. The salaries for cost clerk and general clerk are also to be £90 each, rising to £120, and Mr. F. G. TAYLOR holds the former appointment, and Mr. H. C. ROBERTS the latter. Mr. P. H. SHEARS, canvasser, is to receive £91 per annum, with commission according to scale.

The Ilford U.D.C. has increased the salary of Mr. J. R. MYERS, superintendent of the electricity station, from £200 to £210 per annum, and has awarded him a gratuity of £10 in respect of extra services on the occasion of the recent fire.

On leaving Gillingham (Kent) to take up a position at the Hastings electricity works, Mr. J. RYAN, assistant resident engineer, has been presented by the staff and personal friends with a barometer, silver fruit dish, and a fountain pen.

The Norwich T.C. has adopted the recommendation of the General Purposes Committee (mentioned in the ELECTRICAL REVIEW last week) increasing the salary of Mr. F. M. LONG, city electrical engineer, from £600 to £700 per annum.

The Middlesbrough Electricity Committee has advanced the salary of Mr. H. M. TAYLOR, engineer, by £25 to £450 per annum; and that of Mr. R. SCOTSON, mains superintendent, from £180 to £200.

Mr. FREDERICK SWARBICK, chief engineer to the Galway Corporation electricity department, has been appointed chief electrical engineer and manager to the Minehead Electric Supply Co., Ltd.

Mr. A. A. DAY, the borough electrical engineer and tramways manager to the Bolton Corporation, has resigned through ill-health. Mr. Day was formerly chief assistant electrical engineer of Manchester. He was appointed borough electrical engineer at Bolton in 1900, and three or four years later was also appointed tramways manager.

**Tramway Officials.**—The Birkenhead Tramways Committee has recommended the appointment of Mr. CYRIL CLARKE as tramways manager in succession to Mr. W. WYLD, M.I.E.E., who was recently appointed chief electrical engineer and manager to the Hampstead Corporation. Mr. Clarke received early training with Mr. G. F. Milnes, tramcar builder, of Birkenhead. He was one of the last six candidates for the tramway management of the Southport Corporation, but withdrew from the final appointment in order to appear before the Birkenhead Tramways Committee with regard to the present appointment.

Mr. A. S. SLADE, for some time superintendent of the Perth electric tramways, has been appointed traffic superintendent of the Brisbane tramways, in succession to Mr. A. G. STEPHENS, who was recently appointed assistant manager.—*Mining and Engineering Review.*

**General.**—The address of Mr. E. HILL is 26, not 24, Stanton Road, Wimbledon, as given in our issue of May 16th.

The *Mining and Engineering Review* says that Mr. F. S. LEE, who for some years was in charge of the electrical supplies department of Messrs. Noyes Bros. (Sydney) Ltd., recently resigned that position, and has joined the Sydney staff of the British General Electric Co., Ltd.

The *Times* states that SIR WILLIAM CROOKES, O.M., has been elected a Foreign Associate of the National Academy of Sciences, Washington, on the occasion of its semi-centennial celebration.

Congratulations and good wishes to SIR DOUGLAS and LADY FOX, who, on 26th inst., celebrated the 50th anniversary of their marriage.

Mr. CHRIS. JONES, A.M.I.E.E., has resigned his appointment at West Cannock Collieries, having accepted the position of chief electrical engineer to Cannock Chase Colliery Co., Ltd. Mr. Jones was, on Saturday, presented with a silver-mounted walking stick and instand, from the electrical staff and officials, on the occasion of his leaving.

The resignation of SIR ALFRED HOPKINSON, K.C., of the vice-chancellorship of the Victoria University, Manchester, came

before a meeting of the Court on Wednesday. The *Times* says that the announcement has occasioned much surprise in University circles.

CAPT. H. HALL SANKEY, R.E., has been elected to the Executive Committee of the Declaim Association.

The staff of Messrs. Crompton & Co., Ltd., Aro Works, Chelmsford, have presented a basket of cutlery to Mr. Percy Stokes, on his marriage; and a Gladstone bag to Mr. A. BUTCHER, who is leaving for Canada.

Congratulations to Mr. G. C. HAMILTON on his election as Member of Parliament for Altrincham by a majority of 1,262 as compared with a majority of only 119 gained by his predecessor.

**Obituary.**—The death is announced of Mr. A. H. HARMAN, a director of the firm of Drummond Bros., Guildford.

PROF. J. T. NICOLSON.—We learn with very deep regret of the death, which occurred on Tuesday, of Dr. J. T. Nicolson, who for the last 14 years had been Professor of Mechanical Engineering at Manchester University. The *Times*, after referring to his interest in internal-combustion engines, adds that at the time he was overcome by illness he was engaged in equipping a laboratory at the Manchester School of Technology, for research work in this department of engineering.

Mr. W. M. CALLENDER.—We learn with great regret of the death, which occurred on the 24th inst., at Guernsey, of William Marshall Callender, second son of the late W. O. Callender, of Bournemouth, at the age of 54 years.

**Will.**—The *Times* states that Mr. R. T. PRESTON, engineer, a director of Messrs. J. Stone & Co., Ltd., of Deptford, left estate of the gross value of £91,415, with net personalty £90,511.

## CITY NOTES.

## German Electrical Companies.

The *Treuhand Bank für die Electriche Industrie, of Berlin*, which was originally formed by the Felten and Guillaume-Lahmeyer Works as a financing institution, and was subsequently taken over by the A.E.G., reports that no undertakings were carried out in 1912. The net income from interest, after defraying general expenses and taxes, amounted to £12,700 on a paid-up capital of £312,500, as compared with £11,700 in 1911. A dividend of 3½ per cent. has been declared for 1912, as against 3½ per cent. in the previous year.

The *Kabelwerk Wilhelminenhof, of Berlin*, states that the results for 1912 were not unimproved by the rise in the prices of metals and other raw materials used by the company. The degree of activity also was not uniform, but was often rather of a fluctuating character, although satisfactory on the whole. Including the balance forward and after allocating £2,600 to depreciation, as against £1,900 in 1911, and making other appropriations, the accounts exhibit net profits of £11,900 as contrasted with £12,700 in the preceding year. A dividend at the rate of 15 per cent. has been declared, being the same as in 1911. It is mentioned that a good stock of orders was brought over into the new financial year.

The directors of the *Land und Seekabelwerk of Cologne-Nippes* state that the company was well employed during 1912, although selling prices were not always satisfactory. The gross profits are returned at £67,000, as compared with £64,000 in 1911, and the net profits, after placing £14,000 to depreciation, as against £16,000, amounted to £95,000, as contrasted with £90,000. A dividend at the rate of 10 per cent. has been declared, this comparing with 9 per cent. in 1911. It is intimated that the receipt of new orders has also favourably developed in the current year, apart from those which were brought forward from 1912.

The *Gesellschaft für Elektrische Unternehmungen, of Berlin*, which either owns or is financially interested in 77 supply works or tramways in various countries, reports profits of £324,000 from dividends and interest in 1912, as compared with £306,000 in 1911, whilst the sale of securities yielded £65,000, as against £82,000 in the previous year. After meeting general expenses and taxes and providing for the service of the loan debt of £2,057,000, the accounts indicate net profits and balance forward of £279,000, as contrasted with £271,000 in 1911. It has been decided to pay a dividend of 10 per cent. on the share capital of £2,500,000, being the same rate as in the preceding year. The share capital is now being increased to £3,000,000 by the issue of £500,000 of new shares for the purpose of extending the supply works owned by the company.

The *Elektrizitäts Lieferungs Gesellschaft, of Berlin*, is a supply company having a paid-up share capital of £1,125,000 and a loan debt of £966,000. At the end of 1912, the company owned 23 works, as compared with 28 in the previous year, the reduction being due to the sales of works at a profit; whilst five other works are held under leases. The gross profits realised in 1912 amounted to £274,000, as contrasted with £207,000 in 1911, and the net profits and balance forward were £184,000, as against £124,000. The dividend is at the rate of 12 per cent., this comparing with 11 per cent. in 1911. Formerly the majority of the shares were held by the A.E.G., but they were transferred a few years ago to the A.E.G.'s associated company—the Berlin Electricity Works—in order that the latter might still have scope for activity in the event of the Berlin City Council taking over the Berlin supply works in 1915.

The accounts for 1912 of the *Bergmann Elektrizitäts Werke, of Berlin*, after deducting the cost of manufacturing and writing down stocks by £85,000, show gross profits of £532,000, as com-

pared with £402,000 in the previous year. General expenses, interest charges, and taxes absorb £235,000, as against £203,000, and depreciation of plant £135,000, as contrasted with £98,000, whilst investments have been written off by the sum of £57,000. Including the balance forward the net profits reach £119,000, as compared with £95,000 in 1911, and a dividend of 5 per cent. is proposed on the old capital of £1,450,000, as in the preceding year, and 2½ per cent. on the new capital, of which the Siemens-Schuckert Works furnished £425,000, upon which 50 per cent. has been paid. The large depreciation of investments is understood to chiefly concern the Bergmann Electricity Enterprises Company, and is expected to be continued in the current year. In general the financial strengthening of the Bergmann Works aims at the remedying of the errors of the exceptionally high dividends which were paid in former years.

The report of the *Accumulator Fabrik, of Berlin-Hagen*, states that the turnover in the works in Germany and Austria amounted to £1,016,000 in 1912, as compared with £1,023,000 in the previous year, whilst the oversea business remained on the same level as in 1911. The warlike complications in the Balkans scarcely affected the company, as sales in those parts had hitherto been inconsiderable. The accounts show the following figures for the two years:—

	1912	1911
Share capital ... ..	£600,000	£400,000
Gross profits ... ..	414,000	366,000
Depreciation ... ..	35,000	17,000
Net profits ... ..	225,000	227,000
Dividend ... ..	100,000	100,000
Dividend, per cent. ...	25	25

It should be explained that the additional capital of £200,000 will become entitled to participate in the profits for the first time in the new financial year. During 1912, certain investments were disposed of, thus reducing securities in portfolio from £441,000 to £257,000, and the proceeds were devoted partly to the repayment of the bonds of £150,000, and for the extension of the German works which was purchased, but the site in Buda Peth was sold to the Tudor Accumulator Co., of that city. The share held in the Mark Electricity Works was fully paid up; shares were taken over in the Roumanian Company, and an interest was also secured in other companies concerned with the use of secondary batteries. The orders completed by the end of March, 1913, represented an increase of £100,000 over the corresponding period in 1912.

The report of *Felten und Guilleaume-Carlswerk, of Mulheim*, states that the general industrial development in 1912 was of advantage to the company, and the war in the Balkans had not had any noteworthy influence upon business. The turnover at the Carlswerk experienced a further increase, and both the quantity and value were in excess of any preceding year, whilst better results were in part obtained from the company's investments. Concerning the Frankfort dynamo works which were transferred to the A.E.G. two or three years ago, it is mentioned that the liquidation of the business made further progress, although some years would be occupied in the final closing of the accounts. The requirements in the matter of semi-finished steel had led to an association with Jules Collare and Co., of Steinfort (Luxemburg); the latter had been converted into the Steinfort Iron and Steel Works Co., and preparations had been made for developing the blast furnace plant into a steel works capable of meeting the needs in ingots and billets, etc. During the year business in iron and steel manufactures stood under the influence of the uncertainty regarding the renewal of the syndicates concerned, and sale prices were consequently not very satisfactory. On the other hand, the wire rope works, the cable factory, copper works, rubber factory, and the factory for insulated conductors, were fully employed at favourable prices. The accounts indicate the undernoted results for the two years:—

	1912	1911
Share capital ... ..	£2,750,000	£2,750,000
Loan capital ... ..	1,218,000	1,241,000
Gross profits ... ..	547,000	509,000
Depreciation ... ..	83,000	92,000
Net profits and balance forward ...	278,000	212,000
Dividend, per cent. ...	8	6

The dividend of 8 per cent. compares with 6 per cent. in 1911, 4 per cent. in 1910, 6 per cent. in 1909, and 8 per cent. in 1908, thus showing a recovery since the disposal of the Frankfort department. At the end of 1912, the number of workmen and officials employed was 6,846, as compared with 6,682 at the close of the previous year. The company's investments increased from £1,755,000 in 1911 to £2,162,000 in 1912 by the subscription of shares in the Steinfort Steel Works and other undertakings, and by the completion of further instalments on the interests held in Escher, Wyss and Co., the St. Petersburg United Cable Works Co., etc.

### Russian Electrical Companies.

The directors of the *Russian Tudor Accumulator Works Co., of St. Petersburg*, report that a further increase in the turnover and working results took place in 1912, the expansion necessitating an augmentation in the share capital from £120,000 to £240,000. The net profits amounted to £34,748, as compared with £25,556 in 1911, and a dividend of 10 per cent. has been declared on the larger capital, as against 14 per cent. on £120,000 in the preceding year. It is stated that the orders brought over into the new year were substantially greater than at the beginning of 1912.

The report of the *Russian A.E.G., of St. Petersburg*, for 1912, states that an important development took place in the economic life of the country and the further progress of the company in connection therewith was satisfactory. A considerable increase in the turnover was experienced, and the working results were more favourable than in the preceding year. The St. Petersburg United Cable Works, in which the company is interested, again proposed to distribute 8 per cent. for 1912, as in the previous year. As gross profits the accounts of the A.E.G. show the sum of £129,561, as compared with £105,136 in 1911. After placing £28,000 to depreciation, as against £25,000, and making provision for taxes, reserve fund, and other charges, the balance of the profits permits of the payment of a dividend of 9 per cent. on capital of £800,000, as contrasted with 8 per cent. in 1911. The share capital was raised to £1,200,000 in February, 1913, and the premium of £50,000 realised on the issue has been placed to the reserve fund.

The report of the *Russian Siemens & Halske Co., of St. Petersburg*, states that an exceptional growth in orders was recorded in 1912. It was, however, impossible to keep pace with deliveries to a corresponding extent, as a few weeks after starting full working in the new dynamo works, a strike broke out at both works, and was only settled after lasting for three months, whilst at the same time a scarcity of skilled workers was experienced at the new works. Including the balance forward the accounts exhibit profits of £63,638 for 1912, as contrasted with £52,177 in the previous year on a share capital of £560,000. After allocating £20,000 to depreciation, as against £10,000 in 1911, the balance allows of the payment of a dividend of 6 per cent., being the same rate as in the preceding year. The report further mentions that the completion of the new dynamo works afforded the necessary basis for the carrying out of a long considered scheme for amalgamating the heavy electrical engineering department, as had taken place in other countries, with that of the Russian Schuckert Co., of St. Petersburg. The scheme would be accomplished by the latter, assuming the title of the Russian Siemens-Schuckert Co., and increasing its share capital to £1,500,000, of which about £1,100,000 would devolve upon the Siemens and Halske Co. for the assets brought into the combined undertaking. Of the shares to be received from the Siemens-Schuckert Co., the Siemens and Halske Co. would transfer about £825,000 at the nominal value to the parent company in Berlin in settlement of a loan granted by that company, and the two companies would hold eleven-fifteenths of the capital of the Siemens-Schuckert Co. The light electrical engineering departments would be continued by the Siemens and Halske Co. in its own name. The cable business was in the hands of the United Cable Works, in which the company held one-third of the capital of £600,000, upon which a dividend of 8 per cent. had been declared for 1912, as in the preceding year. It is added that the Polish Electrolishmeil Works of Siemens, of which the company owns the majority of the capital, would pay 4 per cent. for the first year's working, after having written off preliminary expenses. The Russian Ozone Utilisation Co. had terminated its first year with a loss, although the prospects were not unfavourable, especially if the larger installation for the sterilisation of the whole of the water supply for St. Petersburg was to be carried into effect.

### West African Telegraph Co., Ltd.

The meeting of this Company was held on May 21st at Electra House, E.C.

SIR J. DENISON-PENDER, in moving the adoption of the report (see ELEC. REV., p. 864), said that the gross revenue for the year under review amounted to £46,603, as against £54,923 for 1911, or a decrease of £8,320. That decrease would have been larger, owing to the cessation of the payment of the Portuguese Guarantee, if there had not been an increase in other directions. Messages showed an increase of £1,091, and interest and dividends of about £1,600, while they had benefited to the extent of just over £500 by the effect of exchange. With regard to the expenses he was pleased to say they were slightly less than in 1911—£23,900 odd, against £26,000, or a reduction of £2,000. At the same time he must point out that this was entirely due to a reduction of £2,000 in respect of expenses attending the maintenance of cables, the other items of expenditure being practically the same as last year. Therefore they could not rely on that £2,000, for next year if they were unfortunate they might have to pay double that amount in the maintenance of cables. The net result of the year's business showed that they were able, after providing for the usual 4 per cent. dividend, to set aside £18,000 to reserve, which was only £4,000 less than the amount transferred in 1911, and that left the reserve fund at the very satisfactory figure of nearly £300,000. As there had been several decreases in the revenue, he thought it advisable to give the shareholders a short history of the Company to show them what a sound position it was still in. They would remember that the Company was started in 1885 with a share capital of £231,000 and a debenture debt of £300,000; the debentures being subject to annual drawings. At that time they had stations not only at the Portuguese possessions but also at certain French Colonies on the West Coast of Africa. From the Portuguese Government they received a guarantee equivalent to a maximum of £42,000 a year, so that their total income on all through traffic in their Portuguese stations should not fall below that figure. The actual amount received from the Portuguese Government was at the beginning £33,000; but that sum fell to £25,000, and latterly to £21,000 as the traffic developed. The French Government gave

them a subsidy equal to £12,000 a year for the French stations connected by their system of cables. Then came the sale in 1902 of the French cables to the French Government, by which they were able to cancel their outstanding debentures. Of course, the French subsidy ceased when the cables were sold. The prosperity of the Company might be said to date from that sale, and the subsequent relief of the burden of the debenture debt. For years past they had regularly paid a 4 per cent. dividend, and they were able to recommend the same payment this year in spite of the loss of the Portuguese guarantee, which entirely ceased last year, and in face of the fact that there had been considerable reductions in the rates since the cables were opened. At the first blush the present accounts looked unsatisfactory, but when they remembered that the revenue had been earned by traffic and without any subsidies, they would see that it was most satisfactory, and that in spite of the loss of the subsidies the Company was almost certain to continue paying the same dividend and also to put aside satisfactory sums to reserve.

Mr. H. K. GRAY seconded the motion, and the report was adopted.

### Western Telegraph Co., Ltd.

This Company's meeting was held on May 21st at Electra House, E.C.

SIR JOHN WOLFE BARRY, K.C.B., in proposing the adoption of the report (see ELEC REV., p. 822), said that the result of the Company's working during the half-year was satisfactory. There was an increase in message revenue of £2,652 and in interest on investments, etc., £5,664, together £8,316. This result compared with the half-year of 1911, before they largely reduced their tariffs. The period under review had provided no public event in South America of sufficient importance to affect telegraphic traffic to any appreciable extent, and the growth shown was due to the excellent trade conditions existing in the countries they served. The working expenses were higher, for although the increase in message receipts was small, the volume of international traffic dealt with during the half-year was over 20 per cent. greater than during the corresponding six months of 1911, when the higher tariff was in force. The expenses in London were more by £700, principally due to extra staff and increased office accommodation. At the stations the increase was nearly £10,500. The expenses attending the maintenance of cables was more by £10,200, due to increased consumption of coal by the ships and more cable used on repairs than in the corresponding period of 1911. Income tax was higher by nearly £500. The cost of the renewal of the landlines at Santos amounted to £1,400, but against this the cost of landlines at Pernambuco in 1911 was £4,400, showing a decrease of about £3,000. The net increase in expenses was therefore £18,900, and in net revenue there was a decrease of rather more than £10,000. After providing £16,373 for debenture stock interest and £8,361 for income tax, there remained a balance of £237,679, which, with £33,517 brought forward from 30th June last, made a total of £271,196. First and second interim dividends, amounting to £62,379, had been paid, and after transferring £140,000 to the general reserve fund, £25,000 to the provision on account of investment fluctuations, and £10,000 to the land and buildings depreciation fund, there remained £33,817, which was carried forward. In conclusion the CHAIRMAN announced that in future the interim meeting would be discontinued and an annual meeting only would be held in November each year.

SIR J. DENISON-PENDER seconded the motion, and the report was adopted.

### South Metropolitan Electric Tramways and Lighting Co., Ltd.

Mr. C. G. TEGETMEIER presided, on May 21st, at the offices in Kingsway, W.C., over the meeting of this company.

The CHAIRMAN, in moving the adoption of the report (see ELEC REV., p. 821) said that the result of the year's operations showed a surplus of £15,493, compared with £13,939 in the preceding year. The traffic receipts on the tramways amounted to £44,273, or £491 less than in the preceding year. A comparison between the two years was, however, affected by the fact that in 1911 they had an exceptionally fine summer, and the Pageant of the Empire held that year at the Crystal Palace brought them a good deal of abnormal traffic. Last year the weather, especially during the summer months, was very unfavourable, and the holiday traffic on their lines, which constituted a considerable proportion of their receipts, was very adversely affected. They must regard it as satisfactory that they were able to maintain their receipts so well and to show an increase over 1910 of £1,611. Their working expenses on the tramways showed little variation. With regard to the electricity supply section of the business, very steady progress was being made. The number of consumers increased from 1,355 to 1,535, and there was an increase of £1,841 in the sale of current for private lighting. In the four years since 1908, the receipts from this branch of their business had increased from £6,358 to last year's figures of £11,207, and as a considerable portion of their extensive area of supply was still undeveloped, they might look forward to further and continuous growth. Their capital expenditure during the year amounted to £9,986 upon the electricity supply section, and £354 upon the tramways, the larger portion of the former being for the cost of new mains to serve newly-erected houses. As additional houses were built on the line of mains

this expenditure became increasingly remunerative. The combined working balances from the two sections of the undertaking amounted to £27,372, or £219 less than in the preceding year, but sundry receipts were £1,629 more. An important matter was the proposal the shareholders had received to exchange their preference and ordinary shares for shares in the London and Suburban Traction Company, and it was fitting that he should state the reasons which induced the directors to recommend them strongly to accept it. The speaker went on to refer to the incorporation of the London and Suburban Company, and he added that there could be no doubt that the latter was advantageous to the interests of the shareholders of the Metropolitan Electric Tramways and the London United Tramways, and the directors could not see it would be equally in the interests of the shareholders of the South Metropolitan Company to join the combination. Their business had for the last few years shown indications of steady although somewhat slow progress. Their electric supply undertaking was developing and was capable of very considerable further development, and if conditions remained unaltered they might look forward to progressive improvement in their tramway undertaking, which at present provided the greater portion of their profits. But conditions were altering, and they had to anticipate that the same motor omnibus competition which had affected the revenue of the other tramway companies in the London and suburban area would also affect them. Since the beginning of the year they had experienced motor omnibus competition on a portion of one of their routes, and the effect upon their revenue showed what was likely to be the result if the competition became more extended. In anticipation of this competition and for the protection of their interests, they decided to acquire and operate motor omnibuses, and they placed an order in the latter part of last year for 10 'buses, which had recently been delivered to them, but it was obvious that to operate a small number of omnibuses in competition with existing omnibus interests would be a difficult business, and would not secure the best results. If the proposed exchange of shares was carried out, the 10 omnibuses would be worked by the London General Omnibus Company under a similar arrangement to that which existed in respect of the omnibuses of the Tramways (M.E.T.) Omnibus Company. The earnings would swell the profits of the London and Suburban Traction Company in which they would be shareholders, and it was easy to realise that the earnings of omnibuses worked under this arrangement would be much larger than if they were worked in competition with the fleet of the London General Omnibus Company. The preference shares in the South Metropolitan Company were £1 each and entitled to a 6 per cent. cumulative preferred dividend, but they ranked equally with the ordinary shares in any deficiency of assets. They were invited to exchange these shares for shares in the London and Suburban Traction Company, bearing a cumulative preferential dividend of 5 per cent., and having priority of capital over the ordinary shares, and they were offered £125 of new shares for every £100 of shares which they held at present. They would therefore receive £1 5s. of new capital in exchange for £1 of present capital, and the return would be £6 5s. per cent. upon the amount of their present capital instead of £6 per cent. as at present. The shares they received would rank for dividend from the last quarter. They would be entitled to the dividend proposed to be paid on their present shares for the past year, but would, of course, not be entitled to any arrears of dividend. With regard to the ordinary shares in the South Metropolitan, upon which no dividend had yet been paid, the holders of these shares were offered £75 of ordinary shares in the London and Suburban Traction Company for every £100 of shares they at present held. While they would suffer a diminution of capital, he believed they also would be in a better position after the exchange than at present. The profits of the London and Suburban Traction Company would be derived from the dividends it received on the shares it held in the Metropolitan Electric Tramways, the London United Tramways, on the whole of the shares in the Tramways (M.E.T.) Omnibus Company, and on the shares it would hold in the South Metropolitan Company if the exchange was effected. It was difficult at present to form any definite estimate of what these profits would amount to, for one reason, because it would be some little time before the whole of the omnibuses of the Tramways (M.E.T.) Omnibus Company were in public service, and bringing in revenue, but they were satisfied that the preference shareholders would receive their dividend, and that there was a good prospect of a fair return in future to the ordinary shareholders who exchanged their shares. Another point to be borne in mind was that by making the exchange they would become shareholders in a company with a very large capital and with a large number of shareholders, and that there would be a better market for the shares than there was for those which they held at present.

Mr. E. GARCKE seconded the motion.

Replying to a question, the CHAIRMAN said the debenture holders were not affected in any way by the proposed exchange.

Mr. CROFT agreed that the combination proposed ought to result in reduced administrative expenses. He asked who would be the directors of the London and Suburban Traction Company.

The CHAIRMAN said if the exchange was carried through, he would be offered a seat on the Board of the Traction Company.

A shareholder thought that the preference shareholders were entitled to the one year's arrears of dividend, which they would lose if they exchanged their shares.

The CHAIRMAN pointed out that there was no compulsion on any shareholder to exchange his shares. If a shareholder did

not exchange, and the arrears of dividend was paid, then he would receive his share. The scheme was not effective unless 75 per cent. of both classes of shareholders exchanged their shares. At present the holders of over 99 per cent. of the ordinary were willing to do so, and of the preference shares nearly 85 per cent. had consented, so that the scheme did become effective subject to the London and Suburban Traction Company agreeing to increase the capital of that company to the necessary extent.

The report was then adopted.

### Kidderminster and District Electric Lighting and Traction Co., Ltd.

MR. S. E. GARCKE presided on May 22nd over the meeting of this Company, held at the offices of the Electrical Federation, Kingsway, W.C. In proposing the adoption of the report, he said the capital expenditure had increased during the year by £2,534, chiefly in connection with the installation of a new battery, and further expenditure would be required during the year, because a certain increase was necessary to the plant, in view of the demands of the coming winter, which they hoped would be greater than in the past winter. With regard to the profit and loss account, the dividend received from the Kidderminster and Stourport Tramways Co. was at the rate of 3½ per cent., as previously. As to the electric supply business, the total revenue from this undertaking showed an increase of £250. There had been a somewhat serious increase in the price of fuel, and the cost of generation had consequently increased by £240. The sum of £220 had been written off motors in the accounts under consideration, and this item, with the increase he had mentioned, accounted for the total increase of £600 in the cost of the supply. The result was that the available balance carried to the net revenue account was £3,693, as compared with £4,076 in the preceding year. The renewals fund now stood at the substantial figure of £6,819, and the reserve fund at £1,750. Altogether the sum of £16,389 15s. 3d. had been provided out of the past profits for reserve and renewals generally.

MR. W. JONES seconded the motion, and the report was adopted without discussion.

MR. B. SHIRREFF HILTON was re-elected a director, and the remuneration of the directors was fixed at £50 for the Chairman and £25 each for the other directors for the year.

### Brisbane Electric Tramways Investment Co., Ltd.

THE 12th annual meeting was held on May 21st, at Winchester House, E.C., Mr. H. R. Beeton presiding.

In moving the adoption of the report (see ELEC. REV., p. 779), the CHAIRMAN said that the strike, which he described at length at the last meeting, had seriously affected the accounts for the year. The service was entirely suspended for 4 days, and largely interrupted during the whole of the first quarter, causing a reduction in the traffic receipts for those three months of £14,837. With the resumption of normal conditions, however, they not only made good that loss in the remaining nine months, but showed a net increase of £870 at the close of the year. The expenses increased by £34,893. Of this amount £15,305 was directly attributable to the strike, £4,765 to the legal and other expenses in connection with the Australian Employees Association's action, and the balance to the general rise in wages, materials, and power house expenses, consequent upon larger sales of current. They estimated that the total loss incurred directly and indirectly by the strike was fully £32,000. In the circumstances, it was a matter for congratulation that the Tramways Company's profits were sufficient after adding £10,000 to its renewals fund (bringing it up to £100,000) to enable the Investment Company, after providing for its debenture interest and preference dividend, and adding £5,500 to its reserve fund, to pay the usual 8 per cent. on its ordinary shares, leaving £3,781 to be carried forward, with an aggregate of renewals and reserve funds and the undivided profits amounting to £121,909. At the last meeting, he mentioned that the various local authorities, through whose districts their lines ran, had had several joint meetings with a view to coming to an arrangement for the purchase of their undertaking, culminating in their promoting a Bill in the Queensland Legislature seeking powers for the appointment of a Joint Board to negotiate with their Company an agreement to enable them to acquire the undertaking at any time at an agreed price and conceding to them a share of profits in the working in the meantime. The representatives of the local authorities, however, while approving generally the making of such an agreement, were unable to agree as to the constitution of the Joint Board, and the Bill was therefore dropped. He also stated at the last meeting that for the purpose of extensions and renewals they would have to issue in the near future further capital, which would probably take the form of an issue of ordinary shares at par. Negotiations were pending as to the terms on which extensions should be made, and the question of the further issue of capital must be deferred until these negotiations were completed. Towards the end of December 1912, the Commonwealth Arbitration Court gave its award in the matter of the alleged industrial dispute between the Australian Tramways Employees Association and the various tramway undertakings in Australia. That award, so far as their Company was concerned, gave preference to the members of the Employees Association,

an eight-hour day, two weeks vacation, increased wages, and other advantages to the men, the cost of which would amount to a considerable sum. Having been advised that the award was invalid, they immediately applied to the High Court and obtained an order nisi calling upon the Association to show cause why a writ of prohibition should not issue prohibiting any further proceedings against the Company upon the award. The further hearing of the matter had been postponed until June, and might be still further postponed, but until the decision of the High Court was obtained, the award would be in abeyance. As the matter was *sub judice*, he did not propose to say anything further on the point except that they were advised that they might reasonably expect the award to be set aside, as had been the case with other awards made by the same Judge. At the same time, he wished to add that the board had always been willing to accord to their employees a reasonable share in the growing prosperity of the Company, and to consider suggestions for their benefit. Their prospects continued favourable, as was evidenced by the fact that the receipts to the end of April amounted to £99,430, being an increase of £36,190 over the same period last year, and of £23,129 over the same period of the year before. He was glad to be able to report that after giving them the benefit of his presence in London, Mr. Badger had returned to his post in restored health, and to him again, and to the devoted staff which he controlled and inspired, their best thanks were due.

MR. W. F. HAMILTON, K.C., in seconding the resolution, said that he spent ten weeks in Australia last year on the business of the Company. He was very favourably impressed with the great future that lay before Brisbane, and he was convinced that that city would remain the principal port of Queensland. He did not believe there was any likelihood of any labour troubles for many years to come, nor did he think there was any probability of either the Government or the municipalities purchasing the Company's undertaking.

Replying to a shareholder, the CHAIRMAN said that the possibility of motor 'bus competition had been the subject of constant watchfulness on the part of the board, especially in view of the success which had been achieved by those vehicles in London. They, however, felt no fear on the subject, for the two motor 'bus companies which had started in Brisbane had already gone into liquidation, and however much they might succeed elsewhere, he was confident they would never pay in Brisbane.

MR. HAMILTON confirmed the CHAIRMAN's remarks, and said that the conditions in Brisbane were quite unattractive for heavy motor 'buses, the gradients being very steep indeed.

The report was adopted.

The result of the working of the Tramways as shown by the audited accounts of the original Company for the year ending the 31st December, 1912, was:—Total receipts, £254,838. Total expenditure (including strike and arbitration expenses), £162,805, leaving net profit for year, £92,033 plus £2,695 brought forward. There is a balance of profit available of £95,128, which has been appropriated by the Tramways Company in the following manner:—In payment of Dividends on Shares (free of tax), £80,000; in placing to the credit of a Fund for Renewals (bringing it up to £100,000), £10,000, carrying forward £5,128.

### Eastern Telegraph Co., Ltd.

SIR JOHN WOLFE BARRY, K.C.B., presided on Wednesday last week at the meeting of this Company, held at Electra House, Finsbury Pavement, E.C.

The CHAIRMAN, in proposing the adoption of the report (ELEC. REV., page 822), said that the gross revenue for the half-year amounted in round numbers to £753,300, against, for the corresponding period of 1911, £729,400, or an increase of £23,900. The revenue for the period under review was the highest ever received by the Company in any one half-year, and it was gratifying to be again able to report that the increase was spread over every branch of the traffic, with the exception of South America and Egypt. The former was less owing to the reduction by about one-third in the rates brought into operation by the Western Telegraph Co. in May last year, and represented their share of the loss of revenue occasioned by the reduction; but he trusted that this would be gradually recouped as the traffic expanded with the commercial development which was now taking place in South America. The traffic with Egypt was not quite so good as it was in 1911. The ordinary working expenses for the half-year amounted to £273,200, against £245,300, or an increase of £27,900. As he had so often pointed out, they must expect a constant expansion of working expenses in view of the ever-increasing volume of traffic which had to be handled by the staff, and which necessitated the employment of greater numbers and consequent increases under most of the heads of expenditure. General expenses in London were £1,900 more than they were for the corresponding period of 1911, while working expenses at stations showed an increase of £24,700. There was an increase of £10,800 under the heading of salaries and wages, due to a considerable augmentation in the number of the staff, to annual promotions, and to improved conditions relating to Sunday duty and overtime. Maintenance of instruments showed an increase of some £2,000, which was due to the introduction of new and improved instruments for the better working of the cables, while maintenance of landlines was nearly £4,000 more than for the corresponding half-year, due to the substitution of phosphor-bronze for iron wire over a large portion of their landlines in Egypt. Referring to the item "expenses attending maintenance of cables," the CHAIRMAN said that he had repeatedly pointed out how necessarily

variable the charge to revenue in respect of this account must be, depending as it did upon the number and extent of the cable repairs, and the amount received for the charter of their cable-repairing steamers by foreign Governments and other telegraph companies. On the present occasion the charge to revenue was £45,500 more than for the corresponding period of 1911, and was chiefly due to an expenditure on 85 miles more cable, and to the fact that the amounts received in respect of charters and other credits were over £20,000 less than for the half-year ending December, 1911. In consequence, the net profit for the half-year under review was £47,500 less than in the corresponding half-year of 1911; but he was pleased to be able to state that they had been able to contribute £160,000 to the general reserve fund, and that, notwithstanding the increased expenses, the amount carried to this fund for the complete year of 1912 was £30,000 more than for the year 1911. He referred at the last meeting to contemplated expenditure in connection with important renewals of some of their cables, and to the strengthening of their cable capacity east of Suez by the laying of new and important cables, and £65,100 had been charged against general reserve fund this half-year in respect of that work, which it was estimated would, in all, cost about £1,000,000. Owing to the expiry of the original concession granted to the Black Sea Telegraph Co. by the Russian and Turkish Governments in respect of the cable from Odessa to Constantinople, that company has been voluntarily wound up. The shares were held in equal proportions by the Eastern and the Indo-European Telegraph Companies, and the cable then became the joint property of those companies, to whom other concessions to work the cable had been granted by the two Governments referred to. In consequence of the continued depreciation of the reserve fund investments, the board had considered it advisable to make a further provision on this account by transferring an additional £25,000 from the general reserve fund to the special fund provided for the purpose. This special fund now stood at £325,000, which represented approximately the difference between cost and the middle price according to the official list on December 31 last. To replace the cable ship "Duplex," which had been sold out of the cable-repairing service, the board had purchased the "Cambria" from the Telegraph Construction and Maintenance Co., and capital expenditure had been charged with £35,505 on account of its cost. The CHAIRMAN then referred in detail to the new Articles of Association which had been drawn up, the principal alterations in which were provisions for discontinuing the half-yearly meeting and for remunerating sub-committees of the directors. He also remarked that the board had it in contemplation to add another director to the board, which would mean an additional £500 a year in fees.

SIR J. DENISON PENDER, K.C.M.G., seconded the motion, and the report was adopted without discussion.

### West London and Provincial Electric Supply Co., Ltd.

THE annual meeting was held at 14, Ironmonger Lane, London E.C., on May 21st, Mr. Harry Kahn presiding.

The CHAIRMAN said that there was very little comment to make on the balance-sheet, their real interest lying in the successful working of the Chiswick corporation. The profit and loss account showed an increase in the profits carried to the balance-sheet of £668, which was due to the fact of the Chiswick corporation paying a 6 per cent. dividend this year on its shares, instead of 5 per cent., as last year, and also to a slight increase in the engineers' fees received. This enabled the directors to propose the payment of a dividend of 6 per cent. per annum on the cumulative preference shares, and the payment of interest at the rate of 4½ per cent. per annum on the funding certificates for the year 1911. The Chiswick corporation continued to make steady progress. The number of consumers had increased this year by 181, and the revenue by £1,984, the units sold being 10 per cent. over the units for the previous year, and in spite of the fact that more was being contributed this year to depreciation—viz., £1,149, against £932 last year—and that the repairs account and price of coal had been higher, it was satisfactory to note that the corporation had been enabled to increase the rate of dividend to be paid. The revenue of the corporation during the first quarter of 1913 had again shown an increase, also the second quarter so far as it had gone.

Mr. W. B. Esson seconded the adoption of the report, and it was carried.

**Castner-Kellner Alkali Co., Ltd.**—This company on 23rd inst. resolved to increase its capital from £450,000 to £500,000 by the creation of 50,000 new shares of £1 each, which will be issued at 2 premium. There will be no public issue.

**British Electric Traction Co., Ltd.**—It is stated in the financial papers that the directors have declared the dividend on the 6 per cent. cumulative preference stock and a dividend at the rate of 3 per cent. on the 7 per cent. non-cumulative preference stock for the year ended March 31st.

**Mirrlees, Bickerton & Day, Ltd.**—The net profit for the year ended March 31st last, after providing for depreciation and directors' fees, is £11,116, making (says the *Financial News*), with £337 brought forward, an available total of £11,453. Preference interest absorbs £2,184, and the directors recommend a dividend on the ordinary shares of 7½ per cent. for the year, absorbing £7,104, placing £1,000 to reserve, and carrying forward £1,165.

### Birmingham District Power and Traction Co., Ltd.

THE directors' report for the year ended December 31st, 1912, states, according to the *Financial News*, that the total revenue from all sources was £115,698, compared with £109,901 for the preceding year. The expenses amounted to £55,529, compared with £52,395 for 1911. After providing for all sums chargeable to revenue, including repairs, maintenance, sums payable to local authorities, and placing £6,000 to the renewals fund, there remains £55,108, plus £311 brought forward, making £55,419. From this has to be deducted for interest on loans £7,539, interest on debenture stock £16,084, leaving £31,826. After deducting for debenture sinking fund £4,229, and dividend for the year on the 5½ per cent. cumulative preference shares £11,538, there remains £15,359, which the directors recommend should be applied to payment of a dividend on the preferred ordinary shares at the rate of 3½ per cent. for the year £12,250, to reserve £3,000, leaving to be carried forward £109. The gross receipts from the tramways were £53,639, compared with £50,515 in 1911. The gross receipts from the lighting and power department amounted to £29,475, an increase of £3,095. The dividends received from investments produced £30,180, compared with £29,861 in 1911. Expenditure of £3,945 on capital account was incurred during the year for additional plant, mains, &c., for the lighting undertaking in Smethwick; £4,843 for the purchase of motor-omnibuses for hire to the Birmingham and Midland Motor-Omnibus Co., Ltd., and £721 in respect of parcels equipment, extensions at West Smethwick depot, &c. A sum of £11,798 was received during the year, partly in respect of electric cars, motor-cars, &c., sold, and partly in respect of a payment by the City of Birmingham Tramways Co., Ltd., towards the capital cost of the Tidvale workshops. This sum has been placed to the credit of capital account. The total debenture stock now outstanding, including a further amount of £46,453 issued during the year, is £371,146. In the last report particulars were given of the offer of the Electrical and Industrial Investment Co., Ltd., to exchange the shares held by the company in the City of Birmingham Tramways Co., Ltd., for shares and debenture stock of the Electrical and Industrial Investment Co., Ltd., which offer had been accepted by the directors. The exchange has since been completed, and the company now holds the following securities in the Electrical and Industrial Investment Co., Ltd., viz., £1,275 5½ per cent. second debenture stock, 54,022 6 per cent. cumulative preference shares of £1 each, and 161,566 ordinary shares of £1 each. The company has increased its holding of debentures in the Birmingham and Midland Motor Omnibus Co., Ltd., by £6,800, issued for the purpose of providing motor-omnibuses of a modern type for use in and around Birmingham; 20 petrol-electric motor-omnibuses have been purchased by the Motor-Omnibus Co., and are now in operation, in addition to 29 motor-omnibuses hired from this company. The loan to the South Staffordshire Tramways (Lessee) Co., Ltd., has been paid off, the company having accepted £57,733 4 per cent. debenture stock and a cash payment of £7,150 in discharge thereof.

### Dutch-Netherlands Telegraph Co.

THE report for 1912 of the Deutsch-Niederländische Telegraphen Gesellschaft, of Cologne, states that an increase in the traffic with the Far East took place, especially with the Dutch Indies. The negotiations in regard to the erection of wireless stations in the South Seas—Jap, Nauru (South Sea Islands), Rabaul (New Guinea), and Apria (Samoa)—had been concluded and the company, together with the Wireless Telegraph Co. of Berlin, had participated in the formation of the German South Sea Wireless Telegraph Co. of Berlin for the carrying out of the scheme. Both parties had provided the necessary capital, the German Netherlands Co. having taken over £32,500 in shares and £20,000 in loan capital, and a dividend of 6 per cent. on the shares was guaranteed by the subsidy granted by the German Government. The company would be able to defray out of current funds the instalments to be gradually paid for the new undertaking. The station at Jap was approaching completion, and that at Nauru would presumably be finished in June, whilst the work in Samoa and New Guinea was already in hand. The gross profits from the cable traffic amounted to £104,000, as compared with £103,000 in 1911; interest yielded £4,450 as against £3,590, and the sum of £10,800 is brought forward as contrasted with £8,300 in 1911. On the other hand, the general expenses were £22,100 as against £21,600, the cable maintenance fund absorbed £10,200 as in the previous year, the sum of £8,750 has been placed to the cable renewal fund as in 1911, and £15,400 to the cable redemption fund as contrasted with £14,800. The net profits are returned at £42,000 as against £40,700 in 1911, and a dividend of 6½ per cent. is proposed on the share capital of £350,000, being the same rate as in the previous 12 months. The loan capital stands at £282,000, and required £11,200 for its service as compared with £11,800 in 1911.

**Stock Exchange Notices.**—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

Consolidated Diesel Engine Manufacturers, Ltd.—Further issue of 4,413 shares of £1 each, fully paid (Nos. 594,547 to 598,959); and 100,000 vendors' shares of £1 each, fully paid (Nos. 427,077 to 527,076).

River Plate Electricity Co., Ltd.—Further issue of £30,000 ordinary stock.

**London and Suburban Traction Co., Ltd.**—The adjourned meeting of preference holders to sanction the increase of capital is to be held at the Holborn Restaurant on June 4th.

**Prospectuses.**—*Brazilian Traction, Light and Power Co., Ltd.*—Applications have been invited this week for an issue of £10,000,000 6 per cent. cumulative preference shares at par, or £20 11s. for each \$100 share. The company owns over 99 per cent. of the share capital of the Rio de Janeiro and Sao Paulo companies, and it is for the purposes of these concerns, and to repay bank loans contracted in connection with same, that the proceeds of this issue are required.

*City of Las Palmas Water and Power Co., Ltd.*—The list was closed on Tuesday in an offer of £237,000 5 per cent. first mortgage debenture stock at 93 per cent. The company has a 60-year concession for electric light and power from the Las Palmas municipality. The electric lighting of Las Palmas has been worked successfully by a Belgian company—the *Compagnie Internationale d'Electricité*—with whom a contract has been made restricting electric supply competition.

**French Thomson-Houston Co.**—The accounts for 1912 of the *Compagnie Francaise Thomson-Houston* show that investments yielded profits of £79,000, and technical working and subsidiary receipts profits of £217,000, making a total of £296,000. These compare with £81,000, £193,000 and £2,740,000 respectively in the previous year. After meeting general expenses and depreciation, the accounts indicate net profits of £172,000, as contrasted with £153,000 in 1911; and it is proposed to pay a dividend of £1 8s. per share as against £1 5s. in the preceding year. The share capital amounts to £2,400,000 and the loans to £1,120,000, whilst a further issue of 4 per cent. bonds for £600,000 has just been offered for subscription.

**Continental.**—**SWITZERLAND.**—A new company has lately been formed in Geneva, with a capital of £80,000 and the title *La Société de l'Energie Electrique du Valais*.

**FRANCE.**—*La Compagnie Generale de Distribution Electrique à Paris* reports a net profit of £24,339 for the last financial year, as compared with only £17,954 in the preceding 12 months. It is proposed to place a sum of £4,000 to the repairs and accidents account, £17,880 to depreciation and to carry forward. The report of the *Société de l'Energie Electrique de Sud-Ouest*, of Paris, shows a net profit of £17,272, as against only £7,683 in the preceding year. A dividend of 6 per cent. is being paid on the preference shares, but there is nothing for the ordinary shareholders.

**BELGIUM.**—*La Société des Accumulateurs Tudor*, of Brussels, reports a profit of £10,044 for the last financial year.

**Cleveland and Durham County Electric Power Co.**—After deducting debenture interest, the accounts for 1912 show an available sum, including £528 brought forward, of £18,443. The directors recommend a dividend of 3½ per cent., carrying forward £148.

**Bombay Electric Supply and Tramways Co., Ltd.**—The directors recommend a dividend on the ordinary shares at the rate of 5 per cent. per annum, free of income-tax, for the year ended December, 1912.

**Lima Light, Power and Tramways Co.**—The profit and loss account for 1912 shows that the total profits obtained amounted to £p.175,156, and that the net profit was £p.98,890, which the board has divided as follows:—To reserve and redemption fund, £p.25,994; to shareholders, 4 per cent., £p.53,996; leaving a balance of £p.18,900. Out of this the board proposes to pay an additional dividend of 1½ per cent., in respect of the year 1912, and to carry forward £p.2,027.—*Times*.

## STOCKS AND SHARES.

Tuesday Evening.

It can hardly be said that the sudden advent of summer weather has had much forcing effect upon prices in the Stock Exchange. Certainly a few of the Home Railway stocks were benefited, but even in their case the improvement was very fleeting. That is to say, it was soon succeeded by a fresh relapse into dullness. Business, indeed, throughout the House is slack. A dozen reasons can be supplied to account for this, but all the causes work back to the original root of new issues, the enormous quantity of which simply swamps the markets for existing securities.

So far as the Underground Railways are concerned, the brilliant weather has had no beneficial effect upon their quotations. This is not surprising, having regard to the probability that the public will choose outside methods of transport rather than the tubes during the summer time. Metropolitan are ½ down at 51½, and Districts fell to 38½. The Underground Electric Railways issues are flat, there having been some apparently forced selling of the Ordinary shares, which depressed the price to 1, a drop of 5s. while the "A" shares at 11s. 3d. middle weakened in sympathy. The 6 per cent. Income bonds are a point down at 91½.

The feature in the Home Traction market has been a series of vivid rises in British Electric Traction issues. The company has declared a dividend of 3 per cent. on the 7 per cent. Non-Cumulative Preferred stock, and this unexpected announcement served to put up the price of the stock 7½ points. The 6 per cent. Preferred rose 2; the Deferred and the other stocks a point or more apiece. We drew attention last week to the way in which the company's

descriptions were hardening, the especial feature then being a rise of 2½ in the 7 per cent. Non-Cumulative Preferred stock, from which it was inferred that the buying was of the intelligent order. London United Tramways are unchanged. Hastings 4½ per cent. Debenture stock has risen a point.

In the Electricity Supply Department the falls predominate. Citys are marked 10s. lower. St. James' Ordinary and Preference both fell ½, and a similar fall occurred in Kensingtons, Brompton Preference and Westminster. However, 5s. was gained by Chelsea and ½ by Metropolitan Preference; while South London 5 per cent. Debenture stock is again higher, and County Second Debenture stock came into demand at par. That the shares in this market should be dull is not surprising, in view of the season of the year; but it is a little remarkable in that a very large investment order was executed here last week, the purchase money running into many thousands of pounds, and the investments ranging over all classes of securities comprised in this market. Midland Electric 4½ per cent. Debenture stock rose 2, although, naturally, the market is a more or less nominal one, seeing that the stock is to be paid off so soon.

A rough draft of the prospectus of the Wireless Electric Light Syndicate, Ltd., came under our notice the other day. The share capital was stated at £75,000, divided into 70,000 "A" Ordinary shares of £1 each and 100,000 "B" shares of 1s. each, of which it was proposed to issue part of each class. The Syndicate acquires rights in various inventions, one of which is the Moore Light System, with which, no doubt, technical readers of this column are well acquainted.

The telegraph market is depressed as regards the Eastern group. Eastern Ordinary is down 3 points. Eastern Extension shares fell ½, equivalent to 3½ in stock, but the Companies' pre-Ordinary issues are steady. According to the reports of both Companies, just issued, the undertakings occupy a strong position and have little to fear from the wireless competition which, not so very many years ago, was going to extinguish them—according to the fears of the timid—altogether. In some quarters, it is pointed out that investments in good cable companies' shares are preferable, from the security point of view, to those in the shares of the Marconi Company. Various kinds of fantastic estimates are current with respect to what the forthcoming Marconi dividend is going to be. A year ago it was 20 per cent.—4s. per share; and if the present price of the shares is any criterion, the distribution this time ought to be at any rate up to this mark. That it will be, is considered highly improbable, however; and the announcement is awaited with keen interest. The price of the shares at the end of last week dipped to 3½, from which it recovered to 4½; a drop of ½ remains on balance, while the Preference at 3½ are ½ lower. Americans declined at one time to 19s. 6d., Canadians to 12s. 9d., but in both of these cases there have been slight rallies.

The Anglo-American group continues dull and, as regards Direct United States Cable shares, depressed. The last-named fell to 7s. 6d., and the three stocks in the Anglo group are all easier. West India and Panamas at 2½ are ½ down, and Indo-Europeans fell 10s. to 57. The Telephone market is quietly steady, with no movement calling for particular comment. United River Plate Telephones at 6½ are the turn harder, and National Telephone Deferred stock remains in the neighbourhood of 20½.

Brazilian Traction Ordinary shares have fallen 1 on the issue of the prospectus of 6 per cent. Preferred stock at par. Sensibly enough, it was arranged in the market that there should be no dealings in this before allotment; and as the rights on the old stock were valued at nil, it may be said that the new Preferred starts fair and square on its own account. The security is generous; and although possibly enough the underwriters may get left with a certain proportion, there ought to be no difficulty on their part in selling it when the investment markets take a turn for the better.

Mexican issues are still dwindling, fresh declines occurring in Mexican Light and Power Common, Preferred and bonds. Shawinigan Water is also a dull spot, a further fall of a point being registered on the top of that of 2 last week. British Columbia Electric Railway stocks are distinctly weak, the falls in this group ranging from ½ to 3 points. It is thought that the selling—or, at all events, part of it—proceeded from people who have been obliged to sell part of their investment stocks in order to meet their obligation incurred through underwriting and payment of differences. Mexico Trams fell with Mexican Light and Power, and the dullness extended to Rio Tramway bonds. The bright spot in this market is the 5 per cent. issue of the Electric Light and Power Company of Cochabamba, a rise of 2½ taking the price to 97 middle, and surprising the jobbers themselves. Calcutta Electric Supply are better at 6½, while the Trams retain their rise at 6.

The Manufacturing group keeps very steady. Telegraph Constructions went back 10s. in consequence of the dullness in some of the cable companies' shares. Castner-Kellners are ½ off at 3½, notwithstanding the interim dividend for 1913 at the rate of 18 per cent., and Babcocks eased off to 3. On the other hand, British Aluminium Ordinary hardened, and British Insulated Preference are ½ better. British Westinghouse 4 per cent. Debenture stock is a shade higher. Rubber shares were sadly upset by the disappointing report from the Linggi Plantations Company, which somewhat demoralised the whole market. The price of the raw material, however, keeps fairly steady, and the discussion is revived as to whether Brazil will be able to compete with the Middle East if the price of the product falls, say, to half-a-crown per lb. Brazil is making strenuous efforts to encourage rubber cultivation, and it would be interesting if those who use the stuff for the purposes of electrical manufacture would enlighten the public on the point as to why fine hard Para should be specifically stipulated in many of the contracts for which tenders are invited.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

Table listing English Electricity Supply and Power Companies. Columns include Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations May 27th, Rise or Fall, Present Yield p.c., and Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations May 27th, Rise or Fall, Present Yield p.c.

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Table listing Colonial and Foreign Electricity Supply and Power companies. Columns include Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations May 27th, Rise or Fall, Present Yield p.c., and Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations May 27th, Rise or Fall, Present Yield p.c.

TELEGRAPH AND TELEPHONE COMPANIES.

Table listing Telegraph and Telephone Companies. Columns include Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations May 27th, Rise or Fall, Present Yield p.c., and Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations May 27th, Rise or Fall, Present Yield p.c.

\*Unless otherwise stated, all shares are fully paid. - a Paid in deferred interest warrants. † Interim Dividend. ‡ Bs. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations May 27th, Rise + or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations May 27th, Rise + or Fall, Present Yield p.c.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations May 27th, Rise + or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations May 27th, Rise + or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations May 27th, Rise + or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations May 27th, Rise + or Fall, Present Yield p.c.

Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

## PROCEEDINGS OF INSTITUTIONS.

## Electricity in Textile Mills.

THE most important subject which is now engaging the attention of the TEXTILE INSTITUTE is that of textile mill-driving, and a very keen and interesting discussion is proceeding upon the advantages and disadvantages of various prime movers and means of transmission. The question was opened at the last Autumnal Congress of the Institute which was held at Ilawick, and in September last a full report of the discussion, in so far as it related to electrical power, appeared in our columns. It may be remembered that owing to lack of time, the discussion could not be concluded in the ordinary way, and the authors of the papers upon steam, gas, oil and electricity were unable to reply to the many interesting points raised. The matter was therefore left open for further discussion, and the considered views of several members, together with the replies of the authors of the papers, were recently published by the Institute.

MR. A. N. RYE (Guernsey) who was formerly manager of the Electric Lighting Co. at Ilawick, and carried out the greater part of the electrical driving of textile machinery in that district, declared that the whole question of power production was difficult and complicated, and, provided power could be purchased from an electric supply company at a reasonable price, it seemed advisable to leave the power production to those companies which specialised on the subject. A large power company was obviously in a better position to adopt up-to-date plant than the millowner, and the purchaser reaped the benefit of improvements in a reduced power cost without taking risks himself. Mr. Rye offered very pointed criticism upon the papers dealing with steam and gas power, and stated that, in his particular district, he was getting most satisfactory results with Diesel engines.

MR. T. ROLAND WOLLASTON (Manchester), who contributed a paper on gas, said that some members seemed to have drawn the conclusion that he particularly favoured electrical transmission. He pointed out that he had not had sufficient experience of recent electrical transmission installations to have strong views for or against them, and, with many others, merely accepted the proposition that they must have merits which accounted for their steady progress. Mechanical transmission for textile mills was by no means dead yet. The claims of the electrical drive, as regarded regular turning, quick starting and stopping and power absorption only when running, appeared to be real and important. But the most important claim still seemed to be the elimination of shafting load, which, as they knew, was often excessive. Rapid strides had recently been made in developing the application of ball and roller bearings to line shafting, and several firms were now selling bearings at comparatively low prices, which reduced line-shaft friction to a small fraction of the normal figure; two Manchester gentlemen, Prof. Nicolson and Mr. G. F. Buck, were believed to be engaged on important research work which might materially influence future procedure in mill power transmission.

MR. H. T. HILDAGE (Manchester) observed that the analysis of the claims made by the advocates of the various types of prime movers, and the respective value of these from the point of view of reliability, uniformity of speed and economy, was a task of considerable magnitude and difficulty, and when it was completed, he thought that textile manufacturers would have a valuable guide to the solution of power problems. The solution of these problems in the past had been undertaken in too haphazard a manner. A textile manufacturer had called in two or three firms of engine builders and electrical engineers, and asked them to advise him as to the best way of fulfilling his requirements. They had looked at the matter rather from their own point of view than from his, and when he had received all their schemes he had the difficult task of comparing them, analysing them, and selecting the most suitable. The manufacturer would always be well advised to have an independent engineer to look at the matter from his own point of view. Mr. Hildage said that in estimating the value of a new machine, or new plant, an American did not ask himself how long it would be before it was completely worn out, but how long it would be before it would have to be superseded by something more economical and better suited to the demands of his work. English manufacturers, he suggested, should have in mind, when putting down new plants, the state of the industry of manufacturing those plants.

MR. W. BROWNING (Manchester), who dealt with the paper of Mr. J. F. CROWLEY upon electrical power, said the source of supply and the nature of the prime mover was the concern of the electrical engineer only in so far as that it gave him a cheap reliable power of constant periodicity or steady voltage, the greatest quality being reliability. On the question of transmission, electrical *versus* mechanical, it fell to the engineer, being the newcomer, to show justification for any change, and, in agreement with Mr. Crowley, he would say that the deciding factor was not necessarily the cost of power. It was difficult to schedule the whole of the reasons why it was worth while to install, in certain cases, electrical transmission, and he expressed the opinion that a great deal of harm had been done to this subject by the indiscriminate application of electrical driving, for he had not yet seen any reason to believe that it was worth while to put a generator and motors on opposite sides of one wall. He was convinced that there was a large field for electric driving, and the increasing number of machines electrically driven, and the decisions in favour of extensions of existing plant led to this conclusion. There was yet a great deal to be investigated concerning the effects of a steadier speed on spinning and preparation machinery, and he regretted that tests he was carrying

out for a paper which he intended to read before the Institution of Electrical Engineers were not sufficiently advanced to give, at this stage, some indication of the results in point of production and quality.

MR. W. O. PEPPER (Bradford), who joined in the discussion as a consultant in electrical and mechanical driving in mills, remarked that those conversant with the application of modern methods in steam and electricity must be in agreement with the general lines of the papers on these subjects. The newer type of prime mover, the turbine, and the newer agent for transmitting power, electricity, had each a sufficiently good case, whether they were combined or worked separately, and would bear the closest examination under certain circumstances. After urging the need for expert advice in each individual case upon prime movers and the method of transmitting power, Mr. Pepper said that much harm has been done, especially to electrical progress in mill driving, by the indiscriminate advice given by people who were unqualified either by knowledge or experience to give such advice. Within his knowledge electrical driving had been retarded in two cases where it was rashly advocated and installed. The result was that clients were dissatisfied with their plant, and spoke disparagingly of it to their friends and fellow manufacturers.

MR. J. F. CROWLEY, in an exhaustive reply on the discussion relating to electricity, said it was very gratifying to find that the readers of the power papers were generally so favourably disposed to the electrical transmission of the power generated by the prime movers they dealt with. Mr. Ramsingh had questioned the figure of 10 per cent. given for the increased production from a loom on individual electrical drive over that obtainable on the ordinary mechanical drive at present prevailing. It was difficult to induce manufacturers to permit the publication of the results they had obtained, but the case had been given of a mill at Vetschau, where an increase in production of from 15 per cent. to 20 per cent., accompanied by an improvement in quality, was obtained on jute looms. Cases had also been given of a German spinning mill in which the increase in production on a worsted spinning frame was as high as 18 per cent., and of a Lancashire spinning mill where 15 per cent. increased production was obtained. Since the paper was read an important Lancashire concern had given permission for the publication of comparative tests that they had taken on continuous running during the past 12 months on over 100 individually-driven cotton looms, and a very much larger number of similar looms on similar warps mechanically driven. The weekly figures showed that the increase in production was in no case less than 10 per cent. Mr. Ramsingh had made comparisons between the relative costs of electrical driving and steam driving, and had estimated that the capital expenditure on a shed with 1,000 looms on the electric drive would be £10,000, and on the mechanical drive only £4,000, leaving a difference of £6,000. The expenditure of this sum on additional looms, Mr. Ramsingh held, would yield an increased production of 15 per cent., as against the 10 per cent. increase claimed for the individual electrical drive. Mr. Crowley pointed out that Mr. Ramsingh's estimate of the cost of the electrical equipment was on the high side, and a reduction of 10 per cent. might be made. Further, no allowance was made for the cost of ropes or strapping, nor for the large saving that could be effected with electrical driving in the roof and walls of a shed. Putting the cost of these latter items at £1 per loom, which was very much on the low side, on this basis the electrical equipment would cost £4,000, and not £6,000, more than the mechanical equipment, which sum would purchase 10 per cent. more looms. This meant, then, that for an equal capital outlay on machinery, the manufacturer could obtain the same production with an electrical drive on a shed of 1,000 looms, as with a mechanical drive on a shed of 1,100 looms. If he adopted mechanical drive, however, he had to provide and pay for the extra land necessary to accommodate the additional looms, extra lights would have to be installed, additional supervision would be necessary for the larger number of weavers, and the employers' share of their insurance contributions would be greater, while the maintenance of the looms and general expenses would naturally increase with the number installed. The advantage of gaining a given production with a reduced number of weavers was, of course, at once obvious, and should particularly appeal in districts where weavers were scarce.

Many other points of a technical nature, and of more particular interest to those engaged in the control of textile factories, have been brought out by the discussion. As yet, only the fringe of the subject has been touched, and the further discussion of the matter, which is to be proceeded with, promises to be of immense value to textile manufacturers, and to the special Committee of the Textile Institute charged with the duty of reporting from time to time upon various methods of mill driving and upon improvements and developments, both in this country and abroad.

The subject was further considered at the closing conference of the Institute, which was held in Manchester on May 2nd.

MR. J. F. CROWLEY pointed out that various arguments, notably those in regard to transmission losses, which might be advanced against group electrical driving on a large scale, did not apply to the individual electric drive, where the machine itself was direct-coupled to the driving motor. The two main points for electrical driving were:—(1) Steadiness of drive, resulting in higher maintained speeds, increased production and improved quality of material; (2) specific advantages on the adoption of individual drive, resulting in still greater production and improved quality. The production was greater because, by the electric drive, they eliminated still further the joining-up links between the source of power and the machine to be driven. There was a speed at which looms could be run on a perfectly steady drive, and beyond which they should not be run. Electrical engineers did not propose to exceed that speed, but they said that

with the mechanical drive, looms were never run at the exact speed at which they could be run, for mechanical reasons, or for textile reasons. He thought it must be admitted that they had made good their case, because in every instance in which the individual electric driving of looms had been installed the speeds had been put up, and kept up, and, as a result partly of that increase in speed, partly of the quicker start which individual drive gave, and partly of the steady speed leading to fewer breakages, the production had gone up, even on plain looms, 10 per cent. The same thing applied to the individual driving of ring frames. In regard to mules, the question had not been considered to a serious extent, but the problem appealed to the electric man because of the varying load during the mule cycle.

MR. F. R. McCONNEL (Manchester) said that a portion of a mill in which he was interested formerly took 50 H.P. to drive, and now it only took 30 H.P. with electric drive.

PROF. G. F. CHARNOCK (Bradford) said he agreed with a previous speaker who alluded to the remarkable steadiness of speed of the steam turbine, and added that this was so substantial as to lead one to the adoption of the electric drive, since it was contended that only by that means could full advantages be taken of it. If it were true, as had been held, that with the individual electric drive, a loom could be driven with a speed variation not exceeding 2 per cent., every loom in the country ought to be driven by the individual electric drive to-morrow. It was only the textile expert who could decide whether or not they got increased production and improved quality—the Textile Institute should make tests—and if they got an increase in production of 10 per cent., and an improvement in quality of 5 per cent., it did not really matter what the speed variation was.

MR. INGHAM (Bolton) said the "mechanical man" had a means of settling whether his plant was efficient or not, and that was by his coal bill. If the efficiency was going down the coal bill was going up.

MR. CROWLEY replied that even if that were so, the chief point was left—the location of the point where loss of efficiency was occurring. Individual electric drive made it possible for that to be done.

MR. O'BRIEN (Manchester) referred to the success which had attended the introduction of the individual electric drive for spinning frames in an Irish mill, and said that the firm which adopted this form of drive was so well satisfied with the results in the shape of increased production and improved material that they had installed a similar drive in a new mill which they had erected.

MR. OSCAR HALL (Bury) said that a firm of German manufacturers with a small plant obtained their electric power from a central station, and the figures of cost month by month showed that for their particular purposes, the electric drive was better than any other. The total bill was less than it would have cost for a man to look after the engine and boiler.

Several speakers undertook to supply the Institute with detailed information and statistics as to the actual results obtained by various prime movers and particular forms of drive, and there is little doubt that the information so obtained will be of great value to the Textile Mill-Driving Committee of the Institute.

### The Formation of Deposits in Oil-Cooled Transformers.

By DR. MICHIE.

(Abstract of Paper read before the INSTITUTION OF ELECTRICAL ENGINEERS at Newcastle, April 21st, 1913.)

THE object of the present paper is to deal with some of the chemical changes which occur in transformer oils during use, and more particularly with the formation of the solid matter which deposits on the windings and other parts of transformers, subject to which my attention was drawn several years ago by the Newcastle Electric Supply Co. These deposits vary in appearance from pale yellow soft sludges to dark brown or black hard masses, and their presence materially affects the circulation of the oil and leads to overheating of the windings.

It is well known that electrical stresses may cause a separation from oils already having solid matters in suspension, but it is rather difficult to imagine how the electrical stresses can effect a transformation of the liquid oil into the solid sludge. Pairs of sheet-metal electrodes 4 in.  $\times$  1½ in. were set at a distance of 2½ in. apart and placed in a series of glass tanks containing different qualities of transformer oils. A pressure of 20,000 volts was maintained between each pair of electrodes for three weeks, but not a trace of deposit separated out from any of the oils tested. It will be shown later that electrical discharges may have an influence on the formation of these deposits through the generation of ozone.

In only one instance has a deposit been obtained in which it could be definitely ascertained that it was entirely derived from the windings. In this case, the freshly varnished windings had been immersed in the oil before proper drying and hardening had set in. The deposit in this case was quite different from what is usually obtained, and there was no difficulty in detecting the linseed oil used in the preparation of the varnish. Not only is it impossible to detect any quantity of varnish or other insulating compounds in the majority of deposits, but the quantity of deposit is frequently far too great to be accounted for in this way, and deposits also occur in transformers in which the use of varnish is avoided. In most cases the deposits must be mainly derived from the transformer oil itself.

It has been suggested that these deposits are the result of a polymerisation of the hydrocarbon molecules of the oil brought about by the influence of the heat of the transformer. Several

samples of American and Russian transformer oils were heated in glass flasks for 200 hours at 150° C. out of contact with air, but, although the oils darkened in colour, no deposit separated out. Analyses of transformer deposits show that these contain a considerable proportion of oxygen, and as the original oils are free from oxygen the only conclusion that can be drawn is that the formation of these deposits is brought about by the oxidising influence of the air on the transformer oils. In all likelihood there is a simultaneous polymerisation of the oxidised molecules. A sample of sludge taken from a transformer gave the following analysis:—

Carbon.	Hydrogen.	Oxygen.
76.0	7.1	16.9 per cent.

In order to confirm the oxidation theory various samples of transformer oils were subjected to the action of a current air at an elevated temperature. The rate at which the air was drawn through was 0.07 cb. ft. per hour. The flask containing the oil to be tested was placed in an oil bath and kept at a temperature of 150° C. As a rule the passage of the current of air was continued for 45 hours. Different transformer oils when subjected in this way to the action of a current of air gave strikingly different results. Generally the oils darkened in colour and increased in acidity, but whereas in some cases the oils remained clear and bright, in the majority of cases they became turbid from the formation of solid matter. In order to determine the amount of solid matter which separated out, the oils were diluted with petroleum spirit and filtered. The solid residue after freeing from oil by washing with petroleum spirit was then weighed. In some cases no deposit was obtained, while in others it weighed as much as 2.5 per cent. of the weight of oil taken. These differences in the behaviour of different samples are not surprising in view of the different chemical characters of the oils, depending on the source of the crude oil, the method of distillation, and the degree of refinement.

Deposits obtained by treating mineral oils with air closely resemble what is obtained in transformers. A deposit obtained in this way gave the following figures on analysis:—

Carbon.	Hydrogen.	Oxygen.
74.27	6.62	19.11 per cent.

In both cases the deposits are almost insoluble in petroleum spirit, but readily soluble in benzol. The melting or softening point varies from about 70° C. to about 220° C. for different deposits.

Although a temperature of 150° C. has been chosen for these tests, on account of the greater rapidity of the oxidising action, the formation of sludge no doubt takes place at comparatively low temperatures if the period of exposure is prolonged, and there are still other conditions in a transformer which accelerate the formation of sludge. The presence of ozone in the air of the transformer greatly increases the rate of sludge formation, and by using ozonised air a heavy deposit was obtained from an oil in a comparatively short time at 90° C.

The rate of sludge formation is accelerated by the presence of certain metals, notably copper.

The greater the surface of metal exposed to the oil, the greater is the influence on the rate of oxidation. Thus an oil which, when treated with air in the absence of metals, gave no sludge after 45 hours, gave 0.5 per cent. of sludge when the test was repeated on another portion of the same oil containing copper foil of 4.5 sq. in. surface, and 1.8 per cent. of sludge when 25 sq. in. of copper was used. The copper, which, as a rule, is only very slightly attacked, does not enter into the composition of the deposits, and here, as in many other oxidation processes, plays the part of a catalytic agent. In the case of lead, the metal generally shows signs of corrosion, and enters into the composition of the deposits, which are of a characteristic pale yellow colour. In one deposit 36 per cent. of lead was found.

The quantity of sludge which separated out in the oxidation process is largely dependent on the degree of refinement of the oil. As a general rule, the more an oil is refined the more stable it becomes towards oxidising agents.

Although several transformer oils are on the market, which, when subjected to the oxidation test, give no deposit after 45 hours, no oil has been met with which did not give rise to deposit after prolonged treatment. In one instance an oil withstood the test for 150 hours without a deposit appearing. All oils oxidise in time, but it is only reasonable to expect that those which come out well on the oxidation test will also behave well in the transformer.

Apart from the question of the quality of the oil, the design of the transformer has to be considered, and in this connection, if the formation of deposits is to be avoided or minimised, the following conditions should be avoided:—(1) Overheating; (2) undue access of air to the oil; (3) conditions likely to give rise to the formation of ozone; (4) contact of the oil with clean surfaces of copper, iron and lead.

### DISCUSSION.

MR. P. V. HUNTER (N.E.S. Co.) said that the sludging of oils in transformers was costing thousands of pounds per annum. He assumed that Dr. Michie did not consider this paper to be the last word on the subject, as there were sure to be further developments as time went on. Of the four chief requirements, oil only met one, viz., that of high insulation. It did not meet the others because it was inflammable, had considerable viscosity, and was anything but stable. At best, oil was a makeshift, but at present there was no alternative. With regard to the assertion that from the appearance of certain deposits taken from windings a temperature very

considerably over 100° C. must have been attained, he thought that Dr. Michie was mixing up cause and effect, as the appearance remarked upon was entirely due to the ventilating ducts being sludged up, and thus giving the oil no access to them. The total amount of heat generated in a transformer did not increase as sludging increased, at least not to any great extent, and it was thus impossible to tell from the mean temperature or appearance of a transformer whether or not sludging was taking place, and as a matter of fact no evidence of sludging was visible until the transformer was lifted out of its case. For a number of years the Newcastle district was the only one in which sludging seemed to be prevalent. There were two possible explanations for this, one being that in the Newcastle district they used transformers which depended for their cooling upon ducts, and local overheating naturally occurred as soon as these sludged up, whereas, on the other hand, where older designs were in use, in which there were no ventilating ducts, even if the oil did sludge, nothing happened. The other explanation was that, in the Newcastle district, in common with the rest of their machinery, transformers were rated much more heavily than usual. He had come across an interesting case in connection with a furnace transformer which had sludged very rapidly, although the working conditions were not by any means severe, and he could only put this down to the large amount of exposed copper inside the transformer case.

MR. L. R. MOIRHEAD (Caxton House, Westminster) said that some years ago he had been intimately connected with the manufacture of transformers, and the question of sludging had given him a good deal of trouble at that time. The phenomenon was considered to be an electrical one, and also to be due to the wearing out of the materials used in insulating.

MR. J. WILSON (Brown, Boveri & Co.) drew attention to the system of clearing oil by immersing coke breeze in it.

MR. J. SCHULL (A. Reyrolle & Co.) said he had found that different oils varied enormously in their ability to take up moisture. He asked if the purifying treatment to which oils were subjected, left any trace of acid or alkali, as he had come across oils which were accused of attacking the contact surfaces of oil switches. Any analysis which had been made, however, had always proved that the amount of acid or alkali present was extremely small. Another trouble in oil switches was due to minute quantities of the sulphur used in fixing the various parts dropping off and dissolving in the oil. While he agreed that there was no electrical action on clean oil, he thought that there must be some action on oil which had already sludged, as the particles of sludge could be seen moving about rapidly in the oil when subjected to high pressure.

MR. G. STONEY said that the paper explained to him why black deposits were frequently found in the bearings of turbines. Deposits were not generally found if the temperature was kept below 100° or 120° F., but if it was allowed to run up to 160° F., with many oils large deposits took place. He had the impression that the American oils, which were really saturated paraffins, left no deposits, while, on the other hand, Russian oils always gave considerable deposits. In the case of turbine bearings, of course, water was present, and this would in some degree, account for the rapidity with which the action took place. He had in some cases seen deposits as hard as coke. He had noticed that the oils did not attack the copper-tin alloys in the bearings, but that they had a considerable action on zinc alloys, e.g., the nut rings which were usually of zinc alloy frequently showed signs of corrosion. The paper seemed to show that it was possible to get oils which would not give a deposit.

MR. W. C. MOUNTAIN said that so far as he could see, sludging was largely a matter of price, as the highly refined clear oils did not sludge to any great extent, but, of course, they were much more expensive. Another point was that if transformers were rated within more reasonable limits sludging troubles would not occur.

DR. A. C. MICHIE, in reply, said that leaving the conductors bare led to excessive sludging. It was an undoubted fact that the flash point was reduced after filtering, due to the breaking up of the oil under high temperatures. As a rule, filtered oil was liable to form further quantities of sludge. With regard to the question of using coke breeze, the action was already well known, and, as a matter of fact, crude oil was filtered through animal charcoal, in order to take out the colour and other impurities liable to cause sludge. With regard to moisture in oil, under normal circumstances this was so small that it could only be detected by electrical means, and, even in saturated oil, was of the order of '003 per cent. only. Hot oil would, of course, take up a larger quantity, but, on cooling, this separated out in the form of globules. All oils were treated with acid and alkali during purification, and minute traces might be left, but he did not think that these could have much effect on the sludging.

EBOHITE TESTS.

We are informed that some time ago the National Physical Laboratory made some exhaustive tests on various grades of ebonite at the request of the Admiralty for the purpose of preparing a specification for ebonite.

The result has been embodied in the Admiralty Specification No. 756, and the following tests have been laid down by our Naval Authorities.

*Specific Gravity.*—The specific gravity of the material must not exceed 1.21.

*Yield Test.*—For sheets of ¼-in. thickness and upwards and for cylindrical rods exceeding 1 in. the test piece shall be 9 in. long and rectangular in section. For rods of 1 in. diameter or less, the test-piece shall be 9 in. long, and circular in section. The test-piece shall be secured within a clamp at one end, so as to be supported as a cantilever. At a point 6 in. from the nearest edge of the clamp shall be supported a weight of the amount specified in the table below; the section of the test-piece being specified in the table. The cantilever shall be placed in an oven maintained at a uniform temperature of 70° C., and the weight shall be attached not less than 15 minutes after placing the test-piece in the oven. At the end of two hours' exposure with the weight attached, the material shall not yield more than is indicated by the point of support of the weight dropping through a distance of 15 mm. during the time. The distance yielded shall be measured before and after the test with the weight removed:—

Description of ebonite.	Section of test-piece.	Weight applied.
Sheet ¼ in. thickness and upwards, cylindrical rod exceeding 1 in. diameter...	Rectangular 1 in. × ¼ in.	1 lb.
Sheet ebonite ¼ in. thick ...	Rectangular 1 in. × ¼ in.	12 oz.
Cylindrical rod 1 in. dia. ...	Circular 1 in. diameter	14 lb.
" ¾ in. dia. ...	" ¾ in. diameter	8½ lb.
" ¾ in. dia. ...	" ¾ in. diameter	5½ lb.
" ¾ in. dia. ...	" ¾ in. diameter	3 lb.
" ¾ in. dia. ...	" ¾ in. diameter	1½ lb.
" ¾ in. dia. ...	" ¾ in. diameter	8 oz.
" ¾ in. dia. ...	" ¾ in. diameter	2 oz.

*Dielectric Strength.*—In ascertaining the dielectric strength of the material the pressure shall be applied between two metal spheres, each 2 in. in diameter, embedded into opposite sides of the test-piece, so that the thickness of the ebonite between them is about 0.5 mm. An alternating pressure of approximately sine-wave form shall then be applied between the spheres, the pressure being gradually increased (over a period of about 1 min.) until breakdown occurs. Under these conditions, the pressure at which the material breaks down shall not be less than at the rate of 125,000 volts per mm. (This pressure is the effective or root mean square pressure.)

The test piece and spheres may be placed under oil during the test with a view to reducing the size of the test-piece required.

Unless otherwise directed, the test-pieces for this test are to be disks 4 in. in diameter. The spherical recesses in the test-pieces shall be machined out with a keen cutting tool, which is to be re-ground before the last cut is taken. Care shall be taken that the spheres make a good fit in the recesses. This machining will be carried out at the National Physical Laboratory and the spheres will be provided by that body.

No material shall be rejected on the ground of insufficient dielectric strength unless and until two pieces have been tried and both have failed.

As these tests are said to be more severe than any that have hitherto been applied on ebonite, Messrs. Traun & Sons, London Agency, sent some material manufactured by them to the National Physical Laboratory, and we have before us a facsimile of the report received, which shows their material to have achieved most excellent results.

The specific gravity of their material was found to be 1.198. In the yield test both their samples showed after two hours' exposure a yield of only 8 mm., and after four hours only 10 mm.

Both samples showed a dielectric strength of over 125,000 volts per mm., and one sample only broke down after being subjected to this test for four minutes.

These results should be of interest to users of high-class ebonite, which is made from pure fine para, and is especially recommended for the very finest work.

**Social Club.**—The Leyton District Council electric power station employes' Social and Athletic Club was formally inaugurated last Friday week by Mrs. Harman Lewis. Mr. F. Harman Lewis, who presided, and is president of the club, threw himself enthusiastically into the scheme when it was proposed some time ago. The Council allowed the club the use of one-half of the storeroom, where the old gas generating plant used to be, and in their spare time the men prepared the building for its new purposes, the Council providing the necessary timber for partitioning and flooring. In the centre of the room there is a billiard table. Some 74 out of the 80 employes are already members of the club.

**Electrical Equipments for South African Mines.**  
—Mr. R. W. Schumacher, speaking at a recent meeting of the South African Institute of Electrical Engineers on the transition from steam to electricity in the Transvaal mines, said he hoped that electrical machinery makers would not insist upon supplying standards which might be suitable elsewhere but not for the South African mines. Local requirements should be considered, makers should meet them as best they could, and the material supplied should be the best that could be obtained anywhere.—*The African World.*

**STANDARDISATION RULES  
FOR ELECTRICAL MACHINERY: A  
COMPARISON.**

The Rules just issued by the British Electrical and Allied Manufacturers' Association, hereafter called the B.E.A.M.A. Rules, are here compared with the Report issued in 1907 by the Engineering Standards Committee (Publication 36), called the E.S.C. Rules; the revised rules issued by the Verband Deutscher Elektrotechniker (as published in the *Elektrotechnische Zeitschrift*), hereafter called the German Rules; and the rules of the American Institute of Electrical Engineers.

The B.E.A.M.A. Rules deal only with standard pressures and frequencies, high pressure and insulation tests, types of machines, rating, overloads and temperatures.

**FREQUENCIES.**

B.E.A.M.A.		E.S.C.	American.
50 periods per sec.	—	50	60
25 " "	—	25	25

**GENERATOR PRESSURES.**

B.E.A.M.A.		E.S.C.	American.	
D.C.	A.C.		D.C.	A.C.
115	—	115 volts	125	—
230	—	230 "	250	—
460	440	480 "	—	—
525	550	525 "	550	—
—	2,200	2,200 "	—	2,200
—	3,300	3,300 "	—	—
—	6,600	6,600 "	—	—
—	11,000	11,000 "	—	—

The standard high-pressure systems for alternating current are:—

B.E.A.M.A.	E.S.C.	American.
2,000	2,000	—
3,000	3,000	—
6,000	6,000	6,600
10,000	10,000	11,000
20,000	—	22,000 and up

**LOW PRESSURES AT CONSUMERS' TERMINALS.**

B.E.A.M.A.		E.S.C.	American.
D.C.	A.C.		
110	100	110	110
220	200	220	220
440	400	440	—
500	500	500	—

The variations introduced by the B.E.A.M.A. rules in the pressures are probably dictated by other branches of the industry. The pressures are still, however, within the variations provided for in the E.S.C. Report.

**HIGH-PRESSURE TESTS.**

Rated pressure.	B.E.A.M.A.	American.	German.
Volts.	Volts.	Volts.	Volts.
Below 333	1,000	1,000-1,500	1,000
333 to 1,500	three times rated pressure	1,500-3,500	2½ times rated pressure (min. 1,000 volts)
1,500 to 2,250	4,500	5,000	ditto.
2,250 to 5,000	twice rated pressure	twice rated pressure	2½ times rated pressure
5,000 to 7,500	"	"	rated pressure plus 7,500 volts
Above 7,500	"	"	twice rated pressure.

All tests for one minute.

For pressures between 1,500 volts and 2,250 volts, the selection of one test pressure instead of the German rule is curious, and a good reason for it is hard to see.

**TYPES OF MACHINES.**

B.E.A.M.A.		E.S.C.
Open	...	Open.
Protected	...	Protected.
Enclosed ventilated	...	Ventilated.
Pipe ventilated (with or without forced draught)...	...	—
Drip proof	...	—
Totally enclosed	...	Totally enclosed.
Flame proof	...	—

**RATING.**

The various rules are as follows:—

**B.E.A.M.A.**—Continuous rating is the output which a machine will give for a period sufficiently long to attain practically constant temperature and otherwise comply with these Regulations.

**E.S.C.**—The rated load for continuous working shall be the output at which they can work continuously for six hours and conform to the prescribed tests.

**German.**—Rated output for continuous working is that which can be given for any length of time and conform to the prescribed tests, with the qualification that the period of test shall not exceed 10 hours.

**American.**—These are the same as the B.E.A.M.A.

**B.E.A.M.A.**—The short-time rating is defined as the output which a machine will give for one hour, one half-hour, or other specified period, and comply with these Regulations.

**German.**—These are very similar to the B.E.A.M.A.

**American.**—Three classes are defined, as follows:—

1. Intermittent rating (periods of load and rest alternating).

2. Minute rating (load for one minute only).

3. Variable-service rating (not yet defined).

The B.E.A.M.A. Rules define the ratings for machines which have to deal with variations of speed as follows:—

(a) Machines with two or more fixed speeds are to have a definite rating for each speed.

(b) Variable-speed machines. These are of two classes:—

(i) Machines rated to give the same output throughout the entire range of operating speed. In such machines, the heating tests should be made at the lower limit of speed, and commutation tests at the upper limit of speed.

(ii) Machines which are not rated to give the same output at all speeds. These machines should have ratings specified for both minimum and maximum speeds.

These details are not dealt with in the other rules, but are necessary.

The new Rules do not deal with the rating question in a satisfactory manner. The continuous running for six hours as originally adopted by the E.S.C. and the maximum continuous run of 10 hours adopted by the German Rules are both better than the B.E.A.M.A. rule. Machines do not, as a rule, run continuously, so that it would be more satisfactory to rate them for daily service and to reduce the rating for continuous running. The American rules for short-time rating are more satisfactory than the B.E.A.M.A. rules. A short-time rating based on a run of short duration from cold is not a satisfactory one, in so far as it does not provide a comparison in the case of different designs.

**OVERLOADS.**

**B.E.A.M.A. Rules.**—These specify the following periods of running with 25 per cent. overload for machines with continuous rating. Ten per cent. less is allowed for ventilated machines, and no overload at all is allowed for totally enclosed machines:—

100-kw. or H.P. and above	...	two hours
Below 100-kw. or H.P., not below 25-kw. or H.P.	...	one hour
Below 25-kw. or H.P., not below 2-kw. or H.P.	...	one half-hour
Below 2-kw. or H.P.	...	five minutes.

In the case of series or compound motors, the overloads are to be measured in amperes of input. The enclosed type machine must be able to carry momentary overloads, required in connection with commutator tests.

**American Rules.**—These specify for motors and generators 25 per cent. overload for two hours, and for motors 50 per cent. overload for one minute.

**German Rules.**—These specify 25 per cent. overload for half an hour and 40 per cent. for three minutes, but this overload is only permitted when the temperature limits allowed by the rules are not exceeded. They also specify that a machine must run at 15 per cent. excess speed for five minutes.

Although at first it may seem that the B.E.A.M.A. Rules are more onerous than the German, and about the same as the American, they are actually, in the majority of cases, less exacting. The majority of machines now in use come under the reduced overloads, and a very great number

are not allowed any overload at all. Overloads are unsatisfactory, and it would be better to avoid them entirely than to reduce them to a lower value than is adopted by the great commercial rivals of the British manufacturers.

Momentary overloads required in connection with commutator tests are said to be permitted, but what these are is not stated.

HEATING.

The rules specify the following temperature rises. - The B.E.A.M.A. Rules state that they are for an air temperature of 25° C., but no exceptions or alterations are provided until an air temperature exceeding 35° C. is reached, which is the maximum air temperature permitted by the German Rules. The American Rules only provide for the stated temperature rises when the air temperature does not exceed 25° C.

—	B.E.A.M.A.			E.S.C.	Ameri- can.	Ger- man.
	* 46° C.	† 47° C.	‡ 55° C.			
All windings ...	46° C.	47° C.	55° C.	56° C. §	56° C.	66° C.
Coils in which windings are embedded ...	46° C.	47° C.	55° C.	—	—	66° C.
Stationary field coils of alternators measured by resistance ...	55° C.	—	—	66° C.	—	—
Shunt field coils of D.C. machines measured by resistance ...	66° C.	65° C.	76° C.	—	—	76° C.
Commutators ...	55° C.	55° C.	55° C.	—	55° C.	55° C.
Slip rings ...	55° C.	55° C.	55° C.	—	—	66° C.
Bearings ...	—	—	—	—	40° C.	56° C.

\* Open type. † Ventilated type. ‡ Totally enclosed type. § 60° C. if by resistance.

The E.S.C. rules provide for a reduction in these temperature rises of one degree for every degree the air temperature exceeds 25° C. In all cases variation is permitted in the case of machines insulated with heat-resisting materials.

An analysis of these figures would be much simpler if temperature "rise" were replaced in all cases by maximum temperature, and many peculiarities in the rules would be avoided. The B.E.A.M.A. rules provide principally for the use of thermometers in carrying out heating tests, but in all cases the most accurate method available should be specified.

The correction for altitude in the B.E.A.M.A. rules amounts to a reduction in temperature rise of 2½ per cent. for every 1,000 ft. up.

The temperatures prescribed for short-time rating are the same as those prescribed for continuous running. As the former have periods of rest of uncertain length, some alteration either to the rating or the heating is necessary. The alteration should be applied to the rating.

Here, as in the case of overloads, the B.E.A.M.A. rules appear more conservative than they are. For example, the maximum temperatures permitted by these rules, compared with the E.S.C. and German, are as follows:—

	B.E.A.M.A.	E.S.C.	American.	German.
Windings ...	96° C.	85° C.	75° C.	95° C.
Shunt field coils ...	105° C.	85° C.	75° C.	105° C.

These figures show how deceptive "temperature rise" figures can become unless great care is taken to understand them fully.

GENERAL.

If these new rules (B.E.A.M.A.) were set out more completely, and some of the undefined expressions avoided, fewer exceptions to the rules would be necessary. However, they form an interesting addition to the literature on the subject, and when modified by the purchaser, should form a satisfactory basis for carrying on business in this class of apparatus.

It is, however, very desirable that the best of the various rules should be made into one complete set, with a view to their universal acceptance.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

NEXT month the Wheatstone high-speed automatic apparatus, designed to transmit 400 words per minute, will be installed by the Great North-Western Telegraph Co. between Montreal and Toronto.

The Western Power Co. are installing two more units of 13,000 h.p. capacity each.

The city of Calgary, Alberta, is evidently in need of more power, as the consulting engineer has just recommended that a contract be made with the Calgary Power Co. at once for the supply of 5,000 or more horse-power; at the same time he has reported on the question of the utilisation of natural gas, which is obtainable at a distance of some 175 miles from the city. Partly on account of possible failure of such a long pipe line and partly for other reasons, the engineer recommends the adoption of gas-fired boilers and steam engines in preference to gas engines, as the boilers could be readily fired with coal in the event of failure of the gas supply.

The Commission of Conservation has just published some very interesting figures, apparently taken partly from a paper read before the American I.E.E. by Mr. J. V. Hunter in 1911, though the figures relative to freight rates on coal from the mines to the point of consumption have been calculated from Canadian freight tariffs. The figures give a "comparison of fixed charges involved in power transmission and freight charges of fuel transportation"—in other words, they show the saving which may be effected by carrying electricity from the mines to the distributing centre instead of carrying the coal from the mines to such centre. The distance assumed is 100 miles, and it is shown that an annual saving of from about £12,400 for a 5,000-kw. plant, to about £69,300 for a 20,000-kw. plant, may be effected by transmitting electricity instead of transporting coal.

The figures are used as an argument in favour of having an investigation made into the question of utilising the lignite fields in Western Canada by putting down large central stations situated on the fields, as owing to the lignite being of comparatively low calorific value, it would not pay to transport it any great distance.

The same Commission, discussing the causes of failures in water-power projects, chief among which are under-estimation of the cost of development and over-estimation of the water power available, relates that a well-known engineer, now at the head of one of the largest power organisations in the United States, was given the following rule by one of his bankers:—

"We will not consider a water power project unless, after doubling the cost, cutting the available power in two, and reducing the market price by 40 per cent., it will still show interest on the bonds necessary to issue."

The Hydro-Electric Power Commission of Ontario, has this month (May) issued its rules and regulations dealing with ordinary inside installation work in houses, factories, &c.

These rules are based on the National Electrical Code, and, in fact, contain practically the same rules, though the general arrangement is different, and various modifications and additions have been made, chiefly with a view to the safeguarding of life.

There is one important clause in the preface which is worthy of note; this states that, "Until further notice, all such materials, fittings or devices as are formally approved by the Underwriters' Laboratories of Chicago are hereby approved by the Commission. Should it, however, be demonstrated to the satisfaction of the Commission that any fitting, material or device complies in every respect with the specifications of the Underwriters' Laboratories, the Commission may permit the use of the same."

The italics are the writer's. These words evidently indicate that the Commission is prepared to put its own seal of approval on materials, &c., without waiting for that of the Underwriters' Laboratories, provided that it be first satisfied that the specifications of the latter body have been complied with.

This will probably be removed, in Ontario at least, one of

**Cable-Stealing on the Rand.**—According to the *Cape Argus*, a gang of thieves has recently been at work stealing a large quantity of electric cables, the losers including the Victoria Falls Power Co., the Croesus mine, and the Johannesburg municipality. Several arrests have been made, and some coloured men charged.

the difficulties of the British manufacturer in getting his products introduced over here, as he will not need to apply to Chicago for approval, but can go direct to the Hydro-Electric Power Commission. The approval of the Commission will also be a strong recommendation for him in trying to introduce his goods into other provinces of the Dominion.

It must not be supposed that the Commission will readily grant permission for the use of materials, &c., differing from these requirements of the Underwriters, though the opening words of the foregoing quotation ("until further notice") seem to indicate that in the future there might come a time when the Commission would act on its own initiative apart from the Underwriters, though, doubtless, there will always be more or less co-operation between these two bodies.

There seems to be a steadily increasing market over here for electric household appliances of all kinds—toasters, radiators, smoothing irons, &c.—and as, so far as the writer is aware, there are no Underwriters' specifications, but only a few general requirements, to bar the way to the introduction of such appliances, it would seem that the British manufacturer should have a chance if his prices can compete.

Now that the Commission's Rules and Regulations are out, it will, however, be necessary for manufacturers to obtain the approval of that body for any materials, &c., before they can be used in installations in the Province of Ontario, for, referring again to the preface, we find the following:—

"In general, all installation material, conductors, apparatus, &c., must be of a suitable character, approved by the Commission. . . ."

The italics are again those of the writer of these notes—approval is not, of course, required for each individual piece of apparatus, but for the type or design.

**Synchronising Turret Clocks.**—In a letter to the *Times* of April 30th, Mr. H. R. Kempe described a simple and inexpensive method of applying electrical synchronisation to existing turret clocks. The latter are constructed with elaborate and costly devices to ensure accuracy of time-keeping, but the result is notoriously ineffective. However, Mr. Kempe shows that any "old clock" of a clock, so long as it will go at all, can be made to keep as accurate time as the finest clock made, at small expense and without the trouble of climbing the tower. All that is necessary is to regulate the clock to gain a little—as little as one or two seconds an hour, it may be—but to gain without fail. An electromagnet and armature fixed near the scape wheel locks the latter when the electromagnet is excited. This electromagnet is in circuit with a switch formed by the "warning" lever of the striking movement. This lever commences to rise at about 10 minutes before the hour, and in rising breaks the line circuit in which the electromagnet is placed, and on falling (as it does) exactly at the hour again closes the circuit. Wires from the electromagnet and switch pass down from the clock chamber to the base of the tower, where a fairly good quality clock (about £3 in value) is placed; this clock is fitted with a contact (in circuit with the line wires and two small dry cells), which is closed about a minute before the hour and broken exactly at the hour. When the church clock strikes, therefore, it closes the circuit, and being slightly (a second or so) in advance of the regulating clock it is stopped by the armature of the electromagnet being pulled forward. The regulating clock then breaks contact exactly at the hour and releases the scape, so that the church clock starts off exactly regulated to time, or rather exactly in correspondence with the regulating clock. The whole contrivance need cost but a few shillings, and any small error in the regulating clock is corrected by a touch of the finger; Greenwich time being received at the local telegraph office at 9 o'clock every day, enables one's watch (by means of which the regulating clock is kept right) to be set to correct time if necessary. There is nothing very special in the whole arrangement (which, however, answers its purpose admirably) it being a simplification of a somewhat similar device devised and fitted by him some years ago to the turret clock of the old General Post Office building, recently pulled down, and also to the turret clock of the Leeds Post Office building.

The great point to which Mr. Kempe draws attention is this—that as a turret clock when fitted with the arrangement is bound to keep time with the regulating clock, no matter how cheaply the former is constructed, it is only necessary that the latter should be a good timekeeper; and as the latter is far less costly than a large turret clock of good construction, the total cost of the combination—i.e., a cheap turret clock and a good regulating clock—is considerably less than that of a good turret clock, whilst the facility of regulation is very great indeed.

In later issues the subject has been further discussed by a number of correspondents, and Mr. Kempe's letter has evidently aroused a good deal of interest in the matter. Mr. Kempe, in replying to various criticisms, points out that the "forcible" mode of synchronisation which he advocates is used in the case of the Baudot, Hughes, and Delancy telegraph systems, and is in fact the only possible way of obtaining uniformity of running in such cases.

## GOODS AT OWNER'S RISK.

[FROM A LEGAL CONTRIBUTOR.]

It is not often that the trader is able to point the finger of scorn at a railway company on the ground that it has been worsted in a dispute in the Courts. Without in any way presuming upon the position which it occupies as having a virtual monopoly in certain forms of traffic, the railway company generally manages to assume a position of vantage when litigation takes place. The case of Western Electric Co. v. Great Eastern Railway Co., however, which was decided last week by two Judges of the King's Bench Division, serves to show that the railway companies, as carriers, are not able to limit their liability unless they comply strictly with statute; and, furthermore, that the fact that the trader has not asserted his rights for a number of years does not by any means involve their complete abandonment. The facts of the case were briefly these:—

The Great Eastern Railway conveyed certain goods of the plaintiffs from Antwerp to North Woolwich *via* Harwich. They were injured by rain on the train journey from Harwich. In respect of the sea transit, there was a bill of lading containing a clause exempting the company from liability for damage arising, *inter alia*, from the negligence of the crew. The bill of lading was in the company's ordinary form, which would also be applicable where goods were not sent at owner's risk. As to the carriage by land, the plaintiffs had, under the contract, been given the option of paying a higher rate in consideration of the railway accepting the position of common carriers. The County Court Judge held that the agreement was not just and reasonable, inasmuch as the plaintiffs had no optional rate on the sea voyage. He therefore held that the agreement limiting liability was void. The Judges of the King's Bench Division came to the same conclusion. Mr. Justice Channell said: "I think it extremely unjust, but of course Acts of Parliament which are passed with the best possible objects, do sometimes work injustice in particular cases."

The law on the subject is thus stated in "Halsbury's Laws of England," Vol. 4, p. 25: "Every railway and canal company, except in certain special cases, is liable for loss of, or injury to, goods in the receiving, forwarding or delivering of them, caused by the neglect or default of the company or its servants, notwithstanding any notice, condition or declaration given or made by the company limiting its liability. The company may, however, by contract limit its liability for such neglect or default provided that the conditions of the contract are such as are adjudged to be just and reasonable by the Court before whom the question may be tried, and also provided that the contract is in writing signed by the contractor or his agent. A contract purporting to limit the liability of a railway company for the neglect or default mentioned is null and void, unless it fulfils two requisites: (1) It must be in writing, signed by the consignee or his agent; and (2) its conditions must be just and reasonable (*Peck v. North Staffordshire Railway Co.* (1863), 10 H.L. Case 473).

It was held in 1906 that a condition that goods shall be carried at the owner's risk, the company remaining liable "for any wilful act or wilful default of the company or their servants, if proved, for fraud and theft of their servants, or for collision of trains conveying the goods within the company's limits," is reasonable where an alternative rate is offered.

Traders, generally, will not echo the sentiment of the learned judge that the decision at which he felt constrained to arrive was harsh and unjust. In these days of competition, manufacturers and others are fairly compelled to send goods at their own risk, the only alternative being payment of rates which they cannot possibly afford if a profit is to be shown.

**Bitterne.**—The South Stoneham R.D.C. has decided to grant the request of the Southampton T.C., for permission to supply current in the parish of Bitterne, where the Southampton garden suburb is being established.

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

## Water Divination.

In the letter of "W. B. S." we have just the usual letter of the believer in dowswindling. There are flung at us two Sirs, a Marquis, and an Emperor. But the possession of titles is no mark of special ability. What we want is facts. What and where were Sir Edward Fry's tests?

If coins under carpets can make themselves felt, what about the thousand other radioactivities which may come between the twig and water or dryness below?

On what scientific advice did Sir Henry Harman make his Horsham failures? Horsham is in the Weald, a faulted area of clays and sand rocks. I once obtained easily 10,000 gallons per hour from boring at this place. Frankly, I do not believe that Sir Henry called in scientific advice.

As to the late Marquis of Salisbury, if his Hatfield estate was the place, this is in Hertfordshire, a chalk county *par excellence*. The Amwell springs rise out of it, whence flows the New River. I have bored many wells in the county, and have yet to make a failure. In short, I am a mere stratigraphical hydrogeologist, and have been so this 20 years or more; I have bored in every main geological formation in this country, from the Crag to the Cambrian, and I have been concerned in five failures. One of these was in the fine sands of the Bracklesham, or similar sands in Hampshire. There was plenty of water, but by an error of judgment, I bored too small a hole to permit of the use of a suitable sand screen. A second was a dry chalk borehole, out of which we made a success after all by boring to the lower green sand.

A third was a boring in the Kenper Marls, not carried on by my advice, which was refused. A fourth was a borehole specially made against my earnest dissuasion. I had foretold that it would be dry. The fifth was a boring into the Weald clay, which the owner's purse did not allow to be carried through.

Thus, of these five water failures only the second was an advice failure. The fourth was a success, for it proved the correctness of the advice. The third and fifth I was merely connected with, my advice being not asked, and in one case rather brusquely refused. Is not this record of the failures out of hundreds of wells far better than the "blessed" rod of Herr Von Uslar, who makes 21 per cent. failures with an appliance which, if of any real value, would be correct every time?

A dowser was given several chances on an estate in Ireland. Every declaration he made proved a failure. An artesian engineer selected a spot and made a success. Yet the owner retained his belief in dowsing even after that. And such as "W. B. S." will, perhaps, retain their faith after the comic opera of Guildford.

The folly is spread by the daily Press, which will publish anything of this rubbishy order. Were I to send accounts of my successes to the daily Press, the advertisement canvasser would come round next day. But the dowsing charlatan gets all these Press puffs for successes in areas where an experienced man would not hesitate to bore at any spot.

The whole of the men named by "W. B. S." without any disrespect, cannot be named on the same day as water experts with one little white-haired young man of 80 known to us all.

## Hydrogeologist.

Will you allow me to add a few words to this controversy? When, about 40 years ago, I was working with a firm of hydraulic engineers in France, I had frequent opportunities of studying the "dowser" and his ways, as my firm made a speciality of supplying water and boring artesian wells. There are two types of "dowsers," one trusting entirely to luck and the illimitable gullibility of human nature, the other possessing a fair knowledge of the configuration and a smattering of the geological strata of the country he is operating in. Both, however, for reasons

best known to themselves, are most anxious to keep up the belief in the magic power of their craft, and strange to say, one success in scores of failures is generally sufficient to establish the reputation of a water diviner in a district, whereas a few pardonable mistakes may often spoil the business of an engineer who knows his profession; so much for the power of superstition and the credulity of human nature.

With regard to the divining rod, I have known many rational people who firmly believed that such a rod twisted of its own accord when approaching water, and I have myself experienced that uncanny feeling at first. But I am sure that the motion of the rod is simply caused by the muscles of the hand under nervous excitement. The "dowser" takes you to a place where he is almost certain to find water under the surface, and tells you to grip the rod very firmly with your hand and to concentrate your whole mind on the subject. In the case of a novice or a highly-strung person, this is sufficient to cause a slight twitching of the muscles, and with a little imagination he will firmly believe that the rod twisted of its own accord, especially if water is found. In case of failure, the "dowser," with a smile, assures you that you are mistaken in thinking that the rod twisted, as the divining rod can never be wrong, and suggests that you try again.

The testimony of people in high places is a very poor guarantee, as it is a well-known fact that such persons, though acting in perfect good faith, make the best mediums.

G. A. Nussbaum.

London, E.C., May 26th, 1913.

## The Mutual Protection of Engineers.

The letter of "Only an Engineer" in your current issue is not untimely. Engineers in general will have read it gladly, and will thank you for its publication. Something surely *must* be done? And, of course, nothing need long remain undone if the members of our profession would only realise the necessity and value of effective organisation. It certainly would seem apparent that our wages and working conditions may soon differ little from those of the bench. And from the employers' standpoint, why should they? But the existing institutions can do very little, I'm afraid, since they are so obviously allied with the manufacturers themselves. Nothing short of a strong, independent, live association is required. And the sooner we form it the better, is the opinion of

A Birmingham Engineer.

May 25th, 1913.

## Long-Range Instruments.

Kindly allow me to make an observation on a letter of Mr. J. W. Record, in the *ELECTRICAL REVIEW*, of May 9th.

The appearance of my letter in your issue of April 18th arose out of various statements made by Mr. Record. Two of them were published in *Electricity* for January 10th, and are as follows:—

1. "The Record . . . moving coil instrument . . . is outwardly distinguished from all . . . instruments hitherto available by the extraordinary length of its scale."

2. ". . . a number of years ago, Mr. B. Davies introduced a long-scale instrument . . . in this case it was impossible to arrange a longer scale arc than about 180° . . ."

3. "An advertisement of the following form:— We claim to be the *only* makers . . . of long-scale instruments for direct current. All other long-scale instruments are for alternating current and will *not* work on direct current."

Mr. Record does not mean to be inaccurate, but anyone reading my previous letter will see that all of the quoted statements are incorrect.

Moreover, the third statement is erroneous in a twofold sense. Thus, Messrs. Johnson & Phillips have produced an excellent long-scale instrument of negligible inductance and of the true root-mean-square type. Besides, we have still with us our good old friend of the same type, viz. the Cardew meter. These instruments *will* "work on direct current."

The burden of my previous letter was the "long range." This Mr. Record entirely evaded in his letter. He will therefore recognise, I am sure, the obvious necessity of quoting in detail his own statements, so as to bring them face to face with facts—facts easily accessible to all.

But for the quoted statements and the fact that some months prior to the appearance of Mr. Record's instruments Messrs. Gambrell Bros. & Co. had undertaken the manufacture of the 1893 instruments, my letter would not have been written.

As to Mr. Record's quite legitimate and substantial thrust that the writer had "twenty years' start," it may be said with a high degree of probability that had Mr. Record tried his hand at that date his experience would have been the same as mine.

B. Davies.

Enfield, May 20th, 1913.

### Electric Lighting Fittings.

After reading "H. A. W.'s" attack on indirect lighting, one feels that his knowledge is even more ancient than the obsolete type of fittings to which he refers. We are all quite prepared to admit that the old type of inverted fittings were most inefficient, especially as most of them were installed when the use of carbon lamps was in vogue.

At the present time, however, with indirect lighting fittings supplied by firms making a speciality of this form of lighting, and containing efficient forms of reflectors suitable for every condition, the results are entirely different, and, in fact, although the actual current consumption for measured foot-candles may be rather higher compared with direct lighting, it must not be forgotten that there is very little difference in efficiency when taking what may be called "visual activity" into consideration, as owing to there being no bright sources of light in the line of vision, the eye is enabled to work at its fullest aperture without strain of any kind, and one is therefore able to see as well with a lower candle-power than would be required for direct lighting.

Then, again, your correspondent would appear to assume that with indirect lighting, it is not possible to direct light where it is wanted, and thus again displays his ignorance, as with the correct type of reflectors, and the proper chain lengths, it is possible to throw most of the light on the actual working plane, and further, he infers that indirect fittings are necessarily ugly; but if he will refer to some of the lists now sent out, he will see that this is the reverse of the case, many of them being of the most ornamental appearance.

The writer is quite ready to admit that he was not prepared to encourage indirect lighting fittings as recently as two years ago, but since then, with the improvement in fittings now on the market, his opinions have been entirely altered.

In the course of his business, the writer has to put forward various forms of direct light in addition to indirect lighting, and whilst both have their own field, at the same time, indirect lighting has many advantages, amongst them being greatly increased visual comfort, owing to there being practically no shadows, and it is impossible to get in one's own light, with the further advantage, in these days of highly finished papers, that, with indirect lighting, the glaze appears to be entirely eliminated, allowing one to read or write on such paper in absolute comfort; but with direct lighting, this is certainly not the case, as it is necessary to be continually shifting the paper or book.

R. E.

**Electric Steering-gear.**—A method of controlling electric motors used for operating ordnance, steering-gear, swing bridges, &c., is described in Patent No. 1,901 of 1912, issued to A. Martin and others. A rotatable resistance box is geared to the driven apparatus, so that when the contact arm is moved, and the apparatus is set in motion, the box follows the arm until the latter stands at the "off" position, when the motor comes to rest. The rheostat is arranged to act on the fields of both the dynamo and the motor, so as to reverse the direction of the latter without affecting the direction of the former.

## BOARD OF TRADE REGULATIONS FOR OVERHEAD LINES.

THE following regulations have been issued for pressures exceeding medium-pressure continuous current and low-pressure alternating current:—

**Supply.**—1. The supply will be transmitted at a minimum pressure of — volts.

**Conductors.**—2. The conductors will be of hard-drawn copper wire or aluminium.

3. Hard-drawn copper wire conductors will have a breaking load of not less than 24 tons per sq. in., and on breaking the elongation will not be less than 2 per cent. in a length of 10 in. Aluminium conductors will have a breaking load of not less than 12 tons per sq. in., and on breaking, the elongation will not be less than 3 per cent. in a length of 10 in.

4. The minimum sag of the conductor will be regulated to give a stress due to its weight and to wind (but excluding its elasticity) of not more than one-fifth of the breaking load, at a temperature of 22° F. Wind pressure will be taken at 25 lb. per sq. ft., and the effective area of the conductor will be taken as 0.6 of the diameter multiplied into the length.

5. The minimum height of any part of any conductor from the ground will not be less than 20 ft., except with the consent of the Board of Trade.

6. Conductors will not cross any building other than a sub-station or be accessible to any person from any building or tree without the use of a ladder or other special appliance. When the conductors are so placed that a tree, if uprooted, could come in contact with a conductor, an earth cradle enclosing them, or some other precaution approved by the Board of Trade, will be provided to prevent all danger of any shock.

7. Conductors will not be carried by the undertakers across the premises of a consumer, except with the consent of the Board of Trade and subject to such conditions as the Board may prescribe.

**Poles.**—8. The conductors will be carried on poles, either (a) wooden poles, or (b) poles or structures of iron or steel, hereinafter called steel poles.

9. Each pole will be clearly and permanently marked with a number.

10. Danger notices will be fixed on at least one pole in five and on each pole at the crossing of a road.

11. Provision will be made to prevent climbing by barbed wire being coiled round the pole, in one or more coils of an aggregate length not less than 2 ft., the lowest coil being at least 8 ft. from the ground.

12. Where gnyrs or stays are used they will be securely anchored and earthed.

13. A continuous earth wire will be carried from pole to pole, and will be well connected to substantial earth-plates at intervals of not more than five spans; or the iron work on each pole will be connected to a substantial earth-plate.

**Wooden Poles.**—14. The poles will be sound winter felled red fir, free from large knots or other defects, with the natural butt, and will be well injected with creosote, or they will be of a description approved by the Board of Trade.

15. Single poles, or A poles, will be used for the ordinary run of the line. Stouter poles, H poles, or built up or strutted poles, provided if necessary with stays, will be used for terminals, for intermediate anchor poles, for important differences of span, and for corner poles where there is considerable change of direction. Ordinary poles provided with stays will be used where the direction makes a small change.

16. Poles of ordinary lengths, unless in rock foundation, will be set in the ground to a depth of 6 ft. The earth will be well punned into the holes. Where necessary, they will be set in concrete.

17. The factor of safety for the poles will be calculated at 10, for a wind pressure of 25 lb. per square foot; the effective area of a round pole being taken at 0.6 of the mean diameter of the exposed part into the length of that part.

**Steel Poles.**—18. Poles of tubular type will be painted with oil paint not less than once every five years, and poles of the lattice type not less than once in every three years.

19. Each pole will be set in concrete.

20. The concrete below the pole will be dropped on to a substantial cast-iron earth plate bonded to the pole by a wire or rod.

21. The factor of safety for the poles will be not less than 8, taking the maximum wind pressure at 25 lb. per square foot. In the case of lattice poles, the pressure on the lee side will be taken as one-half of the pressure on the windward side.

**Arms.**—22. The conductors will be carried on insulators mounted singly or in pairs on steel channel arms, or singly upon iron brackets fastened to the poles; or if wooden arms are used, an earthing strip or stout wire will be fastened on the upper side of each arm.

**Road Crossings.**—23. Where the line crosses over a public road, canal, or railway, the angle between the line and the direction of the road, canal, or railway at the place of crossing will not be less than 60°, and the height of the line not less than 25 ft.

24. Where the line crosses over a public road, canal, or railway or runs parallel to it at a distance less than one and a half times the height of the highest wire from the ground, it will be erected in a manner approved by the Board of Trade.

Where for the protection of his electric lines or works the Postmaster-General makes requirements, which, in addition to pro-

teering those lines or works, afford ample provision for securing the safety of the public, further protection need not be provided.

25. Provision will be made by earthing brackets, or wires, or other device, to ensure that in the event of a failure of a conductor or of a pole, the line will be put to earth.

*General.*—26. Galvanised iron wire used for stays, cradles, or other mechanical purposes; galvanised iron binding wire; arm bolts, nuts and washers; stay swivels; truss and brace rods and truss tie, tie, and brace bolts; stay rod tighteners; and test pieces, will conform with the British standard specification for such material (British standard specification of telegraph material) so far as that specification is applicable.

27. The work will be carried out so far as circumstances permit in accordance with the Post Office technical instructions for the construction of aerial lines.

28. Where the line crosses, or is in proximity to, any other wire or metal, precautions will be taken by the undertakers against the possibility of a conductor coming into contact with the other wire or metal or of the other wire or metal coming into contact with the line by breakage or otherwise.

29. Every line including its supports and all the structural parts and electrical appliances and devices belonging to or connected with the line, will be duly and efficiently supervised and maintained as regards both electrical and mechanical conditions.

30. Every line, including its supports, will be removed on ceasing to be used for the supply of energy, unless the Board of Trade are satisfied that it is to be again brought into use for such supply within a reasonable time.

*Memorandum issued for the guidance of applicants for the consent of the Board of Trade to the placing of electric lines above ground.*

Every application for the consent of the Board of Trade to the placing of electric lines above ground should be accompanied by the following particulars:—

1. Where the undertakers are a company, or a local authority supplying outside their own area, evidence of consent of the local authority for the district.

2. A statement showing commercial or other considerations why underground cables should not be used.

3. A brief description of the proposed system, including the working voltage; the kind of wire whether copper or aluminium; whether solid or stranded; the total sectional area; tensile strength and elongation; average and maximum length of span; minimum height of wires from the ground; name or description of automatic protective device, if any.

4. A statement whether the supply is to form (1) an extension of an existing system of underground cables, or (2) of an existing traction system, or (3) an independent system.

5. An Ordnance map on a scale of 6 in. to the mile, showing the proposed route of the overhead lines and any existing overhead lines. The sheets of these maps must not be fastened together.

6. In the case of high and extra high pressure, plans of construction of poles, &c., on a scale of about 1 in. to the foot, or a reference to previously deposited plans where these are identical with the proposed work.

*NOTES.*—Codes of Regulations have been made (1) for overhead lines for low-pressure and medium-pressure continuous-current supply, and for low-pressure alternating-current supply; and (2) for pressure exceeding low or medium-pressure continuous-current and low-pressure alternating current. Regulations will be made for each case separately, following these codes unless special alterations are sanctioned.

Attention is called to the necessity for obtaining the approval by the Postmaster-General of plans and works under Sec. 14 of the Schedule to the Electric Lighting (Clauses) Act, 1899.

Board of Trade, *May*, 1913.

**Lignite as Station Fuel.**—It has just transpired that the Berlin Electricity Works Co., whose works are the oldest and the largest hitherto equipped by the A.E.G., recently secured an option until the beginning of October on the lignite mines of Golpajessenitz, near Bitterfeld, and on various adjoining lignite properties, all of which represent a transaction of from £150,000 to £300,000 if carried into effect. The idea, which has already been given effect to in the same locality in connection with the Muldenstein station, which furnishes power for the operation of the Dessau-Bitterfeld electric railway, is to erect a large steam power station with boilers using lignite as fuel, and to transmit the energy at high pressure to Berlin, which is 74 miles distant in a direct air line. It has, however, to be remembered that the Berlin Municipal Council possesses the right of expropriating the Berlin electricity works in 1915, and although negotiations on the question are proceeding, it is uncertain whether the right will be exercised or the company allowed to continue its business. At any rate the Municipal Council has to decide by October 1st, 1913, whether the company's concession shall be prolonged in a modified form or whether the city shall purchase the undertaking in 1915, the former date coinciding with that on which the option on the lignite mines will expire. Nevertheless, it is said to be probable that even in the event of a change of ownership taking place, the great lignite scheme will be proceeded with for other purposes, especially as a plentiful supply of water is available from the river Mulde. It would, for instance, be possible to transmit the energy for the supply of the outlying districts of Berlin and the manufacturing works situated in those localities, whilst at the same time the Municipal Council is thought of as a possible customer should that body acquire the company's works in Berlin.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**BRITISH GUIANA.**—A new Customs Tariff which is to remain in force until March 31st, 1914, saving new legislation, provides for the importation free of duty of telephones and material necessary for the construction of telephones.

**DENMARK.**—The Danish Customs Authorities have issued a decision to the effect that protectors for electric wires, telephone wires, &c., made of plate iron, about 2½ mm. thick of various lengths, one end being fitted with a pressed projecting collar with a perforation, and the other with a riveted pin to fit into the hole, are to be dutiable at the rate of 10 öre per kg. (Note 100 öre = 1s. 1½d.)

**GERMANY.**—The German Customs Authorities have decided that cable silk, *i.e.*, raw silk for the insulation of electric wires in which two or more threads (each thread being once twisted) are united by slight torsion, is not dutiable as silk "once twisted" but as "twice twisted" as follows:—

Not made up for retail sale:			
Undyed or dyed white	...	...	120 marks per 100 kg.
Dyed in colours other than white	...	...	140 " "
Made up for retail sale	...	...	140 " "

**FRANCE.**—The Board of Trade have received information to the effect that in future a commercial traveller who desires to obtain temporary free importation of his samples into France by depositing the amount of duty payable, which will be refunded if the samples are re-exported within 12 months, will be required by the French Customs Authorities to have in his possession a "carte de légitimation" or certificate of identity. These certificates are obtainable from Chambers of Commerce in the United Kingdom.

## PATENTS EXPIRING IN 1913.

The following are abstracts of Electrical Patents applied for in 1899, which expire during the current year. About 950 electrical Complete Specifications were filed during that year; only 53 of these, however, have been maintained for their full term of 14 years.

214. "Railway signals." M. G. L. DE FERREIRA and H. J. PRYCE. January 4th.—Relates to apparatus for electrically interlocking the block instruments and mechanical signals, and a locking mechanism for the commutator handle of the block instrument. The riving plunger works through the spindle of the commutator handle, which carries a plate fitted to the handle or collar. The plate is formed with a slot and notches corresponding with the different positions of the handle, the notches being adapted to receive the locking-pin on the lever armature of the electromagnet.

516. "Electric telegraphs." A. MURHEAD. January 9th.—Relates to arrangements for working ultramarine and other systems of telegraphy, either singly or by duplex methods, and for translating from one cable to another. Various arrangements are described of the coil local and bridge circuits, when duplexing; the use is also described of double or differentially wound synchronous coils, and the use of a second such coil in connection with the local relay or translating circuit.

517. "Printing-telegraphs." C. D. ABEL. (Siemens & Halske, Aktien-gesellschaft.) January 9th.—Relates to apparatus available both as transmitter and receiver in printing-telegraphy. The apparatus is shown diagrammatically, and is too complicated for abridgement.

635. "Lighting gas by electricity." C. FRANZEN. January 10th.—The rotary disk or other gas valve and the incandescent or sparking igniting device are simultaneously operated from a common electromagnet, and the leads of the igniting device are arranged within the incandescent or other burner. The wires and the igniting device are carried by a glass tube, which may be easily detached and renewed.

1434. "Telegraphic Apparatus." S. G. BROWN. January 21st.—Relays for telegraph systems, such as those used in submarine working, are arranged with the swinging coil carrying or connected to a fixed arm, or fixed and movable arms, which bear on the divided periphery of a rotating drum, the two sides of which are arranged in the divided battery circuit. The drum may have two pairs of conducting disks, or may be arranged horizontally when it is undivided; two horizontal drums may also be used. Several arrangements of submarine signalling are described, the essential feature of which consists in the employment of an inductive resistance having a closed magnetic field. The resistance may, or may not, be adjustable, and may have an exciting circuit to bring the magnetic core to near its saturation point.

1862. "Electric telegraphy." F. BRAUN. January 26th.—Relates to systems of wireless telegraphy in which waves of low frequency are employed, such as are generated by a Leyden jar.

4124. "Electric stoves." H. J. DOWLING. February 24th.—Several elongated incandescent lamps are situated in front of angularly-placed reflectors of bright copper or other metal, which, with the back of a casing, form triangular channels in which air is heated and ascends below a forwardly-inclined top.

4576. "Dynamos, regulating." N. BROWN. (Torrill Automatic Potential Regulator Co.) February 27th.—Relates to automatic potential regulators for dynamos, in which a regulating-resistance is suddenly cut in or cut of the field-magnet circuit by means of one or more solenoids. In a shunt taken from points on the supply mains are arranged the operating solenoids, an electromagnet, and a resistance, while in a supplementary shunt taken from other points are arranged contacts operated by the solenoid cores, an electromagnet and a second contact arrangement, operated by a magnet. The shunt field circuit of the dynamo contains a resistance, and its terminals are connected to contacts which are opened and closed by the armature of the magnet. When the potential falls, a pair of levers, connected with the solenoid cores on the one hand and with a spring on the other, cause the closure of the contacts. The magnet thereupon becomes energised, and its armature closes the other contacts, thereby short-circuiting the resistance and producing a rise in potential.

4801. "Electric switches." J. H. HOLMES and F. BROABBENT. March 4th.—Relates to resistance switches for motors or for circuits where it is undesirable to switch on the whole current suddenly. The switch is so arranged that the resistances are cut out slowly and automatically after the main circuit is completed, and means are provided for preventing the switch from being left in improper positions.

5,657. "Wireless telegraphy." G. MARCONI and WIRELESS TELEGRAPH and SIGNAL Co. March 15th.—Relates to improvements in wireless telegraph apparatus. The transmitting-key is provided with a long arm, so that the contacts separate by a considerable distance when transmitting, but fall together when receiving. The contact is connected to that radiator sphere attached to the aerial wire.

5,933. "Telegraphic systems." A. POLLAS, J. VIRAG, J. EGGER and F. SIEMENSSEN. March 15th.—Relates to a system of rapid signalling for submarine and other work in which the message is transmitted from a perforated tape having two rows of short and wide holes. The message is received by a telephonic receiver or an oscillation meter in which a small light mirror is caused to reflect a beam of light on to a photographic paper.

6,229. "Electric telegraphs." F. H. W. HIGGINS. March 22nd.—Colour-printing telegraph receivers are arranged to work with Wheatstone transmitters sending alternating currents. The line currents are employed to operate a polarised double electromagnet, the armature of which controls an escapement on the type-wheel shaft, and a non-polarised magnet the armature of which is released only on the stoppage of the current to effect the printing.

6,949. "Posts." SIEMENS BROS. & Co. and G. W. PRARY. March 23rd.—Telegraph and like posts are steadied in soft ground by means of a steady-plate, through an aperture in which the post is driven, forcing it into the ground. The plate has inclined ribs, and the post may have a shoulder or collar.

6,685. "Primary batteries." R. C. A. HEINRICH. March 25th.—Relates to H-shaped cells in each of which is a liquid electrode, and a common electrolyte. The invention consists in constructing the diaphragms which separate the electrodes from the electrolyte of two perforated disks, either made in one with, or fixed on, a vent tube. The space between the disks is packed with a porous material, such as asbestos.

6,883. "Gzone." M. OTTO. March 29th.—Relates to apparatus for producing ozone and other gases by means of the silent electric discharge. In this case, between fixed electrodes there are "movable separating disks having alternately conducting and insulating sectors, or more generally having alternate sectors, such that whilst one sector allows discharge to pass between the electrodes before which it moves, the following sector interrupts this discharge, and thus automatically prevents the dangerous short-circuits that might otherwise occur."

6,932. "Induction coils." G. MARCONI and WIRELESS TELEGRAPH and SIGNAL Co. April 1st.—Induction coils for use in wireless telegraphy. The primary coils are arranged in parallel or in series-parallel, and the secondary, which may be formed of one or several sections, arranged in series and having a diminishing number of turns as the distance increases from the centre.

7,277. "Electricity, measuring." H. ARON and ARON ELECTRICITY METER, LTD. April 6th.—Quantity meters are provided with clocks for automatically changing the registration during any desired times in each day, either by connecting or disconnecting resistances or shifting change wheels to alter the rate of the meter, or otherwise by shifting connecting wheels so that registration is effected on two or more different sets of dials during the different times.

7,370. "Railways, &c., electric." LEIGH. (F. J. Sprague.) April 7th.—Relates to the "Electric" system of controlling an electrically driven train from any desired point on the train. The master or driver's controllers at each end of the car are connected by local wires to each other and to the motor-controllers and to the train wires which are carried through the whole length of the train by proper couplings. The motor-controller consists of a rheostat cylinder driven by a pilot motor, independent series-multiple switch, and a series switch operated by solenoids, rheostats and a switch which limits the operations of the pilot motor and the solenoids. The general arrangement is such that the main motors are put into series or multiple by manipulating any one of the driver's switches.

(To be continued.)

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,153. "Mariners' compasses." KELVIN & J. WHITE, LTD., and F. A. KING. May 13th.

11,169. "Section insulators for overhead electric trolley wires for tramways." C. WELLS and A. BECKER. May 13th.

11,177. "Telephone exchange system." E. R. CORWIN. May 13th. (Complete.)

11,191. "Electric indicator table for hotels and the like." H. MYLO. May 13th. (Complete.)

11,193. "Individual telephone mouth-pieces." C. S. WARREN. May 13th. (Complete.)

11,208. "Devices for protecting telegraph and like wires against inductive action from neighbouring circuits." O. MALL and P. KUSCHWITZ. May 13th. (Complete.)

11,214. "Dynamo-electric machines." V. A. FENN. (Convention date, May 13th, 1912, United States.) May 13th. (Complete.)

11,215. "Fire alarms." J. STEVENS. May 13th. (Complete.)

11,219. "Method and apparatus for the electrostatic separation and cleaning of grits, grain or the like." (Convention date, April 29th, 1913, Germany.) May 13th. (Complete.)

11,240. "High-frequency dynamo-electric machines." BRITISH THOMSON-HOUSTON Co., LTD. (General Electric Co., United States.) May 13th.

11,243. "Electric telegraph stations." MANOEL CABRAL DOS SANTOS. (Convention date, May 14th, 1912, France.) May 14th. (Complete.)

11,245. "Securing electric lamps in their sockets." R. J. BOTT. May 14th.

11,250. "Receiver holder for subscribers' telephones." G. D. H. ROSS. May 14th.

11,267. "Regulation of electric circuits and means therefor." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke, Germany.) May 14th. (Complete.)

11,274. "Apparatus for regulating electric currents passed through the human body or through electric lamps." E. E. GARFIELD. May 14th.

11,275. "Sparking plug for igniting gases in gas oil and petrol engines by low-tension magneto." A. B. R. PENDER. (W. G. Pender, Rhodesia.) May 14th.

11,277. "Bearings for electrical measuring instruments and the like." H. ARON-ELEKTRICITÄTZAHLFABRIK G.m.b.H. (Convention date, December 14th, 1912, Germany.) May 14th. (Complete.)

11,298. "Electric wire fuses." E. WEISSNER. May 14th. (Complete.)

11,300. "Manufacture of alkali metal alloys by the electrolysis of caustic alkalies in a fused state and the manufacture of alkali metals and derived products therefrom." E. A. ARSCOTT. May 14th.

11,310. "Suspension of overhead line wires for electric traction." Ssc. VINDOELLI, FRATELLI, ET Cie. (Convention date, November 20th, 1912, Switzerland.) May 14th. (Complete.)

11,313. "Alternating-current commutator electric motors." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Convention date, May 14th, 1912, Germany.) May 14th. (Complete.)

11,317. "Instrument for testing the magnetic susceptibility or permeability of magnetic substances." W. H. F. MURDOCH. May 15th.

11,355. "Electric switching devices." H. S. HATFIELD. May 15th.

11,368. "Burglar alarm apparatus for safes and the like." H. S. WOOLATCH. May 15th.

11,371. "Wireless telegraph transmitters." G. MARCONI. May 15th.

11,430. "Rotary magnetic separators." E. C. R. MARKS. (Maschinenbau Anstalt Humboldt, German.) May 16th. (Complete.)

11,440. "Containers for galvanic cells." E. S. FRANKLIN. May 16th.

11,441. "Apparatus for measuring high voltages." E. WILSON. May 16th.

11,453. "Means for detecting continuous electrical oscillations." MARCONI'S WIRELESS TELEGRAPH Co., LTD., and C. S. FRANKLIN. May 16th.

11,470. "Electric pocket lamp." MARCUS WEISS and W. JERGER. May 16th.

11,500. "Shears for cutting wire fences or obstacles or telegraph and telephone lines and the like." N. GULEVITCH. (Addition to 13,613/11.) May 17th.

11,569. "Mariners' compasses." KELVIN & J. WHITE, LTD., M. B. FIELD and D. RENFREW. May 17th.

11,566. "Synchronous dynamo-electric machines." E. ROSENBERG. (Addition to 9,644/12.) May 17th.

11,583. "Regulation of lifts, elevators, and the like." D. TESSIER. May 17th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 3d. (in stamps).

1911.

ELECTRIC SIGNALLING SYSTEMS. R. HACKING. 27,974. December 13th. (June 13th, 1912.)

1912.

DYNAMO-ELECTRIC ALTERNATING-CURRENT MACHINERY. Akt.-Ges. BROWN, BOVERI & Cie. 7,253. March 25th. (January 23th, 1912. Addition to No. 4,460 of 1912.)

AUTOMATIC TOLL RECORDER FOR TELEPHONE SYSTEMS. E. G. GODFREE. 7,264. March 25th. (April 3rd, 1912.)

METHOD OF REGULATING THE ATTENUATION IN ELECTRIC TELEGRAPH AND TELEPHONE LINES LOADED ACCORDING TO THE PUPIN SYSTEM, FOR VIBRATIONS OF VARIOUS PERIODICITIES. F. A. BECKER. 7,503. April 1st. (March 31st, 1911. Addition to No. 65 of 1911.)

TELEGRAPHY. E. S. HEURLEY. 9,733. April 24th.

MANUFACTURE OF ELECTRIC INCANDESCENT FILAMENTS OR BODIES. F. HANSEN and W. F. MOHR. 9,941. April 26th.

ELECTRICALLY-HEATED APPARATUS. E. C. R. MARKS. (Landers, Fray & Clark.) 10,029. April 27th.

ELECTRIC IMPULSE TRANSMITTERS. Automatic Telephone Manufacturing Co. (Automatic Electric Co.) 10,120. April 29th.

MAGNETO CURRENT GENERATORS. E. PODLESAK. 10,299. April 30th.

BRANCH EXCHANGER TELEPHONE SYSTEMS. Telefonfabrik Akt.-Ges. vorm. J. BERLINER. 10,364. May 1st. (May 11th, 1911.)

TELEPHONE SYSTEMS. T. G. MARTIN. 10,376. May 1st. (May 2nd, 1911.)

ELECTRODES FOR PRIMARY OR SECONDARY BATTERIES. A. HEIL. 10,641. May 3rd. (May 9th, 1911.)

ELECTRIC MOTORS. Submersible and J.-L. MOTORS, LTD., and T. L. R. COOPER. 10,634. May 4th.

DYNAMO-ELECTRIC MACHINES. Submersible and J.-L. MOTORS, LTD., and H. B. POYNDER. 10,655. May 4th.

SHADE SUPPORTS AND LAMPLOCKS FOR ELECTRIC INCANDESCENT LAMPS. J. N. MOLLETT and E. E. EDWARDS. 10,753. May 6th.

ELECTRIC HEATING ELEMENTS. Electric and Ordnance Accessories Co., J. D. MORRISON and L. H. DAVIES. 10,765. May 7th.

ADJUSTABLE ELECTRIC LIGHT PENDANTS AND THE LIKE. W. SCHOLDS. 10,780. May 7th.

TRANSMISSION OF ELECTRIC ENERGY AT A DISTANCE WITHOUT CONNECTING WIRES, AND A NEW SYSTEM OF WIRELESS SIGNALLING. R. C. GALLETTI. 10,863. May 7th.

ELECTRIC CIRCUIT-CLOSING DEVICES. Nalder Bros. & Thompson, Ltd., and A. F. HARRIS. 11,260. May 11th.

ELECTRIC WATER HEATER. J. MADD. 11,849. May 13th.

PORTABLE ELECTRIC LIGHT FITTINGS. L. A. WILLIAMSON. 13,162. June 4th.

ELECTRIC INSULATORS. M. MELROWSKY. 13,365. June 6th.

INTERCOMMUNICATING TELEPHONE SYSTEMS. Automatic Telephone Manufacturing Co., W. AITKEN, H. COOPER and C. REMINGTON. 13,963. June 15th.

WIRELESS TELEGRAPHY. W. DUBILIER. 14,015. June 15th.

ELECTRIC CABLE SHEATH. Western Electric Co., Ltd. (Western Electric Co.) 16,153. July 10th.

ELECTRIC CONTROLLERS, STARTING SWITCHES and THE LIKE. Siemens Bros. Dynamo Works, Ltd., and B. G. PAYNE. 16,343. July 12th.

GOVERNING MECHANISM FOR INTERNAL-COMBUSTION ENGINES. British Thomson-Houston Co. (General Electric Co.) 16,442. July 12th.

SIGNALLING ON RAILWAYS. A. T. BLACKALL and C. M. JACOBS. 17,035. July 22nd.

APPARATUS FOR TRANSFORMING DIRECT ELECTRIC CURRENT INTO ALTERNATING CURRENT. P. HILDEBRAND. 17,316. July 25th. (February 14th, 1912.)

PROTECTIVE DEVICES FOR ELECTRIC CIRCUITS. British Thomson-Houston Co., Ltd. (General Electric Co.) 17,660. July 30th.

1913.

BLOW MAGNET FOR ARC LAMPS. Korting & Mathieson Akt.-Ges. 318. January 6th. (May 11th, 1912.)

TELEPHONIC TRANSMITTERS. E. GRISSENG. 2,923. February 4th. (Divided application on No. 7,482 of 1912, March 27th.)

PROTECTIVE DEVICE FOR THE CIRCUITS OF ELECTRIC MOTORS. S. L. GLENN and British Pneumatic Railway signal Co. 3,446. February 10th.

ELECTRIC MOTOR-CONTROLLING DEVICES. British Thomson-Houston Co. and H. E. BRITTON. 4,093. February 17th.

DEVICES FOR REVERSING THE DIRECTION OF RUNNING OF POLYPHASE CURRENT COMMUTATOR MOTORS. Bergmann Elektricitäts Werke Akt.-Ges. 4,691. February 21st. (March 12th, 1912.)

PORTABLE ELECTRIC BATTERY LAMPS. H. F. JOSL. 5,073. February 25th. (Divided application on No. 5,170 of 1912, March 1st.)

# THE ELECTRICAL REVIEW.

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JUNE 6, 1913.

No. 1,854.

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## THE ACCESSION OF ELECTRICAL ENGINEERS TO PARLIAMENT.

SOME months ago a leading article appeared in this journal wherein the view was expressed that there was room for more electrical engineers in Parliament. Since that date there have been two by-elections, in which gentlemen connected with the electrical world have played a prominent and a successful part. Mr. J. C. Denison-Pender, the member for the Newmarket Division of Cambridgeshire, is well known to those who are interested in submarine cables. Mr. G. C. Hamilton, M.P. for the Altrincham Division, served an apprenticeship with Messrs. Scott & Mountain, to become, in later years, a director of Messrs. Drake and Gorham.

Here, then, be two members of Parliament whose intimate acquaintance with matters electrical renders them eminently qualified for a seat in the legislature—apart altogether from political attainments. In the same connection mention may properly be made of Mr. George Balfour, a member of the firm of Balfour, Beatty & Co., who are engaged in tramway and electrical undertakings. But for certain happenings which were recently brought to light in the case of "Balfour v. Tillett and others," we might have been able to add his name to the list of electrical M.P.'s. He stood for Govan in the election of December, 1911. The night before the poll, at a time when there was no possibility of his taking steps to refute it, a rumour was spread abroad that Mr. Balfour, as managing director of the Lanely Tramways, had refused to recognise the men's Union. He lost the election, and brought an action for libel against Mr. Ben Tillett and the *Daily Record*—a Glasgow paper. Before it was heard out, the defendants paid £1,000 and costs in settlement, and apologised. Seeing that nine-tenths of the electors were working men, it is but fair to assume that the libel had some considerable effect on the election, although it was not contended at the trial that it actually cost Mr. Balfour the seat.

It is satisfactory to note that, since our article appeared, two members of a great profession have been summoned to the great Council of the State. Were we to attribute this result to any effort of our own, we might incur the censure of him who, when speaking of the conceit of a young man, said: "He is as shy as a newspaper when speaking of its own merits!" No; the satisfactory feature of this new departure is that it is a sign of the times. Parliaments, like the races of mankind, progress and develop by slow degrees. That progress, although slow, is sure. One hundred years ago the Lower Chamber consisted almost entirely of landowners and lawyers. Either it had not occurred to the man of business to enter Parliament, or it had occurred to those who were in possession to do everything that was possible to keep him out. As for your Labour Member, he had not even been born or thought of

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**THE UNIVERSAL ELECTRICAL DIRECTORY**  
(J. A. Berly's).

# 1913 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,**  
4, Ludgate Hill, London, E.C.

But look at the House of Commons of to-day! It contains representatives of nearly every class, creed, and business in the United Kingdom. The process of evolution has been slow, but it is by no means complete. The labour movement which commenced and developed in the nineteenth century had reached an age equal to the allotted span of human life before it began to make its voice articulate in the Halls of Westminster. Great industries, like great movements, must exist and thrive for many years before their position is thus recognised by the people who have the power of the vote. Moreover, to pass from the industry itself to the men who make and mould it, they, too, have to develop before they acquire the knowledge and the leisure which will enable them to take their places in the Parliamentary fighting line. The head of a great business cannot afford to neglect the routine work of his office unless he has educated a large staff, to whom the performance of much of the detail work can be safely delegated.

The exigencies of contemporary politics make it necessary that those who now seek to represent us in Parliament shall belong to one or other of the great political parties. But knowing, as we do, the type of man who is singled out for leadership in one of the greatest of modern industries, we have no fears on this score. Whether he be Tory or Radical, the special knowledge of the electrical engineer will be at the disposal of the legislature when questions arise which he is well qualified to answer. We are persuaded that he will now and always be an ardent exponent of the doctrine of Rutherford B. Hayes, who wrote: "He serves his party best who serves the country best."

#### Payments on Account.

It constantly happens that in the carrying out of large works it becomes necessary to provide for "payment on account" as the work proceeds. An arrangement is accordingly made whereby when a certain part of the work is done, the builder or contractor becomes entitled to a certain percentage of the contract price.

While the chief duty of the engineer in relation to a contract for a large works is to supervise the work of the contractor, it is by no means an unimportant part of his duty to decide, subject to the terms of the contract, how the contractor shall be paid, and whether he is keeping up to time, having regard to all the unforeseen difficulties which arise in the execution of works of any magnitude. It is proposed to consider the legal effect of the certificate by means of which the engineer usually expresses his decision on all these different questions. As a rule, the engineer authorises the contractor to be paid, and otherwise expresses his approval by means of a certificate. To save trouble and to avoid disputes, the contract between the employer and the contractor should provide for a written certificate. Otherwise a mere verbal statement may be sufficient. Thus, to draw a legitimate analogy from a case which concerned the building trade, in *Elmes v. Burgh Market Co.*, 1891, a contract provided that: "The contractor shall receive payment for his contract at the rate of £80 per cent. for the works completed on the surveyor's certificate of completion and the balance at the end of the term of maintenance, less deductions that may be made in accordance with the terms of the contract and on the surveyor certifying that the whole works are in a complete and satisfactory state." It was held that a certificate within the meaning of this clause might be given orally by the surveyor. Where a written

certificate is expressly required the contractor is helpless unless it be forthcoming. He cannot sue the employer for the price of any portion of the work which he has done unless he can show that the certificate has been withheld by the engineer acting in collusion with the employer, subject to adjustment or re-adjustment at the end of the contract. The mere fact, therefore, that the engineer, by granting a progress certificate during the course of the work, appears to express approval of that which is already done, will not enable the contractor to sue for payment. The "progress certificate" is sometimes termed a "certificate on account." In some forms of Model Conditions sanctioned by the Institution of Electrical Engineers it is specially provided that no such certificate is to prejudice the rights of the purchasers against the contractor or relieve the contractor of his obligations for the due performance of the contract. It is usual to make provision for progress certificates by saying that the contractor shall be entitled, upon the certificates of the engineer, to payments by the employer in accordance with provisions to the following effect:—(1) As the works progress, 80 per cent. upon the contract value of the work from time to time delivered or executed on the site to the satisfaction of the engineer; (2) the remaining 20 per cent. (usually termed the retention money) in respect of each district section or part of the works as follows:—(a) 10 per cent. at the expiration of one month after the employer takes over the works, and (b) 10 per cent. becomes due under (a). Payments made under the former provision are made on "progress certificates." To avoid any chance of misunderstanding as to the effect of these documents, it is often wise to insert a clause providing that the certificates given during the work shall not in any way prejudice the employer in the final settlement of accounts, in case it should appear that the contractor has been paid too much.

#### Postal Electricians in Australia.

It is becoming so usual a thing in Australia for the wages of different classes of workers to be regulated by the State, that it is no surprise to find, from a recent issue of an Australian paper, that postal electricians have applied for, and obtained, a State award. Under the Arbitration (Public Service) Act of 1911, it is not necessary for any inter-State dispute to arise before a claim may be made, and it was, therefore, only necessary for the Postal Electricians' Union to formulate its wishes to ensure consideration under the Act. The case was heard by the President of the Federal Arbitration Court, Mr. Justice Higgins. The award does not extend to either telegraph or telephone operators, but only to linemen, battery men, mechanics, overseers, inspectors, and those engaged in the mechanical department of the telegraph and telephone branches of the Post and Telegraph Department. Some of the claims that were made were rejected on the ground that they involved the transfer of responsibility for administration from the present responsible heads. The Judge declined to dictate a system of management or administration to the Department. He also declined to allow first-class railway fares for journeys over 100 miles, or to insist upon a seven-hour shift in cases where continuous work was necessary.

He pointed out how rapidly the work of the Department had increased in recent years. In New South Wales there were on December 31st, 1900, 45 telephone exchanges, 8,755 lines connected, and 12,197 instruments. Eleven years later, there were 353 exchanges, 34,551 lines connected, and 41,954 instruments in use.

Mr. Justice Higgins protested against reckless liberality as conducive to unrest and dissatisfaction in other branches of the service and kindred industries. He then referred to the rates paid in London and the provinces, and remarked that "s. here would buy as much of a worker's necessaries as 10s. would in Australia. This is a useful comparison to bear in mind."

The award gives the following minimum rates of pay to employes of the department, who are members of the Postal Electricians' Union:—

Telegraph or telephone mechanics, £168 per year; senior mechanics, £198; foreman mechanics, including foreman mechanics in electric light and power, £208; exchange foreman mechanic, £228; telephone inspectors, £228; mechanics, Hobart or Perth, £261; Adelaide, £300; Brisbane, £312; Sydney, £321; Melbourne, £321; cadets, mechanics, or junior mechanics, 14 to 15 years of age, £39; 15 to 16, £52; 16 to 17, £65; 17 to 18, £78; 18 to 19, £91; 19 to 20, £104; 20 to 21, £126; 21 to 22, £140; 22 and upwards, £156; battery-men, £133; foreman battery-men, £186.

It was also awarded that provided it was previously decided that work had been satisfactorily performed, mechanics, senior mechanics, battery-men and foreman battery-men should receive three annual increments of £6 each, and other classes should be entitled to scheduled increases at scheduled times as the Commissioner might determine.

Except in the case of shifts, a week's work was to consist of 44 hours. Overtime to be paid at the rate of time and a half for the first five hours, and double time thereafter. Sunday duty time and a half, holiday duty double time. When shifts are worked, eight hours, including one hour for meals, to be the limit, no shift to be commenced later than 11 p.m.

Holidays to a total of 18 days each year, exclusive of Sundays and public holidays, to be allowed.

Whenever one officer temporarily takes the place of another who receives lower pay than himself, he must not suffer any reduction in pay, and if he relieves one of higher status he shall, after one month's service in the higher grade, be paid the higher rate.

A cadet mechanic is to become a junior mechanic after two years' service, or on attaining the age of 18. Every cadet or junior mechanic who attends classes, or joins classes conducted by correspondence, shall be entitled on the recommendation of his superior officer to a payment of half the fees as they fall due, and of the remainder on his passing the prescribed examination for a mechanic.

Other clauses in the award permit of the wearing of a badge of membership in the Union during working hours—a right evidently much prized in Australia—and permission for the Union to display notices on business premises.

These provisions seem decidedly more moderate in tone and temper than those given in other cases where electrical workers are concerned. They only become operative 30 days after being laid before the Federal Parliament. A motion in Parliament is necessary to vary the terms of the award.

The rates of pay seem high for the class of work to be performed, but, as stated by the Judge, the purchasing power of money is less in Australia than here. As the service is a public one, it really means that the revenue of the department must be so arranged that these rates of wages are feasible. In the end, the public pays. Up to a certain point, the gain in efficiency due to just conditions of labour warrants, even in an economic sense, the increase in working expenses; but there is a point—and that point is for the Judge in such disputes as this to find—beyond which increased working expenses bring no increase of efficiency and only result in making increased charges to the public necessary.

The provision as to help to young workers in the matter of technical class fees is, in our opinion, very good, helpful to the worker and economical to the employer. It is, to a certain extent, done in this country, but there is still room for its more general adoption. The National Telephone Co. gave a good lead to our own Post Office in this respect.

WERE we to come down to breakfast on one of His Majesty's Birthdays, or on the morning of one of those other auspicious occasions when Honours are announced, and discover that those in authority had actually awakened to the real merit of electrical and other engineering men and scientists, we should fancy that we were still under the influence of the visions of the night. As it is we have no need to "pinch" ourselves to find out if we are awake, for after scanning the latest list very closely, we are moved by the same old impulse to "punch" somebody editorially, which means that this Government, and those associated with it in meting out national awards, have been by vaccination, or in some other way, made immune to all engineering and electrical infections. Maybe the Government is sick with Marconi malaise or telephonitis, and does not desire to encourage those associated with these matters in any way. We regard as little short of scandalous the omission of a number of names of electrical men who have rendered signal service to the nation, and whose honours are

long overdue. Of course, we are grateful for such recognition as we find of men who have thoroughly deserved it in departments allied to electrical and other such effort. To these our hearty congratulations—but we profoundly wish that there were more of them, and that they were electrical leaders. These are the names that we select from the list announced on Tuesday last:—

*Privy Councillor*: Sir Alfred Mond, Bart., M.P., managing director of Brunner, Mond & Co. Ltd.

*Baronet*: Archibald Denny, Esq. (a past president of the Junior Institution of Engineers).

*Knight*: Prof. John Harvard Biles, LL.D., *ambassador at Tokyo* inquiry.

*Knight*: Robert Bruce, Esq., C.B., Controller of the London Postal District since 1905.

*Knight*: Prof. E. A. Schäfer, F.R.S., president of the British Association, Dundee meeting.

*Knight*: George Henry Smith, Esq., head of the firm of Frederick Smith & Co., Ltd., wire manufacturers, Halifax and Salford.

*C.B.*: Mervyn O'Gorman, Esq., Superintendent of the Royal Aircraft Factory.

*Imperial Service Order*: C. P. O'Reilly, Esq., Indian Telegraph Department, Deputy Superintendent and Honorary Assistant Superintendent, Allahabad.

### Municipal Parsimony.

A REPORT in the *Irish Times* of June 3rd of a meeting of the Dublin Corporation reveals a mental attitude on the part of some of the members which does no credit to their intelligence, though it may throw some light on the subject of the inadequate salaries of engineers in municipal employ. The revision of the scale of salaries paid to the shift engineers and switchboard attendants of the Electricity Department was under consideration, when a Mr. Partridge proposed that the matter be adjourned until the case of the working men, who taught the shift engineers and switchboard attendants their business, was considered. He said he did not think very highly of electrical engineers, as, in his opinion, it was a profession adopted by men who wanted to draw wages without doing any work.

This eregions delirance was greeted with laughter; tears would have been more appropriate. The Lord Mayor, who evidently is better acquainted with the facts, said he thought engineers and switchboard attendants should get at least £156 and £104 respectively—it was only a clerk's wages. The question was adjourned for further consideration, and it is to be hoped that in the meantime steps will be taken to enlighten the members of the Council as to the duties and qualifications of their technical staff.

A report on the revision of the salaries of the higher officials of the department was also considered. A Mr. Cosgrave said the rates had subsidised the concern to the extent of £45,000, and the ratepayers ought at least to get back their money before the salaries of these officers were increased. Could anything be more paltry? How can the Corporation hope to see the business making a profit unless it employs, and pays, the best men to control it? The aggregate salaries of the three officers concerned amounted to £1,500, and the capital invested in the undertaking is £750,000: the salaries, therefore, represent 0.2 per cent. on the capital value—and the three recipients are to be penalised until a profit equal to 30 years' salaries has been made by the department. The consideration of this report was adjourned for six months. Clearly it is high time that steps were taken to protect the interests of station engineers. The Association of Electrical Station Engineers may well direct its attention to the first case mentioned above, but cannot deal with the second; however, a new association is in embryo, as will be gathered from our "Correspondence" columns to-day, and if it is formed we hope it will prove effective in raising the status of engineers in the eyes of the public.

The extraordinary views of the municipal man were further illustrated in the course of the same discussion, when a Mr. Beattie stated that in 19 years the ratepayers had got only £9,000 back out of the £750,000 they had invested in the electric undertaking. "They had invested"—cannot these gentlemen realise that the ratepayers have not invested one penny in the undertaking beyond the £45,000 derived from the rates? Meum and tuum seem to have lost their meaning in Dublin.

## THE INSTITUTION OF ELECTRICAL ENGINEERS IN PARIS.

(Continued from page 883.)

DURING the visit the six aerial antennae attached to the top of the Tower were heard at work, emitting a crackling sound. On descending, the visitors heartily applauded a brief speech addressed to M. Eiffel by M. Berthelot, expressing their appreciation of his kindness in affording them the opportunity to visit his masterpiece under such agreeable conditions. Many of the party then proceeded to the underground wireless installation controlled by M. le Commandant Ferrié, which



*Cliché du Vêroscopé Richard.*  
THE PARTY LEAVING VERSAILLES.

is situated a few hundred yards from the Tower, and was not easily found by some of the visitors—for even when the pit through which the connection to the aerial is taken has been located, the entrance to the extensive subterranean department remains to be discovered, and at least one gentleman, to our knowledge, only attained this end when he saw the other visitors coming out of the ground. To attempt to describe the equipment of the station in detail in the space here available would be a hopeless task; but we may say that the apparatus works on the "spark" system, with generating plant of about 50 kw., and in order to increase the range and strength of the signals a 100-kw. set is now being installed.

It will be remembered that the Eiffel Tower station maintained communication throughout the campaign



*Photo by B. Thomas.*  
TEA AT THE TRIANON.

in Morocco, in 1908, with the cruiser Kléber, which was stationed at Casablanca; thanks to the great height of the antenna, a power of 10 kilowatts sufficed for this purpose. The success thus achieved led to the development of the station on a permanent basis; progress was delayed by the flood in 1910, which burst an old drain

beneath the underground chambers and flooded the station. The present equipment comprises three sets of transmitting apparatus, namely, the original 10 kw. plant, which is still used for moderate distances; a 40-kw. set, with Moscicki condensers of 0.7 mfd. capacity and a spark-gap which originally consisted of zinc cylinders 25 cm. in diameter  $\times$  50 cm. long, revolving 4 times per second; and a 10 kw. set with a musical spark, fed with alternating current at 600 cycles per second by a Bethenod alternator, with a spark-gap consisting of a brass tube 50 mm. in diameter and 1 mm. thick, having its axis at right angles to a flat copper disk. A blast of air is driven through the tube to blow out the sparks and keep the parts cool. With this type of spark-gap pure and regular tones are obtained, and it needs no adjustment except regulation of the gap. Signals sent by this equipment, using less than 10 kw. at the terminals of the alternator, have been received by the Marconi station at Glace Bay during the night. The success of the tube-and-disk gap led to its adoption for the 40-kw. set, using a brass tube 20 cm. in diameter and 1 cm. thick, with a copper plate 65 cm. in diameter and 2 cm. thick. The spark in this case is 15 mm. in length, and the current in the antenna has reached 60 amperes.

The antenna consists of 6 steel cables, suspended from the top of the Tower and attached at the lower ends to pillars concealed in shrubbery; the middle portions of the cables are effectively insulated from the ends, and are connected together at their lower limits and joined to a single cable dropping vertically into the station. Abundant provision of receiving apparatus is made, and the equipment also comprises all that is



*Cliché du Vêroscopé Richard.*  
AT THE AERODROME, BUC; M. BLERIOT IN CENTRE.

necessary for the conduct of investigations into all branches of wireless telegraphy.

Laboratory accommodation is provided for testing wireless apparatus of all kinds, and a large number of military, marine, and other sets manufactured by the three French wireless companies, were shown in operation. The spark-gap belonging to the "musical" installation for distributing time signals, meteorological and other information of value to navigators and other professional men, was set at work in the presence of the visitors, the sparks sounding like pistol shots. The enthusiasm manifested by M. Ferrié in demonstrating the capabilities of this important station—the official international centre for the distribution of time—was excelled only by the courtesy and good-nature with which he answered questions and explained apparatus, while his staff zealously followed his example.

On Friday morning Mr. Duddell presided at the meeting of the Congress, which was devoted entirely to the subject of electric traction on railways, continuing the discussion which was commenced on Wednesday. Amongst those who took part in the discussion were

Messrs. Thury, Gratzmuller, Latour, Slingo, Mazon, Grousse and Parodi. Mr. Slingo pointed out that in England the telegraphs were more liable to interference owing to the high speed at which our circuits were worked. The adoption of the central battery system for the telegraphs in London had overcome the trouble, thanks to the higher resistance and higher voltage employed, which swamped the stray currents. Alternating current harmonics gave trouble, even on perfectly erected looped overhead telephone lines.

In the afternoon a special train, provided by the courtesy of the Chemin de Fer du Nord, conveyed a large party—some 230 in number—to Chantilly, whence they drove in brakes through leafy avenues to the famous Château. They were conducted through



BLERIOT AEROPLANE ABOUT TO START.

the Musée Condé by the curator, M. Berger, and were charmed with the exquisite works of art which it contained, as well as by the splendour and beauty of the shell in which these priceless pearls are stored. Some found time for a delightful stroll through the richly-wooded grounds, and afterwards driving through Chantilly, the Newmarket of France, the party rendezvoused at the Hôtel du Grand Condé for tea before returning to the city.

Saturday morning at the Congress certainly provided the most interesting and varied programme of the week; Mr. Duddell again presided, and first M. G. Claude delivered a lecture on lighting with vapour tube lamps, a subject of which he is a master, and which he handled with inimitable grace and humour. After referring to the discovery of neon and the other rare gases of the atmosphere by Sir William Ramsay, M. Claude explained that he had succeeded in devising means of producing neon on a commercial scale; the gas was particularly suitable for use in electric lighting, owing to its low resistance to the electric discharge—neon only requiring 13 volts where air required 1,000 volts, to cause the discharge to pass.

Unfortunately, the spectrum of neon is practically devoid of blue rays, the colour of the light being a rich reddish orange, and the gas is extremely sensitive to impurities, which are given off by the electrodes. The latter are also apt to volatilise. However, by using large electrodes, and absorbing the impurities with charcoal cooled by liquid air, M. Claude has succeeded in increasing the life of the neon tube beyond that of incandescent lamps. The voltage required by the neon tube is one-third that of the Moore vapour tube lamp, and the candle-power per metre is 200 c.p. as compared with 60, the efficiency being 0.6 watt per candle against 1.7. The light is physiologically excellent, and increases visual acuity by 25 per cent.

By using mercury vapour lamps alongside of neon tubes the excess of red and deficiency of blue rays can be corrected; M. Claude has applied this correction by placing some mercury in an ordinary neon tube, which then gives the mercury vapour spectrum. When the correcting tube is used together with the ordinary neon tube, the result is an excellent white illumination giving colours in their true tints, with an overall efficiency of 0.8 to 0.9 watt per candle. These facts were admirably demonstrated by a series of experiments, which were completely successful and were extremely effective in driving home the different points made by the lecturer.

On the other hand, for some purposes, such as advertising signs, the orange-red light of the neon tube alone is most effective; with the aid of his colleague, M. de Beaufort, M. Claude has made neon tubes of small diameter in the form of letters, etc., with striking effect, and some of the theatres in Paris employ the neon tube over their entrances, rendering them conspicuous at a great distance.

Next Mr. Slingo read a paper on methods recently introduced into the British telephone exchanges for automatically facilitating manual operating, by distributing traffic evenly over a number of operators' positions, improving the transmission conditions where several call-wires terminate on one "B" position, and by automatically selecting and isolating a call-wire when one is required by an "A" operator. The experimental equipment described in the paper was installed for the Post Office by Messrs. Siemens Brothers and Co., Ltd.

M. Charbonnel briefly summarised the communication for the benefit of his colleagues, and Mr. G. H. Nash also took part in the discussion.

Commandant Ferrié followed with a paper on the application of wireless telegraphy to the distribution of time signals, explaining the methods adopted at the Eiffel Tower station for dispatching the signals, and illustrating his remarks in the most effective manner possible—namely, by receiving the signals sent out from the Tower before and at 10.45 a.m., and rendering them audible to the whole audience.

M. Ferrié also explained how the time can be given with an accuracy of 1-100 of a second by the "method of coincidences"—in essence a very old device of English origin, and familiar to the workers in physical laboratories, but new to the bulk of the audience. This was also demonstrated by a very pretty experiment, and it was explained that by this means differences in longitude could be determined with great accuracy, and observatories could obtain from one another "the right time," so as to tide over periods when bad weather rendered astronomical observations impracticable. At the International Conference held in Paris in October last year, the time signals were reorganised, and the Eiffel Tower was designated as the centre of the International time-service. The new system will come into operation on July 1st. It is interesting to note that in communicating time signals between Paris and Washington, a distance of 6,000 km., the time occupied in the transmission of the electric waves has to be taken into account, being of the order of 0.02



Photo by B. Thomas.

AEROPLANE LEAVING THE GROUND.

second, which is not a negligible quantity; it is hoped that this period will shortly be known so accurately that it will be possible to compare the times in Paris and Washington to an accuracy of 1-1,000 of a second.

M. Ferrié's interesting lecture was followed by a brief discussion, in which Messrs. Turpain and Abraham took part.

In the afternoon the members of the two Societies, with many ladies, forming a party of about 300, were conveyed in motor-omnibuses to Versailles, where they visited the Palace and, as at Chantilly, were charmed with its magnificence and the beauty of its contents. They partook of tea and light refreshments at the Trianon Palace Hotel, and here Mr. Duddell took the opportunity of expressing the gratitude of the British visitors to their hosts, and in particular the thanks of

the visiting ladies to the French Committee of ladies, headed by Madame Grosselin, who had provided so abundantly for their entertainment. M. Berthelot responded, and toasted the lady guests with a cup of tea, in the absence of a more appropriate fluid. We may remark that the thoughtfulness of our French confrères in providing tea on many occasions, often in addition to the products for which their country is justly famed, was much appreciated by many of the visitors.

From Versailles the party proceeded to the Aerodromes at Buc, where they were received by Colonel Renard, and first inspected the establishment of M. Blériot, who also welcomed the guests. A large number of Blériot aeroplanes were marshalled on the flying-ground, and ascended one after another with an ease and certainty that left nothing to be desired. The Government flying-ground was also visited, and various machines—Farman, Esnault-Pelterie, etc.—went up in succession. Often there were seven or eight aeroplanes in the air simultaneously, and the daring evolutions which they performed thrilled the spectators.

It is interesting to note that M. Berthelot himself was one of the first to acquire the title of "aviator"; but unfortunately he was too modest to favour the visitors with an exhibition of his skill.

Finally, the motor-buses conveyed the party to the Gare de Versailles, where they were received by M. Claville, director-general of the State Railways, and Messrs. Mazen and Foucault briefly explained to them the construction of the new electric coaches, in which they returned to Paris. This concluded a meeting which was full of varied interest and will long dwell in the memories of the British visitors as a most enjoyable and successful occasion.

We are indebted to M. Perrin, director of the firm of Messrs. Richard Frères, for several of the photographs which we have reproduced in the course of this article, and to the kindness of our confrères of *La Lumière Electrique*, as well as of many other friends, for innumerable courtesies rendered to us during the visit.

(Abstracts of Papers discussed in Paris at the Joint Meeting of the INSTITUTION OF ELECTRICAL ENGINEERS and the SOCIÉTÉ INTERNATIONALE DES ÉLECTRICIENS, 21st-24th May, 1913.)

(Continued from page 883.)

### Single-Phase Traction.

By MONSIEUR MARIUS LATOUR.

IN the first place the author makes a few general observations in regard to the mechanical construction of single-phase locomotives and to the erection of overhead conductors.

The tests carried out by the Compagnie du Midi have been very interesting, because every type of motor has been tried.



FIG. 1.

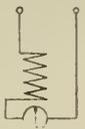


FIG. 2.

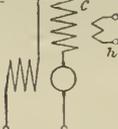


FIG. 3.

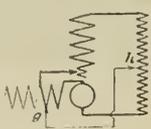


FIG. 4.

The motors experimented with, excluding the well-known Westinghouse series type, have been: (1) the simple repulsion motor (Brown, Boveri) and the compensated repulsion motor (A.E.G.); (2) the series motor with a transverse local field for compensating the electro-motive force of short-circuit under the brushes (Jeumont) and the series motor with an elliptical field (French Thomson-Houston Company).

The simple repulsion motor is shown in Fig. 1. As the present author has shown, there is found in the repulsion motor, due to the current produced in the short-circuited coil by its rotation, a transverse field which interacts with the main field so as to give a synchronously rotating field, thus ensuring satisfactory commutation at that speed. This simple observation, which previous authors have overlooked, has settled the future of the repulsion motors.

At speeds above synchronism, however, the transverse field increases in strength, the commutation becomes unsatisfactory,

the iron losses increase, and at speeds above  $\sqrt{2}$  times synchronous speed the commutation of the repulsion motor becomes worse than that of the series motor.

I have given the name compensated repulsion motor to the motor shown in Fig. 2. This motor has the essential characteristics of an ordinary repulsion motor. It has, moreover, the advantage of working at approximately unity power factor, due to the property of commutator motors with short-circuited brushes having no inductance at synchronous speed and nega-

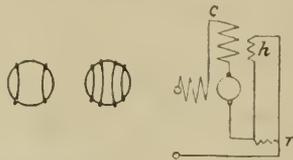


FIG. 5. FIG. 6. FIG. 7.

tive inductance above that speed, even when supplied with simple alternating current.

A series motor with an artificial transverse field which neutralises the electromotive force of short-circuit as happens naturally in repulsion motors at synchronism, is shown in Fig. 3. The winding  $h$  can be connected in shunt to the terminals of the motor. If it is assumed that the compensation in the motor is provided so as to ensure perfect commutation with continuous current, it is clear that the winding  $h$  should carry a current 90 degrees out of phase with the main current. But the winding  $h$  can be allowed to assist compensation, and in this case such winding, in addition to the current which is 90 degrees out of phase, will carry a current in phase with the main current. If, on the other hand, over-compensation takes place with the winding  $C$ , the winding  $h$  will carry a current opposed to the main current.

I have given the name elliptical field motor to the motor arranged as shown in Fig. 4. A short-circuit is established between the point  $g$  of the exciting winding, which can be extended for this purpose, and the point  $h$  of the transformer supplying the motor. Apart from the ordinary compensation, which would give good commutation in the case of continuous current, a local strengthening of the field can be provided, as is shown in Fig. 4; it follows that the point  $g$  should not be so far removed from the rotor.

By rubbing surface we mean the contact area of the brushes on the commutator. The reduction in the contact surface is the important feature in alternating-current machines provided with a commutator. It is easily shown that the losses on the commutator are a minimum when the losses due to the current are equal to the losses due to the short-circuit currents.

Theory shows the decided advantage of a high peripheral speed for the commutator. To obtain the high peripheral speed a high-speed motor should be used. But high speed requires the introduction of gearing. This is the feature of the Jeumont and Westinghouse locomotives, as well as of the Oerlikon locomotive at Lötschberg. Gearing appears to give entire satisfaction from the mechanical point of view.

High speed is not in principle incompatible with any type of repulsion or series motor. But it so happens that in the case of the repulsion motor, where the number of poles is determined by the number of conductors, a frequency of 15 leads to a motor with a small number of poles.

It would seem to be difficult to obtain a pressure between the segments low enough for large powers, but the arrangement of having two short-circuits has been suggested (see Fig. 5), in which the brushes would be placed in a position where the pressure between the segments is still lower; and I have also suggested the use of independent overlapping windings, and especially the arrangement of two overlapping windings with two commutators.

A doubt may arise whether it is possible to arrange for a sufficient number of sets of brushes to carry the current. My arrangement of multiple brushes (see Fig. 6) would, however, at the same time do away with this difficulty.

The bad commutation of repulsion motors is often wrongly attributed to over-synchronism. Faulty compensation is alone responsible in such cases.

The inferiority of the repulsion type of motor at a frequency of 15 appears to lie in its weight, and indirectly in its lower efficiency. In consequence of the smaller number of poles, the repulsion motor requires a greater amount of iron; a larger external diameter is necessary, or, on the other hand, for a given external diameter a smaller bore has to be used, thus leading to a less advantageous utilisation of the material.

Whatever may be the frequency the efficiency of the repulsion motor remains in principle identical with that of a single-phase alternator of the same frequency, whilst the efficiency of a series motor tends at lower frequencies towards that of a continuous-current machine. The difference in efficiency between the two types of motor is thus appreciable at a frequency of 15.

The transverse field which is 90 degrees out of phase, and is required to neutralise the short-circuit electromotive force varies directly as the current and inversely as the speed. Supposing the excitation is provided by constant current, the resultant field of commutation is a function of the speed.

All the types of motors to which we have referred above, even the series motor of which the auxiliary pole is in shunt with the

terminals, possess, so long as their circuits are not modified, a transverse field 90 degrees out of phase, which increases linearly. Accordingly, the electromotive force of short circuit can only be neutralised satisfactorily for a certain speed. It is therefore quite natural to think of adjusting the transverse field according to the speed. These adjustments can be carried out by a centrifugal governor, or by an electrico-dynamical speed device. Complications, however, arise in this respect.

It should be noticed that the presence of true commutating poles in repulsion motors detracts from the simplicity of their construction and connections as compared with the series motor. If simple arrangements could be fitted so as to ensure a transverse field suitable for all speeds and for effecting satisfactory commutation, such arrangements would then be preferable. With the winding  $h$  of Fig. 3 connected across the terminals of a resistance  $r$  through which the principal current of the motor flows (see Fig. 7), it is seen at once that the transverse field will be proportional only to the current, and will be independent of the speed. In other words, with variable speed, the commutation of a polyphase series motor is substituted for that of a repulsion motor.

Whilst the use of a resistance may be practicable at 15 periods, it may be expected to be inadmissible at 25 periods.

In order to reduce the losses in the resistance it is convenient, a low frequency and narrow auxiliary poles having been chosen, to work with reduced air-gaps, high speeds, and a large number of poles. At a frequency of 15 periods these losses can be reduced to the negligible value of  $\frac{1}{2}$  or  $\frac{1}{3}$  of 1 per cent.

### The Electrification of the State Railway: The Paris Suburban Lines.

By MONSIEUR A. N. MAZEN.

THE State railway system, formerly the Ouest lines, serves a very considerable portion of suburban Paris. The lines of this system, which end at three termini, comprise at present a total length in this section of about 500 km. of single track. This total will be increased to 800 km. in a few years' time. A huge traffic naturally corresponds with such a large development of track. From the point of view of the number of outward and inward travellers, the St. Lazare station is by far the most important, not only of the Paris but of European stations. Only Liverpool Street Station in London is at all to be compared with it.

In addition the State railway organisation has to suffice for its main-line service; the system, with its 9,000 km. of track, brings daily from the ten principal extremities more than 80 train loads of passengers into the capital by the main lines. If to these the number of suburban trains are added, a total of more than 820 train-loads entering Paris daily is obtained, which, with the outward trains, amounts to a total of more than 1,640 trains (in and out) in the 24 hours, and as the day is made up of 1,440 minutes, this corresponds to more than a train per minute entering or leaving Paris.

The number of passengers who annually make use of the three State railway termini of Paris amounts to about 70 millions. Of this total the St. Lazare station alone accounts for about 60 millions; and the annual increase is of the order of 2 millions. The permanent way and everything connected with it must be utilised to its maximum capacity. At present the service is only made possible by using coaches with roof seats, which increase the capacity of the trains, but could not be retained in a modern scheme.

The most difficult sections to work are those in which trains having very different speeds (expresses, fast trains, local, and goods trains) are run on the same track. The traffic congestion does not allow of a very good service for the different suburban sections, and the speeds obtained are, in almost every case, insufficient. For the local trains a speed of 25 km. per hour (a speed scarcely greater than that of the Métropolitain, 20 km. per hour) can alone be assured; by the fast locals and fast trains from 35 to 45 km. per hour.

The amount of rolling stock employed in the suburban service is very considerable, in spite of the comparatively small number of trains per hour. It comprises about 1,500 coaches and 200 locomotives which represent, together with the necessary workshops and sheds, a total capital expenditure of more than 50 million francs. The utilisation of the seating capacity does not exceed 18 to 20 per cent., and the weight moved is obviously very great (1,500 million ton-kilometres per year). The final outcome from the financial point of view is a large deficit, which will go on increasing unless stringent measures are taken for improving the service as a whole, while providing for a great increase in traffic.

At a terminus the necessity of making two, three, or four movements for every train coming in or going out blocks the exit roads and undoubtedly increases the chances of accident. To increase the capacity of the terminus and its platforms, it is absolutely necessary to decrease the number of these movements by preventing the transfer of the locomotive from the back to the front of the train, by equipping the train in such a manner that it can be driven either from the front or from the rear.

With electric traction all requirements are satisfied. The system of multiple-unit control allows of all the electric motors driving the axles of the train to be worked from either end. Further, by distributing the electric motors among the different carriages of the train a large adhesive weight is available allowing rapid acceleration, which permits of the trains getting away quickly from the platforms, increasing their capacity.

The considerable experience obtained in the use of steam traction shows that it is useless to try to exceed a maximum of 10,000 to 12,000 passengers per hour with carriages without top seats, on a two-track line with frequent stops. With electric traction, with carriages 3 m. wide, and 22 m. long, and assuming eight carriages per train, the enormous figure of 40,000 passengers per hour is reached, or, considering seats only (no standing), that of 20,000 passengers per hour.

The conclusion is therefore arrived at that electric traction, with its rapid acceleration, allows of the time taken on the journey being so diminished as to double the capacity of the line. It moreover eliminates train movements and reduces the number of platforms at the termini necessary for a given service.

To obtain the preceding figures it must clearly be understood that each section of the line under consideration would be used only by suburban trains running at the same speed. This implies that trains of different speeds shall travel on separate tracks.

No section of a steam line can deal with more than 100 trains in each direction per day, whilst it is agreed that on electrified lines this figure may reach 350.

The electrified line from the Invalides to Versailles has shown traffic increases of 12 to 13 per cent. per year, while the other steam lines showed increases of barely 2 or 3 per cent.

A single type of electric carriage has been adopted, consisting of guard's van and first and second class compartments. This coach can carry 100, including straphangers. During much of the time the service will be carried on by single-coach trains, the number of seats being amply sufficient at such hours. During the time of heavier traffic and on the more busy sections the trains will be composed of several similar coaches.

The Nord-Sud has successfully employed continuous current on the three-wire system, using as conductors an overhead wire and a third rail, each at 600 volts, the track rails serving as a neutral wire. A system has thus been evolved which by suppressing the return current and its drop in pressure is completely innocuous, so far as electrolysis is concerned. The three-phase system hardly lends itself to rapid acceleration, and is useless for multiple-unit working. The other systems only employ two conductors, one of which is, in almost every case, the track rail. The single-phase system permits the use of high voltages on the working conductor; it is therefore possible to use a light overhead wire. The continuous-current system, if normal pressures of 500 to 700 volts are used, is only available with a heavy steel conductor about ground level.

With the single-phase system there is a considerable simplification in distribution from the use of static transformers in place of sub-stations with rotary converters; there is also a saving in the number of attendants, better efficiency, and freedom from electrolysis troubles. With the continuous-current system, the equipment of the coaches is much lighter and less cumbersome, the acceleration more rapid, with a better efficiency of the motors, and lastly, less waste of energy per useful ton carried.

In numerous recent railway investigations for particularly heavy traffic, the continuous-current system has shown a real superiority to the single-phase on the economic side. The stationary installations are cheaper for single-phase than for continuous-current (sub-stations and tracks). On the other hand, the equipment of the rolling stock is both heavier and more costly. The heavier the traffic the greater the advantage of the continuous-current system. It is the same with the working expenses, the more the installation is utilised, the lower is the expense per ton carried by the continuous-current system as compared with the single-phase system, chiefly owing to the weight of the equipments.

As regards the single-phase system, it is necessary to include the difficulties caused to telegraph and telephone transmission, which are not yet overcome. For all these reasons, and particularly since on most of the sections the density of the traffic is already very high and is bound to increase, the State railways, being anxious to make no mistake, have adopted the continuous-current system at 650 volts. This system is sanctioned by long usage, it is thoroughly reliable, and in the present instance it is certainly the cheapest. Everything that exists in Paris in the way of heavy electric traction is worked with continuous current at 650 volts.

To avoid trouble from frost after a thaw, a conductor rail with under collection was proposed. This rail weighs 76 kg. per metre. It is carried by supports of impregnated wood. The motor-coaches collect the current by a special shoe, called "universal," arranged so as to collect either from the upper or under surface of the rail.

The sub-stations, placed wherever possible at junctions, contain rotary converters of 1,500, 1,000, and 750 kw. output, according to their importance. Their distance apart varies from 3 to 8 km., according to the density of the traffic. The sub-stations are supplied by three-phase underground cables at 15,000 volts, 25 cycles. Electric energy will be furnished by two power stations, the construction and working of which has just been entrusted, after public tender, to an industrial syndicate. There is a sliding scale of charges under which, when the stations are finished, electric energy will be sold to the State at an inclusive charge of about 5 centimes per kilowatt-hour.

The two power stations, comprising steam turbine units of 5,000 kw., will be placed at Mouligneux and at Bezons on the banks of the Seine. When the installations are complete, they will have a capacity of about 60,000 kw., and will furnish the State with about a hundred million kw.-hours per annum.

(To be continued.)

## CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

## The Mutual Protection of Engineers.

I observe with pleasure that our engineers are, at last, appealing for mutual protection. Is it not an uncomplimentary reflection on modern times that they, the greatest race of men the world has ever known, should have to do so?

If you could kindly allow a digression, I would take the liberty of reminding you that Alexander the Great made the following list of the Seven Wonders of the World:—The Pyramids of Egypt; the Hanging Gardens of Babylon; the Tomb of Mausolos; the Colossus of Rhodes; the Statue of Zeus by Phidias; the Lighthouse on the Island of Pharos; and the Temple of Diana. But Alexander the Great was not even an engineer. What has happened to his treasures?

Of the first, there is no authentic record as to whom they were erected by. With the second, after a decade, the worms and the weeds had their way. The creation of the third was too exquisite—too precious to last. In the age of Caesar the fourth was but a memory; and though it was of marble, inlaid with gold, ivory and ebony, the Romans tumbled the fifth from its pedestal, and carried it away *en bloc*. Nor has the sixth met with better fortune; whilst even in the time of Paul, the material of the seventh was used for houses and barns by anyone who cared to appropriate it.

These Seven Wonders of the World were things of pride and pomp, constructed to glorify and to amuse the few. Discord and misery and death for the many were the results of the proud plans of their making.

But to-day, if one asked the engineer to make a list of the Seven Wonders of the World, he would probably mention:—The turbo-generator; the ocean liner; the motor-car; the rotary printing machine; the telephone; the tram-car; and the modern express.

These things minister to all the people. They influence the lives of every sane and efficient person. They serve us daily. Unlike the Seven Wonders of Alexander, none are for the exclusive few. All represent inventions, not merely individual things. They can never die, because they are founded on the ideas of a race of engineers, and are self-duplicating.

The principles for which they stand sprang from the brains of the engineers, and now these principles are the priceless heritage of the living world. Other men may die and turn to dust, but the record of our engineering dreams, once made tangible, remains.

An Association for the Mutual Protection of Engineers is long overdue.

M.Sc.

May 31st, 1913.

[Our correspondent appears to be comparing incommensurables—monumental works with inventions; the former were individual constructions, each of which was unique, while the latter were the fruit of evolution extending over long periods. The Forth Bridge, the Taj Mahal, the Eiffel Tower are examples of the former class, while the wheel, the screw and the mariner's compass are comparable with the latter in importance to mankind, and are of immense antiquity. The modern engineer builds upon the foundations laid by his barbarian forerunners, whose work will endure to the crack of doom.—Eds. E.R.]

It is sincerely to be hoped that the correspondence started in your columns on the above subject will develop into the definite formation of some central organised body to protect the interests of members of manufacturers' engineering staffs. When one considers the atmosphere of oppression under which many of us labour, and one's helplessness to combat the many petty inflictions that are continually imposed on us, one cannot help reproaching oneself that we have collectively been so dilatory. It is truly disappointing that in view of

the admirable results of kindred associations (*e.g.*, the various Trade Unions, the British Medical Association, and the Law Society), an association has not yet been formed to preserve the rights and to vindicate the claims of the class of engineers to which I have referred above.

I am afraid that we cannot expect the I.C.E., the I.E.E., or the I.M.E. to champion our cause. These Institutions were formed for the purpose of furthering and promoting the technical aspects of engineering and not of protecting the individual interests of the members. As such, their members are drawn from all classes of engineers; at the Institution meetings, employer and employé fraternise with a genuine unselfish desire to further the interests of the Institution of which they are members. Any action on the part of one of the Institutions to help us now, therefore, would inevitably mean the displeasure and ultimate resignation of the employer members—a course of events which would speedily cause their ruin.

It is obvious, therefore, that we must endeavour to form a new association, something equivalent to, and comparable with, the B.M.A. The function of this association should be solely to regulate conditions of employment, and to deal with allied questions. It should not trespass on the territories of the existing institutions by becoming a technical institution. Neither should it become as academical as these. It should regard itself purely and solely as a means of protecting the interests of staff employé. There must surely be thousands of engineers who would like to see such an association initiated. Now is an opportune time for declaring their views.

Let the opportunity not be missed.

Frank Gill.

[To prevent confusion, we may say that our correspondent is not the well-known telephone engineer of the same name.—Eds. E.R.]

Your correspondents and readers in general may be interested to learn that we hope to submit for publication in your issue of June 13th or 20th definite proposals for the formation of a suitable British Engineering Staff Association. This suggested institution will have as its objective, of course, the maintenance and furtherance of the economic and social interests of engineers—mechanical, civil, electrical, &c. Meanwhile, perhaps those gentlemen who approve of such an Association will kindly give the matter as much publicity as possible.

L. H. Fletcher,

*Hon. Acting Secretary, Proposed Association.*

London, E.C., June 2nd, 1913.

## Heavy Capacity Lampholders and Adapters.

Some little time ago through your valuable columns I stated that the above were very much wanted, so that 5—10-ampere radiators and other medium current consuming apparatus could be fed from any lamp socket, &c. At least one manufacturer has met the long-felt want as regards the lampholder, but no one has yet supplied an adapter to carry the same current without heating up, so that the one without the other leaves the problem only half solved.

C. J. Stonier,

*Sales Superintendent.*

Dundee Electricity Supply,

May 29th, 1913.

## Cable Discounts.

The formulae given on page 894 of the current ELECTRICAL REVIEW appear to be unnecessarily elaborate. List price less 27½ per cent., 15 per cent. and 10 per cent. is equal to list price × .554625. Surely  $L \times .555$  is much more simple than the rather formidable formula given by your correspondent for "C.M.A. £ per mile," and the former gives a result only .07 per cent. too high, surely near enough for the "most conscientious of contractors"? For estimating .55 is quite near enough, as the error is less than 1 per cent.

As it happens, 555 and 55 are very simple multipliers to use, and the result may usually be obtained with very little figuring, and very often by inspection only. As  $555 = \frac{1110}{2}$ , it is evident that 555 multiplied by an even number is equal to half that number repeated three times and followed by 0, thus:— $555 \times 4 = 2,220$ ;  $555 \times 6 = 3,330$ .

555 multiplied by an odd number is equal to half that number, with the sum of the two figures thus obtained repeated twice and inserted between the two figures, thus:—

$$555 \times 5 = 2,775; 555 \times 9 = 4,995.$$

(This is, of course, the same thing as:— $\frac{5550}{2} = 2,775$ ;  $\frac{9990}{2} = 4,995$ .)

If 55 is used, the figure in the case of an even multiplier is repeated twice only, and in the case of an odd multiplier, the middle figure is used once only, thus:— $55 \times 4 = 220$ ,  $55 \times 5 = 275$ . Though this method may appear at first sight to be rather complicated, it is really very simple. As an example, take a list price of £85 10s. (i.e., £85.5). In this case, if 555 is used, one would simply write down from inspection,

$$\begin{array}{r} 44 \cdot 400 \\ 2 \cdot 775 \\ \hline 2775 \end{array}$$

and obtain the result 47.4525, or £47 9s.

If the list price is, for example, £50, the result, £27.75 or £27 15s., is obtained at once by inspection. For "C.M.A.s. per coil" the formula is  $L \times \cdot 69328125$ ;  $L \times \cdot 7$  gives a result under 1 per cent. too high.

For "C.M.A.d. per yard" the formula is  $L \times \cdot 0756307$ ;  $L \times \cdot 075$  gives a result under 1 per cent. too low. In this case it is most convenient to take three-quarters of the list price and shift the decimal point one to the left. In most cases, the result may be obtained by inspection. Similarly, for "N.A.d. per yard," it is convenient to take two-thirds of the list price and shift the decimal point one to the left.

A note may be kept of the percentage error of each formula, and if one wishes, for a special purpose, to obtain a very close figure, the necessary percentage may be added to or subtracted from the result obtained from the approximate formula.

John W. Black.

Glasgow, June 2nd, 1913.

## LEGAL.

### BALFOUR v. TILLET and the GLASGOW "DAILY RECORD."

ON May 29th was concluded, by compromise, in the King's Bench Division, before Mr. Justice Darling and a special jury, an action for damages for alleged libel brought by Mr. George Balfour, managing director of the firm of Balfour, Beatty & Co., the well-known electrical engineers and contractors, against Mr. Ben Tillett, the secretary of the Dockers' Union, and the proprietors of the Glasgow *Daily Record*. The action was a sequel to a strike of tramway men employed by the Llanely Electric Lighting and Traction Co., in which the plaintiff's firm have the controlling interest, and Mr. Balfour alleged that he was libelled by a statement which appeared in the *Daily Record*, and which was instigated by Mr. Tillett. That gentleman denied the publication, which, however, was admitted by the *Daily Record*, and both defendants pleaded justification, alleging that the statement made was true.

MR. DUKE, K.C. (for the plaintiff) explained that his client regarded the libel as a malicious falsehood, published to injure him when he was candidate for Parliamentary honours in the Conservative cause for the Govan Division of Scotland. It appeared that the plaintiff's firm formed the Llanely Tramway Co. They had engaged in many large electrical undertakings of that character, and employed on an average about 1,500 men. They were always willing to recognise a Trade Union. When the Llanely Co. was formed a branch of a Trade Union was commenced among the workmen. On the morning of Mr. Balfour's poll at Govan, in December, 1911, the following appeared in the *Daily Record*:—

"Mr. George Balfour, the Unionist candidate for Govan, is the managing director of the company that governs the tramways of Llanely. The Dockers' Union asked the company to recognise the Union, so that an endeavour might be made to avert a stoppage, but the company refused to do so. On behalf of the Union Mr. Ben Tillett then wired to Mr. Balfour, asking him to recognise the Union in order to prevent an outbreak, and Mr. Balfour has now instructed his head office to refuse that recognition. A Llanely telegram says that the strike is causing great inconvenience in the town."

That statement was read by practically nine-tenths of Mr. Balfour's constituents, who were staunch supporters of Trade Unions in general, and the result was that Mr. Balfour felt the power of the Press and the Dockers' Union, and lost his election. A few days afterwards Mr. Tillett, in a conversation he had with Mr. Balfour, without any change having taken place in the relations between the company and the men, said he was willing to get the men back to work. So he (counsel) suggested to the jury that the tramway men of Llanely had been used as political pawns, while Mr. Ben Tillett had engineered the strike for political purposes and for those purposes only.

MR. BALFOUR, in the witness box, said he served five years in a Dundee engineering works. His firm had always recognised Trade Unions, and based their system of wages on Trade Union scales. In his electoral campaign he advocated the usefulness of Trade Unions. When the threat to strike was received by the company from the Llanely men, he told Mr. Tillett that he would debate the matter directly after his election business had concluded. Although he agreed to that, Mr. Tillett brought the men out, and thus prepared a foundation for the libellous statement which appeared in the Glasgow *Daily Record*. He (witness) had never refused to recognise the Trade Union. He considered that he lost his election through the libel.

Evidence was given by MR. A. McCLEURE, the plaintiff's election agent, to the effect that on the day of the poll, after the libellous statement appeared, the men who had hitherto supported plaintiff cordially, showed signs of hostility. He was also of the opinion that the publication of the statement made an adverse difference to Mr. Balfour's chances of success.

Addressing the jury for Mr. Tillett, MR. HEALY said as far as his client was concerned, he made the statement complained of honestly and *bonâ fide*, believing that it was true. The strike, far from being got up for political purposes, had been going on for months before Mr. Balfour's election contest, and he thought the documents would show that Mr. Tillett did his best to suppress the strike in Wales. It was begun against his wishes and the commands of his Union. Mr. Tillett at no time stated that Mr. Balfour had refused to support Trade Union principles. What he said was that Mr. Balfour had refused to recognise the Dockers' Union, and that was true.

After a two-day hearing,

MR. SHEARMAN said that the *Daily Record* would pay the plaintiff £1,000 as damages and a sum to cover his costs, and express their regret that the paragraph had appeared. They were satisfied that there was no want of sincerity on the part of Mr. Balfour, with regard to his attitude towards Trade Unions, and therefore the appearance of the paragraph did him considerable harm.

MR. HEALY (for Mr. Tillett) said the plaintiffs now saw that his client was not an electoral disturber as had been suggested, and that the strike at Llanely had been threatened long before Mr. Balfour's election took place. Mr. Tillett now agreed that it would be unfair to suggest that Mr. Balfour had refused to recognise the Trade Union, and expressed his regret that the statement had appeared.

MR. DUKE (for the plaintiff) accepted the apology and the damages offered, and after his Lordship had expressed appreciation of the arrangement, judgment was entered for the plaintiff on the terms of the settlement.

### X.L. ELECTRIC Co. v. ARON.

IN the Chancery Division on Friday, May 30th, Mr. Justice Neville had before him a motion by the plaintiffs in this action, by which they sought to restrain the defendant, until the trial or further order, from dealing with certain electric patents in contravention of his agreement.

MR. MORITZ, in support of the motion, said that the order asked for was to restrain the defendant from selling, offering for sale, parting with, dealing with, or otherwise disposing of, certain patents which he had sold to the plaintiff company, and from opposing certain patent applications that were pending. He understood that the defendants desired an adjournment in order to answer the evidence, but much damage might be done to the plaintiffs during the week, and he could not consent to the matter standing over until the following Friday without some undertaking.

COUNSEL for the defendants said that the injunction asked for was extremely wide, and he could not give an undertaking on the terms of it, but he was quite willing to undertake for a week not to part with, charge, mortgage, or dispose of, the two patents in question.

MR. MORITZ said he could not accept that. The second part of the injunction he asked for was the most important. The defendant had entered into a contract with the plaintiff company, by which he covenanted that he had presented applications for letters patent for improvements in the inventions, the letters patent for which had been assigned to the plaintiffs. The company had purchased the defendant's inventions, and he was afterwards taken into the company's employ as electrical engineer. It had been found necessary to dismiss him, and there was consequently a considerable amount of bad blood between them. There were applications pending for patents for his inventions, which under the agreement would belong to the company, and he was threatening to withdraw them or oppose them if made by the company. There was evidence that he had written to the company's solicitor that he was quite open to consider any suggestion coming from them, but unless something definite was arrived at immediately he should withdraw his application for patent No. 19,237 of 1912. That patent, said counsel, was a most important asset of the com-

pany. The agreement between the parties was that in consideration of shares in the company the defendant should assign to them the benefit of the two patents and secure the assignment of them to the company. That he had failed to do, though the share consideration had been assigned by the company. Further, he agreed to submit to the company and its expert advisers any future inventions he might make in connection with the two patents, or any improvements in them, and any inventions in connection with electrically-worked clocks, and such inventions were to be patented at the expense of the company, and the patents assigned to them. The defendant, at the expense of the company, was, when required, to apply for foreign protection, and the attitude the defendant had adopted was calculated to prejudice the company in America, Germany, and elsewhere. The company was a private company, formed on April 28th, for the purpose of carrying out the defendant's inventions, and on May 10th, besides being managing director, he was appointed advisory engineer and superintendent at a salary of £8 a week. From that post he had been discharged for alleged misconduct, and he had now made a distinct threat to withdraw these applications for protection, which were of vital importance to the company.

His LORDSHIP said he would grant the injunction asked as an *ex parte* injunction over next Friday.

COUNSEL, for the defendant, said that the time for withdrawal before the Comptroller of the applications in question expired on Tuesday next, and he thought he ought to have authority from the company to apply to extend the time for withdrawal.

His LORDSHIP said that seemed reasonable.

MR. MORITZ said he had no objection. The company would give authority by letter to apply to the Comptroller in the name of the company and its managing director to extend the time for withdrawal of the applications before him for a fortnight.

On that understanding, his LORDSHIP granted the injunction as asked over Friday next, the motion standing adjourned until that day.

#### LONDON ELECTRIC SUPPLY CORPORATION v. WESTMINSTER ELECTRIC SUPPLY CORPORATION.

In the Chancery Division on Friday, May 30th, before Mr. Justice Eve, an application was made in this case that the order of the House of Lords should be made an order of Mr. Justice Eve's Court. The application was granted.

#### LADY'S TELEPHONE SHARE EXPERIENCE.

In the City of London Court on Monday, before Judge Lumley Smith, K.C., Mr. Walter J. Crumplin, Ockwells Cottage, Kimber Lane, Maidenhead, formerly a member of the London Stock Exchange (he having recently retired), sued Mrs. Kichgessner, 36, Upper Marylebone Street, for £50 5s. 5d. balance due on a purchase of National Telephone deferred shares. By way of defence, the Gaming Act was raised. Mr. Doughty appeared for the plaintiff, and Mr. Harold Travers for the defendant.

MR. DOUGHTY explained that the transaction sued on began in April of last year, when the defendant's daughter wrote on behalf of herself and her mother instructing the plaintiff to buy two Telephone deferred shares. They then stood at 168, and were subject to a certain amount of speculation, in view of the arbitration then proceeding between the Government and the company. The ladies imagined, of course, that the shares were going up as a result of the award. There was now a balance against the client.

PLAINTIFF said he carried the shares over at the defendant's request on several occasions, and cheques were sometimes paid by him and sometimes to him. On December 30th, she paid £13 14s. 10d. when the stock stood at 140. It then fell to 107, on account of the award coming out, and there was a further balance of £33, which defendant owed. The shares again fell, and the present balance was due. In November, he strongly urged the defendant to sell when the shares stood at 168, showing her a profit.

In cross-examination, plaintiff indignantly denied that the transaction was a gamble. Defendant told him she did not intend to take up the shares if he would carry them over, and that she was sure they would rise.

MR. TRAVERS submitted that the transaction was a gamble, and that the plaintiff could not recover.

PLAINTIFF added that he had actually paid for the shares, as he had to close the account and he had paid the difference. He was an agent for the defendant.

Mrs. KICHGESSNER, the defendant, said she never intended to take up the shares. It was only a speculation. She thought they would probably rise when the award was given.

JUDGE LUMLEY SMITH: If this were a good defence nobody would ever lose any money on the Stock Exchange. I do not think it was a gaming or wagering transaction. Judgment for the plaintiff, with costs.

#### THE NATIONAL TELEPHONE CO., LTD., v. POSTMASTER-GENERAL.

In the House of Lords on Tuesday, their Lordships said that the appeal of the National Co. failed. They would give their reasons in writing later. As the case was one which ought to be disposed of at once they formally dismissed the appeal with costs, affirming the judgment of the Court below.

## PARLIAMENTARY.

### London County Council (Tramways, Trolley Vehicles and Improvements) Bill.

ON the motion for the second reading of the above Bill in the House of Commons, an important motion was carried at the instance of Mr. H. Lawson. He moved "That it be an instruction to the Committee on the Bill to insert a provision in the Bill making the erection of trolley-vehicle equipments on, over, under, along or across any street or road in the County of London subject to the provisions of Sec. 23 of the London County Council Tramways (Electrical Power) Act, 1900." He said the question was whether the House, without any cause shown, should practically repeal the provision which was passed for ensuring that overhead wires should not be erected in London without the consent of the local authority of the borough concerned.

MR. MORRISON seconded the motion.

In the discussion which followed, MR. GOLDSMITH pointed out that at the present time the borough councils had an absolute veto with regard to tramways in London, and could stop the overhead system of tramways in their particular districts. In the case of railless trolleys, however, the promoters had not to obtain the authority or the sanction of the road authorities before they came to Parliament. He contended that if the resolution were adopted, it meant that the railless trolley system would never be adopted in any part of the county of London, because each district wanted the most expensive system—the conduit system.

SIR W. BULL, who supported the resolution at the request of the Hammersmith Borough Council, expressed the opinion that in 20 years there would not be a tramway in London.

The instruction was carried by 119 votes to 40.

**Electric Lighting Provisional Order (No. 1) Bill.**—This Bill has been before the Standing Orders Committee and referred for Second Reading. It is for the purpose of confirming Electric Lighting Orders granted by the Board of Trade to the following: To the Urban District Council of Baildon, in the West Riding of Yorkshire; to the Urban District Council of Beckenham, in respect of the parish of West Wickham; to Wm. Albert Schultz, carrying on business as the Chipping Norton Electric Supply Co.; to the U.D.C. of Hazel Grove and Bramhall; to the U.D.C. of Itchen, in the County of Southampton; to the U.D.C. of Skelton and Brotton, in the North Riding of Yorkshire, with clauses enabling them to take a supply of power from the Cleveland and Durham County Power Co.; to the U.D.C. of Southborough, in the County of Kent; to the Burslem Corporation in regard to the inclusion of the whole of Wolstanton ward in the area; to the Truro Corporation; and to the Weaverham Electric Supply Co., Ltd., in respect of certain parishes in the Northwich Rural District.

**Electric Lighting Order (No. 5) Bill.**—On Monday, the Examiners found Standing Orders complied with in regard to No. 5 Bill, which confirms Provisional Orders granted by the Board of Trade to the following:—To the U.D.C. of Caerphilly (powers not to be exercised unless transferred to a limited company); to the Colne Valley Electric Supply Co., in respect of the parish of Pinner; to the Birmingham District Power and Traction, Ltd., in respect of the County Borough of Smethwick (a clause is inserted for the protection of the Shropshire, Worcestershire and Staffordshire Electric Power Co.); to the Urban District Council of Watford, in respect of the parish of Abbots Langley; to the Wellingborough Electric Supply Co.

**Tramway Provisional Order Bill.**—The Examiners have passed the Bill promoted by the Board of Trade for confirming Provisional Orders granted to the Baildon U.D.C., for the construction of about a mile of tramway, and to the Newcastle-on-Tyne Corporation for the construction of a number of small junction lines.

**L.C.C. Greenwich Generating Station.**—Mr. W. Thorne asked the President of the Board of Trade whether his attention had been called to the recent breakdown at the London County Council Power Station at Greenwich; if he was aware that the breakdown was caused by over-loading the machinery in consequence of there not being enough machinery to generate the amount of power required for general use; and if he would cause an inquiry to be held in connection with the recent breakdown?—MR. BUXTON said he was informed by the London County Council that the breakdown in question occurred in consequence of a cotter falling out of the high-pressure piston rod of one of the engines, and that there was no foundation for the suggestion that the mishap was caused by overloading the machinery. He hardly thought that an inquiry, such as suggested, would serve any useful purpose.

**Kent Electric Power Co.**—The late Bill of the Kent Electric Power Co. to provide for the reduction and rearrangement of the capital of the company, was before the Examiners last week, and was found not to have complied with Standing Orders. The Bill will accordingly go before the Standing Orders Committee.

**York Corporation Bill.**—The York Corporation Bill has received the approval of the Unopposed Bill Committee of the House of Commons, and has been referred for Third Reading. The principal object of the Bill was to authorise the Corporation to purchase the gas undertaking, but as this was defeated by a citizens' meeting, it had to be abandoned. A number of minor matters were left in the Bill, including authority to acquire land for the purposes of the electricity undertaking.

**Nottingham Corporation Bill and West Bridgford U.D.C. Bill.**—Owing to an agreement having been come to between the promoters of the above Bills, opposition has been withdrawn, and they have been referred to the Committee on Unopposed Bills. The Notts. Corporation promoted a Bill for powers to construct tramways and provide trolley vehicles and motor-omnibuses, but by an arrangement with the West Bridgford Urban District Council, who are seeking to run motor-buses, the powers for trolley vehicles are dropped.

**Various Bills.**—In the House of Commons on May 27th the Chesterfield Corporation Railless Traction Bill and the Westgate and Birchington Gas and Electricity Bill were read a third time.

In the House of Lords on the same day the Herne Bay Gas and Electricity Bill was read a second time, and the Crowborough District Gas and Electricity Bill passed its third reading.

In the House of Commons on May 30th the Rhondda Tramways (Railless Traction) Bill, and on Monday the Metropolitan Electric Tramways (Railless Traction) Bill were read a third time. The London Electric Railway Bill, Metropolitan District Railway Bill, and Wimbledon and Sutton Railway Bill were read a second time on Monday.

In the House of Lords on June 2nd the following were read a first time:—Metropolitan Electric Tramways Railless Traction Bill, and Rhondda Tramways and Railless Traction Bill.

## BUSINESS NOTES.

**Consular Notes.—Egypt.**—In his recent report on the condition of Egypt in 1912, Lord Kitchener states that the Telegraph Department earned £E.136,888, an increase of £E.9,922 over 1911. Working expenses amounted to £E.113,500, an increase of £E.3,574. There has been an increase in all classes of messages sent and in the revenue derived from trunk telephones. Two new trunk telephone lines, viz., Ismailia to Suez and Cairo to Zagazig, have been opened, a telegraph line from Suez to Safaja, in the Red Sea littoral, *via* Jemsa, two telephone circuits at Safaja, and part of the line along the western coast of Sollum. The telegraph capital account stands at £E.189,921, the interest on the capital being £E.12 3s. 9d. A new scheme of deferred foreign telegrams at cheap rates has been introduced. Fifteen new offices have been opened during the year.

In a further report, dealing with the Sudan, Lord Kitchener states that the number of telegrams sent in the Sudan during 1912 increased by 6 per cent., and this increase is reflected in the revenue. There have been no extensions of the telegraph system during the year, which now consists of 4,777 miles of line and 9,896 miles of wire. The telephone service continues to expand, especially in the towns.

**China.**—The American Consul at Hankow reports that there are three electric light plants there, one for the Chinese city, and two, one of them very small, in the foreign concessions. There is a telephone service operated by the German post-office in the foreign concessions, and a Chinese telephone service in the native city. The Chinese telephone service connects with the neighbouring cities of Wuchang and Hanyang. In Wuchang there is a small electric plant, mostly for official use, but it is understood that a municipal system is contemplated. In Changsha, the capital of Hunan Province, there is a fair electric light plant, and there is also a telephone system, though the latter is little used by private persons. In Kiating there is no electric light plant, in Nanchang there is a small plant, and in both cities there are telephones, although there is no system in general use by any considerable number of subscribers. It would be extremely difficult, if not impossible, for a foreign company to get any public service concession, and the number of Chinese merchants with whom a joint Chinese-foreign enterprise could be conducted is still very small.

**Hawaii Islands.**—Dealing with the prospects of British trade in these islands, the British Consul, in a recent report, states that the lack of direct transportation facilities is an obstacle. Further, local business interests and connections are all centred in the United States. It is, therefore, not possible to urge the ordinary method of having travellers visit the islands, as it is more than doubtful whether any resultant business would directly compensate for the time and expense of a special trip; nevertheless, should such representatives have occasion to pass through the territory it might in certain lines be worth while to delay a little to study the local market. Possibly the most likely way to advance the small British trade would be to encourage the attention of those already handling British goods in the United States. Articles which find a market there might also be able to get a footing in Hawaii, and having no further duty to pay, both stock and organisation in the United States would be available to compete for any business which might be open. Local firms being able to deal so much more easily with the United States than with other countries could be more readily approached from there than by direct trade; this will be particularly the case should the opening of the Panama Canal lead to larger imports from the British Empire to the Pacific coast of the States.

**Philippine Islands.**—Manila and Mangarin are now connected by wireless telegraph, says an American report. A powerful plant was installed at the sugar town under joint action of the Mindoro Co. and the Bureau of Posts. The former found it difficult to conduct its extensive industry without immediate communication. When the Mangarin station gets into swing it will be able to converse with Hong Kong as well as with the stations to be erected in the Southern islands. In the latter connection it is expected to be a helpful link in Philippine communication.

**Canada.** The Canadian Minister of Railways has decided to establish wireless telegraphy between Le Pas and the Hudson Bay terminal when the harbour work is started. This will allow the department at Ottawa to keep in close touch with the progress of the work. Extensive preparations have been made to send north an expedition with dredges and equipment to start work on the harbour at the earliest possible date. The Government will probably do most of the work itself.

**Aluminium Wire Prices.**—It is stated that recent offers of Continental aluminium wire in the most marketable sizes of from 20 mm. to 15 mm. show a considerable advance over former quotations. When the price of ingots was £1 per cwt. the charges of wire ranged from £5 5s. to £6, whereas at present with ingots dearer wire has risen to from £6 10s. to £7 per cwt.

**A Swiss Absorption.**—It was expected when the Swiss firm of BROWN, BOVERI & Co entered into a community of interests with the Alioth Electricity Co., which took place two or three years ago, that the eventual result would be an amalgamation of the two undertakings. It is now announced that Brown, Boveri and Co. have acquired by purchase all the workshops of the Alioth Co. and will continue them as the company's Münchenstein branch.

**"Korfund."**—THE KORFUND Co. have recently received the following orders for insulating machines with their "Korfund" cork foundation plates to prevent the transmission of vibration and noise:—

Belfast.—One 4,000-h.p. Diesel engine.  
Hong Kong.—Two 550-h.p. Diesel engines.  
Rushden.—Two 240-h.p. Diesel engines.  
Southend-on-Sea.—Two 500-h.p. Belliss-Grompton sets.  
Wisebich.—One 70-h.p. Crossley gas engine.

**Patent Applications.**—The Comptroller-General has made an order restoring patent No. 22,125 of 1907, granted to the Westinghouse Brake Co. for "Improvements in automatic fluid pressure brake apparatus for railway and like vehicles." Messrs. Mathiesen Aktien-Gesellschaft, of Leutzsch, Leipzig, are applying for leave to amend Patent No. 22,342 of 1904, for "Improvements in Arc Lamp Electrodes." An announcement appears among our advertisements to-day.

**Ebonite Tests at the N.P.L.**—Referring to our note on the new Admiralty Specification for Ebonite, the ST. HELENS CABLE AND RUBBER CO., LTD., of Warrington, inform us that the National Physical Laboratory has made tests upon their ebonite made to the Admiralty specification, and has signified that it has passed the test required. The Admiralty test is the exceedingly severe one of 125,000 volts per millimetre. Apart from this very high-class ebonite, the company make other classes more suitable (in price) for general work.

**Book Notices.**—*Electrical Tables and Memoranda.* By S. P. THOMPSON, F.R.S. London: E. & F. N. Spon. Price 1s. net.—This is the second edition of the little waistcoat-pocket book, which constitutes the smallest of Dr. Thompson's many works. It is literally a *multum in parvo*, dealing with an extraordinary variety of subjects in its 131 pages; the treatment is, as would be expected, most lucid, and the matter is condensed to a degree only comparable with the tabloid system. We have read many pages of the tiny volume with interest, and find it fully up to date and packed with useful information, including a variety of tables. As a "pocket memory," it should be found very useful.

"Reports for the Year 1912 on the Geological Survey, the Geological Museum in Jermyn Street, the Science Museum at South Kensington, and the Work of the Solar Physics Committee." 1913. London: Wyman & Sons, Ltd. Price 1s.

"The Year-Book of Wireless Telegraphy and Telephony." 1913. London: St. Catherine's Press. Price 2s. 6d. net.

"Car Troubles: Their Symptoms and their Cure." By H. W. SLAUSON. London: Harper & Bros. Price 1s. net.

"Instructions for the Use of Calculating Rule for Illumination and Photometric Measurements." By T. HIROBE and R. MITSUDA. Tokio, Japan: The Electrotechnical Laboratory.

"Chronique Illustrée du Concours International de Télégraphie Pratique, Turin, 1911." Rome: Ministero delle Poste e dei Telegrafi.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 10. May 31st, 1913. Milan: The Association. Price L. 150.

"Bulletin Mensuel de la Société Belge d'Electriciens." Vol. XXX, April, 1913. Brussels: E. Bruylant. Price 1 fr. 75 c.

**British Manufacturers in Australia.**—In the recently-published report of the Australian Association of British Manufacturers and their Representatives (430, Little Collins Street, Melbourne) reference was made to a directory that was being prepared by the Association. We have now received a copy of this publication, known as the "All-Red Directory." It contains only the names, &c., of members of the Association, as all members are entitled to have their names included in all three sections, together with full particulars of the goods which they manufacture, without any further charge beyond the annual subscription of £2 2s. The advantages derived from such publication and from circulation of the Directory are merely incidental to the general benefits of membership of the Association.

**Electric Lighting for Motor-Cars.**—THE CHLORIDE ELECTRICAL STORAGE CO., LTD., of Pendlebury, Manchester, remind us that many motor-car lighting equipments are coming into this country fitted with "Exide" accumulators, and that they manufacture this type of battery, as used on the "Delco" and other electric self-starting and lighting equipments. They also carry stocks of spare parts for these batteries.

**B.T.H. Rotary Converters.**—A most instructive pamphlet has recently been issued by the BRITISH THOMSON-HOUSTON Co., on the subject of rotary converters, which, while it naturally illustrates the methods adopted by this firm in particular, also covers in a brief, practical style the main features of rotary converter practice at the present time. It commences with a *résumé* of the characteristics of rotary converters, under which are discussed voltage and current ratios, armature heating, commutation efficiency, overload capacity, use of rotaries as three-wire balancers, and the power factor of rotaries running A.C. to D.C. Then follow several pages describing the principal methods that have been adopted for obtaining variable D.C. voltage with constant A.C. voltage and *vice versa*, the starting of rotary converters, and a further section is devoted to construction, the whole of the pages being profusely illustrated with specimen machines, curves, diagrams of connections, &c.

Under "Variation of Voltage," are discussed reactance control (*i.e.*, variation of D.C. voltage by the introduction of reactance in the supply transformer or externally) simple vector diagrams being given; booster control—an A.C. booster being inserted between the slip-rings and converter armature, the power factor in this case being independent of load and voltage; regulator control (an induction regulator inserted between transformer and rotary slip-rings); split-pole control, particularly a method using a two-part pole, which has been developed by the B.T.H. Co., and is claimed to be the simplest that has been devised where voltage variation is required independent of power factor; lastly, brush-shift control, which is not recommended.

As regards starting, diagrams illustrate (1) A.C. starting by means of transformer taps, and for machines above 500 kW.; (2) induction motor starting, using squirrel-cage or slip-ring motors; the squirrel-cage motor is recommended, except where reduction of starting current is important. The induction motor is constructed with one pair less poles than the rotary, so that it is possible to speed the rotaries up considerably above normal speed. The connections for direct-current starting are also illustrated, and this is the best method to adopt when a direct-current supply is always available for the purpose.

The section devoted to "Construction" illustrates and describes the main details of the B.T.H. rotary, which, we note, has been built in practically all sizes up to 1,500 kW., and will (if required) be built up to 3,000-kw. capacity for any voltage up to 1,500 for 25-cycle work and up to 750 volts for 50-cycle work.

**Diplomas.**—THE ELECTRICAL ENGINEERING AND EQUIPMENT Co., LTD., have been awarded a Diploma of Honour for their exhibit at the International Kinematograph Exhibition and Conference held in London recently.

THE WESTMINSTER ENGINEERING Co. have also been awarded a Diploma of Honour for their projection and photographic arc lamps exhibited at the same Exhibition. These are made at their works at Willesden Junction.

**For Sale.**—The Bermondsey Borough Council has for disposal three small generating sets. See our advertisement pages in this issue.

**Catalogues and Lists.**—MESSRS. VERITYS, LTD., 31, King Street, Covent Garden, W.C.—Priced and illustrated leaflet (No. 742) particularising their "Aston" ceiling and roof fans for D.C.

MESSRS. A. REYROLLE & Co., LTD., Hebburn-on-Tyne.—We have received a collection of new lists just issued, in an expanding binding cover. The following manufactures are covered—brief descriptive matter on a fancy paper, being followed with illustrations printed on coloured art papers.—Split conductor protection; sheet-steel switchgear (three-phase generator panel up to 3,000 volts); cable glands and fittings for armoured cables; no-voltage release; wall-operated switchgear; plugs and sockets; cast-iron distribution boxes.

THE UNION ELECTRIC Co., LTD., Park Street, Southwark, London, S.E.—Advance copy of 20-page booklet giving a full illustrated account of the "Fortiter" direct-current watt-hour meter.

THE MIRRLEES WATSON Co., LTD., Scotland Street, Glasgow.—Pamphlet C32 gives an illustrated description of the latest surface condensing installation (Mirreles-Leblanc rotary type), supplied by them to Pinkston Power Station, Glasgow. Readings are tabulated giving results of the plant running under the usual working conditions.

THE DIAMOND COAL CUTTER Co., Stennard Works, Wakefield, Yorks.—Twenty-page booklet, being a special exhibition number of their "Machine Mining Monthly," issued on the occasion of the Mining Machinery Exhibition, now open at the Royal Agricultural Hall. It contains half-tone views of many of the shops at the Stennard Works, and a list of users of the "Diamond" coal-cutting machines and conveyors in Great Britain.

MESSRS. ISARIA, LTD., 208, Tower Bridge Road, London, S.E.—Sixteen-page pamphlet containing full tabulated particulars and prices of their "Isaria" table, oscillating, self-rotating, ceiling and port-hole electric fans, also shutters for port-hole fans, starters and rheostats. Copies of the list may be obtained on application.

THE MIDLAND ELECTRIC MANUFACTURING Co., LTD., Stafford Works, Rea Street South, Birmingham.—48-page comprehensive price list of "M.E.M." switchgear. Thirty pages are devoted to ironclad lines, the remainder dealing with various types of fuses, fuseboards, distribution boards, knife switches and other manufactures. The illustrations are numerous and admirably clear, a good art paper being used throughout. Prices are very plainly shown

at the foot of each page. The firm who are now specialising in the manufacture of ironclad switches and switchgear, have recently made extensions and additions to the plant in their works, and larger stocks are now being carried thus ensuring prompt delivery. By mutual agreement, Messrs. G. O. Fisher & Co. ceased to represent the company's interests for Glasgow and Scotland last month, and Messrs. Andrews & Co., 198A, St. Vincent Street, Glasgow, are now their representatives, and are carrying stocks of their standard manufactures.

MESSRS. LANDIS & GYR, LTD., 28, Denman Street, London, S.E.—Leaflet relating to their switchboard wattmeters for single-phase A.C. circuits and three-phase circuits with balanced loads. Dimension sketches and diagrams of connections appear.

MESSRS. DAVID BROWN & SONS (HUDD., LTD.), Huddersfield.—16-page booklet containing information and excellent illustrations describing the "DBS" spur gear and its application as a speed reducer; also a list of double helical gears.

**Mining Machinery Exhibition**—This exhibition at the Agricultural Hall, Islington, closes at the end of this week. We shall refer to the matter in our next issue.

**Canada.**—Mr. James A. Farrell, president of the United States Steel Corporation, in testifying as to the corporation's export trade in the United States Government suit, referred to the Canadian business in part as follows:—"Through Montreal we sell about 60,000 tons of wire product a year, sheet-iron, mine rails, and sometimes standard rails, when they cannot be supplied by their own corporations. We are now supplying the Canadian Northern Railway with 25,000 tons of rails shipped by boat from Chicago and thence by rail to Calgary, where they cost \$17.13 delivered. At Vancouver we supply much material, but the freight weight from Pittsburgh there is \$18 a ton. Material from Liverpool or Antwerp may be shipped for \$6 to \$8 a ton. After we established our office there we found it necessary to run a steamship service there. Our ships leave about every two months, making stops all along the line. On the return we go into a general merchandising business."—*Canadian Engineer.*

**Dissolutions and Liquidations.**—ADAMS MANUFACTURING Co., LTD.—The following creditors were, on May 9th, appointed a committee of inspection in this matter.—Mr. Price, of Dunlop Rubber Co., Ltd.; the secretary of the Varley Magnet Co.; Mr. Brain, of Thomas Green & Co.; Mr. Watson, of the Rochdale Electric Co.; Mr. George Smith, of James Smith (Norwood), Ltd.

H. A. HARVEY & Co., LTD.—A petition was to come before the Court on Wednesday for the winding up of this company.

SOUTHPORT AND LYTHAM TRAMROAD Co.—A meeting is called for July 3rd, at 14, Castle Street, Liverpool, to hear an account of the winding up from the liquidator, Mr. J. T. Wood.

HILO MANUFACTURING Co., LTD.—A meeting is called for July 4th, at 58, Coleman Street, E.C., to hear an account of the winding up.

CANADIAN BRITISH ENGINEERING Co., LTD. (registered in 1910).—A meeting is called for July 7th, at 18, Austin Friars, E.C., to hear an account of the winding up from the liquidator, Mr. P. J. Hellis.

R. & H. DOBSON, electrical engineers, 39, Dean Road, Salford.—Messrs. Robert & Hugh Dobson have dissolved partnership. The latter attends to debts, &c.

ENGINEERING INSTRUMENTS, LTD.—This company is winding up voluntarily, with Mr. J. W. Watson, Tubwell Row, Darlington, as liquidator. An agreement has been made between Mr. J. E. Hodgkin, on behalf of the company, and the Skerne Works, Ltd., for the sale by transfer of the undertaking and the assets to the Skerne Works, Ltd. A meeting of creditors is called for June 11th, at Savings Bank Chambers, Tubwell Row, Darlington.

BULLOUGH'S ADJUSTABLE RAIL JOINT SUPPORT Co., LTD.—This company is winding up with Mr. Raymond Wells, 2-6, St. John Street, Smithfield, E.C., as liquidator.

**Fire.**—A fire on Monday afternoon at the extensive grocery premises of Mr. William Wakefield, Hetton-le-Hole, County Durham, caused damage to the value of over £5,000. An electrical plant with dynamos was completely wrecked.

**Metal for Handling Acetic Acid.**—Referring to an inquiry in our last issue, the BRITISH ALUMINIUM Co., LTD., write to point out that vessels made of pure sheet aluminium with autogenously welded seams are practically immune from corrosive action due to juices containing acetic acid. The information may be of interest to other readers besides the correspondent who made the inquiry.

**Trade Announcements.**—MESSRS. PETO & RADFORD, LTD., who have been at 100, Hatton Garden, E.C., for more than 25 years, are removing their London headquarters to 12, Heddon Street, Regent Street, W., where they will have facilities and space required by their increasing business, including covered accommodation for fitting up 25 cars at a time.

MR. T. W. MURRAY, of the Felix Street branch of Messrs. Drake and Gorham, Ltd., of Westminster, is no longer connected with the firm.

MESSRS. W. A. SHAW & Co., electrical engineers, of Warren Street, Stockport, have taken new premises at 107, Princes Street, Stockport.

MESSRS. EDWARD LE BAS & Co., of Dock House, Billiter Street, E.C., notify that their telephone numbers have been altered; in future they will have five lines, all No. 5463 Avenue.

## LIGHTING and POWER NOTES.

**Abercarn.**—It was reported at the May meeting of the U.D.C. that the B. of T. had refused to grant the Council a prov. order for electric light.

**Accrington.**—Fourteen arc lamps in the Market Hall are to be replaced by twenty 200-c.p. Osram lamps. It is computed that the change will effect a saving of nearly £49 per annum. The recently-introduced alternative charge with regard to electric lighting has been adopted by 47 persons.

**Atherton.**—The D.C. has approved of an amended estimate of the new electrical sub-station prepared by Mr. T. L. Miller, the consulting engineer, and application has been made to the L.G.B. for sanction to a loan of £6,300 instead of £5,500.

**Banbridge.**—The B. of T. has decided not to grant the prov. order recently sought by this Irish town.

**Barrow-in-Furness.**—At the T.C. meeting on June 2nd, Alderman Smith stated that the accounts of the Electricity Committee for the year ending March 31st last had now been completed. The total capital expenditure upon the undertaking had been £120,802, and of the amount they had repaid, £39,250, leaving the existing debt at £81,552. The revenue during the year, as compared with the preceding 12 months, had increased by £1,694, and it was the largest amount they had ever had. Unfortunately, the costs had increased to a greater extent, namely, £2,562, and the net profits had been reduced to £971. The increased revenue was made up of £609 for lighting, £526 for power, and £559 for traction. On the expenditure side, they had had to provide for increased rates and increased cost of coal. The output was increased by 310,940 units, which was equal to 22 per cent. Before next winter it was hoped to complete the extensions to the works, whereby they would be able to reduce the cost of production. The report was approved.

**Bexley Heath.**—Messrs. Gillespie & Beales recently organised a successful demonstration of electric cooking with the "Tricity" cooker. The lectures and demonstrations were given by Mr. Grogan on the British Electric Transformer Co., Ltd., who has interested large audiences twice a day during the past week.

**Birmingham.**—Sanction has been received from the L.G.B. to the borrowing of £50,000 for the erection of additional plant at the Summer Lane Station.

**Bispham.**—Formal sanction has been received for the borrowing of £8,155, of which £3,835 is for excess expenditure on buildings, plant and street lighting; £2,780 for additional plant wanted; and £1,540 for prospective expenditure. The Board deferred the granting of the Council's application for a loan for the extension of electric lighting to the Greenlands end of the district, because the consent of the B. of T. had not yet been obtained by the Council.

**Blackburn.**—The annual report of Mr. Wheelwright, the borough electrical engineer, on the electricity department, shows a net profit of £3,521 on the last year's working. The total units generated for lighting, power, traction and heating amounted to 6,108,685, an increase of nearly a million on the previous year. The series of interesting curves published with the statement show the progressive character of the undertaking, which has approximately 1,500 looms, with individual motors, connected to its mains in addition to other power users, who altogether aggregate 5,000 B.H.P. The report states that a noticeable increase has occurred in lighting supply, which has been introduced into the electrically-driven weaving sheds. A second turbine set has been installed, and the whole of the first three-phase H.T. contract has been completed. The original turbine installation last year was greatly delayed by the strikes, and consequently the advantage from its use was not felt. One of the curves included shows typical loading of the three-phase mill supply on March 17th last, and affords an instructive comparison with typical week-day and Sunday load curves, which are also given.

**Brighton.**—On the suggestion of Mr. J. Christie, engineer and manager of the electricity works, the Lighting Committee of the T.C. recommends the purchase of electric cooking apparatus, to be let out on hire, at the cost of £250, and the purchase of six Jackson cookers at £12 1s. each. Mr. Christie also suggests that a loan of £3,000 or £5,000 should be applied for, for the purchase of cooking apparatus, and that this should be included in a large loan for mains and feeders, motors and street lighting on the Front.

**Burnley.**—The electricity department has decided to construct a sub-station in the Burnley Lane district, and the estimated cost is £1,300. Plans have already been passed.

**Canada.**—The City of Alberta is proposing to spend £65,000 in extensions to the electric light department.

**China.**—The General Electric Co. is supplying through its Chinese branch, three H.T. three-phase alternators, coupled to Bolinders oil engines, and a 14-panel switchboard for the Fatshan Electric Light and Power Co., which will supply Fatshan, near Canton.

**Cleckheaton.**—In the annual trading accounts for the year ended March 31st, the electricity and destructor department of the Council shows a loss of £635, as compared with a year ago.

**Continental Notes.**—RUSSIA.—According to a report from St. Petersburg, the electric power station at the well-known Branski Iron and Steel Works was destroyed by fire a few days ago.

FRANCE.—La Société de l'Energie Electrique du Littoral Méditerranéen reports a net profit of £60,863 for the last financial year, as compared with only £17,154 in the preceding 12 months.

**Croydon.**—The report on the sixteenth year of the working of the Corporation electricity works was presented at the B.C. meeting on Monday, with the accounts. The borough electrical engineer (Mr. Alex. C. Cramb) reported an increase of 242,516 units sold, of which 56,558 were for heating and cooking. It was hopeless, he remarked, to expect any material increase of business from cooking until the Corporation took in hand a satisfactory scheme for developing this business by hiring out cookers at reasonable rates. The increase of £1,082 in capital expenditure was entirely upon distribution. On the revenue account the total expenditure was £40,063, an increase of £5,074; and the total receipts were £66,740, an increase of £4,147. The cost of generation went up owing to the increased coal bill; coal contract prices had risen from 11s. 11d. per ton in 1909-10, to 18s. 3d. for certain contracts of the present year. There had been an advance in prices from 10 per cent. to 20 per cent. on practically all material purchased. At the end of the year the reserve fund stood at £39,031, plus £1,045 interest on investments, but £8,026 had since been withdrawn for new plant. There were outstanding liabilities for work chargeable against this fund amounting to £7,693. Owing to the coal strike in the spring of 1912, the new 1,000-kw. steam turbine plant, which should have been running last November, was not yet complete. A credit balance of £2,792 was carried to the appropriation account, from which £3,000 was taken towards relief of the rates. The auditors pointed out that £6,466 had been debited to revenue account, which might have been regarded as capital. The chairman of the Lighting and Electricity Committee strongly protested against the Finance Committee having taken a further £3,000 of the profits to relieve the rates, against the Committee's will. The money was needed for use in the business. Alderman Lillioe remarked that that would mean that the rates would never get any benefit at all. Alderman Fox suggested that the Committee's plan now of charging certain large expenditures to revenue was to prevent the Finance Committee getting anything from the rates next year. Alderman Betteridge calculated that if coal had remained at the price it was three years ago, they would have been £8,000 or £9,000 more to the good. An amendment that the expenditure on certain new works relating to distribution and a new induced-draught plant—involving over £1,700—should not be charged to revenue, was defeated by a large majority.

**Dundee.**—The accounts of the Corporation electricity department for year ending April 30th, 1913, have just closed with a net profit of £7,028. The increase in the sale of units is between 1½ and 2 millions, representing an increased revenue of £4,000. The bulk of the increase is again for power purposes, although there is a gratifying increase of a quarter of a million units for lighting. On the expenditure side, there is, of course, a big increase in the coal account, which latter is fully £3,000 more than last year, while the assessments and taxes are also £1,000 higher due to a certain extent to the large profit in the previous year. The whole of the profit has been allocated to the reserve fund, bringing this up to fully £21,000, which is very creditable when it is considered that this has practically been built up in three years.

**Eccles.**—The revenue account of the electricity undertaking for the year ended March 31st, shows a profit of £111, based on the payment for energy by the Salford Tramways Committee from April, 1912, being calculated at the rate of 1d. per unit, both subject to adjustment on a settlement of the rate to be paid. The amount has been transferred to the credit of the reserve fund.

Officials of the Corporation have discussed with officials of the Salford Corporation the terms of settlement in reference to the price to be paid by the latter to the Eccles Corporation for energy supplied to the cars running in the borough, which is referred to on page 936.

**Epsom.**—The U.D.C. has applied to the L.G.B., for sanction to borrow £450 to defray the cost of services in connection with the electricity undertaking.

A L.G.B. inquiry was held on the 23rd ult., into the Council's application to borrow £500 for laying an electricity main in connection with the water undertaking. The inspector was informed that the pumping could be done by electricity, at the rate of 3½d. per thousand gallons. He afterwards visited both electricity and waterworks.

**Ford.**—The Sunderland R.D.C. has received an offer from the Durham Electric Supply Co. to illuminate the parish of Ford at 30s. per annum for each 50-c.p. lamp, plus 8s. for maintenance. The Council has asked the company to make the same offer in regard to the areas of Castletown and North Hylton.

**Guatemala.**—The town of Ocos is threatened with outer darkness. According to the *Popular Electricity Magazine*, a steamer of the Kosmos Line, about four years ago, was carried into shoal water by a tidal wave, and remained fast, though undamaged, near the shore. A native is said to have utilised the ship's lighting

plant during this period for supplying electricity in the town. Now, however, a salvage company has succeeded in refloating the vessel, and, incidentally, deprived the town of its electricity supply.

**Grimsby.**—The T.C. has received from the L.G.B. sanction to loans of £8,760 for additional plant for the electricity works, £420 for extension of cooling towers and oil separators, and £6,000 for mains (prospective).

**Halifax.**—The Tramways and Electricity Committee proposes to lay a h.t. cable along the main road to Well Royd, and then to erect an overhead line across open country to the premises of Messrs. C. Lindley & Co., Ltd., Beauvoir Works, Luddenden, at an estimated cost of £1,364, subject to the consent of the B. of T. being obtained. The Town Clerk is instructed to make the necessary application to the B. of T.

The Corporation has received the sanction of the L.G.B. to the borrowing of £23,180 for the provision of electricity plant and mains.

**Hebden Bridge.**—An inquiry was held by Mr. T. C. Ekin, on behalf of the L.G.B., into the request of the Council for sanction to borrow £3,250 for extensions to the electricity works. A ratepayer who was present at the inquiry said that there was a feeling amongst ratepayers that as regards efficiency and output the works had not come up to expectations, and recently the supply of electricity had been very erratic.

**Heston-Isleworth.**—The anomaly of charging some 100-c.p. lamps at £5 per annum and others £3 being considered undesirable, the U.D.C. has adopted the electrical engineer's advice to charge all such lamps in future at £4 per lamp; and also to reduce the price of 50-c.p. lamps from £3 to £2 15s. each. This will mean a reduction in the Council's charges for public lighting of £91 10s. per annum, and a corresponding decline in revenue, but the concession, it is felt, will be ultimately to the advantage of the department.

Mr. Rycroft's annual report to the Electricity Committee states that the total income for the past year was £8,878, and the working expenses £4,308, leaving a gross profit of £4,569, and a net profit of £409, after payment of £1,160 in respect of interest and repayment of principal. The net capital expenditure at the end of the year was £66,970, and the percentage of gross profit to capital expenditure, 6·8 per cent. In the previous year, the total income was £8,321, the gross profit £4,273, and the net profit £150. The output for the 12 months in units generated was 1,094,789, compared with 1,040,774 for the previous year. In regard to units sold, there was a net increase of 44,201, which may be considered satisfactory, as it is chiefly made up of new small consumers and a general expansion in business. The engineer comments on the number of improvements effected during the year, both in respect to machinery and the organisation of lighting arrangements, and notes with satisfaction that the first month of the current year shows an increase over the corresponding month of the year under review of nearly 20,000 units.

**Japan.**—According to the last Japanese mail, negotiations are in hand with the view of effecting an amalgamation of the four companies at present supplying electrical energy for lighting and power purposes in Tokio.

**Keighley.**—The Corporation has applied to the B. of T. for an order for powers to supply the urban district of Bingley with electricity in bulk. It is the intention of the Board to make the order.

**Leek.**—At a recent meeting of the U.D.C. it was intimated that Messrs. Nicholson & Hall, Ltd., a large firm of silk manufacturers, would not renew their contract for supply from the Corporation electricity department beyond the present year. The firm intends to extend the use of electricity throughout its mills, and to install its own generating plant of 800 H.P., and it is expected that the cost of power will be not more than 55d. per unit, a price at which the Council is unable to compete. Special meetings of the Council and Committees are being arranged to consider the matter.

**Leicester.**—The T.C. on May 27th adopted recommendations from the Tramways and Electricity Committee to install additional generating plant, at a cost of £62,350, in order to cope with the demand for power. A 5,000-H.P. three-phase turbo-generator is to be installed at the Lero generating station, with reversible rotary converters, switchgear, &c., and steam-raising plant; at the Aylestone station a 600-H.P. rotary converter is to be provided, and high and low-tension cables are to be laid in the various areas.

**Liverpool.**—The Mersey Docks and Harbour Board has decided to lay an electric supply main from the north-east corner of Salthouse Dock to the Albert Dock warehouses at an estimated cost of £800.

**Llandudno.**—Madoc Street and Lloyd Street are about to be lighted by electricity.

Representations having been made by leading hotel proprietors for more favourable terms for electricity for lighting purposes, the Electricity Committee recommended to the Council that a supply be provided at 3½d. per unit (as now), but that the minimum should be reduced from 15,000 to 10,000 units, with a discount of 2½ per cent. for prompt payment—these terms to apply to all consumers of 10,000 units per annum. The Council, however, has adopted an amendment to the effect that the Electric Light Committee should consider whether it would be possible to make a reduction to the general consumer.

**London.**—**FULHAM.**—The gross surplus on the working of the undertaking during the year ending March 31st last amounts to £6,020, as compared with £2,512 in the previous year. The net available surplus is £4,666, and gives a total available revenue balance of £7,899 to be carried to the next year's account. The revenue account shows a gross income of £40,988, as compared with £34,219 for the previous year, while the gross expenditure amounted to £36,322, as against £32,678. The total number of units sold for private purposes during the year was 3,091,166 at an average net rate of 2·352d. per unit, as compared with 2,505,747 units the previous year, at an average rate of 2·422d. per unit. The percentage of increase in the units sold during the year 1912-13 over the year 1911-12 is thus equal to 23·4%, while the actual increase in income derived from private sales was £1,989. The outstanding capital at March 31st amounted to £235,104, and the total capital repaid amounted to £49,363, equal to 17·35 per cent. of the total loans taken up. The showroom trading account shows a total income of £265, against an expenditure on stores of £224 and on rates, taxes, &c., of £155.

An expenditure of £295 has been authorised for the complete equipment of a new sub-station to improve the supply to consumers on the Queen's Club Gardens Estate, West Kensington. An expenditure of £980 has also been authorised for the erection of another new sub-station, &c., at Brandenburg Road to improve the supply in the Crabtree district.

**BERMONDSEY.**—The additions at the electricity station have been assessed at £1,590 gross and £530 rateable.

**Manchester.**—The detailed statistics and accounts of the electricity undertaking for the year ended March 31st, which were before the Electricity Committee last week, show that sales of current produced £467,194, as against £427,701 in the previous year. Hire of motors yielded £1,293, as against £8,616. Working expenses, other than capital charges, absorbed £253,561, as against £215,895—the difference being due to additional consumption of coal, expenses of new business, and inflated coal prices. The balance left was £223,926, as against £220,422. Average costs of production worked out at 1·033d. per unit sold, against 1·045d. in 1912. The cost of coal over the year was 12s. 4d. per ton, against 10s. 10d. in the previous year. The average price realised in pence per unit sold were 1·085 for lighting and power, and 1·046 for traction, as against 1·131 and 1·017 respectively in the previous year. The total units sold were 104 millions, against 93 millions in the previous year. On mains, the net addition was 15 miles 1,147 yards. Important developments in the lighting of the streets by electricity have taken place. The balance of £223,926 was appropriated as follows: Interest, £67,745; statutory sinking fund and voluntary supplementation thereof, £127,850; rate aid, £24,500; loss on India 3 per cent. stock, £23,831.

Mr. T. C. Ekin conducted a L.G.B. inquiry last week into an application to borrow £75,000 for electricity purposes. Mr. P. M. Heath, deputy town clerk, said the sum was made up of £45,000 for mains, £15,000 for services, and £15,000 for consumers' sub-stations. Mr. S. L. Pearce, chief electrical engineer, said they were asking for rather less than the amount allowed by the Board during the past three years. For the year ended March 31st the total units sold for all purposes was 104,340,000 units, an increase of nearly 11,000,000 units on the previous year. Mr. P. Percival, who opposed the application on behalf of the Ratepayers' Association, said he understood that the money for sub-stations was required chiefly for large power consumers, in which case these consumers had an unfair advantage over the large body of ratepayers. The inquiry was closed.

**Neath.**—The B. of T. has granted the R.D.C. an order empowering it to supply electricity in all the parishes of the Vale of Neath and the Dulais Valley.

**Nottingham.**—The Lighting Committee, reporting on the working of the department during the year ended March 31st last, states that experiments are still being carried out with clock-work automatic lighting and extinguishing apparatus, which continues to act very efficiently. The apparatus is now attached to 486 lamps. As the most efficient method of lighting, four powerful electric lamps have been erected across the middle of the open space at the top of Derby Road. This had proved most satisfactory, both as regards the lighting and the reduction of the danger arising from the cross traffic.

**Portsmouth.**—A special Electric Light Sub-Committee is considering the electric power rates charged in various towns with a view to generally reducing the rates in Portsmouth and securing a better motor load.

**St. Helens.**—A L.G.B. inquiry was held on May 28th into the application of the T.C. for a loan of £3,700 for electricity purposes—£1,049 in respect of excess expenditure on a loan of £10,800 sanctioned in 1911, £511 for switchgear, and £2,040 for a 2,000-kw. alternator. There was no opposition.

**Salford.**—The Council's E.H.T. switchgear is to be divided into two parts; this proposal will involve the provision of three extra isolation switches and five blank operating panels; the work is to be carried out by the British Westinghouse Co.

**Stafford.**—In pursuance of the arrangement as to profit-sharing by the employes at the E.L. works, the T.C. has for the past year paid a bonus of 9·90 per cent. on the wages paid, as against 11·7, 10·4 and 7·9 per cent. in the three previous years.

**Stoke-on-Trent.**—The T.C. has decided to lay a high-tension main from the Burslem works to the Tunstall boundary, in order to supply *en route* current to Mr. Alfred Meakin's Highgate Tile Works and the Goldendale Iron Works. The cost will be £3,500.

**Stretford.**—The U.D.C. is presently contemplating considerable extensions to plant, &c., 1,000 kw. is mentioned, at the generating station at Longford Bridge. The capacity of the plant at present is 1,800 kw.

**Swansea.**—After considering the price of current supplied to theatres and picture halls, the Electric Light and Tramways Committee of the T.C. has decided to reduce the charge from 3½d. to 3d. per unit. The revenue derived from these places of amusement is about £2,000 a year.

**Tempo.**—An electric lighting company has been formed in this Ulster village, the power required being obtained from a suction gas engine and water-wheel at a local saw mill.

**Ventnor.**—The U.D.C. has decided to enter into a three years' agreement with the Electric Light and Power Co. for public lighting, with 24 800-c.p. lamps.

**Wallasey.**—The Electricity Committee contemplates extensions on a large scale and the T.C. is to be asked to confirm a recommendation that borrowing powers to the extent of £65,000 be applied for. The scheme is to secure a site near the gasworks and build a new three-phase power station. It is proposed to use the present building in Seabank Road as a transforming and converting sub-station.

**Waterford.**—Mr. Mark Ruddle, city electrical engineer, Dublin, has visited the town at the request of the Corporation to report as to the advisability of starting a municipal electricity supply undertaking.

**West Ham.**—The Education Committee has decided to experiment by heating a school with electricity.

**Wood Green.**—At the May meeting of the U.D.C., an important statement was made by Mr. W. P. Harding, the clerk, upon the present position of the electric light question. As already reported in the ELECTRICAL REVIEW, the Tottenham and Edmon-ton Gas Co. has promoted a Bill to supply the district of Wood Green with electric light, and the North Metropolitan Electrical Power Supply Co. is also anxious to supply the district. The clerk reported that, as the result of a two days' inquiry held by the B. of T. into the application of the North Metropolitan Power Distribution Co. for a prov. order, the Board decided, after hearing all parties, not to proceed further with the application. On May 1st a Committee of the House of Commons sat to hear the application of the North Metropolitan Electric Power Supply Co. to allow it a *locus* to oppose the Bill of the Gas Co., but the Committee decided that the Supply Co. was not entitled to be heard in opposition to the Bill, and disallowed the *locus* accordingly. The petition of the Tottenham Urban District Council against this portion of the Bill had been withdrawn. Several hundreds of notices had been served upon the owners, lessees and occupiers of all dwelling houses within 300 yards of the proposed site of the Gas Co.'s generating station, and only one objection had been offered. It would now be open for the Electric Power Co. to apply to the Committee of the House of Lords for a *locus*, but, in view of the facts, the clerk concluded there was very little chance of any Committee of the House of Lords allowing a *locus* at this stage.

**Worcester.**—The accounts of the electricity undertaking, which were presented to the City Council on Monday, showed that the income for the year ending March 31st, 1913, amounted to £19,418, compared with £17,294 for 1911-12, an increase of £2,124. There was a net profit of £640, but this, and a sum of £1,526 from the general district fund, had been spent in carrying out improvements, chiefly in adopting the change from single-phase to poly-phase system. This change over had been expedited because of the unprecedented increase in the demand for power. During the year, 62 new customers had been connected, and the total increase of demand was equal to 9,742 30-watt lamps. There had been an addition of 61,721 units for lighting, and for power purposes an increase of 303,840 units. The costs of production had fallen, despite substantial increases in certain charges, from 1'0d. to 9'11d. per unit sold. The chairman of the Committee said there had been a phenomenal demand for power and lighting. The capital expenditure on the undertaking had been £168,588, and £81,000 had been written off.

**Worthing.**—Acting on the recommendation of the Electricity Committee, the T.C. approved of extensions to the plant and buildings at the generating station at an estimated cost of £6,750. Of this sum £4,850 is for extensions of the plant; and in recommending the purchase of a Diesel engine of approximately 400 B.H.P., direct-coupled to a generator of 260-kw. capacity, the resident electrical engineer, Mr. G. Porter, says that the experience of the past 16 months with Diesel engines has been extremely satisfactory. During the year ending March 31st last, the use of the oil plant enabled the fuel bill to be reduced by £750 with an increase of 10'8 per cent. in the number of units sold, as compared with the figures for the previous year. The proposed extension of the engine room buildings will afford space for a future 350-kw. set when required.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—The Tramways Committee has approved of the report and recommendations of a Sub-Committee regarding the tramways extension in the city. The scheme involves the running of motor-omnibuses and the equipment and running of railless trolley cars. The estimated cost is £7,830 and £6,230 respectively.

**Accrington.**—For some time past the accommodation at the car-sheds has been inadequate, and Mr. Pilling, general manager, has now prepared a preliminary report. The Electricity Committee has gone into the matter, and the borough engineer has been instructed to prepare plans for an extension.

**Bingley.**—A conference has been held between representatives of the U.D.C. and of the Bradford Corporation with reference to the commencement of the Bingley tramway. At a meeting of the U.D.C. Mr. Dawson, who formed one of the sub-Committee, stated that after discussion the conclusion arrived at was that there was no reason why the Corporation should not go on with the work of laying the line forthwith. The powers granted required that the work of construction was to be substantially commenced within 12 months, and as the powers were granted on August 6th last year, he thought the requirements would be met, and that every preparation was being made.

**Blackpool.**—On May 30th the brake on a Promenade car at the Gynn failed to act, and the car ran across the road, crossed the Fleetwood tramlines, and was only prevented from descending the steep Warbrick Hill by colliding with a trolley standard. Fortunately there was no Fleetwood car passing, or there might have been a serious smash.

**Bradford.**—The city tramways traffic report for the 54 days of the year show that the receipts were £46,018, and the car-mileage 920,800, against £41,193, and 892,262 miles for the 55 days of last year. The receipts for the present year show an increase of £1,825 on last year.

**Brighouse.**—The T.C. has complained to the Halifax Corporation about the totally inadequate service of cars from Brighouse to Bailiff Bridge, especially since the inauguration of the Bradford Corporation tramway service to that place.

**Croydon.**—The figures presented at the B.C. meeting on Monday showed increased mileage run and a considerable decrease of passengers, due to motor-bus competition. To meet it the whole of the Council's 75 cars were in service on a recent Saturday, Sunday and Monday. The chairman of the Tramways Committee (Councillor Denning) declared that it would be suicidal, with the present competition, to reduce the mileage.

**Darwen.**—Instead of giving the work to an agent as formerly, Darwen Tramways Committee have decided to take over all matters concerning advertisements on Corporation tramcars.

**Davyhulme.**—An agitation has been set on foot for securing the running of cars through Trafford Park to Davyhulme, a village near the Ship Canal, which is being rapidly developed.

**Edinburgh.**—Following suggestions as to the possibility of adapting self-propelled cars to the existing service, Mr. W. A. Stevens, of the Tilling-Stevens Co., makers of the electric 'bus and car, visited Edinburgh last week, and accompanied by the burgh engineer, inspected certain routes. The power stations were also inspected. Later, Mr. Stevens had an interview with Mr. Shepherd, manager, and Mr. Harris, engineer, of the Edinburgh Tramway Co. At a meeting of the Tramway Committee held later in the week, Mr. Stevens stated that there would be no difficulty in applying the self-propelled car to any of the lines in Edinburgh. On the other hand, he was afraid that the Edinburgh cable car could not be adapted to the petrol-electric chassis. That, he explained, would be commercially impracticable. The Committee also discussed the report of the deputation which visited various English towns in connection with the tramway developments.

**Greenock.**—The Corporation has appointed a deputation to collect information regarding the railless trolley system. The intention is to introduce the system, if it is found suitable, in the upper parts of the town where such facilities are urgently required.

**Huddersfield.**—The difficulties between the Huddersfield Corporation and the W.R. County Council and the District Councils of Elland and Greetland in regard to the proposed tramway extension from Birchcliffe to West Vale have been overcome. The extension is to be completed within three years, and Long Wall is to be widened to 27 ft. for its whole length. This latter work will cost £1,500, and has been apportioned as follows:—Huddersfield Corporation, £525; W.R. County Council, £525; Elland Council, £325; and Greetland Council, £125.

**Hurst.**—The U.D.C. has decided, subject to the consent of the B. of T., to grant a lease for five years of the tramways to the Ashton-under-Lyne T.C. It is not intended to reserve any rent by the lease, but the T.C. will covenant to expend £300 on renewing the tramways during the five years, and to pay any part of that sum not actually expended to the U.D.C. at the end of the term.

**Glasgow.**—The representative of the REVIEW in Glasgow has been favoured with the following official report of the year's working of the T.C.'s Tramways Department:—

Average track mileage open during year (single) ...	194½	Increase.
Car-mileage ... ..	23,335,008	899,932
Traffic receipts ... ..	£1,007,652	£20,372
Traffic receipts per car-mile ...	10'36d.	dec. '19d.
Traffic receipts per passenger ...	77d.	dec. '08d.
Passengers carried ... ..	311,480,086	35,869,701
Passengers per car-mile ... ..	13'34	1'06

The following statement gives the number of passengers carried at each fare:—

	May 31st, 1913.	May 31st, 1912.
½d. ... ..	191,944,261	121,212,468
1st two-stage ... ..	—	9,062,479
2nd do. ... ..	—	9,058,682
1d. ... ..	87,676,208	104,334,320
1½d. ... ..	20,354,233	20,337,702
2d. ... ..	6,191,033	6,258,659
2½d. ... ..	2,761,992	2,736,945
3d. ... ..	1,317,543	1,340,308
3½d. ... ..	1,076,768	1,109,998
4d. ... ..	158,048	158,824
	311,480,086	275,610,385

**Leeds.**—The Corporation Parliamentary Committee has decided to promote a Bill in the next Session providing for extensions of the tramway and railless traction systems.

The Corporation Tramways Committee has decided to establish ½d. fares on the Headingley, Roundhay and Chapletown routes at the earliest possible moment.

**Liverpool.**—The Council at its meeting this week will consider a motion as to the practicability of using the tramways for the conveyance of goods to neighbouring towns.

**London.**—The first of the tramway trailer cars was put into service by the L.C.C. on March 17th, the B. of T. consent being for three months. The Board has now asked for a report on the working of these cars at the expiration of that period, and the Highways Committee being of opinion that experience should be gained in their use over conduit routes of greater length has asked the Board to sanction their being run on the Merton circular route, *via* Tooting, Clapham, and the Victoria Embankment.

In connection with the opening of the Rushey Green and Forest Hill tramway, on May 29th, the L.C.C. allowed the public free rides on that day in order to give publicity to the new route.

A Progressive member of the L.C.C. is urging the desirability of issuing monthly and quarterly season-tickets on the tramways in view of the popularity of return tickets on South London routes.

An article recently appeared in the *Financier* criticising the experimental conversion of three old horse cars for petrol-electric working. The article refers to the success of the Tilling-Stevens petrol-electric motor-bus, but considers that the experimental tramway car is a patchwork arrangement, which cannot do justice to the petrol-electric plant and system of working. It points out that the petrol consumption is wasteful, *viz.*, 8 miles per gallon, or the same as for a motor-omnibus requiring 300 per cent. more tractive energy per ton. The article concludes that the new car distinctly suggests that it has been a case of "too many cooks," and that this is borne out by the fact that the L.C.C. engineering department appear to have superintended the whole job.

**Newcastle-on-Tyne.**—At a meeting of the Tramways Committee, on the May 29th, the chairman made his annual statement. He said the year just closed had been one of records in income, expenditure, gross profit, and net surplus. During the year they had taken for traffic £226,281, and for parcels £1,810, a total of £228,091, and an increase over the previous year of £11,500. There had been received for public street lighting £4,619, and for lighting for public buildings £1,067, for advertising on the cars they had received £3,678, and with other items the total income reached £238,204, an increase of £11,570 over the previous year. The traffic expenditure had been £64,493, against £60,663 in the previous year; general expenses totalled £18,674, against £17,730. This increase was largely accounted for by the increase of rates and taxes, and the extra charges for accident and fire insurances. For general repairs and maintenance the expenditure had been £25,943 against £27,122. They had had to pay out of the reserve fund £1,229 for car renewals. On the permanent way they had expended £7,692 against £5,800, the outlay being simply for the repair of streets, and on the electric equipment they had spent £2,088, compared with £3,612. Power expenses had been £11,998 against £9,239, an increase almost wholly due to the late coal strike. The coal bill had been £8,191, as compared with £5,416. During the strike, the Committee secured itself by buying and stocking a very large quantity of coal, and it had to buy it at a considerably enhanced price, which more than doubled the coal bill for the time. The Committee could, however, congratulate itself on the fact that it had always sufficient coal in stock, and was able to keep a full service of cars running without having to shut down a single minute during the whole progress of the strike. After the settlement it had to purchase again at a high price, and for the present year the coal bill was estimated at just about twice the amount it was before the strike, *viz.*, £10,000. During the year, £3,510 had been spent on maintenance and repairs

at the power station and the sub-stations. The cost of repairs to steam and electrical plant was also higher owing to increased attention to the machinery necessitated by wear, and here it might be stated that the Committee had placed an order with Messrs. Parsons & Co. for a new turbine. This provision was necessary to meet the peak load. The total working expenditure for the year had been £129,019 against £122,012, and there was a gross profit of £109,181. Out of this there had been paid for interest on loans £30,431 and £39,556 for sinking fund, leaving a surplus for the year of £38,504. Of this sum, £12,000 had been paid to the relief of the rates, and after meeting certain other items there remained £21,189 to go to the reserve and renewal fund, which would make it £119,407. He mentioned that no less a sum than £60,000 was included in this year's estimates for renewals.

**Nottingham.**—The City Council at its meeting on Monday adopted the annual report of the Tramways Committee. The report showed that the receipts for the year, exclusive of interest on investments, amounted to £167,160, an increase of £4,562. The average per mile was 11'50d., or an increase of '28d. over the previous year. The working expenses amounted to £108,273 (increase £2,111), leaving a balance of £58,886. This has been disposed of as follows:—To interest on stock and loans, £14,349; to repayment of capital, £19,761; in aid of district rate, £19,000; to reserve and renewals fund, £4,775; and to part cost of removal of centre poles in Mansfield Road, £1,000. The increase of expenditure includes £1,340 in wages of traffic staff and £1,128 in maintenance charges. Against this increase is a saving of £1,448 in the reduced consumption of electrical energy. The maintenance charges of £18,683 include £8,517 expended upon cars, £1,305 upon the overhead electrical equipment and £8,361 upon permanent way. A number of new and improved motors have been charged against the reserves and renewal fund, which now stands at £63,744. The cars ran 3,485,789 miles, an increase of 9,527 over the previous year, the result of increased services on two of the busiest routes. The number of passengers carried (38,481,032) was an increase of 2,457,561. There was an increase of 3,008,954 in the number of children's tickets issued. This concession, however, affected the issue of penny tickets, in which there was a decrease of 947,096, as against an increase of 395,713 in those of a higher figure. Ordinary penny tickets formed 74'69 per cent. of the total issued, and the least used were the workmen's 2d. and the ordinary 3½d. fares.

The discussion of the report produced a string of suggestions for the improvement of the undertaking.

In reply, Ald. Radford said the Corporation was applying for powers for railless trolleys in the Bill now before Parliament. It might go on reducing fares until it cut the revenue away altogether. The Committee had considered the question of transfer tickets, but could not see that the thing was practicable with efficient working of the system. "Pay-As-You-Enter" cars would be considered, but the question arose how to prevent the blocking of traffic at busy times. The Committee were unanimous that universal penny fares were not practicable.

The report was adopted.

On the Sherwood section of the Nottingham tramways, work is in progress in the removal of the central trolley wire standards; with the completion of this work the last remaining centre poles in the city will have disappeared, side poles for the central standards having been substituted along the other routes.

The Corporation has decided to drop all the clauses relating to the running of motor-buses outside the city in the Bill which it is promoting in the present Session of Parliament. As a consequence of this action the West Bridgford Council's Bill, the object of which is to provide a motor-bus service for its district, will now be proceeded with. The original proposal in the Corporation's Bill was to run a motor-bus service from the city through the Bridgford district, also through the urban districts of Carlton and Arnold.

**Plymouth.**—The solicitor to the London and South-Western Railway Co. has informed the Corporation that Clause 33 of the Bill promoted by the company with respect to road vehicles has been withdrawn. By Clause 33 it was provided that the company may work in connection with, or extension of, their whole railway system, "road vehicles" driven by horse, electrical or any mechanical power, for the conveyance of passengers, luggage, parcels and goods, "whether to and from any of their stations or otherwise." Spirited opposition is responsible for the result stated above.

**Salford.**—The Council has accepted the offer of the Eccles Corporation to supply current to the Salford tramways in Eccles for a term of five years at 1'12½d. per unit for a minimum consumption of 675,000 units per annum, and for all above that quantity at 75d. per unit. A coal clause is to be inserted in the agreement.

**South Shields.**—The annual report on the working of the Corporation tramways just issued, shows that the net profit of £6,318 creates a record, being an increase of £654 on the previous year. The total revenue was £34,151, an increase of £1,219. The receipts averaged 10'06d. per car-mile, as against 9'71d. in the previous year. The working expenses show a slight increase—£19,221, as against £18,426, or 5'66d. per car-mile, against 5'44d. in the preceding 12 months. This increase is principally due to advances of employes' wages, and payment under the Insurance Act, the maintenance costs being practically the same as last year. Out of the gross profit of £14,930, £8,612 was paid for interest and sinking fund. The practice of the tramways department in carrying on its own insurance has amply justified itself, the total amount paid in accident claims being £497, which included the costs of a case carried into court. The profit on carrying 68,000 parcels was £284.

**Sunderland.**—The manager of the Corporation tramways (Mr. A. R. Dayson) has reported to the Tramways Committee upon the request of the Sunderland District Tramways Co. for running powers over the Corporation's lines from Granttown to the centre of the town. The Committee agreed that such powers are desirable, and has consented to grant them, providing it has power to do so, upon conditions to be mutually agreed upon.

**Walthamstow.**—Notice of objection is to be drawn against the assessment of the tramways undertaking; a special Committee is to consider the reorganisation of the staff and employes in the tramway department.

**West Hartlepool.**—At a special meeting of the T.C. on May 29th, Alderman Suggitt moved a resolution authorising application to the Light Railway Commissioners for an order under the 1896 Act, amending the West Hartlepool Light Railway Order, 1897, with the object of assuring for the Corporation further powers with reference to the borrowing of money, &c. It was explained that with respect to the purchase of the tramways by the Corporation it had the necessary powers for all sections with the exception of the Seaton Carew section which was constructed under the Light Railways Act. It was, therefore, necessary to obtain those powers by an amendment of the order. The resolution was adopted.

## TELEGRAPH and TELEPHONE NOTES.

**Greece.**—A Bill has been introduced into Parliament sanctioning an outlay of 1½ million francs for the purpose of extending the telegraph and telephone networks.

**Imperial Wireless System.**—The Select Committee on the Marconi Contract sat on Monday and yesterday to consider the chairman's draft report on the rumours regarding the dealings of Ministers in shares. The *Times* states that alternative reports were put forward by the Unionist and Liberal members respectively, treating the question on party lines.

**Libel Action.**—The action for libel brought against Mr. C. Chesterton by Mr. Godfrey Isaacs was still in progress yesterday. Last week Mr. Samuel and a number of official witnesses were examined as to the course of the negotiations between the Post Office and the Marconi Co. Sir Rufus Isaacs was then called, and in the course of cross-examination, stated that the facts regarding his purchase of shares of the American Marconi Co., and his dealings with Mr. Lloyd George, were privately communicated by him to Mr. Falconer and Mr. Booth, members of the Select Committee of the House of Commons, before the journalists were examined by the Committee. [It will be remembered that the Committee, by a majority vote, refused to allow the witness to answer a question as to whether any of the Committee had received private information of this nature.] Mr. Godfrey Isaacs was next examined and described the negotiations with the Post Office. He stated that at present the company had 1,600 telegraph stations on board merchant ships. There were also installations on board some ships and on board men-of-war which were not managed by the company. The company had supplied 163 military field stations and 200 or 300 land stations. The company employed about 200 skilled engineers, and the total number of employes was about 3,000. All the £250,000 7 per cent. preference shares were now issued. In addition to the £500,000 ordinary shares, £250,000 ordinary shares were created in October, 1911, and the subscribed capital of the company was now £1,000,000. The company was incorporated in 1897, and down to the beginning of 1910 no dividend was paid. The preference shares were created in 1908, and the first dividend on them was paid in 1910. On September 1st, 1911, an interim dividend of 5 per cent. was paid on the ordinary shares, and the dividend for the year on the ordinary shares was 20 per cent. From 1910 down to 1912 the business of the company increased very largely. In July, 1911, the contracts in hand amounted to about £250,000, and in July, 1912, they amounted to about a million sterling. The latter sum included the Post Office contract, which amounted to £360,000—six stations at £60,000 a station. After the declaration of a dividend in August, 1910, the value of the Marconi ordinary shares began steadily to rise.

Mr. Isaacs was cross-examined with regard to companies with which he had been previously connected, and stated that he had never received any complaint from any shareholder or from his co-directors in respect of any of those companies. The Judge repeatedly intervened to check the cross-examining counsel.

On Monday Mr. Isaacs's examination was concluded, and on Tuesday Mr. Marconi was the principal witness; he expressed the greatest confidence in the ability and integrity of Mr. Isaacs, and similar evidence was given by former colleagues of the latter. The case for the defence was then opened.

**Loaded Telephone Lines.**—According to the *Journal Télégraphique*, the longest line in Europe provided with Pupin loading coils is that between Stockholm and Lules, 1,299½ km. in length. The Pupinised line between Berlin and Aix-la-Chapelle is almost 700 km. long.

**Norway.**—A submarine bell has been placed at Lille Faerder, at the entrance to Christiania Fjord. The bell is worked by electricity.

**Nose Telephone.**—A new telephone transmitter has been devised by Dr. Jules Glover, with a nose-piece intended to catch the nasal sounds which occur so frequently in the French language, for example, and which are lost when the ordinary mouthpiece is used alone.

**Telephone Cable from Dublin to Holyhead.**—The telephone trunk line connecting the General Post Office, Dublin, with the new cable which crosses from Holyhead to Howth has now been completed. The wires are carried on high standards, which have been set at some distance from those of the Tramway Co. The standards, instead of being placed on the road, have been erected on concrete foundations in the sea along the edge of the harbour, and are carried thence on the western side of the railway line to the city.

**Wireless Service between Germany and America.**—Experiments have been made since the end of January last between the Telefunken station at Nauen, near Berlin, and the station at Sayville, Long Island, which is owned by the Atlantic Communication Co., of New York. These experiments have given satisfactory results, and have, for the first time since the inception of wireless telegraphy, allowed radio-telegraphic messages to be sent across the ocean on the route, New York-Berlin. The distance bridged in this connection works out at about 6,500 km., whereas the distance between Ireland and Canada, where a Marconi service has for some years been in operation, is only about 3,200 km. The experiments above referred to are being continued with a view to collecting all necessary data for establishing a regular radio-telegraphic service. We are not informed whether the communication is effective during daylight hours.

**Wireless Telephony.**—A record in telephony is claimed to have been accomplished by the Telefunken Co., of Berlin, in connection with the experimental station at Nauen by the use of the company's high-frequency machine for the production of sparkless oscillations, in conjunction with a new method of switch arrangement. Having previously notified various receiving stations of the intention, extracts from newspaper articles were recently read aloud at the Nauen station, and are said to have been transmitted distances of from 370 to 430 miles, as, for instance, to the Vienna Technological Museum, where they were perfectly understood by Prof. Kann.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Accrington.**—The electrical engineer has been instructed to prepare specifications and obtain tenders for the work of replacing 14 carbon arc lamps in the Market Hall by 20 200-c.p. Osram lamps.

**Atherton.**—June 10th. Two 150-kw. single-phase transformers, for the U.D.C. See "Official Notices" May 30th.

June 11th.—Contract No. 1: Sub-station buildings; No. 2: extra-high-tension, high-tension and low-tension switchboards and transformers; No. 3: mains. W. Garnett, Clerk to U.D.C., Town Hall.

**Australia.**—VICTORIA.—June 11th. Switchgear and instruments, for the Melbourne City Council. See "Official Notices" April 25th.

June 24th.—H.D. copper wire, telephone parts and telephones, for the P.M.G. See "Official Notices" May 23rd.

July 1st. Telephone instruments and submarine cable, for the P.M.G. See "Official Notices" May 23rd.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

July 8th.—Rubber-covered wire, batteries, telephone switchboards, measuring instruments and telephone instruments, for the P.M.G. See "Official Notices" May 30th.

TASMANIA.—June 9th. Telegraph and telephone material for the P.M.G.'s Department. See "Official Notices" May 23rd.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 9th and 30th and August 6th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

June 11th. Metal-filament lamps, for the P.M.G. See "Official Notices" May 23rd.

July 23rd.—Telegraph and telephone instruments, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telephone switchboards and parts, for the P.M.G. See "Official Notices" to-day.

July 30th.—Cable, switchboard, for the P.M.G. See "Official Notices" to-day.

**SOUTH AUSTRALIA.**—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

**NEW SOUTH WALES.**—July 9th. Switchboards, for the P.M.G. See "Official Notices" May 30th.

**Austria.**—June 13th. The Austrian State Railway authorities in Vienna are inviting tenders for an electric power installation at the Railway boiler works at Simmering.

**Belgium.**—June 14th. The Belgian Telegraph authorities, at La Sille Madelaine, Brussels, are inviting tenders for 5,234 metres of telegraph cables, with accessories.

**Brazil.**—June 23rd. Tenders will be received for the establishment of rubber-refining works (1) in Manaus, capital of the State of Amszone; (2) and in the States of Piauby, Ceara, Rio Grande do Norte, Pernambuco, Bahia and São Paulo; and (3) for the manufacture of rubber goods in the towns of Manaus, Belen do Para, Recife and Bahia. Particulars from the Bureau de Renseignements die Brésil, 59, Rue Richelieu, Paris.

**Chile.**—September 10th. According to an advertisement in the *Times*, tenders are invited for the establishment of a "thermo-electric central station and distribution of electric energy at the port of Valparaiso." Particulars, &c., can be obtained at the offices of the Chilean Legation, 48, Grosvenor Square, W. Tenders to Offices of Ports Commission, Santiago.

**France.**—NEVERS.—August 31st. The city of Nevers has opened a competition with a view to the supply and installation of a water-boasting system at the new waterworks. Steam, suction gas or electric motor systems may be submitted, the power required being equal to raising normally 120 litres of water to a height of 72.30 metres actual. Particulars and plans from M. Huet, Ingenieur en Chefs des Ponts et Chaussées, 2, Rue de la Poissonnerie, Nevers.

**Germany.**—July 3rd. The Prussian State Railway authorities (Maschinen-Amt, 2) at Bremen, are inviting tenders for two electrically-operated coal-loading cranes.

**Halifax.**—June 6th. One natural draught chimney type water cooling tower, for the Electricity Department. See "Official Notices" May 23rd.

**Hungary.**—June 15th. The municipal authorities of Torokbecse are inviting tenders for the concession for the public and private electric lighting of the town. Deposit 5,000 kronen. Particulars from the Gemeinde Notarsamt, Torokbecse, Hungary.

**MARJÓUSVÁR.**—June 15th. Tenders are invited for the supply and erection of an electric lighting installation at the Royal Salt Mines at Torda. Particulars of the K. Ung. Oberbergamt, Marjóusvár, Hungary.

**Leyton.**—June 24th. Electric lighting and hot-water heating for the new Church Road Schools, for the U.D.C. See "Official Notices" to-day.

**London.**—ST. PANCRAS.—June 9th. Welsh and other steam coal for the Electricity Department, 57, Pratt Street, N.W. L.C.C.—June 24th. One 50-ton overhead travelling crane for Greenwich generating station. See "Official Notices" to-day.

June 25th.—Electrical installation at Randall Place Elementary School, Greenwich, S.E. See "Official Notices" to-day.

**HAMMERSMITH.**—June 18th. Air-cooled static transformers, for the Borough Council. See "Official Notices" to-day.

**SOUTHWARK.**—June 11th. Supply of cable for 12 months, for the Borough Council. See "Official Notices" to-day.

**Manchester.**—June 7th. The Electricity Committee invites tenders for the supply of stores required during the 12 months ended June 30th, 1914. Particulars and forms of tender from Mr. F. E. Hughes, secretary, Electricity Department, Town Hall.

**Newcastle-under-Lyme.**—June 21st. Supply and laying of cables, for the Corporation. See "Official Notices" to-day.

**Newport (Mon.).**—July 1st. Refuse destructor for the T.C. Borough Engineer, Town Hall.

**Portsmouth.**—June 11th. Wiring for electric light installation at Workhouse Infirmary extensions, &c., Milton. See "Official Notices" May 16th.

**Rawtenstall.**—June 10th. One 1,500-kw. turbo-alternator complete with condenser, for the Corporation. See "Official Notices" May 23rd.

**South Africa.**—WELLINGTON (CAPE PROVINCE).—Tenders are called for an electric lighting installation for the municipality comprising two 70-h.p. suction gas engines and producers (or, as an alternative, superheated steam engines), two 48-kw. three-wire dynamos, one 10-kw. motor-balancer, and one three-wire battery booster set, battery and distilling plant, switchboard, poles, copper, insulators, feeder pillars, travelling crane, meters, instruments, &c. also for erection, overhead equipment, &c. Specifications on deposit of certified cheque for 10 guineas, payable to the order of the Town Clerk, Wellington, from Mr. Chas. G. Trevett, consulting engineer, 70, Fletcher's Chambers, Cape Town.

**Southampton.**—June 19th. Electric lighting of the old pavilions at the Infirmary, Shirley Warren. See "Official Notices" May 30th.

**Spain.**—June 16th. The municipal authorities of Montalban (province of Cordoba) are inviting tenders for the concession for the electric lighting of the town during a period of 13 years.

**Stalybridge.**—June 7th. Engine fuel and stores for the Joint Tramways and Electricity Board for 12 months, commencing July 1st next. Specification, &c., obtainable from Mr. R. Blackmore, Engineer-in-Chief, Generating Station, Stalybridge.

**Swansea.**—June 6th. Installation of electric light and bells at the new training college, Glamor, for the Education Committee. See "Official Notices" May 23rd.

**Swindon.**—June 23rd. Cooling tower, water softening plant and flanged cast-iron piping, for the Electricity Department. See "Official Notices" to-day.

**West Hartlepool.**—June 14th. Two 300-kw. rotary converters, complete with transformers, switchgear, &c. for the Corporation. See "Official Notices" May 30th.

**CLOSED.**

**Belgium.**—Two tenders were submitted to the Société du Canal et des Installations Maritimes de Bruxelles for the supply of five electrically-operated 3-ton cranes for the loading of steamers on the Brussels Ship Canal, the lowest being that of the Société des Ateliers de Constructions Electriques, of Charleroi.

**Bennis Contracts.**—The following contracts have been received by Messrs. E. Bennis & Co., Ltd.:—

- Rawtenstall Corporation electricity station.—Two stokers and self-cleaning compressed-air furnaces (repeat order).
- Rochdale Corporation electricity works.—Four chain-grate stokers.
- British Insulated & Helsby Cables, Ltd., Prescott.—One chain-grate stoker (repeat order).

**Bolton.**—The Tramways Committee has accepted the tender of Mr. T. W. Ward, Sheffield, for 150 tons of old rails, and that of Messrs. Todd Bros., St. Helens, for 50 tons.

The Electricity Committee has accepted the following tenders:—

- B.I. & Helsby Cables, Ltd.—Cables.
- Doulton & Co.—Conduits.
- T. Wragg & Sons.—Conduits.

**Brighton.**—The Lighting Committee of the T.C. has accepted the tender of Messrs. Gardner, Locket & Hinton, Ltd., for not less than 40,000 tons, or more than 48,000 tons of Grangerigg washed nuts for the Southwick electricity works for two years, at 16s. 5d. per ton.

**Coventry.**—The T.C. has accepted the tender of Messrs. Edgar Allen & Co., Ltd., for a track lay-out at the car-shed of manganese steel, at £315; and that of Messrs. Shaw & Nicholas, for the erection of a car-shed, at £3,838.

**Derby.**—The E.L. Committee of the T.C. has accepted the tender of Messrs. Newton Bros. for a motor-alternator, at £1,835, and that of Messrs. Graves & Co. for chains for the coal elevator and conveyor, at £54.

The Tramways Committee has accepted the tender of the Brush Electrical Engineering Co., Ltd., for five roof covers for tramcars, at £548.

**Eccles.**—The T.C. has accepted the tender of Thos. Beeley & Son, Ltd., for a Lancashire boiler at the electricity station.

**Harrogate.**—The T.C. has accepted the tender of Messrs. Ferranti, Ltd., for switchboard extensions for the new generating plant, at £195.

**Hull.**—The City Education Committee has accepted the tender of Messrs. J. Walsh, Ltd., for installing electric light at Sauer Street Schools, at £271.

**Leeds.**—The Tramways Committee of the T.C. has accepted the tender of Messrs. Wm. Airey & Son, for the erection of a tramway shed, depot and workshop offices at Sovereign Street, at £22,199.

**Liverpool.**—The T.C. has accepted the following tenders:—

- National Steam Car Co., Ltd.—Motor chassis for the Tramways Department.
- Pope's Electric Lamp Co., Ltd.—Annual supply of 40-watt and 60-watt metallic-flament lamps.
- J. Huoter & Son, Ltd.—About 8,000 yd. of worsted serge for use in the Tramways and Electricity Departments.

**London.**—LEYTON.—The U.D.C. has received the following tenders for the supply of cable for the new feeder to Leigh Road:—

R. R. Todd .. .. .	(accepted) £1,719
Standard Cable Co., Ltd. .. .	1,797
Western Electric Co., Ltd. .. .	1,820
B.I. and Helsby Cables, Ltd. .. .	1,827
Niemens Bros. & Co., Ltd. .. .	1,827
W. T. Henley's T.W. Co., Ltd. .. .	1,860
Glover & Co., Ltd. .. .	1,860
Johnson & Phillips, Ltd. .. .	1,860
Electrical Engineering and Equipment Co. .. .	1,834
Callender's Cable Co., Ltd. .. .	1,982
General Electric Co., Ltd. .. .	2,049
Pirelli, Ltd. .. .	2,068
Union Cable Co., Ltd. .. .	2,168
General Cable Manufacturing Co. .. .	2,190
Connolly Bros. .. .	2,850

Tenders for annual supplies of meters have been accepted from Verner & Co., Electrical Apparatus Co., B.T.H. Co., B.I. and Helshy Cables, Ltd.

The quotation of the British Westinghouse Electric and Manufacturing Co., Ltd., has been accepted, at £16 10s., for a spare armature for two 25-h.p. fan motors, and, at £21, for a spare armature for two 8-h.p. machines.

MARYLEBONE.—The following tenders have been accepted by the B.C. for supplies to the electricity department:—

- Flexible leads.—Pirelli, Ltd.; Armorduct Manufacturing Co.
- Carbon brushes.—Le Carbone, Ltd.
- Box compound.—The Dussek Co.
- Rubber insertion.—North British Rubber Co.
- Para strip and black tape.—Siemens Bros.
- White Silesian tape.—J. North Hardy & Co.
- Fireproof tape.—Siemens Bros.
- Rubber nuts and manhole rings.—Messrs. Ingram.

The tender of Herbert Morris, Ltd., has also been accepted, at £100, for four 10-ton travelling cranes at the Aybrook Street station.

The Local Government Records and Museums Committee received the following tenders for electric lighting installation at Geffrye's Almshouses, Shoreditch, which buildings are now being adapted for museum purposes:—

W. C. Tackley & Co., Ltd.	.. .. .	(recommended)	£113
R. H. & J. Pearson, Ltd.	.. .. .	.. .. .	119
Cunningham, Ltd.	.. .. .	.. .. .	184
G. Weston & Sons, Ltd.	.. .. .	.. .. .	149
P. Lawrence & Sons, Ltd.	.. .. .	.. .. .	161
C. H. Cathcart & Co.	.. .. .	.. .. .	225

L.C.C.—The Highways Committee received tenders, as below, for (1) slot rails and conductor tees; (2) track rails and fastenings; (3) special track rails, renewable guards and fastenings, for the tramways:—

Frodingham Iron and Steel Co.	.. .. .	(recommended)	£19,812
John Batt & Co., Ltd.	.. .. .	.. .. .	15,711
Walter Scott, Ltd.	.. .. .	.. .. .	16,566
Chief Engineer's estimate, £15,875.			

		Carbon steel.	High silicon steel (Sandberg process).
A. W. Nye (Société Anonyme d'Ougrée-Mari-haye, Belgium) (fish bolts not quoted for)	.. .. .	219,930	—
Bolckow, Vaughan & Co., Ltd.	.. .. .	£4,822	£25,072
J. Batt & Co. (London), Ltd.	.. .. .	24,470	25,599
Walter Scott, Ltd.	.. .. .	24,512	26,012
A. Brown & Co. (Soc. Anon. des Acieries d'Anclieur, Belgium)	.. .. .	26,892	27,940
Barrow Hematite Steel Co., Ltd.	.. .. .	36,526	(no tender)
Cammell, Laird & Co., Ltd.	.. .. .	(fish-plates only quoted for)	

Bolckow, Vaughan & Co., Ltd.	.. .. .	£17,014	£17,476
Barrow Hematite Steel Co. (no bolts quoted)	.. .. .	17,441	(no tender)
J. Batt & Co., Ltd.	.. .. .	18,504	19,197
Walter Scott, Ltd.	.. .. .	19,481	20,406

For an overhead travelling crane for the permanent way dépôt, Leven Road, Poplar, the tenders received were:—

J. Spencer & Co., Ltd.	.. .. .	(recommended)	£72
Higginbottom & Mannaock	.. .. .	.. .. .	84
Thos. Smith & Sons	.. .. .	.. .. .	90
East Ferry Road Engineering Works Co., Ltd.	.. .. .	.. .. .	107

The Committee has extended for a year contracts with the Morgan Crucible Co., Ltd., the Sloan Electrical Co., Ltd., and Messrs. W. Geipel & Co., for carbon traction motor and other brushes for electrical machinery.

BERMONDSEY.—The B.C. received tenders for time switches from the Adnil Electric Co., the Bat Meter Co., G. Braulik, Chamberlain and Hookham, Ferranti, W. Geipel & Co., Landis & Gyr, Reason Manufacturing Co., Siemens Bros. Dynamo Works, and Veritys, Ltd. The offer of the Reason Co. was accepted.

Maidstone.—The Electricity Committee of the T.C. has accepted the tender of Messrs. Wm. Cory & Son, Ltd., for a year's supply of coal as follows:—Northumberland rough, 16s. 6d. per ton; Yorkshire house screenings, 18s. 6d. per ton.

Newport (Mon.).—At a recent meeting of the Electricity Committee, tenders for a turbo-alternator and for a 600-kw. D.C. generator were considered, and after careful consideration of a report of the tenders (prepared by the borough electrical engineer, Mr. A. Nichols Moore), the Committee recommended for acceptance the tender of the A.E.G. Electric Co., Ltd., for a 3,000-kw. turbo-alternator, and that of the Lancashire Dynamo Co. for a 600-kw. D.C. generator. We understand that in the case of the turbo-alternator the accepted tender was the most favourable and advantageous, the price being approximately £1,000 lower than that of any English tenderer, and earlier delivery was guaranteed. The steam consumption guaranteed was also lower.

According to the discussion which took place at the special Council meeting on Tuesday, as reported in the *Times*, Mr. John Moxon, the chairman of the Electricity Committee, said that they had no option but to ask the Council to go outside the country for the bigger plant. There were 36 tenderers for the turbo-generator, and 28 for the direct-current generator. No English firm came anywhere near the price quoted by the German firm. It was unfortunate to have to go out of the country, but they as a Corporation could not afford to be philanthropists. The matter of the Germans being able to supply at a lower cost than that of British manufactures was explained by the existence in Germany of a "common good fund," provided jointly by the manufacturers and the State, to recoup any loss a manufacturer may sustain in such a contract. Another point was that the English firms had

modified the contract conditions set down by the Corporation, and no English firm could carry out the whole of the work. If the contract was let to English manufacturers, it would mean that the Council would have to deal with three firms, and they had had some experience in the matter of dividing responsibility in such cases.

In the speech of Mr. Robjert, as reported in the *Monmouthshire Evening Post*, this gentleman said that as a member of the Committee he did not consent to the main contract going out of the United Kingdom. The loss of wages to our workpeople, compared with the small capital cost saving, was a weighty argument against acceptance of the tender. While the British manufacturers had combined together and inserted in their tenders certain conditions, which were not conditions acceptable to the Committee, on the other hand, the German firm had practically accepted the whole of the conditions the borough electrical engineer put forward. A good many things had happened since that time. The English manufacturers had been given to understand the position, and the result had been that they agreed to the whole of their conditions, and at the present moment they compared, to all intents and purposes, with the German manufacturer. They had modified very considerably their tenders, and whilst the A.E.G. Co. had imposed fresh conditions, the English manufacturers had come down.

Nuneaton.—The T.C. has accepted the tender of Messrs. W. Lucy & Co., Ltd., for 25 street lamp brackets, at 14s. 6d. each.

Salford.—The following tenders have been accepted by the T.C.:—

- J. Gerrard & Sons, Ltd.—Erection of new extra-high-tension switch-house and foundations at the Frederick Road electricity station, £957.
- Bertram Thomas.—Copper strip for main lighting and power switch-board, £308.
- British Thomson-Houston Co., Ltd.—Switchgear required for the bulk supply meter house of the Lancs. Electric Power Co., £1,352.
- Bell Bros.—Annual supply of natural black oil, 1s. 1d. per gallon.

South America.—Messrs. Siemens Bros. Dynamo Works, Ltd., have received a contract for the supply of "Wotan" pure-drawn tungsten wire lamps for a large town in South America. The lamps, which have just been dispatched from their Shacklwell Lane stores, are mainly intended for street lighting. The total number of lamps for the consignment is 36,100, and the total C.P. 2,117,000. The highest C.P. lamp employed will be 400, and the lowest 16. These lamps are for a circuit voltage of 200. "Wotan" lamps were decided upon after exhaustive tests.

Southampton.—The following tenders were received by the T.C. for the installation of electric light at the Regent's Park School:—

L. Groves & Co.	.. .. .	(accepted)	£121
F. W. Cook & Co.	.. .. .	.. .. .	175
J. Davis & Co.	.. .. .	.. .. .	185
A. Kingman & Co.	.. .. .	.. .. .	189
W. Dibben & Sons	.. .. .	.. .. .	265

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturday, June 7th.—At 8 p.m. Lecture on "Radioactivity; The Radioactive State of the Earth and Atmosphere," by Prof. E. Rutherford.

Salford Technical and Engineering Association.—Wednesday evening, June 11th. Visit—Follock & McNab, Ltd., Britannia Machine Tool Works, Bredbury.

British Engineers' Association.—Thursday, June 12th. At 2.15 p.m. At Institution Rooms, 200, Buchanan Street, Glasgow. Meeting, Mr. T. C. Stewart presiding. Addresses by Captain T. C. FitzHugh and others on "China."

Tramway and Light Railway Association.—Thursday and Friday, June 12th and 13th. At Blackpool. Annual Conference. The papers to be read are as follows:—"Possibilities for Increasing Profits on Interurban Lines," by E. H. Edwards; "Tramways—a Résumé," by F. Bland; "Railless Traction and Motor-Buses," by H. Eogland; "Standard Rules for Motormen and Conductors," by A. V. Mason.

Physical Society.—Friday, June 13th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Experiments on Tinfoil Contact with Dielectrics," by G. E. Baird. Paper on "A Method of Measuring the Pressure of Light by Means of Metal Foil," by G. D. West.

THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAP.

The following orders have been issued for the current week:—

- Monday, June 9th.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 6th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.
- Tuesday, June 10th.—"B" Company. Ditto.
- Thursday, June 12th.—"C" Company. Ditto.
- Friday, June 13th.—"D" Company. Ditto.

Saturday, June 14th.—Headquarters will be opened for the transaction of regimental business from 10 a.m. to 12 noon.

(Signed) J. H. S. PHILLIPS, Major, L.E.E.  
For Officer commanding L.E.E.

## NOTES.

**Wanted—Five Hundred Pounds.**—Our readers will have noticed that an invitation has been given in several issues of the *ELECTRICAL REVIEW* for six gentlemen or firms to subscribe £100 apiece so as to enable the Electrical Trades Benevolent Institution to take advantage of Mr. E. G. Byng's offer of £100, provided nine other offers were forthcoming within three months from April 16th. Last week we omitted the notice with a feeling of disappointment that generously-minded men were of so very retiring a disposition, but we are only too glad to publish the table again this week, for the fifth hundred pounds has come along from the kindly heart of a veteran of the industry. Sir William H. Preece, K.C.B., F.R.S., in his advancing years, has shown his desire to assist the Institution of which he has for a number of years been president, and his name accordingly appears below. Five spaces still remain open, and once again we renew our appeal to the large-hearted to phone or write to the secretary, or to us, under the first impulse that possesses them after reading this note. Maybe there are some whose nature it is to shrink from publication of their gifts of charity. To such we would put it that the effect of their example might be rightly to influence others, but we would also add that there is always the alternative of anonymity. So long as the money is brought to the coffers of the fund, so as to be available for ameliorating the lot of the needy sons and daughters of the electrical industry, what matters it whether the hundred pounds be by name or anonymously? The position now stands as follows:—

1	Mr. E. G. Byng	...	...	...	...	...	£100
2	Mr. G. Sinton	...	...	...	...	...	£100
3	Mr. H. Hirst	...	...	...	...	...	£100
4	Mr. E. Garcke	...	...	...	...	...	£100
5	Sir W. H. Preece, K.C.B., F.R.S.	...	...	...	...	...	£100
6	*	...	...	...	...	...	
7	*	...	...	...	...	...	
8	*	...	...	...	...	...	
9	*	...	...	...	...	...	
10	*	...	...	...	...	...	

**Electrical Contractors' Dinner.**—The annual dinner of the Electrical Contractors' Association, Inc., will be held on Tuesday, June 17th, at Frascati's Restaurant.

**The B.E.A.M.A.**—The following firms have been elected "Members" of the British Electrical and Allied Manufacturers' Association:—

The Wilson-Wolf Engineering Co., Ltd.  
Tilghman's Patent Sand Blast Co., Ltd.

The following firm has been elected an Associate:—

Maschinenfabrik Augsburg-Nurnberg A.G.

**Institution and Lecture Notes.**—JUNIOR INSTITUTION OF ENGINEERS.—On June 30th, at 8 p.m., at the Institution of Electrical Engineers, Victoria Embankment, the Gustave Canet Lecture on "The Working Fluid of Internal Combustion Engines" will be delivered by Dr. Dugald Clerk, F.R.S. Tickets may be had on application to the Secretary, 39, Victoria Street, S.W. Also at 8 p.m., at the Great Western Hotel, Birmingham, Dr. Dugald Clerk's lecture will be delivered before the Midland Section by Mr. A. A. Remington. Tickets may be had on application to 60, Arderton Park Road, Moseley, Birmingham. From July 4th to 7th the Institution week-end visit to Ghent Exhibition will take place.

**INSTITUTION OF ELECTRICAL ENGINEERS.**—At the meeting on May 30th, the Report of the Council was adopted, and it was announced that the following gentlemen had been elected to the Council, the list of Members being, otherwise, as given in our issue of April 4th:—Ordinary Member of Council (one vacancy) Mr. R. A. Chattock; Associate Members (three vacancies), Mr. F. E. Berry, Capt. Henrici and Mr. A. W. Martin; Associates (two vacancies), Mr. E. R. Clarke and Mr. A. M. J. Ogilvie.

**MUNICIPAL TRAMWAYS ASSOCIATION (INC.).**—A meeting of the Managers' Section opened yesterday (Thursday morning) at the Town Hall, Sunderland. After the usual Corporation welcome, there were discussions on the following subjects:—"Description of Sunderland Corporation Tramways System," by Mr. A. R. Dayson; "Interim Report of Rail Corrugation Committee," introduced by Mr. R. H. Wilkinson. After luncheon at the Town Hall, the party went by steamer to South Shields. To-day, again at Sunderland, the following subjects will be introduced for discussion:—"Petrol and Trackless Trolley Vehicles," by Mr. C. J. Spencer; "Standardisation of Specifications for Tramcar Equipments," by Mr. J. W. Hawe.

**"Increased Powers" Bill.**—We read in the *Times* that on Wednesday afternoon Sir Howell Davies (Bristol) presented a Bill to give increased powers to local authorities with regard to electric lighting and other purposes connected therewith.

**Damages Against the L.C.C.**—The L.C.C. was, on May 29th, sued in the King's Bench Division for damages before Mr. Justice Bankes and a common jury, for the loss of a husband. The action was brought by the widow, Mrs. Lilian Phyllis Cobbett, on her own behalf and on behalf of her two young children. The deceased man was driving a horse and cart at Lower Tooting, and he turned off the tramline, the wheel of his cart caught in the

rails, with the result that he was thrown out, run over and killed. The accident, it was said, arose from the fact that the rails were much worn, and that the guard rail was, in consequence, 1 in. above the other side of the rail. The jury awarded the plaintiff damages to the amount of £500.

**Appointments Vacant.**—Assistant to the County Electrician, Middlesex Education Committee (42s.); Showroom attendant for the Torquay borough electricity department. See our advertisement pages to-day.

**Bombardment at Earl's Court.**—We think we can say with little hesitation that the Imperial Services Exhibition at Earl's Court, which was opened by the Duke of Connaught on Saturday last, will be very popular during the coming months. We do not now refer so much to the exhibits themselves, as these we have not yet closely examined, but we are very much mistaken if the performance or display of naval and aerial warfare in the Empress Hall is not going to "take" with the public in these days of boy scouts and of increased feelings of personal responsibility in the matter of national defence and self-preservation. The spectator witnesses an attack on a fortified coast town by a number of warships, some of 19 ft. and others 30 ft. length, which are models of modern vessels in our fleet to-day. The models were built by Messrs. Bassett-Lowke, Ltd., at Northampton, and they are operated by a couple of men by means of a 1½-h.p. electric motor of special design and a battery of 28 Premier cells. The public will be able to have their heart's content of thrill and noise, as the forts are attacked and respond, as the city is fired, and after a more or less stout resistance shows the white flag—all in a matter of a comparatively few minutes—quickly almost as a cinematograph film tells its story. The interest of the display is added to by the control by the Raymond Phillips wireless system of a 22-ft. airship which manoeuvres over the scene prior to the conflict. There were whispers of bomb-dropping from the said airship and of submarine mines in the lake, but these were not in evidence on the occasion of a preliminary Press view at which we were privileged to be present. However, there was quite sufficient to convince us of the popular appeal which such a demonstration is likely to make. The show is well worth seeing.

**Copper.**—Messrs. Merton's monthly circular for May shows considerable activity in the market for this metal, the total deliveries (Europe) reaching the extraordinarily high figure of 61,020 tons. The drop in visible supplies, however, only shows as 833 tons, the decrease in English stocks of 1,240 tons being largely compensated for by increase in French stocks and quantities afloat. The decrease in total European stocks is heavier, the drop (when including Rotterdam, Hamburg and Bremen stocks, and quantities estimated for other ports) being 4,141 tons.

Supplies to Europe from North America are considerably above the average. Spain and Portugal send a small quantity to England and France. Chile shipments are rather low, and Australasia not up to average. The drop in American visible supplies during April was 12,822 tons, a large quantity, and the decrease in the world's visible supply (including Holland and Germany) was 14,068 tons.

**Celluloid Regulations Bills.**—With reference to our recent comments by way of criticism of the two Bills in which unreasonable provisions were set forth for the control of premises containing small quantities of celluloid, it is satisfactory to note that the City of London Celluloid Regulations Bill was thrown out on the second reading on Wednesday last week. The House divided on Mr. Baird's motion for the rejection of the Bill, and the voting was as follows:—For the rejection, 127; against, 47; majority for the rejection, 80. The London County Council then withdrew the celluloid part of its Bill. We believe our readers will agree with us that this is a very satisfactory climax to a piece of unnecessary and grandmotherly legislation. Mr. T. R. Brooke, of the British Xylonite Co., Ltd., and others who took early and energetic measures in connection with this matter are to be congratulated.

**More Strikes.**—We seem to be again in the midst of wars and rumours of wars in the industrial world. In the Midlands a wide-spread strike is in progress, involving the Metropolitan Amalgamated Railway Carriage and Finance Co., the Midland Carriage Works, and some hundreds of men employed by the General Electric Co., Ltd., at Witton. The trouble at Stewarts & Lloyds, Ltd., is still in progress, though a conference between the men and the directors is proceeding. At Bedford there has been a strike of girls employed by Cryselco, Ltd., but all is now normal.

**The Bolton Vacancy.**—In regard to the vacancy created by the resignation of Mr. A. A. Day, borough electrical engineer and tramways manager at Bolton, the Corporation Tramways Committee has appointed a sub-committee to confer with the Electricity Committee as to the best way of filling the office.

**Colliery Fatality.**—Mr. G. C. Lewis, coroner, has held an inquiry at Old Hill respecting the death of Albert Priest, who was killed at the Fly Colliery, Old Hill, the previous Tuesday. The evidence adduced showed that the deceased had been putting a piece of wood behind the electric cable, which it would be necessary for him to move; and George Hickman, a loader, found him hanging by three electric wires, which he had hold of with both hands. The electrician at the mine said the cables were supported by string and protected by rubber; he was of opinion that the cable had been stripped by the weight on the timber. The jury returned a verdict that death was due to electric shock, and expressed the opinion that some better method of protecting the cables should be adopted in the future.

(Continued on page 946.)

## TWO NEW MEMBERS OF PARLIAMENT.

WE count ourselves happily placed in being able to look at Parliamentary elections from a detached point of view. With party politics in the generally accepted sense we, as a journal, have nothing to do, though we have occasionally



Photo by

[Lafayette.

MR. C. G. C. HAMILTON, M.P.

felt it our duty to state our views upon legislative questions. This has not been done with any desire to contribute to party controversies, but with the hope that we might afford assistance in the consideration of questions affecting electrical and engineering industries and the labour and other problems with which all concerned in those industries have been faced. When, therefore, we express satisfaction at the result of certain recent by-elections, it need not be inferred that we are glorying in the success of one party over the other. As we indicate in our leading article to-day, we welcome the return of Mr. J. C. Denison-Pender and Mr. G. C. Hamilton to the Parliamentary councils of the nation, not so much as the Members for Newmarket and Altrincham respectively, as because of their specialised experience in fields of scientific application and industry that the *ELECTRICAL REVIEW* represents. Both of these gentlemen are by training and experience well qualified to overwatch the interests of the engineering profession and industry, which have down to the present had far too few spokesmen at St. Stephens. Both are young men, comparatively speaking, and an interesting coincidence is that both were married in 1906, and each of them has one son and one daughter.

Mr. Collingwood George Clements Hamilton, M.P. for Altrincham, is the youngest son of the late Ven. George Hans Hamilton, Archdeacon of Northumberland and Canon of Durham, by his marriage with Lady Louisa Frances Clements, sister of the fourth Earl of Leitrim. He was born at Eglingham, Northumberland, in 1878, and is accordingly 35 years of age. Educated at Aysgarth School, Yorkshire, and at Charterhouse, he entered upon the career which gives him a claim upon our attention in this

journal, for he served with Messrs. Ernest Scott & Mountain, Ltd., the Newcastle-on-Tyne firm who for so long a period held a front-rank place among engineering concerns engaged in electrical and mining installation work. In these days, when we are all saying so much about the necessity of foreign travel for electrical engineering men, and, indeed, when prominent after-dinner speakers are expatiating upon the importance of more trips abroad by Ministers, it is interesting to note that Mr. Hamilton saw "active service" for the firm with which he was apprenticed, in India, Egypt, Bulgaria, Greece and Russia. He is now joint managing director with Mr. B. M. Drake, of the well-known electrical firm of Drake & Gorham, Ltd., of London, Manchester, &c. He is chairman of the Knutsford Conservative Club, and a member of the Knutsford Urban District Council.

Mr. John Cuthbert Denison Denison-Pender, the new member for Newmarket, is the eldest son of Sir J. Denison-Pender, K.C.M.G., and Lady Denison-Pender. Born in 1882, he is 31 years of age. After his education at Eton, he passed through the numerous branches of the Eastern Telegraph Co., including important cable-laying operations, and he is to-day a director of the Eastern Telegraph Co., Ltd., the Eastern and South African Telegraph Co., Ltd., and the West African Telegraph Co., Ltd.

Mr. Denison-Pender is a grandson of the late Sir John Pender, who was one of the pioneers of submarine telegraphy, and who represented the Wick Burghs as a Liberal in 1883, and retained his seat as a Liberal Unionist in 1886 after the Home Rule split. He is also a nephew of Sir James Pender, Bart., the well-known yachtsman, who captured Mid-Northamptonshire from the Liberals in 1895, defeating the Hon. Robert Spencer. The new member contested South St. Pancras as a Municipal Reformer in the L.C.C. elections of 1910 and 1913, winning the seat on each occasion by majorities of over 1,000.



Photo by

[J. Jarman.

MR. J. C. DENISON-PENDER, M.P.

To both of these gentlemen we wish a long and successful career in the new and larger sphere of life upon which they have now entered.

THE SPERRY GYRO COMPASS.

As our knowledge of electrical science advances, each fundamental step forward constitutes the basis for many useful inventions which can be built upon it. The possibilities of utilising the reaction of rotating bodies have been known to mankind for years, but it is only within comparatively recent time that we have had any means for maintaining a high speed of rotation while at the same time eliminating brushes and moving wires, which might disturb the equilibrium of the wheel. This fundamental step was made by the development of the induction motor, and as a result of this step we now have the gyro compass, or, we may say, the electrical compass, inasmuch as its operation depends entirely upon the application of electricity.

The development of the gyro compass has come at a very opportune time. The use of steel in our modern ships has made the ship a magnetic shell, so that very little magnetism reaches the magnetic compass, and it is consequently weak and vacillating in its tendency to hold the north, and its use involves the constant application of numerous corrections, many of which are very imperfectly known.

On the other hand, the gyro compass depends for its directive force upon an earthly phenomenon which is absolutely changeless and undeviating. This phenomenon is the rotation of the earth. The manner in which this phenomenon might be used to keep the gyro compass in the north and south meridian has been

known for years, but the problem has been so difficult that few have attempted it, and hardly any have been rewarded with anything like success.

A brief description of the theory of the gyro compass will give the reader an understanding of the problem involved in its development, and will enable him to understand how this problem has been solved in the Sperry gyro compass.

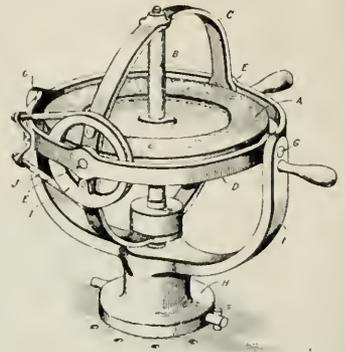


FIG. 3.—MODEL GYROSCOPE.

The inertia of a rotating wheel is relative to space, and by reason of its rotation it offers great resistance to any angular movement impressed upon it. Impressing any angular force on a rotating wheel tending to deflect its plane of rotation results in an angular movement at right angles to the impressed force, termed precession.

For instance, we have in fig. 3 a gyroscope suspended so that it is free to rotate about its vertical axis *BB*, and free to move about the horizontal axes *EE* and *GG*. If we impress a force about the axis *GG* by pushing down on the

near side of the horizontal ring, that force will be resisted, and movement of the gyro will take place about the axis *EE*, the top of the ring *C* moving to the left.

If we had impressed the force about the axis *EE* by pushing to the left on the top of ring *C*, movement about the axis *GG* would have taken place. In other words, the gyroscope tries to place itself so that it is rotating in the plane of the force impressed upon it.

If we had maintained the impressed force on the near end of the axis *EE*, the rotating wheel would eventually have turned to rotate in the plane of the force we had impressed upon it, which in this case would be the vertical plane.

Inasmuch as the inertia of the gyro is relative to space, if the wheel is rotating in a vertical plane with the axis east and west, and if the wheel is suspended with freedom about all axes, the earth in turning will tend to rotate "out from under" it, and the axis of the gyro will apparently incline relatively to the horizontal at the particular spot where it is situated. If we use gravity or some other means to suppress the freedom of the gyro, so that it inclines against an impressed force, precession towards the meridian will be instituted. This precession will continue until the axis of the gyro precesses across the meridian and the earth turns "out from under" it in the opposite sense, thus causing it to precess back. If freedom is further suppressed about the vertical axis, the gyro will not only precess towards the meridian when its axis is inclined, but will also precess towards the horizontal, so that the oscillations will be damped,

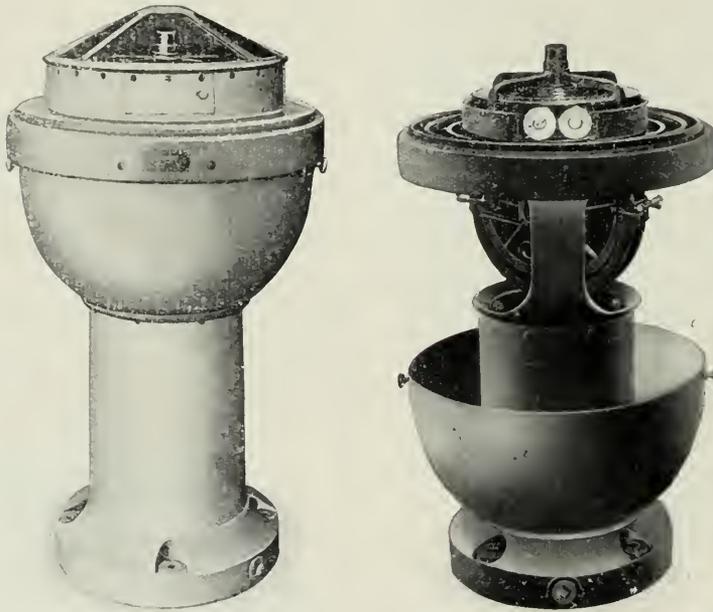


FIG. 1.—SPERRY GYRO COMPASS, WITH AND WITHOUT COVER.

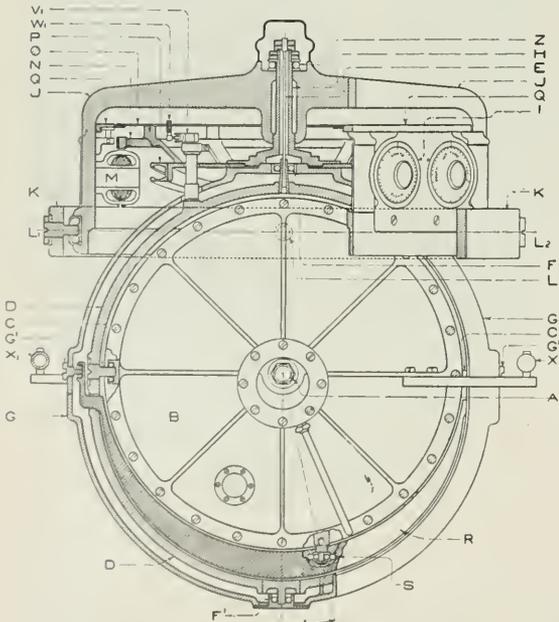


FIG. 2.—PART VERTICAL SECTION OF THE SPERRY GYRO COMPASS.

and the compass will, within a comparatively short time, settle down into the only position of equilibrium it can find, which will be with its axis on the north and south meridian, and with its plane of rotation coincident with that of the earth. This, briefly, is the principle of the gyro compass.

The directive force of the gyro compass depends upon the angular velocity of the earth and upon the speed and weight

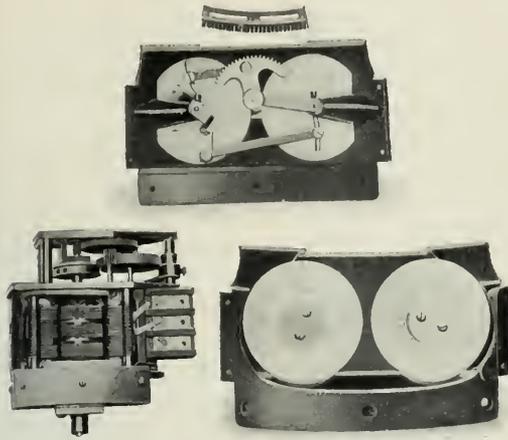


FIG. 4.—CORRECTION DEVICE.

of the wheel. Because the angular velocity of the earth is so very small (one revolution in 24 hours) the directive force of the gyro compass must be very minute, and the problem of the development of the gyro compass becomes extremely difficult. We find, however, that the directive force varies directly as the speed, but as the square of the weight, so from this we see that to get an efficient gyro compass we must use a heavy wheel, inasmuch as a large increase in speed will not give very much of an increase in directive force, and will have mechanical disadvantages which are always inseparable from high speeds of rotation. No matter if a very heavy wheel is used, the directive force will still be very small, so we must find some means of suspending this wheel which will almost entirely eliminate friction about the vertical axis.

A further problem is involved due to the fact that the freedom of the wheel must be suppressed about the horizontal and vertical axes by just the right amount for the purpose in hand. After these things have been accomplished, we find that the gyro compass has a certain natural error depending upon three variables, viz., the speed and course of the ship in which it is mounted and the latitude. If we depend upon tables to correct these errors, we have not made much of an advance from the magnetic compass, inasmuch as the application of corrections from tables is always a confusing process and a serious disadvantage.

The instrument must also be made substantial and durable, as it is quite likely to receive considerable knocking about on board ship.

To summarise, the problems involved in the development of the gyro compass are :—

1. To provide a method of suspension which will permit of the use of a heavy wheel, while at the same time providing perfect freedom for the wheel to move about the vertical axis.
2. To provide a means for suppressing the freedom of the wheel about the horizontal and vertical axes by just the right amount to cause it to settle down on the meridian.
3. The force used for suppressing forces about the horizontal and vertical axes must necessarily be some form of pendulum or device acted upon by gravity, and must be such that the acceleration pressures arising from roll, pitch and change of speed of the ship do not cause deviations of the compass.
4. To correct the natural error of the compass automatically, so that no tables are necessary.
5. To make the instrument substantial and durable.

The manner in which all of these problems are solved will be readily understood by reference to fig. 2, which is an elementary partial vertical section of the compass through

its east and west plane. The wheel is here considered as rotating on the axis *A*, which is perpendicular to the plane of the paper. The axis *A* is carried on bearings in the airtight casing *B*; this casing is further suspended on horizontal pivots in the vertical ring *D*.

The gyro wheel, its casing and the vertical ring *D* are termed the sensitive element in contradistinction to the non-sensitive frame. The ring *D* is suspended by a stranded steel wire *E*, the top of which is carried in the stem *H*. This stem forms a part of the frame surrounding the sensitive element and carrying the compass card. Part of this frame is termed the "phantom" ring (marked *G* in fig. 2).

Fastened to the ring *D* and projecting through, but not touching the ring *G*, is a small post, on which is carried a silver trolley wheel *V*. This trolley wheel rests on contacts *W*, which are carried on the frame surrounding the sensitive element. The silver trolley wheel co-operating with these contacts controls the motor *M*. The shaft of this motor carries a pinion which drives the frame surrounding the sensitive element.

It can be seen that the stranded wire suspension permits the use of a very heavy wheel. As the wheel tends to turn about the vertical axis in its tendency to place and keep itself in the north and south meridian, the silver trolley wheel co-operating with the contacts *W*, operates the motor *M* to cause the stem, frame, and phantom ring to follow the gyroscopic or sensitive element. It can be seen from this that friction about the vertical axis is almost entirely eliminated, inasmuch as the top of the suspension wire is constantly made to move to follow the bottom of it, so that it is virtually a torsionless wire. The gyroscopic or sensitive element need only manifest a tendency to move, all the work of movement being assumed by the motor *M*.

The phantom ring *G* is always held in positive relation to the ring *D*, but is nevertheless quite independent from it, and consequently can be used as a base from which to suppress the freedom of the gyro wheel. The freedom is suppressed by the pendulum *R*, swung in horizontal pivots in the ring *G*, and attached to the gyro casing at the point *S*. When the axis of the gyro is perfectly horizontal the pendulum *R* has no effect, but if the axis of the gyro is off the meridian, the earth will cause it to incline against the weight

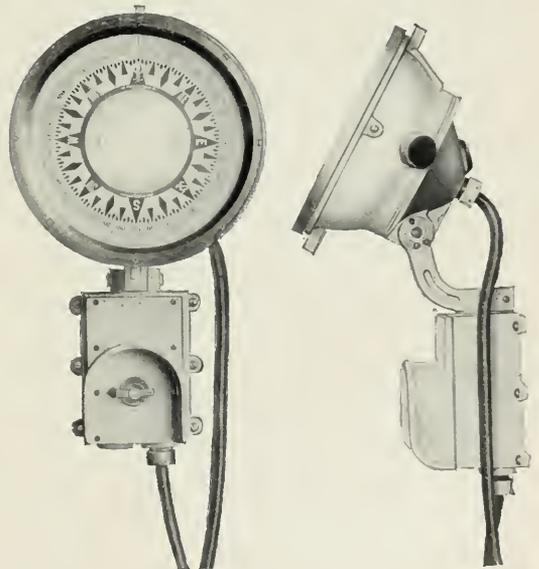


FIG. 5. REPEATER COMPASS.

FIG. 6.

of the restraining pendulum, which will impress a force about the horizontal axis and also about the vertical axis, inasmuch as the point *S* is eccentric to the vertical axis of the gyro. The effect about the horizontal axis institutes precession towards the meridian, while the effect about the vertical axis precesses the axis of the gyro back to the horizontal position, and so damps the oscillation of the gyro to

cause it to settle down in its only position of equilibrium, which is with the axis north and south and horizontally.

To correct automatically the natural errors of the compass, an arrangement of cams is used. These cams are laid out on curves of the logarithmic functions of the variables. The dials of the cams for speed and latitude can be seen in fig. 2. These are set to approximate speed and latitude by hand; the cam for course is under the compass card, and is set by the compass itself. These cams serve to adjust constantly and automatically a system of levers, which are so arranged as to add or subtract their arms and adjust the reference point or lubbers' line of the compass to correct its natural error. Front and back views of this correction device are shown in fig. 4.

It can be seen from fig. 2 that the instrument has few parts, and is consequently very substantial and durable, and not at all likely to get out of order.

Attached to the gyro casing are the levels  $x_1$  and  $x_2$ . If

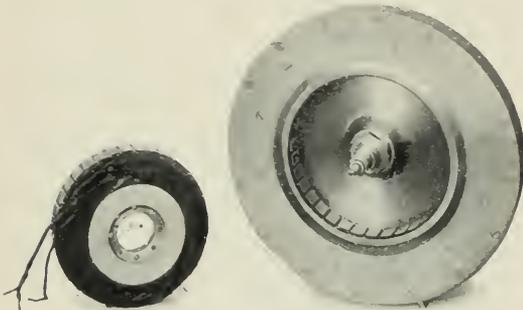


FIG. 7.—GYRO WHEEL AND STATOR.

position in the ship, and is used to operate repeater or auxiliary compasses utilised for steering and navigating the



FIG. 8.

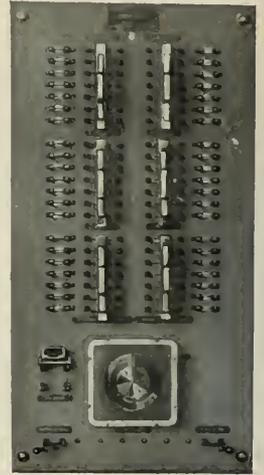


FIG. 9.

MAIN AND SYNCHRONISING SWITCHBOARDS.

the axis of the gyro should for any reason be displaced from the meridian, it must necessarily incline, and this inclination will be shown by the levels. Consequently a glance at the levels will always reassure one as to whether the compass is exactly on the meridian or not. In fact, if one should deliberately try to force it off the meridian, the

ship. These repeater or auxiliary compasses are operated by a rotary step-by-step system, which in principle is similar to that used in electric clocks and other devices for reproducing movement at a distance.

Figs. 5 and 6 are illustrations of one type of repeater compass. The small switch shown is used for varying the

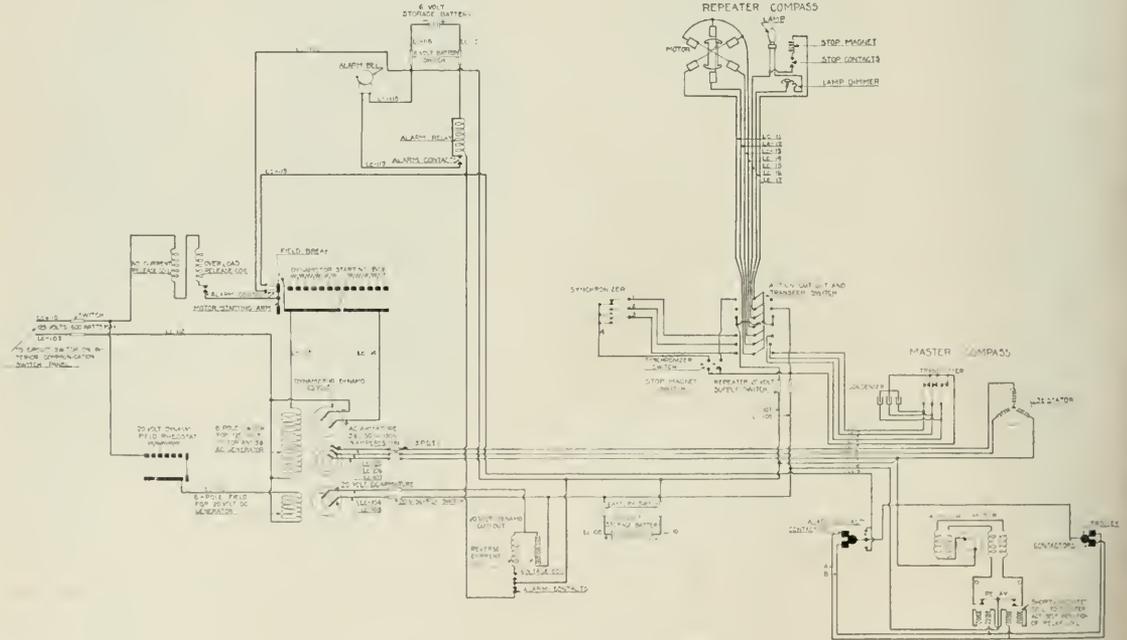


FIG. 10.—DIAGRAM OF CONNECTIONS.

levels would show that it was going off before any deviation took place.

Fig. 1, p. 942, shows the appearance of the master compass with covers removed, and with covers in place.

The master compass is placed in a well protected

amount of illumination on the card, which is obtained by a small lamp placed behind it.

Another type of repeater compass is used for taking bearings. The repeater compass for this purpose is swung in gimbal rings, and is used in conjunction with an alidade,

or azimuth circle, with which the true bearing of any object can be obtained directly.

The development of the gyroscopic compass has involved numerous electrical problems of the greatest interest.

The gyro wheel is spun by an induction motor at a normal speed of about 8,600 R.P.M., although the directive force is quite sufficient when the speed is anywhere about 3,000 R.P.M. The wheel is shown in fig. 7, and, as can be seen from this view, the inside of the wheel is hollowed out, and the internal periphery is inlaid with the short-circuited bars of the induction motor. Attached to the side of the wheel casing, and projecting inside the wheel, is the stator, which is shown to the left in fig. 7.

To reduce the amount of power used, the wheel is spun in a vacuum, and for this reason the major problem in the design of the induction motor was to arrange the windings and laminations, so that the heat arising from the current would be efficiently conducted to the outer fins of the casing and radiated from them. A surprising degree of success has been attained in this, which makes it possible to keep the wheel quite cool, although there is no air wash to facilitate the removal of heat.

The design of the contacts for controlling the azimuth motor was a very interesting problem, as they are constantly making and breaking contact, and must be so designed that this constant make and break will not "pit" them.

After a great many trials of all sorts of contact material it was decided to use tungsten. The efficiency of a contact which is constantly making and breaking depends upon the melting point of the material used. The melting point of tungsten is far above that of any conductor except carbon, and carbon is prohibitive for contacts on account of its high resistance when used for that purpose. As a solid block of tungsten cannot be obtained, it was necessary to use a sheet of tungsten "wetted" to a steel back by means of copper. The tungsten could not be wetted directly to the steel back, as the oxide between tungsten and steel is a non-conductor. The oxides between tungsten and copper and between copper and steel are conductors. Wherever used on the compass the contacts are made quickly detachable, so that they may be conveniently withdrawn and examined.

The silver trolley co-operating with the tungsten contacts controls the azimuth motor  $M_2$  by means of a relay, so that the current broken by the contacts is very small. Still further to reduce the spark at these contacts the relay coils are wound with a secondary winding of exactly the same size as that used for operating the relay. This secondary winding is short-circuited. The current generated in the secondary relay coil upon making and breaking exactly counteracts the induction of the active coil, and so absolutely eliminates any spark discharge at the contacts.

The azimuth motor is wound with two separate sets of field windings, wound in opposite directions. This makes it possible to reverse the motor with one contact. It also makes it possible to reverse the motor almost instantaneously, inasmuch as the current does not have to die down and build up in the same set of fields.

The commutator of the azimuth motor is novel, in that the insulation between the commutator segments is not extended to the surface of the segments. This gives absolute reliability in the azimuth motor, as there is no possibility of the insulation holding the brush off the commutator.

The transmitter for operating the repeater or auxiliary compasses has three pairs of tungsten contacts, operated by steel cams driven by the master compass.

Three-phase alternating current, at a voltage of about 100 and a frequency of about 150 cycles, is required for spinning the gyro wheel. The relay, azimuth motor and repeater compasses are operated by means of 20-volt direct current. The ships on which the compass is used usually have a supply of direct current at a voltage of 125 or 220, and this current is converted into alternating current and 20-volt direct current by means of a so-called dynamotor-dynamo. This dynamotor-dynamo has two sets of fields both energised from the current of the ship. Rotating within one of these fields is an armature, on which are wound the direct-current motor windings, and in the same slots the three-phase alternating-current windings. Rotating within the other set of fields is an armature wound to produce 20-24 volt direct current.

A 10-cell accumulator is floated on the 20-volt line. An automatic cut-out between the 20-volt generator and the battery automatically cuts out the generator if its voltage falls below that of the battery and automatically cuts it in again immediately the voltage rises above that of the battery. This cut-out has two coils wound on the same core, one in series with the current and one in shunt, the design being similar to that of devices used on automobiles.

Fig. 10 is an elementary diagram of the electrical system. The synchroniser connections there shown are for the purpose of adjusting the repeater compasses to synchronise them with the master compass when first starting. When synchronising, the repeater compasses are connected to the synchroniser, which is a hand-operated transmitter, and a circuit to a stop magnet within the repeater is connected. The synchroniser is then turned, so that its card passes through  $360^\circ$ . No matter where the repeaters have been previously, the synchroniser must turn them to the zero point. When they are near the zero point, contacts on the repeater card complete the circuit to the stop magnet, which draws a latch down on the armature shaft of the repeater motor. When the repeater comes to exact zero this latch falls into a slot on the armature shaft, and thus stops and locks the repeaters at zero.

The operator in the central station thus knows that after he has turned the synchroniser through  $360^\circ$  the repeaters must all be at zero. He then turns the synchroniser to zero, and releases the stop magnet. The repeaters must now be at the same reading as the synchroniser, and free to turn with it. As the synchroniser or repeater switchboard is immediately adjacent to the master compass, the operator has only to glance at the card of the master compass to see what the reading of the repeaters should be; he then turns them to the reading of the master compass, and switches them off the synchroniser and on to the compass.

An alarm system is provided which immediately gives notice of failure of the supply of current to the dynamotor-dynamo, or of failure of the 20-volt direct current. Contacts on the master compass also serve to operate this alarm, in case the frame of the master compass fails to follow.

After much study and experiment a very convenient switchboard has been evolved for the supply of current to the gyro compass system. The most convenient feature of this switchboard is the small direct-current voltmeter and voltmeter switch, which are used for finding the voltage of the supply, the voltage of the battery, the voltage at the 20-volt dynamo terminals, and positive or negative leakage in any part of the circuit. The connections to this voltmeter which make it possible to find the leakage at any time are especially valuable, as it will usually be found that the only source of trouble on board ship with electrical apparatus is leakage in the wiring of the ship between the various parts of the apparatus. Leakages are usually due to nothing but neglect, and if convenient means are provided for ascertaining whether or not there is leakage at any time, it is a very simple matter to hunt down and eliminate the trouble.

Fig. 8 is a view of the main switchboard, and fig. 9 shows the switchboard used for cutting out and synchronising the repeater compasses.

Space does not permit of our dwelling on the many advantages which accrue to men-of-war, submarines and merchant ships by the use of an absolutely accurate compass without "lag." Most of these advantages, however, are quite obvious. It may be interesting to add that repeated tests of the Sperry gyro compass under the most severe conditions of roll, pitch and change of speed, have failed to show a deviation of more than  $\frac{1}{2}$  of a degree at any time.

A branch office of the Sperry Gyroscope Co. has been opened at 57, Victoria Street, London, S.W., and in this office will be installed a gyro compass mounted on a testing machine capable of subjecting the compass to heavy roll and pitch and rapid changes of course.

The Sperry gyro compass is now in successful operation on board some 16 battleships of the United States Navy, in addition to eight submarines. Wherever it is used the compass is depended upon for all purposes connected with navigation, to the exclusion of the magnetic compass, which is used as an occasional check; and up to the present time its adoption has proceeded without encountering that manifestation of the laws of inertia known as "conservatism."

## NOTES.

(Concluded from page 940.)

"The Point Fives."—We are informed that Dr. Ferranti will open the discussion at the meeting on June 17th, which will take place at the Delico Restaurant at 7 o'clock (tickets, 3s. 6d.).

At the recent debate on the standardisation of cookers, the following "five points" were unanimously agreed upon:—

"Whilst 'The Point Fives' in no way wish to hamper the development of cooking apparatus by attempting, at this early stage, to standardise details, they desire to place before manufacturers a number of general preliminary principles which, as a result of their use of various types of cooking apparatus, they consider to be of importance:—

"(a) That domestic and other cooking ranges (consisting of oven, grill and hot plates) should have each sub-circuit separately fused, and each protected by a switch. (The oven should have two or more circuits.)

"(b) That switches and fuses be placed in such a position that they cannot become unduly heated, that they cannot be damaged by liquids being spilled over them, and that they are easily accessible.

"(c) That provision should be made for efficiently and thoroughly earthing all apparatus.

"(d) That cooking ranges be fitted with at least one indicating device (separately fused), which will clearly show whether any circuit is turned on.

"(e) That manufacturers and designers should endeavour to develop a hot plate which will work satisfactorily at a red heat."

In the time available it was found impossible to deal fully with this matter, and it was left for future meetings to add to the above-mentioned points. The standardisation of electric tariffs was also deferred to a future meeting.

**Electric Vehicle Progress in England.**—Supporters of the movement to introduce the electric battery vehicle into this country on a practical scale will welcome the news that an unofficial reliability run is to be made next week from Dumfries to London, by an Arrol Johnson-Edison coupé, a product of the Arrol Johnson Co., which, as previously mentioned, has taken up the manufacture of electrical vehicles, and judging by external appearance, has succeeded in producing a handsome equipage.

The body, of aluminium, is mounted on an underslung chassis with Lanchester type springing. The electric motor is in the centre with an "under" worm drive, which is somewhat of a novelty for this type of car, and an Edison battery is placed half under the bonnet and half under the rear seat.

The vehicle is a three-seater with wheel steering, the wheel being inside, as in the majority of American electric cars.

The Dumfries-London run is, of course, partly intended for demonstration purposes, and the various halts are more numerous than would otherwise be the case. These include (Monday) Carlisle, Penrith, Kendal, Lancaster, Preston and Manchester, where the night will be spent. From Manchester (Tuesday) the run will be *via* Burslem, Stafford, Walsall, Birmingham, Rugby, Northampton, Bedford, Luton and Barnet, at each of which a short stop will be made, the arrival in London being timed for about 11 p.m.

The organisation of the trip is due to Mr. W. H. L. Watson, of the Edison Battery Co., who has invoked the aid of the numerous central station engineers in the towns visited. We understand from Mr. Watson that in connection with the paper on electric vehicles to be read at the Kingston meeting of the I.M.E.A. on June 19th next, 16 different electric cars, of both the pleasure and commercial types, by various makers, will be on view for demonstration purposes, thus affording an excellent opportunity for close acquaintance with the modern battery car, the successful introduction of which depends so largely on the charging facilities which the municipal authorities must now be prepared to give.

It is a sign of the times that H.M. Post Office has now obtained a trial electric mail truck, built by the Silvertown Co., for postal deliveries; we understand that a wholesale adoption of these trucks, in place of horse vans, in one centre, is being considered, the Postal authorities possessing exceptional facilities for battery charging from their own plants. In London, Messrs. Liberty's have obtained the first of 30 Edison battery cars for town delivery work; Messrs. Harrods have received four 1-ton Edison battery vans, and are proposing to introduce 60 for London deliveries, while we gather from Mr. Watson that his firm has inquiries for as many more. It is interesting to notice that the Glasgow Corporation is proposing to obtain 25 battery-driven scavenging vehicles, and the Marylebone Council is considering the adoption of 18 similar vehicles.

The Ilford authorities have an Edison battery bus under consideration, and a tower wagon for tramway repair work, equipped with an Edison battery, has been adopted by one system.

From the foregoing it will be gathered that station engineers must now seriously consider the matter of providing adequate charging facilities. The standardisation of the charging voltage is also a matter of the first importance.

**The I.E.E. Conversazione.**—Invitations have been issued by Mr. W. Duddell, F.R.S., President, and Mr. John Smithers, and the Council of the Institution of Electrical Engineers to the conversazione to be held at the Natural History Museum, Cromwell Road, S.W., on Thursday evening, June 26th, from 9 to 11.30 p.m.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—The town electrical engineer and tramways manager of East London, South Africa, Mr. J. MORDY LAMBE, expects to arrive in this country in June. In view of the considerable extensions in the electricity supply and tramways undertakings of East London now in contemplation, Mr. Lambe is particularly interested in central station plant and machinery and motor-buses, and will attend the Imperial Motor Transport Conference to be held in England in July. His address will be:—Care of Wm. Dunn & Co., Broad Street Avenue, London, E.C.

Owing to the operation of the Glasgow Boundaries Act, 1912, MR. T. C. PARSONS and MR. W. SILLERY have retired from the management of the Govan and Partick electricity undertakings respectively.

At the Watford Council Offices recently, the staff presented to MR. F. W. PURSE, the electrical engineer, who has been appointed to a similar post at Carlisle, a silver coffee-pot and four silver vases. The presentation was made by Mr. W. F. Goodrich, chairman of the Council.

Accrington Electricity Committee has engaged MR. HARVEY WHITTLE as a special canvasser for the department.

Having concluded 12 years' service at Weybridge with the Urban Electric Supply Co. as assistant engineer, MR. SELBY HOWARD, has been presented with a silver cigarette case and a cheque by the employés. Captain H. W. Watts, resident engineer, made the presentation on Thursday last week, at the Lincoln Hotel.

MR. ARNOLD GILL has been appointed second assistant electrical engineer at the electricity works of the Hebdon Bridge District Council.

We understand that our notice of last week with reference to Basingstoke electric lighting was not quite correct. Mr. John B. Morgan, electrical engineer to Horsham U.D.C., only asked the permission of his Council to render assistance to Mr. F. R. Phipps, the Basingstoke surveyor, in connection with the preliminary preparations for the electric lighting scheme which has been placed in his hands. The work of supervising and laying down the plant will be undertaken by the Basingstoke officials.

The salary of MR. J. SHEPPARD, mains engineer of the Southampton undertaking, has been advanced from £104 to £130 per annum.

MR. A. G. LOV has resigned his position with the Carlisle Corporation to take up the post of shift engineer at the Stockton-on-Tees Corporation Electricity Works.

**Tramway Officials.**—The Tramways Committee of the Derby T.C. has increased the salary of MR. P. W. BANCROFT, chief clerk, from £130 to £156 per annum.

The Blackpool Tramways Committee has increased the salary of MR. F. S. FIELD, tramway engineer, from £3 10s. to £4 per week.

At the West Ham Tramways Committee meeting on Tuesday last, the resignation of MR. H. E. BLAIN from the position of manager was received and considered. Mr. Blain is about to take up an appointment elsewhere in this country. The Committee decided to recommend the Council to accept the resignation with regret, and many good things were said regarding the splendid service rendered to the borough by Mr. Blain. It is proposed that the Council present him with an illuminated testimonial under seal, and that a successor be advertised for at a salary of £550 per annum, advancing by £50 per annum up to £700.

**General.**—MR. LAWFORD GRANT has resigned his position as president and managing director of the Canadian British Insulated Co., Ltd., Montreal, to take over the management of the Eugene F. Phillips Electrical Works, Ltd., Montreal, one of the largest wire and cable factories in the Dominion of Canada. Mr. Grant, who is the honorary secretary-treasurer for Canada of the Institution of Electrical Engineers, has built up a large business for the Canadian British Insulated Co. He went from England to Canada about six years ago as manager of the company in the Dominion, and later assumed the position of president and managing director of the Canadian Co., which, we understand, now numbers amongst its customers all the most important power supply companies and cities in Canada.

MR. FRANCIS W. T. BRAIN, Gloucestershire's new knight, has been closely identified all his life with the mining industry of the Forest of Dean. We are informed that he was a pioneer in the application of electricity to mining. Our correspondent writes:—"It was at the Trafalgar Collieries, with which he is still associated as managing director, that electricity was first applied underground. This was in January, 1883. He contributed papers explanatory of the work done, to the South Wales Institute of Mining Engineers, and also to the Bath Meeting of the British Association in 1886. Mr. Brain is recognised as an expert in electric blasting. Electric fuses, now so generally used in collieries, were first perfected and supplied by him more than 25 years ago, and the Cinderford or Brain's fuse, manufactured under his patents, is still well known and largely used. He was President of the Mining Association of Great Britain in 1911-12."

On the occasion of the visit of Mr. JOHN BURNS to Beckenham last Saturday to open Kelsey Park to the public, he was welcomed by Mr. George Sutton, J.P., in his capacity as chairman of the District Council. A commemorative oak tree was planted by Mrs. Sutton.

MR. W. J. LING has resigned his position in the electrical department of Messrs. A. Emanuel & Sons, Manchester, and has joined Mr. A. Borghys (trading as Royer & Borghys, 59 and 61, New Oxford Street, London, W.C.) as a partner. The name of the firm will be unaltered.

ALD. H. W. PEAL, J.P., chairman of the Borough of Ealing Electricity Committee, is lying ill at Switzerland with rheumatic fever. Though reported to be making satisfactory progress, it will be a considerable time before he is able to return home.

The *Australian Mining Standard* states that Mr. W. M. ARNOT has resigned his position as general manager of Messrs. Siemens Bros., and intends visiting London on private business at an early date.

**Obituary.**—Our readers will regret to hear that CAPT. W. R. LUGAR, who had been in bad health for six months, passed away at his residence, 5, South Street, Halifax, N.S., at 4.30 a.m. on May 21st, in his fifty-ninth year. The Nova Scotia papers pay tribute to his memory and to the esteem in which he was held by all, and his English friends will be in accord with the expressions of the *Halifax Recorder*, which says: "Captain Lugar was highly esteemed for his many sterling qualities. Conscientious in all his dealings, he has passed away to the deep regret of those with whom he was brought in contact." We extend to Mrs. Lugar and the sons and daughters our deep sympathy in their bereavement.

We regret to read of the death, which occurred on May 30th, at Catford, of MR. FREDERICK HENRY ALMROTH STEVENS, who was for 48 years with the Telegraph Construction and Maintenance Co., in his sixty-third year. The funeral took place on Tuesday last at Hither Green Cemetery.

**Will.**—MR. E. M. UNDERDOWN, K.C., chairman of the Direct U.S. Cables Co., Ltd., who died in April, left £108,556 gross and net personalty £14,057.

## CITY NOTES.

### Crompton & Co., Ltd.

AN extraordinary general meeting of this company was held on Wednesday at Salisbury House, E.C., to consider a scheme for reconstruction, and to pass resolutions adopting same and winding up voluntarily (with Mr. E. Reeves as liquidator) for the purpose of registering a new company, to be named Crompton & Co., Ltd. A second extraordinary general meeting is to follow on June 19th for confirmatory purposes. The letter issued to the shareholders contains the following statement explaining the reasons of the board for bringing forward the scheme at the present time:—

"For some time past the directors have had under their careful consideration the question of the reorganisation of the company's capital, and the provision of further working capital which is urgently required to enable the business to be carried on at a profit to the shareholders. The demand for electrical machinery and appliances is increasing and prices are rising; consequently the present appears to be a favourable opportunity for placing the company in a position to take advantage of the improved trade conditions. During the ten years ending March 31st, 1909, the profits earned by the company, after providing and paying all outgoings, including depreciation, interest on debentures and loans, &c., amounted to £143,324, or an average of £14,332 per annum. In the years ending March 31st, 1910 and 1911, and in the first half of the following year, there was a scarcity of orders, and losses were incurred, due partly to inability to keep the works profitably employed and partly to losses on a contract abroad. Since 1911 the position has much improved. The volume of orders has increased, considerable reductions have been made in the standing establishment charges, and, with adequate working capital, it is fully anticipated that satisfactory profits will be earned. With a view to the adjustment of the capital account, and to the introducing into the business of the necessary working capital, the directors, after consultation with the principal shareholders, have decided to recommend the scheme of reconstruction, which is fully described in the memorandum enclosed herewith, and which can be carried through with but little, if any, interference of the company's business. The directors are of opinion that with this fresh capital the prospects of the new company will be distinctly favourable. The amount required to pay 7 per cent. dividend on the proposed preference shares is £9,520, and arrangements have been made to underwrite the issue."

The scheme of reconstruction submitted by the directors includes voluntary liquidation with a view to the transfer of its undertaking to a new company in consideration of (a) The discharge by the company of the debentures of the present company and the performance and fulfilment of the pending engagements of the present company, and the costs and expenses of and incidental to the liquidation of the present company. (b) The allotment and issue to members of the present company of fully-paid ordinary shares provided for below. (c) The rights of the shareholders of the present company to apply for and have allotted to them,

and/or their nominees, partly-paid shares in the new company on the terms stated below.

The new company will be incorporated with a capital of £221,000, divided into 221,000 shares of £1 each, of which 136,000 shall be 7 per cent. non-cumulative participating preference shares of £1 each, and 85,000 ordinary shares of £1 each for the purpose, *inter alia*, of carrying on the business of the present company. The preference shares will be preferential both as to dividends and capital, and will also be entitled, after payment of a non-cumulative dividend on the ordinary shares of the company for the time being at the rate of 7 per cent. per annum, to participate in the profits available for further dividends, *pari passu*, with such ordinary shares, and after repayment of the capital in a winding-up to participate in the surplus assets, *pari passu* with such ordinary shares in both cases in proportion to the amounts paid or credited as paid on the preference and ordinary shares respectively. The 85,000 ordinary shares will be allotted, credited as fully-paid up, to the registered holders of the ordinary shares in the present company, and/or their nominees, in the proportion of one ordinary share for every one existing share held by them; the preference shares credited with 12s. 6d. per share paid-up, to be offered to the registered holders of shares in the present company, and/or their nominees, in the proportion of eight of such preference shares for each five shares held by such shareholder in the present company. Failing acceptance of any of the preference shares by the shareholders of the company, and/or their nominees, within the period specified below, such shares shall be issued to the nominees of the liquidator of the present company, credited with 12s. 6d. per share paid thereon.

The new company shall be at liberty to issue first debentures for £100,000, carrying interest at the rate of 5 per cent. per annum, for the purpose of being exchanged for the debentures of the present company, such new debentures to constitute a first specific charge on the freehold and leasehold property, patents and patent rights of the present company, and a first floating charge on the remainder of the property, present and future, of the new company, including its uncalled capital, and to be secured by a trust deed in a form to be approved by the trustees of the trust deed securing the debentures of the present company.

The period during which the holder of shares in the present company shall be entitled to claim as of right by himself and, or his nominees, an allotment of preference and ordinary shares in the new company, is to be stated in the notice, or notices, inviting applications for such shares, but shall not be less than seven days from the posting of such notices.

The unpaid liability of 7s. 6d. per share on the preference shares of the new company shall be payable as to 1s. per share on application, 1s. 6d. on allotment, and the balance by calls not exceeding 2s. 6d. per share at intervals of not less than three months.

The new company shall be at liberty to procure the underwriting of the whole of the preference shares at a commission of 5 per cent. and an over-riding commission of 1 per cent. on the sum of £51,000 which will be provided by the issue of those shares, and also to pay the expenses of and incidental to the formation of the new company, and of the transfer to it of the property and assets of the old company.

We understand that at the meeting on Wednesday the resolutions were carried without opposition.

### British Thomson-Houston Co., Ltd.

THE eighteenth ordinary general meeting was held on Wednesday, May 28th, at the offices, 83, Cannon Street, E.C., Mr. J. F. Nauheim presiding.

THE CHAIRMAN, in moving the adoption of the report (see ELEC. REV.) said the past year had been a very satisfactory one from the point of view of orders received. Both in the home and export trade they had had record figures, but, on the other hand, their deliveries had not been satisfactory owing to the great difficulties which they experienced in obtaining raw material owing to the coal strike. Those difficulties continued up to the end of the year and seriously affected their output, and it was largely owing to this that the profit for 1912 was only as large as that shown for 1911. They had, however, also to take into consideration that they had had to pay higher wages, the cost of the new Insurance Act and the increased amount for interest on the advances to pay for the various extensions mentioned in the report. Generally speaking, they had made good progress, and the volume of business secured in 1912, which would come into account in 1913, entitled them to look forward to a very favourable result for the present year, all the more so that the orders secured since the beginning of this year showed an important increase over those secured in the same period of 1912. The workshops were fully occupied, and the additional facilities which they had provided justified entirely the large outlay of capital already expended and to be incurred.

MR. G. FRANKLIN seconded the motion, and the report was adopted.

### Birmingham District Power and Traction Co., Ltd.

THE meeting of this Company was held on May 28th, at Electrical Federation Offices, Kingsway, W.C., Mr. C. S. B. HILTON presiding.

THE CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 907), said that at the meeting last year he stated that the business had shown expansion in both branches, and he was happy to be able now to inform them that those hopes had not been disappointed, and that the expansion had been continuous throughout the past year and showed no sign of

abatement. The total result of the year's operations showed a surplus of £55,449 15s. 6d. This compared with £52,341 16s. 0d. in the preceding year. Those results were really better than they appeared. In 1911 they had an exceptionally fine summer, which had a beneficial effect on the general traffic of the tramways, while last year's receipts were prejudicially affected by the exceptionally bad weather, in spite of which, however, the traffic receipts showed an increase of £2,400, and the receipts from parcels an increase of £700, while the expenses of the tramways department showed an increase of only £400, and the receipts of the tramways of the subsidiary companies showed improvements in all cases. Turning to the electricity supply, the Company's steady progress was well maintained. The receipts showed an increase of £3,000, while the expenses had increased by about £2,300. The increase of profit was, though small, satisfactory, as it represented current sold to new consumers, who had more than replaced one very large consumer who was supplied at a very low rate. Repairs and maintenance showed a slight increase, and there was a small increase in administration and general expenses. The renewals account had again been credited with £5,000; £3,000 had been added to the reserve fund, against £3,570 in 1911, while the sinking fund, under the operation of the trust deed, received £460 more. The dividends and interest received on investments from the associated companies amounted to £30,180, compared with £29,861 in the previous year, and this in spite of the fact that the Electrical and Industrial Investment Company paid no dividend on its ordinary shares, in which that company had so large a holding. The renewals account now stood at the substantial sum of £12,000, and the reserve account at about £12,500, while the debenture sinking fund stood at £27,919, making altogether over £52,000 passed to various reserve accounts from profits. In addition to these sums the subsidiary companies had separate reserve and renewals funds, the total amount of which was £68,744. Turning to the capital account, until the Smethwick Electric Lighting undertaking had been transferred to the Shropshire Power Company, expenditure on mains and additional plant must be provided by this company, and such expenditure as had already taken place would, it was hoped, be adjusted during the present year, when the undertaking of Smethwick was transferred to the Shropshire Company under the Board of Trade Transfer Order now awaiting confirmation by Parliament. It would then be possible to reduce the loan from the Shropshire Company, standing at £212,091 in the balance sheet, by at least £166,347, the amount expended up to December 31st last on the Smethwick undertaking, and the balance of the loan would be still further reduced if negotiations now in progress for the acquisition of a transfer to the Shropshire Power Company of the electricity supply undertaking in Dudley were duly completed. An amount of £4,843 had been expended at December 31st on the purchase of motor omnibuses out of a total liability of £21,698, of which at present about £6,000 was undischarged. It was considered preferable that the Company itself should purchase omnibuses and lease them to the motor omnibus company rather than that the Company should further increase its holding in debentures of the motor omnibus company. This method had the advantage of enabling the omnibuses to be operated by the company in districts away from Birmingham, should it ever be necessary, as that company was not restricted in its operations to Birmingham only. It was hoped that by the end of the present month 49 omnibuses would be in operation. To summarise, the combined working balances from the two sections of the undertaking amounted to £35,128, an improvement of £3,400. Sundry receipts were about £650 less, interest and dividends from investments £319 more, with the result that after making all the provisions he had referred to, they were able to recommend a dividend of 3½ per cent., against 3 per cent. for 1911, and to carry forward a rather larger sum. While all these results were satisfactory and encouraging, it was important to remember that the operating costs showed a tendency to increase. The increased cost of coal, due to last year's strike, they must accept as permanent, while the prices of all stores and materials had risen, and, in addition the company had been faced with the necessity of improving the rate of pay of the employees all round. Early in April considerable agitation arose amongst the men employed by the Company and the other companies operating the Black Country tramways, for increased pay and improved conditions, and the main argument put forward was the increased cost of living. The men asked to be put on the same scale of pay, etc., as the men employed by the Birmingham Corporation, but it would be realised that what was possible to a municipal system running in a city like Birmingham was not possible for a company serving a poorer and more widely scattered population. The cost of meeting the men's demands on all the Black Country tramway companies would have meant some £7,500 a year, which was about two-thirds of their gross increase in traffic receipts for the past year before providing for expenses. On May 16th they gave the men an all-round improvement in their pay and other conditions. The men recognised that the board had done all that could reasonably be expected of them, and he was hopeful that things would now resume their normal aspect. The CHAIRMAN proceeded to deal with the exchange of the Company's holding in the old City of Birmingham Co., Ltd., for stocks and shares in the Electrical and Industrial Investment Company, which was sanctioned last year, and said there was every reason to expect that for the present year a substantial dividend would be paid by the Investment Company on its ordinary capital, and a larger return might be anticipated on the investment than was received on the old investment previous to 1911. As to their investment in the Birmingham and Midland Motor

Omnibus Company, although that company had not quite recovered from the losses made in previous years, it had made substantial progress, and the outlook was encouraging.

Mr. S. R. BLUNSTONE seconded the motion, which was carried unanimously.

### Kalgoorlie Electric Power and Lighting Corporation, Ltd.

THE seventh ordinary general meeting was held on May 28th, at Winchester House, E.C., Mr. R. W. WALLACE, K.C., presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELEC. REV., page 855), said that last year he told them they were unable to pay any dividend on the ordinary shares, because of the cyclone which had taken place, and which destroyed their cooling towers and a large number of their transmission lines. He estimated that the cost of repairing the damage would be about £3,000, but fortunately it only cost them £2,300. The inconvenience of an accident of this kind, over which, of course, the management had no control, did not only extend to the replacing of the damaged plant, but it also affected the working during the year. The brunt of that loss had fallen upon the present accounts, and they estimated that it amounted to between £2,500 and £3,000. He was glad to say that all their difficulties had been overcome; they had no trouble with their consumers, and except for the delay of a few hours they kept their tramways running. Another matter which had depreciated the profits last year was the change in the working of the water supply company from Perth, which consisted in adding chemicals, probably lime, to their water, in order to get rid of the acidity in the water in the mains running from Perth to Kalgoorlie. When those alterations were made the Company took the very best expert advice that could be obtained, for the effect of using that water with the chemicals in it was that coating took place in certain of the tubes in their boilers which necessitated the use of more fuel, thus adding to the expense of working. He was glad to say that the difficulty had been effectively overcome now. With regard to the business, the power sales were very much larger than usual, but the cost of manufacturing had gone up. Last year he told them they were putting down a new unit of plant. That had now arrived, but they had not yet had the benefits of its working. It was satisfactory to be able to say that the new plant had been entirely paid for out of the internal resources of the Company, and they expected that there would be increased profits in the future as a result of further economy in working. In conclusion, the CHAIRMAN said he wished they had been able to declare a dividend on the ordinary shares, but they were not justified in doing so at the present moment, and it was only by the working of the new plant that they could anticipate that their profits would increase to enable them to pay a dividend in the future.

Mr. EDWARD POPE seconded the motion.

The CHAIRMAN, replying to Mr. Crose, said that as the Company was not paying, it was only natural that the shareholders might think that the directors were too highly paid, but he could assure them that the work of the board was no sinecure, and that they were by no means excessively paid. Speaking on the spur of the moment, he should say that the effect of the new plant ought to mean an increased profit of between £6,000 and £7,000, and if that was so, it would enable them to pay a dividend on the ordinary shares.

The report was adopted.

### Urban Electric Supply Co., Ltd.

THE annual meeting was held on Wednesday, last week, at Salisbury House, E.C., Mr. P. D. TUCKER presiding.

In moving the adoption of the report (see ELEC. REV., page 862), the CHAIRMAN said that the first and most important item in the accounts was that of profits earned at the various works, and this, he was glad to say, showed a 13 per cent. increase of £6,586, in spite of the coal strike last Spring, which, apart from the indirect loss it entailed, had directly resulted in an extra coal bill of £4,427, compared to what it would have been at the old prices. This represented an increase of 24 per cent. in the price of coal, and he need not tell them that it had proved a heavy burden. It was all the more fortunate, therefore, that trade had been good and that they were blessed with a summer which, in spite of its compensations, he imagined few of them wished to see repeated. But for these favourable influences he was afraid the results for the past year might have proved disappointing, whereas he thought they would agree that the actual results realised were not unsatisfactory. The balance of £54,265 carried down to net profit and loss account compared with £47,649 a year ago. Interest charges were up some £3,560 in consequence of the comparatively heavy capital expenditure of the last two years, and the provision for the redemption of debenture stock was increased by £411, leaving a net disposable balance of £18,083. This they proposed to apply by appropriating £10,000 to reserve for depreciation, and £7,500 to the payment of a 3 per cent. dividend on the preference shares, carrying forward £986. Capital expenditure had increased by £54,079, as against £68,006 the previous year, the issued debenture stock, less amount redeemed, being increased from £320,818 to £367,534. The principal change, however, arose out of last year's reduction of capital. The ordinary share capital now stood at £240,000, instead of at £400,000 as

formerly, the difference of £160,000 being represented by the new capital reserve fund, against which had been written off the expenses incurred in connection with the reduction of capital and the cost of plant dismantled, hitherto appearing as a suspense account item on the assets side. The existence of a fund formed in this way, and representing their estimate of the depreciation or permanent loss of capital value existing at the date of the capital reduction, was, of course, unusual, but they felt that in the case of a company whose undertakings were subject to purchase, it was desirable to deal with the matter in this way, writing off losses from time to time as they were actually ascertained, rather than to reduce their assets by the full amount at one stroke. The existence of this fund in no way relieved them of the obligation to provide for current and future depreciation. It was essentially a fund to provide for a potential loss which already existed, but of which only a small part had yet been realised. This year, as he told them last year would be the case, they would, in the ordinary course, have also written off against this fund the two items of preliminary expenses and discounts and stamp duty on debenture stock issued, but the recent telephone arbitration had suggested that it might be unwise entirely to eliminate such items, and consequently, as he was unable to give the matter the careful consideration it deserved, owing to his having been called away to the United States in April, they decided to let these items stand this year with a view to their being dealt with next year, as might then seem best. To the debenture redemption reserve they had this year added £5,257 from profit and loss, plus £618, the discount on the debenture stock redeemed, and they now recommended the appropriation of a further £10,000 to the depreciation reserve, making the joint total £42,995, a figure which he thought they would agree represented a substantial beginning, considering the short time those reserves had been forming; and, in addition, some £1,800 had been set aside during the year for battery maintenance, wiring stocks had been written down by £434, and some other small reserves made in the branch accounts. Without in any way unnecessarily overdoing it, they had every intention of safeguarding the future by the provision of adequate reserves, and, as their prosperity increased, he hoped it might be possible for them to increase still further the amount of the annual provision now made, for, in spite of the fact that it was not always recognised, he maintained most emphatically that the strengthening of the Company's financial position by the provision of adequate reserves was in the real permanent interests of the ordinary shareholders no less than in that of the debenture holders and preference shareholders. Proceeding to refer to the table of lamp connections, the CHAIRMAN said they would be glad to see that they had increased their connections by the equivalent of 87,758 33-watt lamps, an increase of nearly 15 per cent., compared with increases of 9 per cent., 10 per cent., and 12 per cent. in the three previous years. This steady progress constituted a most satisfactory feature, showing as it did the healthy growth and active potentialities of the business. It was true that a large part of the increase, as in the previous year, was attributable to Cornwall, and 72 per cent. of it represented power, but it was all good business, and was not to be despised because it might represent a somewhat smaller proportionate profit than an equal amount of lighting connections. As compared with the previous year, the lighting connections showed an increase of 7 per cent., and power an increase of 26 per cent. The output for the past year increased by 5,494,331 units, from 11,196,157 to 16,690,488, a 49 per cent. increase, for which, as in the case of the lamp connections, Cornwall was principally responsible, the power and heating units representing an increase of 66 per cent., as against a 7 per cent. increase in the lighting units. For the first quarter of the current year, they had connected the equivalent of 14,585 33-watt lamps against 21,804 for the corresponding-period last year, when they had an exceptionally large connection in Cornwall. Consequently, of this year's total the lighting connections represented 47 per cent., as against only 16 per cent. a year ago. During the same period the output had increased 47 per cent., the lighting units showing a 5 per cent. increase and the power units a 64 per cent. increase, and these increases were accompanied by a satisfactory growth of profit, so that in spite of the continued high price of coal, he thought they might consider that the outlook was favourable. Referring to the results realised by the individual undertakings, they would see that Newton Abbot continued to show a steady growth of profit, as did also Grantham and Newbury, those three towns being the ones least affected by the increase in the cost of coal, Newbury being a water-power station. Caterham had also done well, and it might be a source of satisfaction to them to notice that the return on the capital invested there was now over 5 per cent., whereas it was little more than 1 per cent. when he joined the board five years ago. The poor results shown by Hawick were principally due to the rise in the price of coal, which, in the case of an undertaking like Hawick with a large power load, was a far more serious matter than in the case of a purely lighting station. Both Weybridge and Twickenham had been adversely affected by dearer coal, and apparently the influence of the metal lamp was still felt in a greater degree there than elsewhere, since in neither case had there been any substantial diminution in the growth of lamp connections, and yet the revenue had not shown a corresponding expansion. Dartmouth had suffered from dearer coal, and also from the adoption of metal lamps by the Naval College, which constituted a large proportion of the load. For the bulk of their increased profit they were indebted to Cornwall, as was only natural in view of the large amount of capital spent there during the last two years; and this profit should again show a large increase for the

current year, for he was glad to say the business was developing in the most satisfactory manner, and gave every promise of fully justifying their policy in embarking on it. The only drawback was that it was developing so rapidly and satisfactorily that, to cope with it, they were reluctantly obliged to incur fresh capital expenditure before they had reaped the full benefit from their original expenditure, but it was a purely passing phase, and however inconvenient it might prove to those who were responsible for the raising of the money in these unpropitious times, it was not a matter which need occasion them any anxiety, for they could not well have a better or more direct indication of the prosperity awaiting them. The other towns, Stamford, Godalming, Glossop, and Berwick had all suffered from the effects of dearer coal, and this principally accounted for the poor results shown by them. With reference to the position generally, he did not know that he could usefully add anything to what he had said on previous occasions. From the particulars he had already given them they would have gathered that the business was making steady progress, and everything pointed to its continuing to do so. Without entering into further details, he would content himself by saying that the increased earnings for the current year should more than suffice to pay the increased cash dividend on the preference shares.

MR. FRANCIS E. GRIPPER seconded the motion, and the report was adopted without discussion.

Replying to a vote of thanks, the CHAIRMAN said he hoped the shareholders would stick to their holdings and not throw them away at the present low prices, for he was certain that by holding on they would find the position for all classes improve.

### Delhi Electric Tramways and Lighting Co., Ltd.

MR. A. W. TAIT presided on May 29th over the seventh ordinary general meeting of this Company, held at Basildon House, E.C.

In moving the adoption of the report, the CHAIRMAN said that the results for the year 1912 were unsatisfactory, but there had been several contributory causes. The chief causes were the low receipts and high traffic expenses of the tramway system, the abnormal amount of repairs executed owing to the poor condition of the cars and their equipments and the amount of overhauling which had been necessary to the plant in the Power Station. The year's operations had also been affected by the considerable rise in the cost of coal, which might be emphasised by the fact that fuel expenses for the twelve months under review were nearly as high as the figure for the fourteen months ended December, 1911. The increase in the cost of coal was approximately 20 per cent., and he did not see any prospect of this being reduced in the near future. It was, therefore, all the more necessary for the Company to consider the generation of the whole of the power required by Diesel oil engines, which were much more economical in operation. Owing, however, to the fact that the existing oil engine had to undergo extensive overhaul during the year, the generating costs were adversely affected, and the service of the tramway system was, therefore, on various occasions, interrupted. These interruptions naturally prevented the tramway system from being worked in an economical manner, and this part of the Company's business had shown a loss for the year. They had, however, during the year, done a great deal to improve the condition of the plant and equipment on the tramway system. The Company had also had to contend with the increase in labour rates of all classes, and this rise might be regarded as permanent. Another difficulty had been the low receipts per car mile. A tramway expert who had considerable knowledge of Eastern conditions, and who, at one time, was face to face with the same difficulty and had successfully overcome it, had made an exhaustive report, suggesting drastic changes in fares and traffic conditions, and, after consideration, the Board decided to adopt his recommendations. These had only been in full operation for the last two or three weeks. For sixteen weeks from 1st February, the traffic receipts showed an increase of approximately Rs. 15,000, which was equal to about 55 per cent. For the period since 31st December to date, 1,839,000 passengers were carried, as against 708,000 for the corresponding period of last year. This would seem to prove that the tramway system was now catching on with the native population, and they might, therefore, look for a continuation of the increase in receipts. In order to deal efficiently with the traffic under the new conditions, a European traffic superintendent had been appointed. The exceptional expenditure for maintenance would no doubt go on for some time yet, until the system was put into thorough working order. The generating costs for the year were high—due to the increased cost of coal, also to the amount of expense incurred in overhauling and maintenance. It had also been necessary entirely to renew the battery equipment, and they had purchased a condenser, which was now placed in position. It was the hope of the directors that the position of the Company would warrant, in the near future, the installation of further Diesel plant, not only to meet the increased demands which were coming on the system, but also to supersede the existing steam sets, leaving them only as a stand-by in case of breakdown. From recent information received from the Manager, it would seem to be necessary, owing to the growth of the load on the station, to instal further plant at a comparatively early date. The Board had this matter under consideration, and were obtaining competitive tenders for the plant required. With regard to the electric supply undertaking, the gross receipts for the year amounted to £9,136, as compared with £10,360 for the corresponding twelve months of the previous year, which included the special Durbar receipts.

For the four months to 30th April, 1913, as compared with the corresponding four months of the previous year, there was an increase in receipts of over £1,800, equal to over 65 per cent. In addition to the growth of the ordinary lighting demand, the demand for power for small motors continued to grow satisfactorily, and, in order to encourage this still further, the Directors had recently agreed to a reduction in the scheduled rates, which they hoped would attract a considerable number of the small mill-owners in the city. They had also successfully completed negotiations with the Municipality for a new contract for street lighting for a period of five years, which was a considerable extension on the previous contract; and they had also been successful in recently connecting to their mains one or two large institutions which would take a fair supply for lighting and fan work. The number of units which had been generated during the year was 999,347, of which approximately one-half had been sold for lighting and power purposes, the balance being used by the tramway. The average price per unit sold for all purposes was 4.30d.; and the consumers connected during the year amounted to 202, as compared with 157 last year. The total number of consumers at 31st December, 1912, was 887, and, from a cablegram which they had just received from the General Manager, this had now risen to over 1,000. The number of fans which they had connected to their system was 1,059 at 31st December, 1912, as compared with 865 at 31st December, 1911; of which 194 were connected during the financial year as against 162 in the previous financial year. These statistics showed the encouraging progress which had been made by the lighting section. They were also in negotiation with the Government for a supply to their temporary works to the north of the existing city. This supply would, in the first instance, probably be for a period of from 4 to 5 years, although it was impossible to say for what time it would be extended at the expiration of that period. The load was, however, a satisfactory one, and it would enable the Company to reduce considerably the generating costs per unit on the whole system. With regard to the development of the power and lighting station in the new City, it was impossible to give any definite information at the present time. As they knew, the Government experts had made a very close study of the situation, and it was only comparatively recently that they had definitely fixed upon the site for the new City. They were in touch with the officials of the Government—both here and in India—and had received intimation from them that when the Government plans were fully developed, the Company would be asked to tender for the supply. They must, therefore, wait until the scheme was developed, and, when it was received, it would be submitted by them to consulting engineers, in order that they might be advised as to the best and most economical method of carrying out the work and the form of tender which should be sent in. Should the Company be successful in obtaining the concession for the new City and the contract with the Government, this would involve a considerable extension of its capital account. The Company would have to provide for the increasing load on the power station, and a certain amount of capital expenditure would, therefore, be necessary very soon. The Board had the matter under consideration as to the best and most economical manner in which the necessary capital could be raised. He hoped and believed that, to a certain extent, the amount required would be minimised by the profits which should now accrue from the system. It must be the policy of the Board for some little time to come, as profits were made, to retain them in the Company for the purpose of providing for the necessary capital expenditure, which would all tend ultimately to improve results. The affairs of the Company had taken a decided turn for the better, and there was every prospect that its position should slowly but gradually improve. The local board in Delhi was no longer necessary and had been dissolved. It would be better that all matters of administration should be dealt with direct between the London Board and the General Manager in Delhi. In conclusion the CHAIRMAN dealt briefly with the accounts, and also referred to the retirement of COL. SIR BUCHANAN SCOTT from the chairmanship of the Company owing to ill-health, although he retained his seat on the Board.

COL. SIR BUCHANAN SCOTT seconded the motion.

A shareholder pointed out that last year they were told they would be able to obtain some Diesel engines from the Government, but they still appeared to be working by steam. He also understood that another company was going to bring current from some falls near Delhi where it could be generated much cheaper than they could do it, and it was suggested that they should work with the promoters of the scheme.

In reply to this and other speakers, the CHAIRMAN said they were advised locally not to divide up the accounts of the two undertakings. With regard to the new expenditure they had got out certain alternative tenders for plant which would be required to meet their own normal increase, and also the supply to the Northern City. These tenders were on the other side, and until they received them back it was impossible to say what the expenditure would be. He believed that the resources they had, viz., the balance of debentures not yet placed and the profits they were able to make, would enable them to finance that capital expenditure. This was, of course, quite apart from the capital expenditure involved in dealing with the new City of Delhi. They would be very glad to put aside depreciation if they had it. He agreed that the shareholders had had a long time to wait, but they were slowly pulling round. They were like others learning by experience.

The report was adopted, and the retiring directors were re-elected.

### Metalite, Ltd.

THE further adjourned ordinary general meeting of the shareholders of the above Company was held on Friday at the offices, Christopher Street, Finsbury, E.C., MR. STEWART (Chairman) presiding.

The CHAIRMAN said he understood that at the last meeting Mr. Bentley presided, and informed them that a Receiver had been appointed by the Bank, and that arrangements had been made by which no sale should take place up to the end of August, to enable the directors to form a scheme of reconstruction. The board had now decided on the general outline of such a scheme, and it had been placed in legal hands, and would be issued to the shareholders he hoped by the end of next week. The new capitalisation of the Company would be nominally £80,000, with £20,000 7 per cent. cumulative preference shares to be issued for cash; a distribution of £20,000 ordinary shares amongst the existing distribution holders and a further £20,000 of 5s. ordinary shares credited with 3s. 6d. paid amongst the existing ordinary shareholders. The present Board would retire, and a new Board would be elected by the shareholders of the new company, for which a special meeting would be called. However, the full scheme would be before the shareholders, and a meeting would be called to consider it, as it was impossible to discuss it that day. He thought they would agree that under the existing unfortunate circumstances it was the best thing that could be devised. He formally moved that the meeting stand adjourned until August 29th, in order that the scheme might be carried into effect.

MR. STONE seconded the motion.

MR. GREGORY asked if August 29th was not too long an adjournment. If they were to assent to any scheme it was important that matters should go quickly.

MR. VINCENT said August 29th was purely an arbitrary date. The shareholders would be notified to attend an extraordinary meeting, and if a scheme was carried through the adjourned meeting would never be held.

MR. GREGORY said he was satisfied with that explanation. He would like to know if it was intended to invite the shareholders to confer with the Board before a scheme was finally drafted.

MR. VINCENT said it was intended to call the ten largest shareholders to a conference.

MR. ANDERSON said that in a public room in Birmingham he heard it stated that the Company had no lamps. Such a statement was calculated to prejudice the Company, and he suggested that in issuing the scheme the Board should give some information about the lamp and its present position.

MR. GREGORY said there was no justification for such a statement.

MR. HARRISON said they could take it from him that the Company had manufactured lamps. He had manufactured many thousands of them.

The motion was then carried.

### Electrical Apparatus Co., Ltd.

THE directors' report for the year ended 31st December, 1912, states that the profits (after providing £502 for depreciation and £302 for various items written off) amounted to £5,408 plus £132 brought forward. After deducting directors' fees £1,902, works manager's bonus £32, and preference dividend for the year £285, there is available £3,322. It is proposed to deal with this as follows: Dividend of 8 per cent. per annum on the ordinary shares, £1,256; reserve account, £1,000; development risk account, £250; appropriation to workmen's bonus account, £100; writing down patents account to the nominal amount of 1s., £348; writing off the balance of Milford Works account, appearing in balance sheet under New Buildings, £89; writing off the balance of development account, £110; leaving to be carried forward, £169. The rapid expansion of the Company's business has necessitated an extension of the works and offices; new buildings have been erected this year at a cost of upwards of £3,000, giving an additional floor area of over 10,000 square feet. To provide for the larger volume of trade the issued capital was increased from £13,550 to £22,250, and the Board was augmented by the election of Mr. H. K. C. Partridge, who has taken over the works management, and Mr. H. Taylor, who retains the secretaryship. The sum standing to the credit of reserve account on 31st December, 1911, with the further sum set aside out of the profits to that date amounted to £3,000. This has been distributed amongst the ordinary shareholders by the issue of 3,000 fully-paid ordinary shares, being equivalent to a dividend of 3 1/4 per cent. on the ordinary share capital shown in the last balance sheet. The turnover of the Company shows an increase of nearly 60 per cent., and the net profits 66 per cent. over the previous year's trading. This satisfactory result has been contributed to by the higher prices at which the Company's products have been sold during the year under review. A number of new products were developed, from which, however, the Company did not reap any benefit during the year covered by this report, but it is anticipated that considerable improvement will result therefrom in the business for the current year.

**Gwynnes, Ltd.**—The directors report that the accounts for the year to January 31st, after deducting debenture interest, show a credit balance of profit and loss account of £237.

**Edison & Swan United Electric Light Co., Ltd.**

The directors have issued notices to the 4 per cent. first debenture stockholders, and the five per cent. second debenture holders, calling extraordinary general meetings of such stockholders for Wednesday, June 18th, at 12.30 and 2.30 o'clock respectively. The circulars read:—

"The reason for asking your assent to these proposals (see below) is to provide additional working capital for the general purposes of the business. The progress of the Company is being retarded owing to insufficiency of working capital caused mainly by the heavy outlays which it has been necessary to make during the past years in erecting further plant, the expenditure upon this heading since 1905 having amounted to upwards of £60,000. The proposals now laid before you, which include the amalgamation of both classes of debenture stock, have been submitted to several of the largest debenture stockholders, and the scheme has met with their approval. You will notice that the Resolutions empower the directors to call up a sum not exceeding £1 per share of the liability now existing upon 99,261 'A' shares of the Company. In return for this the directors propose to hand over to the trustees for the stockholders as further security £25,000 5 per cent. debentures and 33,346 shares of £1 each fully paid, held by the Company in the Altrincham Electric Supply Ltd., and further to raise the rate of interest upon the first debenture stock by  $\frac{1}{2}$  per cent., the rate of interest on the second debenture stock being correspondingly reduced. (The circular to the second debenture holders adds at this point: 'but, on the other hand, the second debenture stockholders will have a benefit of ranking *pari passu* with the first debenture stockholders.') In addition, one-third of the profits in each year will be set aside for redemption of debenture stock. The Altrincham Co. is the sole supplier under statutory powers of electric light and power for the town of Altrincham and surrounding district, about eight miles from Manchester; its operations are very successful, as will be seen from the profits made during the last three years, which are as follows:—1910, £4,586; 1911, £4,744; 1912, £5,750. For the current year it is anticipated that they will amount to not less than £7,250."

The following is part of the resolution that will be submitted authorising and agreeing to the arrangement between the Company and holders of the said stocks:—

1. The £313,872 Four per cent. First Debenture Stock of the Company constituted and secured by Trust Deeds dated the 12th January 1897 and the 22nd November 1898 respectively, and now outstanding, and the £135,602 Five per cent. Second Debenture Stock of the Company constituted and secured by trust deeds dated the 19th June 1900 and the 25th November 1900 respectively, and now outstanding, to be consolidated into one stock bearing interest as from the 1st day of July 1913 at  $\frac{4}{2}$  per cent. per annum, and so that the securities respectively constituted by the said Trust Deeds shall henceforth be held by the Trustees for the holders of the said Consolidated Stock for the benefit of all such holders *pari passu* in proportion to the amount of the Consolidated Stock held by them respectively.

2. By way of further security for the payment of the principal moneys, interest and other moneys to become payable in respect of the said Consolidated Stock the Company to charge by way of specific security in favour of the Trustees for the holders of such stock, £25,000 of Debentures and 33,346 Shares of £1 each fully paid and in the Altrincham Electric Supply Limited, but so that such Trustees may in their discretion permit such a number of the said Shares as shall be necessary to qualify the representatives of the Company upon the Board of the Altrincham Electric Supply Limited to remain registered in the names of such representatives for the time being.

3. The Company to covenant with the Trustees for the holders of the said Consolidated Stock that in every year, commencing from the 1st day of July 1913, the Company will apply one-third of the profits of the Company available for the payment of dividends upon the shares of the Company in the redemption of the said Consolidated Stock either by purchase in the market or otherwise at or under par or by drawings at par.

4. Notwithstanding the provisions of the said Trust Deeds and the charges there respectively constituted the Company to be at liberty from time to time to call up the capital for the time being uncalled upon the shares of the Company for the time being issued to an extent not exceeding in the aggregate £1 per share, and to apply the moneys so called up for the general purposes of the Company's business.

In the course of a circular addressed to the "A" shareholders, the directors say that they regret the necessity for making a call, but feel that if the business of the company is to be successfully carried on, it is absolutely essential that further working capital be provided, and in their opinion this should have the effect of considerably augmenting the future profits. The call will become payable by instalments not exceeding 5s. each, at intervals of not less than three months.

**New General Traction Co., Ltd.**

THE seventeenth annual general meeting was held on Monday, at the offices, 8, Crosby Square, Bishopsgate, E.C., Baron Emile B. d'Erlanger presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 855), said it would be noticed that the accounts covered a period of eight months only, the previous balance-sheet covering a period of 16 months. In future the accounts would always be made up to March 31st. The balance-sheet was now a very simple affair, due to the fact that they had in the course of the year paid off all the prior lien debentures and the floating debt owed by the company, and they had redeemed £41,700 of the 5 per cent. mortgage debentures, leaving £154,300 still outstanding. Those debentures were now covered over and over again both as regarded capital value and earnings. Since they had now entirely sold the Coventry tramways they had only the following three sources from which they could hope for profit—the American undertaking from which they got a fixed and guaranteed income; the profits from the Douglas Tramway Co., which was a small concern, whose net earnings fluctuated with the weather conditions prevailing during the holiday season; and the large interest they still retained in the Norwich Tramways. It was from the latter source that they could hope to improve the situation either by increasing their profits or by diminishing their expenditure. As to increasing the traffic, they were in the hands of the public—all they could do was to give as good a service as possible. They were, however, in hopes of decreasing the expenditure by improving the generating station. By a capital expenditure of between £3,000 and £4,000 they hoped to be able to make a reduction of some £1,500 or £2,000 in the annual expenditure.

Mr. R. J. WEST seconded the motion, and the report was adopted.

**Provincial Cinematograph Theatres, Ltd.**—Notice of interim dividend of 5 per cent. has been declared, payable on the ordinary shares to shareholders whose names appear on the registers from May 26th.

**STOCKS AND SHARES.**

Tuesday Evening.

To deal at all adequately with the markets this week a thorough-going bear would be required. The ordinary man, seeing the prices dwindle of securities in which he has placed his faith and his money, makes a poor stick to deal with the dismal catalogues of losses shown by all the markets of the Stock Exchange during the past few days. Everybody clamours for a reason that shall explain the fall, but the real cause is too humdrum to satisfy most people. It is too simple a thing for the average man to hear that the stream of new issues is responsible for the greater part of the slump. He demands an explanation of more exciting character, and, to satisfy his appetite, all sorts of rumours are being circulated with reference to this, that, and the other house being in financial straits. Naturally, a prolonged and a heavy fall must have disquieting effects upon the position of houses speculatively inclined, but quite a lot of the reports are manufactured simply in order to meet the demand for them.

Money is in eager demand all over the world. London, Canada, South Africa, Australia, China, Mexico, and the South American Republics are amongst clamant competitors for fresh capital. The ordinary man might well suppose that underwriters could put the brake on new issues if they wished to do so; and it is a matter of astonishment to many people that they do not consider it good policy to set some bounds to the issues which they are prepared to underwrite, knowing full well that the success of them with the public is a dubious matter.

Coming to our own particular departments, most of them show losses more or less substantial in amount. There has been, and is still, a good deal of pressure to sell on the part of people who must have money to meet calls from other directions. This week and last, investment stocks have been coming out in noticeable quantities; and in the House it is becoming more and more difficult to sell what is commonly described as rubbish.

**Stock Exchange Notices.**—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to:—

Mississippi River Power Co.—Scrip, fully paid, for a further issue of \$3,000,000 first mortgage 5 per cent. 40-year gold bonds.

And to allow the following securities to be quoted in the Official List:—

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Further issue of \$404,000 general mortgage  $\frac{4}{2}$  per cent. 30-year gold bonds of \$1,000 each (Nos. 9,362 to 9,765).

Madras Electric Tramways (1904), Ltd.—20,000 6 per cent. cumulative preference shares of £5 each, fully paid (Nos. 1 to 15,000 and 80,001 to 85,000) (renewed special application).

National Telegrapher Co., Ltd.—100,999 preferred ordinary shares of £1 each, fully paid (special application).

Underground Electric Railways Co. of London, Ltd.—Further issue of 21,000 shares of £10 each, fully paid (Nos. 7,201 to 8,200 and 26,793 to 46,792).

**Consolidated Gas, Electric Light and Power Co. of Baltimore.**—The directors have declared a dividend of  $\frac{1}{4}$  per cent. on the common stock for the quarter ending June 30th, being 6 per cent. per annum.

**Mackay Companies.**—The directors have declared the regular quarterly dividend of  $\frac{1}{4}$  per cent. on the common shares.

The Home Railway industry is threatened with another strike, an extension of the trouble which originated in the shipping yards. Much bellicose talk characterised the week-end meetings of the men, but, even without this, stocks would probably have gone back. Metropolitan are  $2\frac{1}{2}$  down, Districts lost 3, Central London Deferred 2 and the Ordinary stock 1. The slump spread to Underground Electric Railways issues, where the £10 shares in particular were acutely depressed, drooping 10s. to 3s. The income bonds fell to 8s., while the other issues also declined. British Electric Traction have quieted down, though the 6 per cent. Preferred and the Deferred are  $\frac{1}{2}$  up at  $11\frac{1}{2}$  and  $6\frac{1}{2}$  respectively. South Metropolitan Tramways fell back to  $\frac{1}{2}$ , partly on a fall in London Suburban Traction shares, these being depressed by statements that a new issue is in contemplation.

Something akin to slump has befallen the Latin-Canadian group. All kinds of inferences are drawn from the violence of the drop, but none are in any way reliable. Brazilian Traction have lost  $\frac{1}{2}$  points, Mexico Trams 3, British Columbia Railway issues  $\frac{1}{2}$  to 2 points, Montreal Light and Power  $\frac{1}{2}$ , and so on. The various companies' bonds and Debenture stocks have given way to a lesser degree, the principal decline is 2 points in Mexico Tramway Sixes

In one or two cases the sales appear to have come from stale "bulls" closing their accounts; in others, they are evidently due to pressing need for money, a need the satisfaction of which has led to more or less steep falls in many purely investment securities. Calcutta Trams, and Anglo-Argentine First Preference, are amongst the few shares which have risen superior to the general tendency of depression. In both cases small advances have occurred.

English Electricity Supply descriptions are, in the words of a dealer in that market, stupid to dull, the last-named being the Stock Exchange way of describing slight depression. This is most noticeable in Charing Cross and City shares, the Ordinary and the City undertaking Preference showing losses of 5s. Counties are also down. Other prices are not notably altered to any extent worth noticing. Metropolitan  $\frac{1}{2}$  per cent. Debenture stock is again harder. Regret is felt at the way in which the cohesion of the Publicity Committee seems to be in peril, especially considering the vast amount of time, work and thought spent upon it in recent years, and those who follow the matter have been overheard to hope that the threatened schism may be averted even at this eleventh hour.

The scheme for reconstituting the finances of the Edison & Swan Company is an elaborate and rather an involved affair. One of its first consequences was to raise the protest that the proposals formed an attempt to tamper with the security of the proprietors of the First Debenture stock. Following this there came other objections, to meet some, if not all of which, another circular is to be issued by the board. On the first one, some of the shareholders took what was not unnatural alarm, and tried to give away their partly-paid shares for nothing, in order to escape the liability. It may be doubted, however, whether many shares changed hands on this basis. The Second Debenture stock has lost several points.

It is refreshing in these drab markets to be able to write of cheerfulness and better prices in the British Westinghouse trio. The shares are  $\frac{1}{4}$  higher; the 4 per cent. Debenture stock has put on 2 points, and the prior lien 1. British Aluminium Ordinary have hardened. Sympathy with the Telegraph market brought down Telegraph Constructions 10s. Castner-Kellners are  $\frac{1}{2}$  lower, the shares being quoted ex-rights. Rubber shares rallied a little after being uncomfortably flat, but the results of this week's auctions are rather disappointing.

Telegraph descriptions reflect the weakness of other investment markets. Eastern Ordinary is marked down 3, and Eastern Extensions are 10s. lower, for both of which the dividend deductions account. Western Telegraphs lost their recent improvement. Anglo-Americans continue to fall away; West India and Panama First Preference are back to 9 $\frac{1}{2}$ . Cuba Preference, however, rose 5s., and Direct United States have improved. United River Plate Telephones fell back  $\frac{1}{2}$ .

Marconia, which were 3 $\frac{1}{2}$  when we last wrote, have been down to 3 since then, from which a rally on bear-covering lifted the price to 3 $\frac{1}{8}$ . Americans dropped to 12s. 6d., Canadians to half-sovereign before support came to brace them up to 14s. and 11s. respectively. In National Telephone Deferred stock there has been little going on, the price remaining about 20 $\frac{1}{2}$ .

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, June 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dsc.
a Acid, Hydrochloric .. .. per cwt.		5/-	..
a " Nitric .. .. .. per cwt.		22/-	..
a " Oxalic .. .. .. per lb.		23d.	..
a " Sulphuric .. .. .. per cwt.		5/6	..
a Ammoniac Sal .. .. .. per cwt.		42/-	..
a Ammonia, Muriate (large crystal) per ton		£29 10	..
a Bleaching powder .. .. ..		£6 5	..
a Bisulphide of Carbon .. .. ..		£18	..
a Borax .. .. .. ..		£17 10	..
a Copper Sulphate .. .. ..		£23 5	..
a Lead, Nitrate .. .. ..		£27	..
a " White Sugar .. .. ..		£25 5	..
a " Peroxide .. .. ..		£32	..
c Methylated Spirit .. .. .. per gal.		2/6	..
a Potassium, Bichromate, in casks .. per lb.		83d.	..
a Potash, Caustic (88/90 %) .. .. per ton		£22 10	..
a " Chlorate .. .. .. per lb.		84d.	..
a " Perchlorate .. .. ..		44d.	..
a Potassium, Cyanide (98/100 %) ..		74d.	..
(for mining purposes only)			
a Shellac .. .. .. .. per cwt.		82/6	..
a Sulphate of Magnesia .. .. .. per ton		£4 10	..
a Sulphur, Sublimed Flowers .. ..		£6 10	..
a " Recovered .. .. ..		£5 10	..
a " Lump .. .. .. ..		£5	..
a Soda, Caustic (white 70/72 %) ..		£10 6	..
a " Chlorate .. .. .. per lb.		83d.	..
a " Crystals .. .. .. per ton		£3 5	..
a Sodium Bichromate, casks .. per lb.		83.	..
METALS, &c.			
b Aluminium Ingots, in ton lots .. per ton		£95	..
b " Wire, in ton lots ..		£112	..
(1 to 14 S.W.G.)			
b Sheet, in ton lots ..		£126	..
b Babbitt's metal ingots .. ..		£50 to £221	..
c Brass (rolled metal 3" to 12" basis) per lb.		10d.	8d. dec.
c " Tube (brass) .. .. ..		83d.	8d. dec.
c " " (solid drawn) .. .. ..		74d.	4d. dec.
c " Wire, basis .. .. ..		114d.	1d. dec.
c Copper Tubes (brass) .. .. ..		105d.	1d. dec.
c " " (solid drawn) .. .. ..		£26	..
c " Bars (best selected) .. per ton		£85	..
c " Sheet .. .. .. ..		£85	..
c " Rod .. .. .. ..		£72 10	£1 5 dec.
d " (Electrolytic) Bars .. .. ..		£89 10	£1 5 dec.
d " " Sheets .. .. ..		£77 10	£1 5 dec.
d " " Rods .. .. ..		94d.	3d. dec.
f Ebonite Rod .. .. ..		4/6	..
f " Sheet .. .. .. ..		1/0	..
n German Silver Wire .. .. ..		7/- to 8/-	..
h India-rubber, Para fins .. .. ..		3/8d.	14d. dec.
i Iron Pig (Cleveland warrants) .. per ton		£50 8	9/6 dep.
i " Wire, galv. No. 8, F.O. qual. ..		£14	..
g Lead, English Pig .. .. ..		£20 to £20 5	£1 inc.
m Manganin Wire No. 28 .. .. per lb.		6/6	..
g Mercury .. .. .. .. per bot.		£7 10	..
e Mica (in original cases) small .. per lb.		6d. to 8s.	..
e " " " medium .. .. ..		8/6 to 8/1.	..
e " " " large .. .. ..		7/6 to 11/-	..
o Nickel, sheet, wire, &c. .. ..		8/6 to 4/6 nom.	..
p Phosphor Bronze, plain castings ..		1/1 to 1/3d.	..
p " " rolled bars & rods .. ..		1/02 to 1/2	..
p " " rolled strip & sheet .. ..		1/28 to 1/51	..
o Platinum Wire .. .. .. per oz.		103d.	3d. dec.
o Silicon Bronze Wire .. .. .. per lb.		£65	..
r Steel, Magnet, in bars .. .. per ton		£213 to £215	£11 dec.
g Tin, Block (English) .. .. ..		2/8	1d. dec.
n " Wire, Nos. 1 to 18 .. .. per lb.		£50 to £228	..
p White Anti-friction Metals .. per ton		£27 5s.	£1 15s. dec.
z Zinc, Sh $\frac{1}{4}$ (Vielles Montagne bnd.) ..			..

Quotations supplied by—

- a G. Boot & Co.
- b The British Aluminium Co., Ltd.
- c Thos. Bolton & Sons, Ltd.
- d Frederick Smith & Co.
- e F. Wiggins & Sons.
- f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- g James & Shakspeare.
- h Edward Tilt & Co.
- i Rolling & Lowe.
- k Morris Ashby, Ltd.
- l Richard Johnson & Nephew, Ltd.
- m W. T. Glover & Co., Ltd.
- n P. Ormliston & Sons
- o Johnson, Matthey & Co., Ltd.
- p W. F. Dennis & Co.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of wks.	Total to date.		Route miles open.	Inc.
		£	£*		£	£*		
Bath .. .. ..	May 28	4,302	523	22	17,192	492	..	..
Blackpool-Fleetw'd .. ..	" 31	8,723	327	21	10,115	647	8	..
Bristol .. .. ..	" 30	33,376	5,768	..	155,634	15,370	30-5	..
Brit. Elec. Trac. Co. .. ..	" 23	104,373	12,576	21	483,761	34,551	..	..
Chatham and Dist. .. ..	" 22	5,695	859	20	16,375	660	14-98	..
Cork .. .. ..	" 29	2,629	78	21	9,826	230	4-89	..
Dublin .. .. ..	" 30	24,710	518	..	121,788	124	54-25	..
Hastings .. .. ..	" 29	4,222	518	..	..	891	19-3	..
Lancashire United .. ..	" 28	6,478	682	21	30,285	2,584	39	..
Llandudno-Col. Bay .. ..	" 30	1,408	354	26	5,460	708	6-5	..
London United .. ..	" 29	57,771	1,855	..	118,231	1,750	..	..
Tyneside .. .. ..	" 28	2,705	8	22	10,314	416	11	..
Anglo-Argentine .. ..	" 27	27,031	20,917	..	1,175,186	99,667	24-11	8
Auckland .. .. ..	" 9	21,612	2,838	44	220,578	50,165	..	..
Bombay (B.E.T.) .. ..	" 3	13,16	710	18	55,979	2,002	..	..
Brisbane .. .. ..	April 15	16,930	4,710	17	9,430	86,196	..	..
Brit. Columbia Rly. .. ..	.. .. ..	..	..	..	..	..	..	..
Calcutta .. .. ..	June 2	16,225	1,098	..	..	..	..	..
Cape Electric T. Ld. .. ..	April .. ..	3,073	..	19	11,313	..	20-6	..
Lisbon .. .. ..	May 31	1,889	162	..	17,8	4	1,229	15-25
Madras .. .. ..	May 31	29,815	3,176	30	229,607	17,76	..	..
Montevideo .. .. ..	.. .. ..	..	..	..	..	..	..	..
Cen. London Rly. .. ..	May 31	18,722	1,619	22	114,238	11,949	6-78	4
City & S. Lon. Rly. .. ..	" 30	10,155	1,750	22	63,263	5,848	7-26	..
Dublin-Lucan Rly. .. ..	" 30	607	97	22	2,570	67	7	..
G.N. and City Rly. .. ..	" 24	5,354	817	21	39,740	4,096	5-5	..
L'pool Overh'd Rly. .. ..	" 25	7,082	698	..	33,866	2,243	6-6	..
London Elec. Rly. Co. .. ..	" 31	68,825	105	22	315,400	8,995	21-25	..
Mersey Railway .. ..	" 31	8,409	556	22	49,423	8,200	4-6	..
Metropolitan Rly. .. ..	" 25	68,816	1,200	21	344,948	4,84	25-75	..
Met. District Rly. .. ..	" 31	61,659	637	22	285,467	12,109	25	..

\* Compared with the corresponding period of 1912.  
 † Two weeks only.  
 ‡ Includes horse, steam and other receipts.

Prospectus.—Sir W. G. Armstrong, Whitworth & Co., Ltd.—This company has been making an issue at par of £1,000,000 5 per cent. non-cumulative second preference shares of £1 each.

William Beardmore & Co., Ltd.—The list closes to-day in an issue of 1,000,000 6 per cent. cum. pref. shares of £1 each. at par, for paying off £86,400 outstanding second mortgage debentures, and for general purposes.

Doulton & Co., Ltd.—The directors' report for 1912 states that after providing £14,000 for debenture interest, and £711 for depreciation of investments, writing £500 off goodwill and deducting the debit balance of £9,782 brought forward, there is a credit balance of revenue account of £13,812, which it is proposed to carry forward.

Mirrlees, Bickerton & Day, Ltd.—At the annual general meeting, held in the Chartered Accountants' Hall, Manchester, on Tuesday last, the directors recommended the payment of a dividend of 7 $\frac{1}{2}$  per cent. on the ordinary shares and 5 $\frac{1}{2}$  per cent. on the preference shares, which was approved.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

Table listing English Electricity Supply and Power Companies. Columns include Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations June 3rd, Rise or Fall, and Present Yield p.c. Includes companies like Bonruemonth & Poole, Charing Cross, and Metropolitan.

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Table listing Colonial and Foreign Electricity Supply and Power companies. Columns include Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations June 3rd, Rise or Fall, and Present Yield p.c. Includes companies like Adelaide, Calcutta, and various international power companies.

TELEGRAPH AND TELEPHONE COMPANIES.

Table listing Telegraph and Telephone Companies. Columns include Name, Stock or Share, Dividends for 1911 and 1912, Closing Quotations June 3rd, Rise or Fall, and Present Yield p.c. Includes companies like Amazon, Anglo-Portuguese, and Western Union.

\*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend, ‡ Bs. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railways and tramways in the home market. Columns include Name, Stock or Shares, Dividends for, Closing Quotations June 3rd, Rise + or Fall, Present Yield p.c., Name, Stock or Shares, Dividends for, Closing Quotations June 3rd, Rise + or Fall, Present Yield p.c.

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railways and tramways in colonial and foreign markets. Columns include Name, Stock or Shares, Dividends for, Closing Quotations June 3rd, Rise + or Fall, Present Yield p.c., Name, Stock or Shares, Dividends for, Closing Quotations June 3rd, Rise + or Fall, Present Yield p.c.

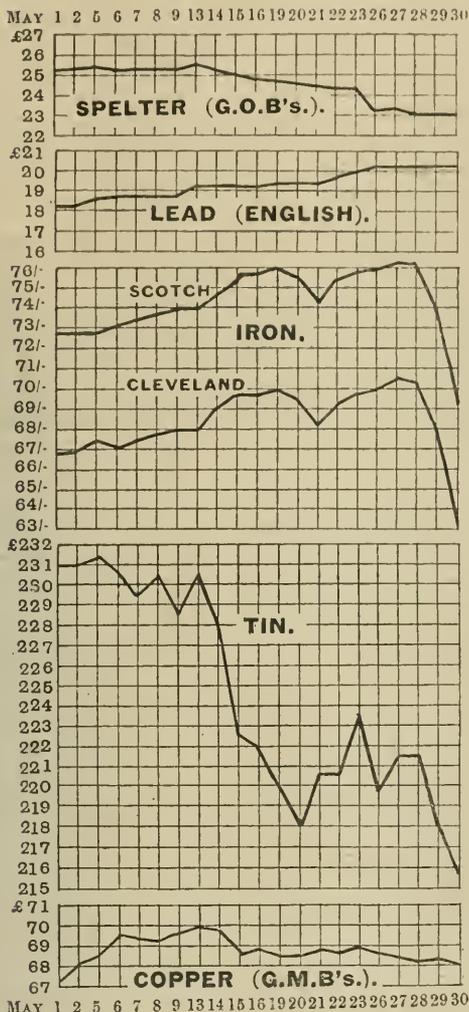
MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Shares, Dividends for, Closing Quotations June 3rd, Rise + or Fall, Present Yield p.c., Name, Stock or Shares, Dividends for, Closing Quotations June 3rd, Rise + or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

METAL MARKET.

Fluctuations in May.



REVIEWS.

*Metallurgy of Iron and Steel.* By MESSRS. SEXTON and PRIMMOSE. Manchester: The Scientific Publishing Co. Price 12s. 6d. net.

The subject of the metallurgy of iron and steel is at the present time almost beyond the scope of any one individual. All volumes containing up-to-date information are acceptable, and the present one is especially so, as it is written with undoubted authority. It forms the second edition of a previous work with the same title. Great progress has been made during the last few years in the science of metallurgy, and this book has, therefore, many features of an entirely new work. The authors' aim has been to present a text-book of moderate dimensions for the student, but at the same time to cover the whole field of the metallurgy of iron and steel. A work of this nature cannot possibly gain the approval of every reader, but the authors have made a very careful selection of the more important facts relating to this industry.

The volume begins with a somewhat extensive list of errors, which, for the sake of appearances, might have occupied a less conspicuous position; and, after a quotation from Bacon, the student is introduced to the importance of iron. The first few pages are devoted to introductory remarks on the classification of iron ores. The book is then divided into sections, the first of which deals with the production of pig-iron. This part of the book gives a very clear and interesting account of our present knowledge of the subject. No important facts are omitted, and such vital questions as cost and durability of furnaces receive brief but necessary attention.

Part III treats of malleable iron, and deals with the subject in a very comprehensive manner, especially from the point of view of the English manufacturer. Part IV is devoted to the production of steel, and a considerable amount of space is given up to the important and interesting study of the micro-structure of iron and steel. The authors touch upon the subject of electric steel, but this is disposed of in four pages. We are of opinion that considerably more attention might have been devoted to this section of the book, especially in view of the growing importance of this branch of the industry. Two electric furnaces are illustrated, but neither of these has come into extensive use, whereas other types are now well known. We notice that the appendix contains a diagram of an electric smelting furnace, which has recently been undergoing trials in Sweden.

The book throughout is exceedingly interesting. It is copiously illustrated, both with diagrams and photographs, which, besides giving a fair knowledge of the principles involved, offer some idea of the actual plant in action. The volume teems with useful tables and information, and may be recommended to anyone interested in the subject. Our best thanks are due to the authors for presenting such a useful and valuable compilation compressed into so small a volume.

*Electroplating.* By W. R. BARCLAY and C. H. HAINSWORTH. London: Edward Arnold. 1912. Price 7s. 6d. net.

This volume, comprising 400 pages, deals with the subject of electroplating in a very comprehensive manner. It is written from the engineering side, and is eminently practical. We must take note, however, that the book is not intended to take the place of practical experience, but rather to supplement the already acquired knowledge of the electroplater. The writers have taken as their basis a course of lectures delivered to students in the technical classes of the University of Sheffield, supplemented by the syllabus in electrometallurgy of the City and Guilds of London Institute.

The volume commences with a chapter on fundamental chemical principles. These are disposed of in a few pages, and will be of very little use to anyone who has no previous knowledge of chemistry.

Following this is a chapter devoted to electrochemical principles, which is very simply and concisely written. The next chapter introduces the electroplater to fundamental

**The German Accumulator Industry.**—A remarkable conflict of opinion has just arisen regarding the situation of business in the German trade in secondary batteries. As in connection with the Board of Trade in Great Britain, so in the Fatherland there exists a Government official organ which professes to reflect the position of the labour market and of trades at certain intervals. On the present occasion the organ, apparently referring, in the first place, to last year, states that complaints were made of inadequate activity in the manufacture of stationary accumulators, whilst the works engaged on the production of portable batteries were only moderately employed. The decline in the receipt of new orders for stationary batteries, which started in the autumn, continued at the opening of 1913, although this was not entirely surprising, as business in the early months is always quieter. In March and April it is customary for orders to experience a large increase, but in the current year the newspaper declares that the decrease has become accentuated, whilst the call for delivery on old contracts has also abated. The execution of the latter still permits of the maintenance of full working, although a limitation, it is added, will be inevitable in the near future. Although there are various manufacturers of storage batteries in that country, the largest individual firm is the Berlin-Hagen Co., which also exercises, to some extent, a monopoly in the trade, owing to its wide connection with the largest groups of manufacturers, and with the central stations established or promoted by them and their associated interests. This particular company, which brought over into 1913 orders exceeding by £100,000 in value those on the books at the beginning of 1912, recently reported that business continued very active, and that a further development was taking place in the portable battery trade. If then the smaller makers are suffering, according to the official labour organ, it is apparent that the largest undertaking at any rate has no grounds for complaining of the situation of the trade.

electrical principles. These are very hurriedly disposed of, and will prove somewhat confusing to readers who are not electricians. Then we have the usual theoretical considerations relating to primary and secondary cells and the dynamo. These chapters should prove of considerable interest to the electroplater.

The authors then introduce the real business in hand, namely, the practical side of electroplating. This part of the book is by far the most interesting, and contains a very complete *résumé* of the present known processes of plating. It is well illustrated, and for the most part expressed in language that will commend itself to the class it is written for. Numerous recipes are given which will undoubtedly prove of great value. The theoretical considerations are, as a rule, clearly expressed. There is, however, a tendency to give information whose connection with the theory and practice of electroplating is not at once apparent. We find several passages in the book which are likely to lead to misconception. On p. 249, for example, the idea of catalysis is somewhat confusing, and will probably be misunderstood. The authors further state that recent researches suggest that colloids added to the electrolytic bath move to the cathode. We might point out that this is an actual fact, and not a suggestion, as can easily be demonstrated by the use of the microscope. The subject of electrotypes is touched upon *en passant*, and we consider that this might, with profit, have been considerably elaborated. There is extreme difficulty in gaining accurate information on this latter subject, and more precise knowledge would have been gratefully received.

Throughout the book, simple methods for the analysis of various materials are described. These are perfectly clear, and will not lead to ambiguity. We sincerely hope that this volume will be well received. It deserves the careful consideration, not only of those directly employed in the electroplating industry, but also of those interested in the wider field of electrotechnics.

*Applied Electrochemistry.* By A. J. ALLMAND, D.Sc.  
London: Edward Arnold. 1912. Price 18s. net.

It is a lamentable fact that this country, the birthplace of electrochemistry, falls a long way behind the German Empire in the production of standard literature. Neither country has any great natural facilities for the development of water power, or for the production of cheap electricity, except from coal. In spite of this, however, Germany has taken the lead in the world of electrochemistry, whereas England has fallen considerably behind. There are numerous volumes written in the German language dealing with electrochemical processes, but hardly any in English. Nevertheless, electrochemistry is quietly gaining a firm foothold amongst a certain class of English manufacturers, who are ready to assimilate new facts relating to their technical processes. The present volume is evidently intended to fill their requirements. The author, in his preface, states that he has designed his book for both technical men and students; a laudable ambition, but difficult to fulfil. There is no doubt that the volume will be of immense value to the student. It presents, in book form, facts relating to electrochemical processes which have hitherto been confined to periodical literature.

Dr. Allmand commences his book by a general theoretical introduction, and deals with commercial electrochemistry based on theoretical considerations. A few pages are devoted to the question of power, and the information is of necessity somewhat fragmentary. The reader is then introduced to simple problems of equilibrium, whose general utility is hidden behind involved electrochemical nomenclature. This chapter is quite comprehensible to an advanced student of electrochemistry, but entirely useless to the average technical man. In fact, the chief fault we have to find with the book is the too frequent use of complicated formulae. The first part of the work deals entirely with the theoretical side of electrochemistry. It is undoubtedly well written, and offers many novel conceptions which have hitherto not been presented in book form.

The second part of the book deals with the commercial side of electrochemistry. There are the usual considerations of primary and secondary cells, treated from the

theoretical side. The author then turns his attention to the refining of metals. All the well-known processes are described and diagrammatically illustrated. Electroplating and typing are touched upon and disposed of in a few pages. Other electrochemical industries are dealt with in turn, and described with accuracy. The very interesting work on the fixation of atmospheric nitrogen is ably dealt with at some length; also many other industries which have not been so fortunate as the former in firing public imagination.

It is a pity that working costs are not discussed. To the technical man this is of primary importance. The diagrams are numerous and clear, but give little conception of the actual plant. Greater elaboration would have been useful to the technical man. It is suggested that the book would have been more useful if written in two entirely separate volumes; the first volume treating of the subject from a theoretical standpoint, and the second volume designed exclusively for the technical man. However, it is pleasant to notice that no important electrochemical development has been omitted. The book undoubtedly fills a great need, and is extremely well written and interesting. The thanks of all students of electrochemistry are due to Dr. Allmand for his very interesting addition to our standard electrochemical literature.

*Measurement of Induction Shocks.* By ERNEST G. MARTIN.  
1912. London: Chapman & Hall, Ltd.

This little volume gives a concise account of an improved apparatus for producing standardised electrical stimuli as an aid to physiological research.

The methods adopted by the author are the outcome of observations carried out over a considerable period, during which he became impressed with the necessity of having exact measurements, with a view to obtaining results that could be compared with those of other workers.

The earlier chapters are devoted to an explanation of the conditions affecting the character of Faradic stimuli, an historical review of the progressive steps taken to improve the technique of the work, and a statement of the various requirements necessary for the construction of an ideal apparatus.

The suggestions put forward by the author to overcome the difficulties encountered are extremely ingenious, and apparently the apparatus made in accordance with his ideas gives uniform and satisfactory results.

Full instructions are laid down in connection with the calibration of the instruments, and the mathematical issues involved are clearly dealt with, forming a decidedly unusual feature of electromedical literature.

It is to be feared that the circulation of the book will be limited, as it can only be of direct interest to physiologists, but to such the book will be of undoubted value and, in all probability, it will be instrumental in co-ordinating future work in an important branch of science—important, because physiological knowledge is the basis of medical and surgical procedure.

*Handbook of Wireless Telegraphy.* By J. ERSKINE-MURRAY, D.Sc. London: Crosby Lockwood & Son.  
Fourth Edition. Price 10s. 6d. net.

Considerable revision and additions to this work are features of the fourth edition, and Dr. Erskine-Murray is certainly to be congratulated on his endeavours to keep the book abreast of progress, and to effect improvements therein. Much new matter has been added, mainly in connection with more recent developments. The description of the Poulsen system is amplified, and the more recent methods and types of apparatus used by the Telefunken Co. are fully considered. The Goldschmidt high-frequency alternator and the Galletti system of transmission also receive attention.

In reference to these latter the descriptions given are very meagre, and it is doubtful whether more than a vague idea of the methods will be conveyed to the student. Taking the case of the Goldschmidt alternator, it is suggested that an explanation of the reactions occurring in low-frequency alternators when the power factor has a very small value would

pave the way for the student to understand the principle involved in the Goldschmidt machine. It could, with advantage, be pointed out how an alternator takes upon itself the functions of a transformer, in addition to those of a generator under certain conditions of working; and how the frequency due to rotation is added to the armature frequency when this transformer effect comes into play.

The high-speed methods and appliances designed for use in connection with the European Poulsen system are adequately illustrated and described. At the end of the book extracts are given from the Marconi Co.'s outline specifications for high-power stations proposed for the Imperial wireless chain.

*La Télégraphie sans Fils pour Tous.* By F. DUROQUIER. Paris: E. Orlhac. Price 3 fr.

The author sets out to provide an elementary treatment of the construction and installation of wireless apparatus and the applications of wireless telegraphy. We must congratulate him on his happy knack of spanning wide gulfs, in the theory and developments of apparatus and methods, in such a manner that the discontinuity is hardly noticed, but, at the same time, we believe that few non-technical readers would be able to follow the book. In our opinion, it is admirably suited to the needs of the general electrical engineer who, having read indiscriminately a certain amount of matter dealing with wireless telegraphy, wishes to acquire a good elementary grounding in the subject, either with a view to proceeding to a more advanced study, to enable him to take up amateur wireless work or simply to enable him to read, with greater intelligence and profit, the current "wireless" Press.

In his opening paragraphs, the author sketches the present importance of wireless telegraphy and the general nature of Hertzian waves. The methods of generating and radiating the latter are then considered. When it is stated that Transmission is dealt with in 4½ pages, under the following paragraph headings: Ruhmkorff Coil, Condensers, Interrupters, Transmitting Circuits, Antennae, Direct and Indirect, Shunt and Inductive Excitation of the Aerial, it will be seen how summarily these matters are dismissed. No explanation is given of most of the technical terms employed, hence the layman is not likely to derive much benefit from the book. On the other hand, a reader grounded in general electrical engineering would gain a good elementary understanding of the subject dealt with. If suitably amplified by lectures, the book should prove useful for students' use.

In Section III, dealing with the reception of Hertzian waves, the Branly and other coherers and relay circuits for use with these are described and illustrated. Various forms of detectors and their advantages in conjunction with telephone receivers are next considered. Surely it is too sweeping a statement to say that crystal detectors are more sensitive than the best electrolytic types? Quite the best printed explanation and distinction which we have seen of and between the telephone sounds produced by damped and aperiodic radiations is given as *cr. crrr* and *tú. láúúú* (French pronunciation). The author's detector, using a semi-conducting artificial crystal, appears to be highly sensitive, and, by the uniformity of its structure, little subject to derangement; tests have shown it to be eminently suitable for use in field and other sets exposed to rough usage. An explanation of the nature and importance of syntony leads to an explanation and comparison of various arrangements of the receiving circuit. Considering the knowledge assumed in other sections, it seems to be unnecessary to explain the distinction between series and parallel connection on p. 22.

The second part of the work (comprising 20 pages) deals with the construction and installation of wireless apparatus for amateur work. The author is careful to explain that no apparatus, methods, tests or results are described with which he has not had experience and success which can be realised by any reader following the instructions set forth. A station suitable for transmitting messages up to 150 km. is described, but this is rather beyond the needs of the average amateur, and the equipment suggested would certainly be too expensive for the latter. The construction and use of a number of pieces of apparatus—including a convenient ball-interrupter—are explained and clearly illustrated.

Some useful suggestions are made as to methods of arranging and suspending the aerial network (often a matter of perplexity to the amateur), and a simple arrangement is described whereby telephone subscribers may use their exchange line as a receiving aerial without in any way affecting the working of the ordinary telephone service. Tuning circuits are described in some detail, and the section concludes with an enumeration of points requiring attention in the maintenance of a wireless equipment.

The third part of the book reviews the present applications of wireless telegraphy, including public service, time signals, weather reports, naval and code messages, Press reports, &c., and sets forth, *inter alia*, the Morse code, a number of station call-ciphers, and the procedure followed in transmitting various signals and reports.

The Appendix includes 14 wiring diagrams, showing the principal arrangements of transmitting and receiving circuits, and commenting briefly on the characteristics and advantages of each. The volume suffers from the defects, common to most French books, of having no index and of being paper bound, but it is certainly to be recommended as a reliable work and a good investment.

## BUSINESS METHODS IN NEW ZEALAND.

By WIGWAM.

In some previous notes on electrical matters in New Zealand, we foreshadowed these comments on usual business methods, and in view of difficulties that commonly arise in importing plant and material, we are led to believe that there are a number of English manufacturers who might read them with profit.

It must be borne in mind that the State controls interests in the Dominion that are commonly in the hands of private individuals at home. It not only administers the Public Works, and Posts and Telegraphs, but also the railways, two of the principal coal mines, and its own printing departments. Incidentally, it may be worth mentioning, as showing the extent of such public ownership, that the State runs a Tourist Department, including the administration of the town of Rotorua, which is the centre of the thermal district, a State insurance department, and a number of experimental farms. Recently it has secured control of all the latent water power in the waterfalls and rivers, and has actively commenced to develop it.

To the operations of the Government departments may be added the activities of the municipal bodies, Harbour and River Boards, &c., and together they may be taken to be the purchasers of the great bulk of electrical and mechanical plant, as distinct from agricultural and allied machinery. It will be understood, of course, that such materials as lighting accessories, small motors, and so on, are purchased and installed by private traders and contractors. But, in general, the remarks following may be considered applicable.

Practically all important contracts are publicly advertised, and tenders are invited to a prepared specification. So far, the usual practice in England is followed. Where it differs is in that there are almost invariably the following conditions: First, a deposit has to be paid in when a tender is submitted; secondly, sureties have to be found to guarantee due fulfilment of the conditions if the work is secured.\* To these may be added the usual payment for copy, or copies, of specification and drawings, and penalty for delay in completion. The deposit is generally from 2½ to 5 per cent. of the contract price, and has to be made in the form of a marked cheque of an approved bank (the tenderer's own cheque being insufficient); it is held until the contract has been signed by the successful tenderer. Should any hitch occur in settling the final details with the successful firm, the deposit of the next in order of merit, or even of all the remaining firms, may be held, pending settlement, and no payment or allowance is made for bank interest. Thus, on a tender of, say, £30,000 value, a deposit of £750 might be held for weeks, and even months, without acknowledgment of interest due, and when a number of tenders close on

\* "Wigwam" is apparently not aware that sureties are often required in this country.—EDS. ELEC. REV.

or about the same date, it will be seen that the total amounts outstanding in that way may be considerable.

The second condition is sometimes even more difficult to deal with. Two sureties are generally to be named, who will together bind themselves in a sum usually of about 10 per cent. of the contract price, for the fulfilment of the contractor's obligations. These sureties are to be approved by the purchasers, and usually the clause is so drafted that it is practically essential to find local men.

Thus the local representative of an English firm is in the position of having to find two bondsmen to back him up on behalf of a firm who may be totally unknown to them. Not only has he, therefore, to add their payment for such bond to his price, but unless his principals guarantee him, he may have to pledge his own property as security. If to these risks is added that of a penalty for delay in delivery or completion, it will be seen that to successfully compete, there must be entire confidence and trust between the local and the home house. It might be argued that the home firm might tender direct, but there are numerous reasons to be urged against this, of which, perhaps, two will suffice.

A firm outside the Dominion, and doing local trade, does not thereby escape the attentions of the income-tax department. The Commissioner of Taxes, in the absence of evidence in the shape of the firm's books, may assess their profit himself, and tax them on his own assessment. The possible result only needs a little contemplation to prove the folly of risking this course.

The second reason is that very frequently the time allowed for completing estimates and making up tenders, does not admit of obtaining detailed prices from home, even if the home firm knew that tenders were being invited.

It will be seen, then, that the position of a local representative endeavouring to open up business, particularly for a home firm whose name is unknown, is not altogether an enviable one, and that he needs not only the friendly assistance but the active co-operation of the home manufacturers. The extent to which this is forthcoming will be largely the measure of their mutual success, or otherwise.

Competition is keen, a fact which many manufacturers do not seem to realise. There is a certain class of British manufacturer who invariably quotes for cash against shipping documents at English port, involving his selling agent in a further expenditure for bank exchange, as well as interest on the value of the goods while they are at sea, *i.e.*, for about two months. He further throws upon the selling agent the risks of making good defects in the material itself, breakages in transit and delays in shipment, or disputes, all of which would appear to be difficulties in which he might reasonably be expected to bear a fair share.

It thus often happens that the local man is unable to agree to some clause in a specification, which involves too much risk to himself in matters over which he has no control, and by striking out such clauses, he places himself at a disadvantage with competitors whose principals support them.

The bank exchange, for instance, where payment is obtained by drawing on a London bank on production of bills of lading, costs about 1½ per cent., a sum quite sufficient on, say, a contract for cables, to put prices out of competition. If payment is made by cheque through the mail on receipt of invoices, the rate can be reduced to about ¼ per cent.

It may be argued that the manufacturers equally cannot afford to stand out of the payments for the time the stuff is in transit, but in how many cases of similar contracts made at home would he receive payment in less time?

To turn to other phases of the subject, wherein the makers can materially help their representatives, as has already been said, tenders are often called at short notice, and unless local people have up-to-date prices, it is important that they should be able to obtain them cheaply and accurately by cable—*i.e.*, a complete code system is necessary. Recently there has been introduced a system of deferred cables at half the usual rate per word. They are, however, only transmitted after all the ordinary cables have been put through, no code words or figures are allowed, the message must read intelligently and convey no other meaning than its text implies.

The cost of cabling special points of a specification is heavy, and sometimes the time allowed for completing figures is just sufficient to allow of detailed particulars being sent home by mail and the prices cabled on receipt.

The Customs tariff is often a stumbling block. Suppliers often fail to make the necessary declaration as to the origin of the material on the back of their invoice. British material is admitted at preferential rates, in most things the foreigner being liable to pay 150 per cent. of the home maker.

The duty is assessed on the trade value of the material, plus packing. It occasionally happens that suppliers quote *c.i.f.* prices, and make out their invoices in the same way. The importer may thus be charged duty on freight and insurance costs included in the total. These should all be shown separately, to save dispute. Quotations should also show both *f.o.r.* and *c.i.f.* costs, and give both shipping weight and dimensions, since local railage, wharfage and cartages vary in different districts, and unless the local man has this information, he must either guess the tonnage, or allow extra for contingencies.

The term "Trade value" is the price at which the material is commonly sold to the trade, *i.e.*, list price less discount. If a deduction is shown as commission, this is taken to mean that the deduction is a special one for the benefit of that particular purchaser, and is liable to duty. In assessing the duty, a primage of 10 per cent. is added to the invoice amount; *i.e.*, the duty on £100 worth of goods would be charged on £110.

It is essential to detail all the items that appear on an invoice, and to avoid showing a lump sum for a composite article made up of a number of parts subject to different rates of duty. This particularly applies to electrically driven machines. For instance, machine tools are admitted free, as also are certain classes of mining plant, while cranes and machines generally, other than agricultural plant, are classed as "manufactured articles of metal" liable to duty of 20 per cent. The motors are liable to 10 per cent. only. Insulators are dutiable, whilst the bolts are free. It may be taken that the Customs officials exact the maximum amount to which they can lay claim, and it facilitates matters considerably if manufacturers make out their invoices showing the separate values of each of the items that go to make up the total, and where the different classifications are known, separate invoices should be made out.

It should also be borne in mind that mistakes made either in this connection, or, indeed, in any business transaction, require practically three months to clear up, this being the length of time that usually elapses before a reply is received in course of mail.

The tendency of most public bodies, including Government Departments, is to purchase through local houses rather than through London shippers, as used to be the case, and to hold the local firm responsible.

There is a greater sense of security in having the principal accessible in case of difficulty or dispute, rather than in relying on suppliers who are some 14,000 miles away, and who can only be reached by correspondence.

There can be little question that manufacturers who are represented by thoroughly accredited local houses of good standing and with a working knowledge of the goods to be handled, are those who secure the bulk of the business, and that the most successful combination can only be attained by complete working harmony at home and in the Dominion.

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**An International Fire Library.**—The British Fire Prevention Committee having established a technical library that will be known as the International Fire Library, with a nucleus of over 2,000 books dealing specifically with matters of fire prevention, fire service and fire loss, is desirous of calling the attention of authors, public authorities, publishers and collectors to the fact that a new catalogue is in preparation, and that any books, pamphlets or reports which they are able to spare for this collection should be addressed, as soon as possible, to the Honorary Chief Librarian, The International Fire Library, 8, Waterloo Place, Pall Mall, S.W. The chairman of the Library Committee is Mr. Oswald Wylson, F.R.I.B.A., and the hon. secretary, Mr. D. W. Wood, insurance surveyor. The library, which is the first of its kind anywhere in Europe, promises to be a very complete specialist technical library, and will be made easily available to all primarily concerned in the subject of fire protection.

**NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.**

**Scott's Patent Air Compressors.**

Messrs. ISAAC STOREY & SONS, LTD., of Empress Foundry, Cornbrook, Manchester, have introduced the Scott patent air compressor in which an interesting type of valve is employed. As shown in the part sectional view, fig. 1, the valve consists of two plates and a number of small hardened steel balls. The bottom plate is drilled with a series of holes of two diameters, the top portion slightly larger and the lower portion smaller in diameter than the balls, thus forming a pocket for the ball and a seat for it to rest on. The upper plate is drilled to the same template as the

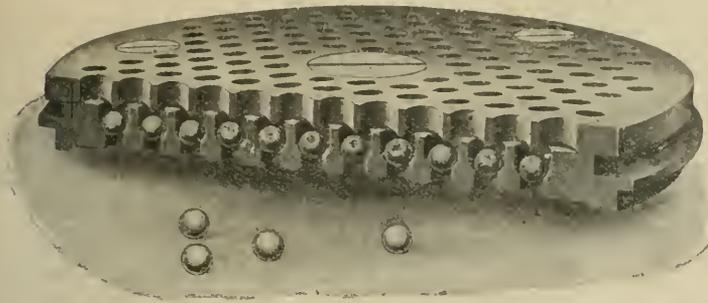


FIG. 1.—BALL VALVE FOR SCOTT PATENT AIR COMPRESSOR.

lower one, and is fixed so that the holes in it are staggered with those in the lower plate, the bars between the holes forming a stop for the lift of the balls. The plates are screwed together, and the valve is thus to all intents and purposes a one-piece device, with positive and rapid opening, large area with small lift ( $\frac{1}{8}$  in.), no springs, and small clearance space. The wear is inappreciable, and the valves cannot be broken.

The application of the valve is shown in fig. 2, a section of a simple single-crank compressor. The end of the trunk piston is closed with one of the valve plates above described, which

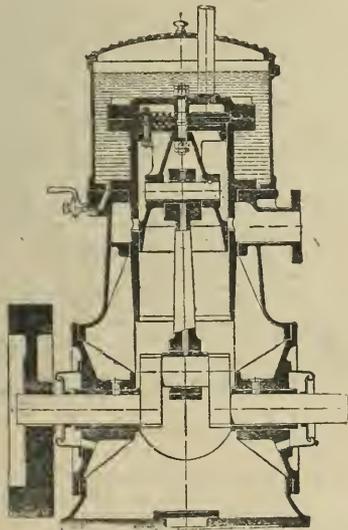


FIG. 2.—SECTIONAL VIEW OF SCOTT COMPRESSOR.

approaches almost to touching the fixed valve plate, so that the clearance is exceedingly small. The inlet air passage is cast in the top of the frame, and communicates with the interior of the cylinder through inlet ports round the circumference. The upper end of the cylinder is cooled by a surrounding water jacket containing a large body of water. It will be noticed that the momentum of the balls in the piston valve-plate tends to open and close the valves automatically at the right moment.

The compressors are made of single or double stage type, with one to three cranks, and are designed for driving directly or through gearing by electric motors, as well as by various other means. The air pressure is up to 100 lb., and the maximum capacity 3,000 cu. ft. of free air per minute.

An automatic pneumatic-electric control system has been developed for use with these compressors.

**The Anger Automatic Brake Adjuster.**

An ingenious device which is being marketed at the present time, after a number of years of testing under various conditions in all parts of the world, is the Anger improved automatic brake adjuster.

This device is the invention of Mr. John Edward Anger, the general manager of the United Electric Car Co., and is being placed on the market by the ANGER MANUFACTURING AND SUPPLY CO., LTD., of Preston. The company has factories at Manchester, Paris, Brussels, and is at present arranging for them in Canada and the United States.

The principle of this apparatus is very simple, and it can be applied to any type of truck with any type of platform brake gear.

The question of automatic slack adjustment in brake shoes has of late become quite pertinent, not only in its relation to economies in car maintenance, but in the saving that results from reducing energy consumption and preventing accidents.

Great care and attention should be given to the adjusting of brakes, but this work is often more or less overlooked or neglected, and in most tramways the men appointed to do this kind of work are at the same time called upon for many other duties, with the result that brake adjustment is always more or less attended to in a hurry, and, in many cases, not done with the accuracy that is necessary to give the motorman perfect control of his car.

It is an established fact, and well known to tramway engineers, that the proper place to adjust or take up the slack or wear of the brake shoes is at the point nearest where this is caused, and the Anger adjuster is the only device of its kind that operates on the brake rods, which is the nearest point in the brake equipment to where the slack takes place.

The action of the adjuster is as follows:—

In the application of the brake, the brake lever is drawn outwards, which causes the connecting rod to move the casing in the direction indicated by the arrows, fig. 5. Should the brake lever on the truck be allowed to travel farther than a certain point (owing to the wear of the shoes), the casing which carries the little pawl will travel on the ratchet nut, the pawl engaging with it, and upon the brakes being released and the brake lever returning to its normal off position, the ratchet will be moved forward one tooth and thereby tighten up on the thread on the rod to the amount of the wear

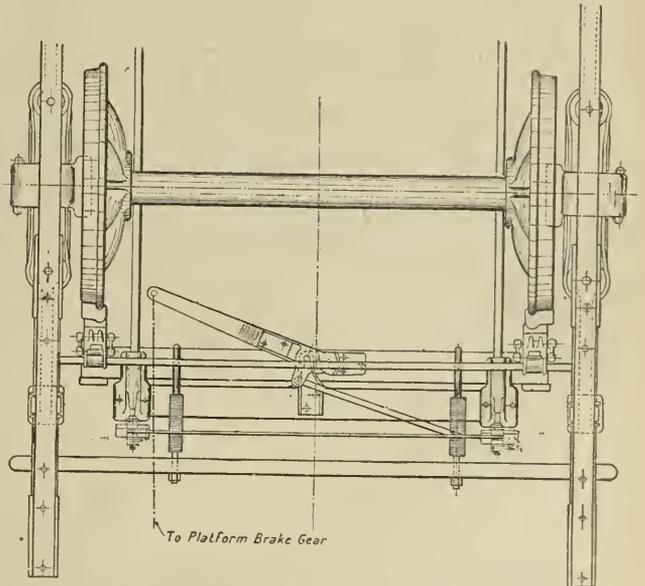


FIG. 3.—PLAN VIEW OF ANGER BRAKE ADJUSTER.

that has caused this extra travel of the brake lever. Thus whenever the slack increases so as to allow the brake lever to move the casing a greater angular distance than one tooth, upon its return the slack is automatically taken up, and the winding upon the brake rod is always in one direction; the ratchets being connected by a top connecting rod, both sides are simultaneously wound up in one direction, and the brake shoes are always kept the proper distance from the wheels until they are worn out.

It is only necessary to press down the thumb-lever, when the adjuster becomes a simple nut, and unwind it with the wrench, in order to replace the shoes.

The threaded part of this adjuster is made of best phosphor bronze to prevent jamming on the thread, and ensure perfect working and freedom on the rods; it eliminates the old trouble of having to replace rod ends by cutting them off when the hand nuts

were corroded and jammed on the rod. This device is at the present time in use successfully in over 60 systems in this country, and 75 other systems in all parts of the world, and everywhere we gather that it is giving entire satisfaction.

The company's orders for Corporation systems at the present time include 100 sets for Sheffield, 100 for Birmingham, and 60 for Cardiff, and it has executed its third order for Manchester and its second order for Salford. The device is included in the new specifications for trucks for the Corporations of Sheffield

On removing the hand from the handle, the two contacts referred to close again, and the no-volt coil is shorted and the hub is released from the rim and returned by a spring to the "off" position. The starter is retained in the "full on" position by destroying the short circuit across the no-volt coil when the hand is released. This is done by introducing into one of the leads from

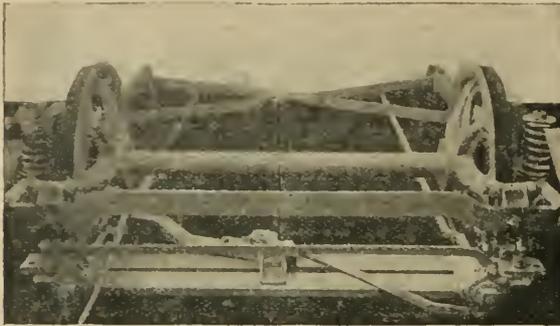


FIG. 4.—ANGER ADJUSTER APPLIED TO STANDARD GAUGE TRUCK.

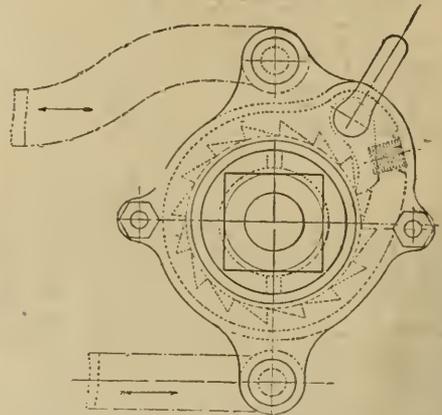


FIG. 5.—ANGER RATCHET ADJUSTMENT.

York, Walthamstow, Santos, East London, Capetown, Ayr, Salford, and many other places.

All of the cars have been recently equipped for the Preston and Blackpool Corporation tramways, and these two systems have placed orders for their bogie trucks as well.

**The "Rex" Totally-Enclosed Fuse.**

THE GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., have just introduced an enclosed cartridge fuse, in which a number of improvements have been embodied. It is claimed for the "Rex" fuse that it is reliable in operation under the most severe conditions; fuses of one capacity cannot be inserted in bases designed for fuses of another capacity; all metal parts are entirely shielded, rendering it impossible to touch any current-carrying parts when inserting or removing the fuse; and an

the handle to the no-volt coil terminal, a pair of contacts arranged so as to be open-circuited by the arm in the "full-on" position only. Thus when the arm is in the "full-on" position, it is immaterial whether the hand is removed from the handle or not, because there is a break introduced into the short-circuiting circuit as described above. The no-volt coil is also short-circuited in the usual way by the operation of the overload release.

The object of the device is to make the gear automatic and quite independent of the operator for returning to the "off" position, either due to overload or failure of the supply. The operator is not able to leave the starter in any intermediate position, but only in the "full-on" position. The gear is also certain in its action; it does not rely entirely upon a strong magnetic pull for keeping the

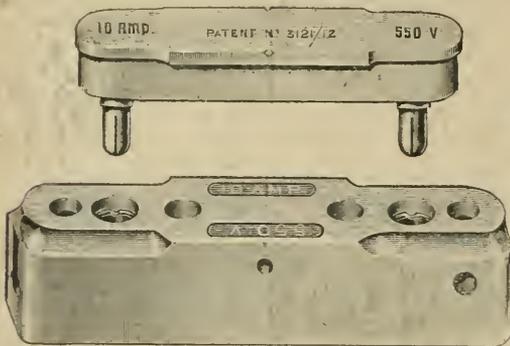


FIG. 6.—"REX" ENCLOSED FUSE.

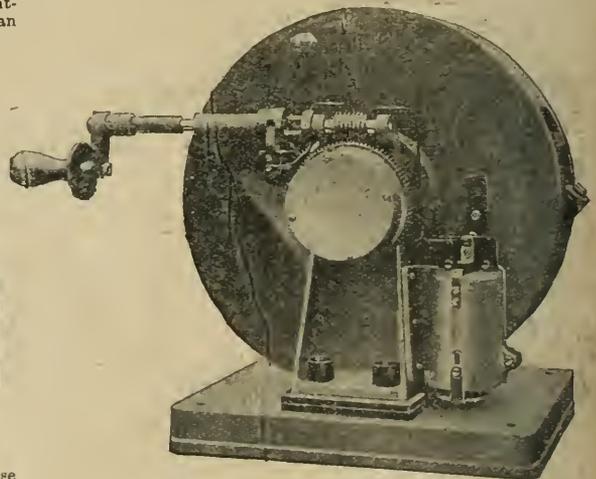


FIG. 7.—BOOTHROYD SLOW MOTION GEAR, APPLIED TO WOOLLISCROFT LIQUID STARTER.

allowance is made for blown fuses upon their return. The fuse can readily be fitted on existing fuseboards with the ordinary 2½-in. break, and it meets the requirements of the Home Office and Supply Authorities. An indicator shows clearly when the fuse has blown.

**Slow-Motion Starting Gear.**

MESSRS. H. T. BOOTHROYD, LTD., of Bootle, have brought out a slow-motion gear for operating electric starters and the like (fig. 7). It consists of a special worm and wheel device arranged to be double automatic in any position of the starter arm, and also arranged so that the arm cannot be moved until the main switch is closed, or left in any position other than the "full on" position.

The arm is fixed to the hub of the worm wheel, whilst the rim of the wheel is loose on the hub, and the worm can drive the rim round the hub so long as there is a connection between the two. The connection is provided by a coil—the no-volt coil—which is energized in the usual way, and which operates an armature carrying a toggle and pawl, the latter engaging with teeth cast on the inside rim of the loose worm wheel. The worm handle carries two contacts connected to the terminals of the no-volt coil, and these contacts are closed (thereby short-circuiting the coil) until they are opened by pressure of the hand on the turning handle, thus removing the short circuit, and so allowing the coil to be energized, and the hub of the worm wheel to be picked up by the rim clutch.

catch in position, as this is accomplished by a toggle arrangement, which requires very little magnetic energy to retain the pawl in action, and thus it is able to use a very small no-volt coil, which is usually not in service with the field circuit. Also, with this type of gear the operator is able to rotate the switch to the "full-on" position, or bring it from the "full-on" position gradually to the "off" position, which is very useful for slowing-down motors for putting on belts, &c., when it is not required to stop the machine entirely. The worm and worm-gear are always in mesh, and one hand only is required for operating the starting gear.

**Low-Water Alarm and Feed Regulator.**

MESSRS. O. ELLEFSEN & Co., of 26A, Silver Street, Bradford, have brought out a new patent low-water alarm and feed regulator of very ingenious design.

A copper tube is attached to the boiler shell, projecting into the interior, and carries at the further end a lever at right-angles to its axis. The lever carries at one end a bucket, and at the other a counter-weight. The inner end of the tube is closed, and is supported by a sling from the boiler shell. Within the tube is a steel rod, fastened to the inner end and projecting through the boiler shell at the base of the tube; the free end of the rod carries

part of a switch, which closes an electric circuit when the rod rotates.

The bucket is open at the top, and is normally immersed in the water; when the level of the water falls, the weight of the full bucket at the end of the lever exerts a torque upon the end of the tube, which is thus slightly twisted, and the steel rod within it actuates the switch, closing the circuit and ringing a bell, or by means of a relay starting a motor which drives the feed pump. When the water is restored to the proper level the circuit is broken.

The system presents the advantages that the inside of the boiler is completely sealed; there are no sliding or rotating joints, which are apt to stick or leak, and at the best offer a great deal of friction; and the movement is obtained through the flexibility of

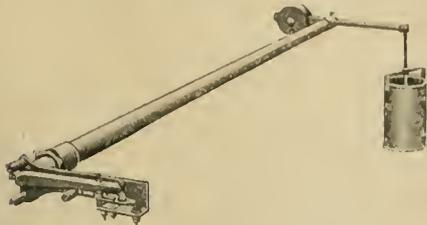


FIG. 8.—ELECTRIC LOW-WATER ALARM.

a tube, which is not likely to vary with time. There is no electrical connection to the boiler. The apparatus can be employed to start a steam pump, or to operate the feed valve if several boilers are fed from the same pump. It is, of course, applicable to other vessels besides boilers.

#### Vulcanwax.

A new wax for insulating and impregnating cables and wires has been introduced by MESSRS. WERTHS & CO., of 41, Aldersgate Street, E.C., under the above title. It is a rubber-like product, highly resistant to weather and to water, acids, &c., with a high electrical resistance, and can be vulcanised. It can be melted, becoming fluid at 75° C., for impregnating braiding, &c., and forms a smooth coating on the cable, which is not sticky in hot weather or brittle in winter, nor does it smear when handled.

## PROCEEDINGS OF INSTITUTIONS.

### Royal Institution Discourse and Exhibition.

At a meeting of the Royal Institution, on May 23rd, Prof. S. P. Thompson delivered an interesting discourse on "The Secret of the Permanent Magnet." The lecturer remarked that artificial magnets had long since replaced the lodestone for practical purposes but, although it was known before the Christian era that iron was magnetic and could be magnetised, it was even to-day unknown why iron and steel could be magnetised to so much greater an extent than any other materials. Much progress had been made, however, during recent years, in elucidating the actual process of magnetising iron, and in determining the conditions essential to the manufacture of a good permanent magnet. About 150 years ago, many English investigators were engaged in magnetic researches and English magnets had a world-wide reputation. Unfortunately, much of our prestige in this field had been lost, and the further study of the causes of permanence in magnets was undoubtedly a legitimate commercial and scientific problem, to which greater attention should be paid in this country.

By breaking up and testing the fragments of a hack saw and by the well-known tube-of- filings experiment, the lecturer justified the hypothesis that magnetisation depended on the orientation of the particles of the material concerned. The sound of a bar being magnetised and demagnetised was clearly heard all over the auditorium; the increasing length of an iron bar when magnetised was demonstrated simply and effectively, and the orientation of the particles in an emulsion of lodestone, when subjected to a magnetising field, was beautifully illustrated by showing that light could then pass through the "cohered" emulsion, parallel to the direction of magnetisation of the suspended particles.

The genesis of the hysteresis loop was explained, and Dr. Thompson showed that from the magnet-maker's standpoint, the important section of the curve was that reproduced in fig. 1 here-with, in which  $OR$  was a measure of the remanent magnetism, *i.e.*, of the retentivity of the iron, while  $OC$  expressed the coercivity or fixidity of the magnetisation. Madame Curie had found that 0.06 per cent. and 1.2 per cent. carbon steels had roughly equal retentivity, but the coercivity was negligible in the former and high in the latter case. The famous Alleverd (Savoy) steel—made from a material which was no good as iron—was known to be a splendid magnet material for years before the cause was determined. Analysis showed that this steel contained 5.5 per cent. tungsten, and it had since been discovered that tungsten, vanadium, molybdenum, nickel and chromium all gave magnetically valuable alloy steels. Manganese steel, on the other hand, was practically non-magnetic.

At the present time, a remanence of 800-900 and a fixidity of 50-60 in carbon and 70-80 in special steels could be obtained, and the lecturer believed that the time would soon come when his ideal magnet iron, with a remanence of 1,000 and a fixidity of 100, would be manufactured commercially. The self-demagnetisation coefficient of a magnet could be expressed by the angle  $\alpha$ , fig. 1, the height  $OR$  representing the actual "permanent" retentivity of the material. By demagnetising the steel somewhat (from  $P$  to  $M$ , fig. 1), the retentivity would be reduced to  $EQ$ , but the fixidity would be increased to  $EC$ , hence the "letting down" by prolonged "seasoning" of magnets in steam or boiling water was to be recommended strongly. Inspection of their hysteresis loops showed that Hemy steel was best for short and Bohler steel best for long or nearly closed magnets. The form of magnet most favourable to permanence was the horseshoe with closely adjacent poles. Lantern slides showing micro-photographs of etched steel sections

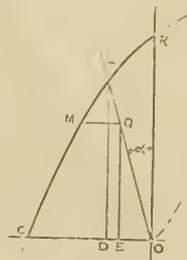


FIG. 1.

were exhibited, and it was explained that a fine granular structure was best for permanent magnets (as would be expected from Ewing's hypothesis). Summarised, the secrets of making good permanent magnets were:—The use of tungsten steel; the shaping of the metal to a nearly closed magnetic circuit; the forging of the metal at as low a temperature as possible; the heating of the steel above the temperature of recalcescence; its quenching while in the non-magnetic state; and finally the prolonged seasoning of the magnetised metal. The actual magnetisation was the least important of all the operations involved. The great problem yet to be solved was why iron and steel could be magnetised at all.

At the conclusion of the lecture, the working of Poulsen's telegraphone was demonstrated. Among the exhibits in the library, Messrs. R. Paul showed a wide range of "Unipivot" instruments, for simple electrical measurements, insulation and bridge tests or use in conjunction with thermocouples, as well as Campbell's vibration and bifilar galvanometers and an inductometer bridge and other instruments. Messrs. Everett, Edgcombe exhibited portable photometers, a reverse A.C. relay; power factor and frequency meters; charge and phase indicators. The phase indicator, comprising essentially a small three-phase motor, is most useful in avoiding incorrect connections in phase meters, &c., where the sequence of the phase connections is important. Messrs. George Cussons & Son showed a novel form of Atwood's machine and other interesting mechanical apparatus, and Dr. W. Rosenhain exhibited some fine etched steel sections. A number of firms showed permanent magnets of all kinds. The Cambridge Scientific Instrument Co. exhibited the Grassot fluxmeter and search coils, and Mr. F. J. Mudford illustrated the practical application of the magnetic method of determining hardening temperatures for steel. The  $CO_2$  Thermoscope, shown by the Underfeed Stoker Co. should do much to popularise flue gas analysis and the scientific control of boiler working.

### Prices Charged for Electric Power.

By SIDNEY SIMPSON, A.M.I.E.E.

(Abstract of paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, at Leeds and Sheffield, April, 1913.)

THE position of an undertaking from the commercial standpoint is gauged by the balance available after meeting all debts and liabilities in respect of capital expenditure, working expenses and depreciation.

A review of the returns of many electrical supply undertakings throughout the country would indicate that in comparison with most industries an adequate and true profit on capital invested is not being made.

Whether the working capital be obtained in the form of a loan, to be repaid with interest within a fixed number of years, or from the issue of debenture stock, mortgages, preference and ordinary shares, when the time arrives that the plant, mains, buildings and apparatus require renewal, or have ceased to have an economical productive value, then the loan covering this amount or the capital originally expended should have been redeemed, and interest on outstanding money paid annually out of the receipts from the undertaking.

Of the loan repayment and depreciation periods, whichever be the shorter period, this liability should be met by an annual charge on the undertaking before any true profits can be taken out of the

business. Unless adequate provision is made, a time must arrive when, owing to some of the plant, mains and apparatus having become wholly obsolete, an amount will have to be debited to profit and loss account, which should in strictness have been borne by previous years.

There is the certainty of deterioration, and always the risk of obsolescence, even though kept in good repair. The estimate of the period of useful life therefore can only, after all, be an estimate. Very seldom does plant, &c., wear out or become obsolete exactly in the way anticipated.

The method of dealing with depreciation in which a fixed percentage is taken annually out of receipts to write off the original outlay within a fixed period, paying at the same time interest on the outstanding amount, appears to be the soundest method; repairs and renewals as necessary being made a separate charge to revenue accounts. An average depreciation or writing-off of the capital account within 15 years should be allowed for.

An analysis is made of the published returns for the year ending March, 1912, and appearing in the *Electrical Times*. This is divided as follows—Table A, covering 21 local authorities of more than 15 years' working. Table B, covering 33 local authorities of 15 years or less working; each with 2,000 kW. or more of plant, and with total capital costs per kW. of plant, £60 or less.

The amortisation of the capital account on a 15-year basis to bear 3½ per cent. interest on outstanding principal is taken as an annual charge per £100 of capital expended of £9 14s. This figure covers depreciation and minimum interest, to this amount must, therefore, be added working expenses, set against revenue account before contingencies and true profit can be arrived at.

On this basis the results, as summarised below, are most unsatisfactory. However, since a few undertakings show a substantial profit, the soundness of the basis taken is, I think, confirmed:—

From Table A. From Table B.

Years working ... ..	16 to 28 years	7 to 15 years
Total capital cost per kW....	£48 7s	£42
Per cent. revenue to capital ...	14 6 %	16 %
Working costs per cent. of revenue	45 %	53 8 %
Load factor (based on maximum demand).	11 55 % to 25 16 %	13 9 % to 29 4 %
Standing charge per unit sold ...	823d.	663d.
Works cost per unit sold ... ..	617d.	665d.
Total net production costs per unit sold.	144d.	1328d.
Average price obtained ... ..	1375d.	123d.
Present loss per unit ... ..	665d.	988d.
Loss as % of revenue ... ..	475 %	805 %

A consideration of these results indicates that an increase in price is necessary to bring about financial stability.

The tariffs as set forward below would appear to meet the respective cases, and to form the basis of a scale of charges which would meet the capital and working costs involved. The questions of contingencies and profit are eliminated.

Table A.—Total capital cost per kW. = £48 7s. This written off in 15 years at 3½ per cent. interest = £4 27s as a standing charge per annum per kW. of plant in commission—i.e., £6 05s as a standing charge per kW. of plant installed. The average works costs = 617d. per unit sold, and assume this on 20 per cent. load factor of station plant.

We then have:—Standing charge £6 05s per kW. of maximum demand + works costs per unit sold, based on load factor of use of supply, or:—

	Per unit.
For 20 % load factor supply use a charge =	823 + 617 = 144d.
" 10 % " " " " =	1646 + 812 = 2458d.
" 40 % " " " " =	4165 + 447 = 8635d.

Table B—Total capital cost per kW. = £48 7s. This written off in 15 years at 3½ per cent. interest = £3 65s as standing charge per annum per kW. of plant in commission—i.e., £1 85s as a standing charge per kW. of plant installed.

The average works costs = 665d. per unit sold. We then have:—Standing charge £4 85s per kW. of maximum demand + works costs per unit sold, based on load factor of use of supply, or:—

	Per unit.
For 20 % load factor supply use a charge =	663 + 665 = 1328d.
" 10 % " " " " =	1326 + 845 = 2171d.
" 40 % " " " " =	3315 + 482 = 8135d.

Present prices charged for supply of load factors up to 10 per cent. are, generally speaking, remunerative, and the losses are made on the supply at higher load factors—in other words, on the industrial power supply. Unless the charge be based on these lines all round equity is not obtained, and the tariff on these lines appears to be the only basis on which capital expenditure is justified.

It is suggested that accounts should be subject to revision—say, annually—with regard to the following points effecting the tariff:—

*Diversity.*—This factor varies from time to time, being greater, the greater the variety of industries served.

*Power Factor of Load.*—The effect of low power factor to choke the revenue-bearing property of the capital outlay. In order that the importance of this fact may be brought to the notice of the consumer, it is necessary that he should contribute his proportion of the extra charges involved.

A minimum payment equivalent to half the estimated total revenue should be enforced in order that the tariff shall be equitable. Not only is it necessary to cover the standing charges of the plant, but the establishment charges have to be met whether units be taken or not.

The efficiency of consumers' working capital and the result of putting money saved on power plant down in productive machinery does not appear to have had the proper consideration and use as a very real argument, that it might have had.

Whereas £100, if put into the power plant yields 5 per cent. interest, if put into the business instead, for productive plant, it yields 5 per cent. and 7 per cent.

The inherent advantages of the electric drive are becoming more and more realised, and it is up to the supply undertakings to insist on them when negotiating business.

DISCUSSION AT LEEDS.

MR. T. ROLES said that no doubt the author had based his figures on a general principle of all-round equity to all types of consumers, but he (Mr. Roles) held that it was impossible to get that. The only basis upon which they could hope to run a supply undertaking was in a general way to aim at charging every class of consumer at a price somewhere in the near neighbourhood of the cost at which he could, in the alternative, supply himself. If they wanted to get a large power user, they would probably have to charge him in the neighbourhood of 3d. or 4d.; and in his judgment it was absolutely necessary to get the large power user. If the amount of returns from a mill was sufficient to pay the capital charges on a main and transformer station, they could make their profit on the lighting consumers.

MR. H. H. WRIGHT was inclined to agree with Mr. Simpson that where profits had been made at all they had been made on the small consumers, and he contended that the losses which were recorded by Mr. Simpson were due to the low prices charged to the larger consumers. The actual cost of driving a weaving mill with steam, including everything that ought by any possibility to be taken into account, was 18s. 10d. per loom per year of 2,730 hours, or 4½d. per week. Upon a carefully prepared estimate of the cost of electric driving he arrived at a cost of 50s. per loom per year, or 1s. per week.

DR. R. POHL said he thought there must be fundamental mistakes at the bottom of both the author's and Mr. Wright's conclusions. Mr. Wright had assumed the maintenance of the maximum load right through, whereas he thought the average load would be considerably less. In the second place, if they had a shed of about 100 looms those would not all be running at the same time. There would be a diversity factor that might be anything between 60 and 75 per cent., and that had not been taken into account. Mr. Simpson's mistake seemed to lie in the standing charge per unit sold, which Mr. Simpson calculated at a depreciation rate which wiped out all the capital in 15 years, and which at the same time included 3½ per cent. on the capital standing in the books at any given time. Surely they did not propose to depreciate the entire site value in 15 years; the greater probability was that the site value would appreciate. Fifteen years might be all right for the life of generating plant, but the depreciation was surely altogether excessive on buildings and mains, the latter of which accounted for quite 50 per cent. of the capital as a rule. Altogether, he considered that the figures for standing charges were quite excessive, and that was sufficient to explain the extraordinary result according to which practically every central station in the kingdom was losing money continually. If they were to accept Mr. Simpson's suggestions as to charge for maximum demand, they would not get a single power consumer, and would, in effect, be definitely declaring themselves bankrupt. He agreed with Mr. Simpson that, to a large extent, they made the lighting consumer pay for the large power consumer, and that was the way in which the supply authorities managed to make a profit, as he contended they did. Instead of increase of prices, he would suggest a very considerable reduction of the lighting rates, so that the cooking and heating load would increase rapidly, as well as the lighting load. He fully believed that, if they took their courage in both hands in that matter, the demand would increase at such a rate that there would be no risk of having to increase power charges.

MR. E. S. RAYNER said he was anxious for information as to how to tackle the power load question, because Doncaster was now a centre of very rapid development, and he did not see how it was to be done satisfactorily. How could they compete with a firm putting down their own plant in the case of a place which wanted 1,000,000 or 2,000,000 units per annum?

MR. SCHOFIELD agreed with Mr. Simpson's figures. He thought that Mr. Wright had made a mistake somewhere in his cost of electric drive in a weaving shed, because a loom of the kind referred to had been found by actual tests to consume about 10 units per week, and at a 3d. per unit, that was only 5d. instead of 1s.

MR. J. C. B. INGLEBY said he was particularly struck with the low revenue of the supply authorities, compared with the amount of capital embarked. Any business should, surely, at least turn over its capital once a year. The only way to do this was to increase the load-factor, and reduce the capital costs, and not touch the prices at all, or, if anything, reduce them.

MR. H. BROWN agreed that any increase of prices would be very difficult, and thought that the only thing to do was to increase the load factor, and keep prices as they were.

MR. SIMPSON, in reply, defended his theory of charging the various classes of consumers on principles of equity, and argued the matter out, at some length, with Mr. Roles.

## DISCUSSION AT SHEFFIELD.

Mr. H. E. YERBURY objected that the author's period of 15 years for repayment of capital was too short, and did not bear a correct relation to actual experience. In their last Parliamentary Bill in Sheffield, for instance, they obtained a 20 years' period for power stations and cables. The really equitable method of charging appeared to him to be for each consumer to pay a sufficient sum to cover standing charges on the plant required for his purposes, plus a charge based on works cost and a reasonable percentage of profit. Then as the output for any station increased the customers would get the benefit of the increase by way of the lowering of the proportion of the works costs charged. The great difficulty about the proposition for an increase of prices was that in proportion as these were put up inducements would be offered to manufacturers to install their own generating plant. Low-priced energy was one of the means of attracting new undertakings to a city for the benefit of the ratpayers.

Mr. H. A. NEVILLE said that if Mr. Simpson's 15 years' proposition meant that he would equate all loans and pay them out in 15 years, he could not agree to it at all. The principle of equated loans seemed to him to be absolutely wrong. The only equitable basis for repayment of loans was to take each section of the works and plant at its own determined life or at a reasonable estimate of its life, and reckon a varied period of repayment for each section. He differed from Mr. Simpson in regard to his suggestion that the lighting consumer was being charged a high price in order to make up for the low price charged for power. When they took into consideration the load factors, it was easily seen that the long-hour consumer at a low price was a much more profitable consumer than the short-hour consumer at a high price.

Mr. W. N. Y. KING also defended the position of the larger consumers who, he thought, ought to be credited with a good deal of the economy on the running costs, as well as on the capital costs, and he agreed with Mr. Yerbury that in municipal supply there should be no question of profit, but merely a desire to produce energy as cheaply as possible in order to assist and stimulate productive industries.

Mr. J. C. B. INGLEBY urged the importance of cutting down capital expenditure, and said he thought that the most expedient way to do that would be by having rather less expensive buildings and a more economical management of the laying of mains. If they could reduce the capital expenditure by a reasonable amount most of the undertakings dealt with in Mr. Simpson's tables would be made to show a working profit. They could not, in his opinion, increase the charges for electricity.

Mr. E. J. MARSH pointed out that in Sheffield they had to compete with gas supplied at 11d. per 1,000, which, of course, meant a very low power figure. He thought, too, that a mistake was made in having too many systems of charging for electricity. A simple system was what the consumer required. If he had the choice of 30 different systems he would never be satisfied that he had selected the right system for himself.

Mr. SCHOFIELD said he entirely agreed with the wisdom of the 15 years' period for repayment, and thought that they should consider, not so much what they could get in the way of prices, as what was profitable.

Mr. W. E. BURNARD said that in regard to capital expenditure, he was always struck by the very large amount of plant that had to be kept up for the sake of a load which only came on for a very few hours in the year. This plant was really out of all proportion to the amount of income from it. In Sheffield the spare plant to meet the needs of a peak load, which was used not more than five hours a year, represented 8,000 kw.

The CHAIRMAN (Mr. W. B. Woodhouse) said he was afraid there was only one ideal system of charging, and that was on the simple principle of the highwayman who demanded: "How much money have you got?"

Mr. SIMPSON, reverting to the Leeds discussion, held that the final effect of Mr. Wright's contrast of steam and electric driving costs was that by the use of electricity in such a case £4,800 would be saved on capital account, and with that money the manufacturers would be able to put in 160 more looms, and that meant an increase of profit of about £760 per annum, in addition to which there must be considered the additional advantages of the speeding-up of the drive and the extra output, which would result from the steadier running. As to his 15 years' period, he adopted it as a conservative figure, which was hardly likely to be on the wrong side, though time alone would show that. As to his grading of the tariff, unless it was done on some such lines, they could not justify capital expenditure. There was this to be remembered in regard to the loan period, that whatever the loan periods were it was the actual life of the plant which determined the soundness or unsoundness of the depreciation basis.

## Recent Developments in the Street Lighting of Manchester.

By S. L. PEARCE, M.I.E.E., AND H. A. RATCLIFFE, M.I.E.E.

(For abstract of Paper read before the INSTITUTION OF ELECTRICAL ENGINEERS, see our issue of March 21st, 1913.)

## DISCUSSION AT GLASGOW.

Mr. R. D. MITCHELL (Glasgow) said the authors referred to lowering gears rather than to their detriment. He, personally, emphatically endorsed the conclusion come to at the recent London conference, that lowering gear made a great saving. In Glasgow they had not only gone in for flame lamps with lowering gear,

but for magnetically operated switches with control from a central point. Where flame arc lamps were substituted for ordinary arc lamps, it was almost necessary to adopt these appliances owing to the greatly increased cost of carbons with flame lamps. Economies had to be got in other directions, so that the total cost might not be seriously affected. Lighting authorities in general were quite willing to accept the greatly increased illumination but they were not willing to pay more—at any rate, not very much more—for the change. It was by automatic switching, long-hour lamps and lowering gear that these economies might be effected. In Glasgow they had 837 arc lamps now, nearly all flame arc lamps, and they were busy fitting the last 100 lowering gear. When the electric control was first put into use, the trimming staff numbered 23 men. This change enabled them to reduce the number to 11. With the long-hour magazine lamps and lowering gear, a further reduction to four regular men and one spare man would be brought about. Each man attended to 62 lamps per day and no Sunday work was necessary. In the summer, out of the four men, two could be taken off the lamps to do overhauling in the shop. The switching was done by the inspectors, who, after switching on, set out on bicycles to do their rounds, each taking one-half of the city. All the lamps were switched on in five minutes. He considered that in connection with any new scheme of street arc lighting electric control should be taken into account. The control cable was laid at small expense along with the arc leads. His experience was that the candle-power of high-pressure gas lamps did fall off 50 per cent., and that quickly. He had found in high-pressure gas lamps in Glasgow streets, a falling-off of about 33½ per cent. in one week's time, the first reading being 3,200 C.P. at 20°, second reading 2,200 C.P. at 50°, and less than 2,000 C.P. at 20°. He saw it remarked by the authors that the use of clear globes was objectionable, due to the glare causing eye strain. He did not think there was glare to that extent. Even when the globes were quite clear the light appeared to emanate from the whole surface of the inner globe, more intense, of course, but the arc itself should not be taken as the source. Clear globes with lower surfaces only obscured were inevitable, in his opinion, in view of the competition to be faced. The gas people never thought of using anything else, glare or no glare. With reference to the experiments made with dioptric globes, it was stated in the paper that the tremendous intensive heat was due to the open lower end of the globes. No doubt that was so, but did the authors not find also by using dioptric globes with open lower ends that the fumes from the carbons condensed on the cold surface of the outer globe, and in a very short time obscured it? Some experimental lamps in Glasgow had shown this effect after having been in place for two weeks.

Mr. ALEX. WILSON (general manager, Glasgow Corporation gas department) said the authors stated that the electric lighting possessed all the practical advantages. As to lower cost, he agreed that in Manchester they might be quite right; the arc lighting there had been taken in hand in a scientific way. The reason for the difference between the state of affairs in Manchester and in London was the excessive gas leakage which was shown to have existed in Manchester. With regard to the simplicity of switching operations and the possibility of dispensing with lamplighters, they in Glasgow had a large proportion of lamps where the switching was done automatically, and automatic switching could be carried out in any way desired. As to the C.P. of the lamps in Manchester, the efficiency of these was far too low. They had had a great deal of trouble in Glasgow in getting the lamps adjusted, but having done that, they got an efficiency of, say, 60 candles per cb. ft. He noticed that the outlay was very heavy; the actual cost was about £30 a lamp, and for gas £48. In Glasgow they would want four or five lamps for that.

Mr. J. A. ROBERTSON (Greenock) said he believed that in the Westminster lighting district the maximum candle-power to be obtained was specified as to be taken at 20° and 45° from the horizontal. It seemed to him, looking at the curves, that it would be a comparatively easy thing to get at the result by using a proper globe, so that the specification which called for a particular candle-power at a given angle was upon the basis of what they wanted. So far as lowering gear was concerned, he could understand difficulties arising with types of gas lamps, but it was exactly here that electricity had the advantage. His belief was that they should always try to get an illuminant approaching nearest to daylight. They were rushing to extremes in high candle-power for street lighting, and when that was taken in conjunction with the illumination caused by shop-keepers and at picture palace frontages, there was sure to be a reaction, if for nothing else than for the safety of the public.

Mr. S. LONGLANDS (inspector of lighting to Glasgow T.C.) expressed himself as not altogether favourable to lighting tests on the streets, for many matters had to be taken into consideration where they had a mixture of grey, white and red stone buildings. He thought in every case the laboratory test was best. At present his department was equipping a laboratory for this purpose, so that it might stand in perfect fairness right between the gas and electricity departments.

Mr. PEARCE, in the course of his reply, said he quite appreciated the value of the economies which could be obtained by using raising and lowering gear, but those who knew the conditions in two typical Manchester streets would appreciate their position. He was, however, open to conviction on the general question of fixing lamps, and, if they had future extensions in Manchester, they would consider the question of traversing and lowering gear. A point which weighed with them in this connection was the extreme difficulty of getting the necessary permission from property owners for attaching the gear to the walls of buildings. In connection with the depreciation of gas mantles, he thought street trading

had a great deal to do with that, to say nothing of heavy vehicular traffic. In both those respects Manchester was a very bad city, and in one of the districts referred to in the paper the change from gas to electricity was made because of that. Gas leakage was inevitable, and he admitted that in Manchester it was excessive. As to the efficiency of Manchester lamps, it seemed to him that if they wanted to get up to the neighbourhood of 50 candles per cb. ft., it must be got by gradually increasing the pressure and renewing mantles more frequently at the expense of maintenance. The general point of the paper was that, assuming electricity cost twice as much as it was stated to cost in the paper, or assuming that the gas lamps were twice as efficient as given, the result was in favour of electricity. As to uniform lighting, that was frequently obtained at a cost out of all proportion to the advantage resulting from it.

MR. RATCLIFFE also briefly replied.

## PATENTS EXPIRING IN 1913.

(Continued from page 920.)

7,427. "Rotary converters." J. IMRAY. (Proc. Académie pour la Transmission de la Force par l'Electricité.) April 8th.—Relates to a converter or transformer for converting simple or alternating currents. Two armatures, preferably Gramme rings, are mounted on one shaft. The one ring rotates within an inductor of an asynchronous motor supplied with alternating current. The other ring rotates between field magnets in the polar extensions of which are fitted rings connected by copper bars.

7,525. "Submarine telegraphy." A. MUIRHEAD. April 10th.—Relates to arrangements in connection with submarine telegraphy for transmitting, receiving and translating either in single or duplex working. The specification describes a number of modifications for obviating a shifting zero, employing and regulating carb currents, and the use of "outflow" and "overflow" circuits in connection with the artificial line for regulating and sharpening the signals in translating from one circuit to another.

7,592. "Electric batteries." E. W. JUNGNER. April 14th.—Relates to both primary and secondary batteries, and consists in the use of an electrolyte which remains unchanged during the charging and discharging of the battery, except that its solvent water is separated from it. Potassium and sodium hydrates are examples of such electrolytes. The plates or electrodes consist of insoluble oxides of metals or finely-divided metals.

8,223. "Electricity measuring." G. C. FRASER and G. K. B. ELPHINSTONE. April 19th.—A portable apparatus for measuring the currents necessary to fire primers, and given by firing batteries, and for testing the condition of primers; it consists of a dead-beat ammeter, connected in series with a key and a variable resistance between two terminals in a case; two other terminals, connected together, are also provided.

8,961. "Telegraph and telephone recording apparatus." V. POTLSEN. April 25th.—Relates to means for recording and reproducing messages, such as telegraphic or telephonic messages, by means of an electromagnet acting upon or being acted upon by a magnetisable wire or strip. A cylinder is covered with a close spiral of steel wire, which is to take the place of the phonographic plastic cylinder, and an electromagnet is mounted on a sliding carriage to take the place of the stylus. The carriage is mounted on a rotating tubular frame, and is provided with a centrifugal lever, which brings the edge of the magnet against the wire while the frame is rotating. The removal or obliteration of the messages from the strips is obtained by traversing the wire, &c., with a magnet carrying a steady continuous current. (A petition for extending this patent has been filed, but the result is still pending.)

9,882. "Lighting railway, &c., vehicles." E. J. PRESTON and A. B. GILL. May 10th.—Relates to improvements in train, &c., lighting. A switching arrangement for controlling the number of lights is used. The current is supplied from a battery or other source, and the lamps are divided into two sets connected to a switch consisting of two drums engaging with contacts. The spindle carrying the drums is rotated by electromagnetic means controlled by a switch. The contact faces on the drums are so arranged that one or both sets of lamps may be alight or both may be extinguished.

13,703. "Crabes." J. G. W. ALDRIDGE. June 29th.—In electric cranes, the switch handle is connected by links to the clutch for the hoisting-drum, so that, as the motor is started, the drum is automatically and simultaneously geared with the motor-shaft. The descent of the load is regulated by a hand or other brake.

13,561. "Electric motors." M. J. BARREAU. June 30th.—Relates to a construction of electric motors, designed to secure maximum efficiency, notwithstanding variations in speed, especially applicable to electric traction, but also applicable to navigation and transmission of motive power. The windings of the induction coils are divided into sections, and by means of a rotary controlling-switch these sections are variously connected into sets or groups, while the battery cells are similarly grouped, in order to give the variations of speed desired.

(To be continued.)

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

11,551. "Ratchet and pawl free-wheel driving pulleys fitted to dynamo used for electrically lighting motor-cars." O. BRID. May 19th.

11,553. "Method of and means for protecting and supporting pipes, tubes, conduits and the like when exposed to furnace flames or subject to other high temperature." R. C. LIXESS. May 19th.

11,560. "System of enumerating telephone calls and apparatus therefor." S. D. WILLIAMS. May 19th.

11,561. "Mariners' compasses of the projector type." KELVIN and J. WHITE, LTD., and M. B. FIELD. May 19th.

11,573. "Selector arrangement for several stations lying on a common line." K. BECKMANN and ART. GES. MIX & GENEST. May 19th. (Complete.)

11,590. "Graded service automatic or semi-automatic telephone system." H. BARON. (G. Heilmann, Germany.) (Addition to 11,261/12.) May 19th. (Complete.)

11,609. "Telephony." S. G. BROWN. May 19th.

11,623. "Electrically operated or controlled valve." E. C. IRVING and J. P. O'DONNELL. May 19th.

11,629. "Trolleys for electric traction systems." E. M. MUNRO and R.E.T. CONSTRUCTION CO., LTD. May 19th.

11,680. "Circuit arrangements for telephone systems." SIEMENS & HALSKE ART. GES. (Convention date, May 25th, 1912, Germany.) May 23rd.

11,694. "Process for the electrolysis and treatment of sulphate liquors." E. J. HUNTER and W. T. GIBDEN. May 19th.

11,657. "Protective device for electric distributing systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 19th.

11,658. "Electrical control clocks for trunk line switchboards." AKTIESELSKAPET L. M. ERICSSON & Co. (Convention date, May 21st, 1912, Sweden.) May 19th. (Complete.)

11,673. "Incandescent electric lamps." C. W. READ. May 20th.

11,674. "Electric method of burning lime." G. C. GOODMAN. May 20th.

11,677. "Electric heating and cooking apparatus." E. W. LANCASTER. May 20th.

11,678. "Electric heating and cooking apparatus." E. W. LANCASTER. May 20th.

11,704. "Arc lamps." H. E. MOUL. (Korting & Mathieson Akt.-Ges., Germany.) May 20th. (Complete.)

11,715. "Electrically-operated mechanism for advertising and other purposes." J. R. BELL, jun. May 20th.

11,737. "Spark plugs." L. J. DIRAND. (Convention date, October 29th, 1912, United States.) May 20th. (Complete.)

11,750. "Apparatus for the production of alkali metals by the molten electrolysis of alkali compounds." G. W. JOHNSON. (Deutsche Gold und Silber Scheide Anstalt vorm. Rosler, Germany.) (Addition to 1,983, 1913.) May 20th. (Complete.)

11,751. "Electric relays." J. H. BAKER and A. E. McKECHNIE. May 20th.

11,791. "Cramp belts adaptable as electro contact cramps and the like." J. S. ROMANES. May 21st.

11,825. "Electricity meters." COMPAGNIE INTERNATIONALE D'ELECTRICITE SOC. ANON. (Convention date, May 31st, 1911, Germany.) May 21st. (Complete.)

11,839. "Wireless telegraphy." H. L. SHORT, A. E. SHORT and H. O. SHORT. May 21st.

11,850. "Electric cut-outs with multiple safety fuses." R. DESPRESALLE. (Convention date, March 31st, 1913, Belgium.) May 21st. (Complete.)

11,852. "Electrostatic apparatus for separating and cleaning grits, grains, seeds or the like." J. KRATS. (Convention date, April 30th, 1913, Germany.) May 21st. (Complete.)

11,858. "Electric safety-lamps for use in mines and other places." T. HARRISON and A. STRONG-FRAXER. May 21st.

11,860. "Electrical equipment of motor vehicles." H. LEITNER. May 21st.

11,872. "Electrolysis of aqueous solutions." SOC. OF CHEMICAL INDUSTRY IN BASLE. (Convention date, December 9th, 1912, Germany.) May 21st. (Complete.)

11,886. "Commutators." C. ZENE. (Convention date, May 21st, 1912, United States.) May 21st. (Complete.)

11,888. "Automatic or semi-automatic graded service telephone system." H. BARON. (G. Heilmann, Germany.) May 21st. (Complete.)

11,896. "Electric water heaters or the like." R. WEAVING and FERRENTI, LTD. May 21st.

11,905. "Means of equalising or balancing electric currents, applicable to rotary converters or other dynamo-electric machines." A. H. RAILING and C. C. GARRARD. May 22nd.

11,930. "Construction of electrical hot-plates, boiler rings, and the like." C. R. BELLING. May 22nd.

11,945. "Contact make-and-break devices adapted for use in wireless telegraphy and for other purposes." L. B. TURNER. May 22nd.

11,960. "Electrical connectors of the plug and socket type." A. P. LUNDBERG, G. C. LUNDBERG, F. A. LUNDBERG and G. PEGG. May 22nd.

11,970. "Illuminated signs." J. G. A. TETART and M. J. STAEBC. May 22nd.

11,972. "Automatic ships' telegraph alarms." J. A. SULLIVAN. May 22nd. (Complete.)

11,975. "Production of electrical resistance materials." RESISTO-ELECTRICAL MANUFACTURING CO., LTD., and C. RZCZKA. May 22nd. (Complete.)

11,990. "Electric ignition generators." B. LAWRENCE. (Addition to 14,324 and 21,682, 1912.) May 22nd. (Complete.)

11,993. "Urns, or the like, for heating water by electricity." J. MANN. May 22nd.

11,997. "Chemical, electrochemical and electric treatment of plants, fields, seeds, crops or the like." R. MIES. May 22nd. (Complete.)

11,998. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) May 22nd. (Complete.)

12,001. "Igniters." E. C. JONES and J. PEARSON. May 22nd.

12,035. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) (Addition to 13,970/12.) May 23rd. (Complete.)

12,054. "Incandescent electric lamps." C. A. HARRISON. May 23rd.

12,060. "Telephone systems." SIEMENS & HALSKE-AKT.-GES. (Convention date, May 25th, 1912, Germany.) May 23rd. (Complete.)

12,061. "Trolleys for electric traction systems." E. M. MUNRO and R.E.T. CONSTRUCTION CO., LTD. May 19th.

12,065. "Electric welding." E. H. JONES. May 23rd.

12,074. "Oscillation spark gaps." W. T. DITCHAM and GRINDELL-MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD. May 23rd.

12,075. "Microphones for use in wireless telephony." W. T. DITCHAM and GRINDELL-MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD. May 23rd.

12,076. "Apparatus for use in wireless telephony." W. T. DITCHAM and GRINDELL-MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD. May 23rd.

12,082. "Arc lamps." H. AYRTON. May 23rd.

12,100. "Multiple way indicators." T. G. HODGKINSON. May 23rd. (Complete.)

12,115. "Fittings for metallic conduit systems for housing electrical conductors, specially applicable to ceiling rose fittings and the like." SIMPLEX CONDUIITS, LTD., and L. M. WATTS-ROUSE. May 24th.

12,129. "Apparatus for heating liquids electrically." BRITISH ELECTRIC HEATER CO., LTD., and C. KRATT. May 24th.

12,157. "Switching arrangements for use in wireless telephony and wireless telegraphy." W. T. DITCHAM and GRINDELL-MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD. May 24th.

12,162. "Telephone systems." AUTOMATIC TELEPHONE MANUFACTURING CO., LTD. (Automatic Electric Co., United States.) May 21th. (Complete.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

ARC LAMP ELECTRODES. British Thomson-Houston Co., Ltd. (General Electric Co.) 18,689. August 13th.

CONTROLING AND REGULATING DEVICES FOR ELECTRIC LAMPS. E. JOHNSON. 22,127. September 24th.

WALL-PLUGS FOR ELECTRICAL FITTINGS. F. SCHEIDIG. 23,689. October 15th. (October 16th, 1911.)

# THE ELECTRICAL REVIEW.

Vol. LXXII.

JUNE 13, 1913.

No. 1,855.

## ELECTRICAL REVIEW.

## THE I.M.E.A. CONVENTION.

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ON Tuesday next week the Annual Convention of the Municipal Electrical Association will be commenced at the Institution of Electrical Engineers, London. It is seven years since last the Convention was held in the Metropolis, and we can assure the members that they may count upon a cordial welcome and excellent entertainment. Although the Association is not numerically strong, it undoubtedly represents the great bulk of the municipal supply undertakings in this country, and therefore its proceedings are vested with an importance which renders the Convention one of the principal events in the calendar of the electrical year.

Of the papers to be discussed one cannot say much at present; though fewer in number than usual, they touch on matters of great interest at the present time, and ought to lead to considerable discussion. Dr. Ferranti's paper on "Prime Movers" will, we believe, somewhat disappoint those engineers who have been craving for information as to the highly-superheated steam turbine; Mr. Christie's paper describes a useful development in the shape of a water filtering plant for the cooling air, in connection with turbo-generators; and the paper by Messrs. Watson and Mitchell deals with the electric battery vehicle—a subject which is of the greatest importance to central station engineers at the present time. In view of the progress which the authors' firm is making with the Edison battery vehicle in this country, and the demonstration of various types of electrical vehicle which follows the reading of this paper, it is to be hoped that the visitors will be stimulated into displaying rather more practical interest in the subject in the future, than has been the case in the past. A most urgent matter is the standardisation of charging voltages and appliances, and we trust that the opportunity will be seized to arrive at a decision on this point.

But it is not only with the reading of papers that the Convention is concerned; visits have been arranged to the historic Deptford generating station, the West Ham Corporation's electricity works, the Chelsea Underground Railway power station (which we illustrate in this issue), and to the Chingford Reservoir, to view the celebrated Humphrey pumps. Many of the visitors to Kingston-on-Thames will, no doubt, find much to interest them in the horizontal Diesel generating plant recently installed in the Corporation's electricity works, a brief illustrated description of which appears in this issue.

On this occasion the proceedings will be conducted partly *in camera*, the discussion on the Electric Lighting Bill promoted by the Association, and on Electric Heating and Cooking, being restricted to Members and Associates. We have received a copy of the Bill from the hon. secretary, Mr. H. Faraday Proctor, it having been introduced on Wednesday last week; most of its provisions are of a non-

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,**

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contentious nature, and are likely, if approved by Parliament, to prove beneficial to the industry, but there is one clause which is sure to arouse the bitter opposition of the electrical contractors—the familiar clause which confers full powers upon the local authorities to provide, sell, let for hire, and fix, repair, maintain and remove electric lines, fittings, apparatus and appliances for all purposes. The only restrictions imposed upon them by the clause are that the local authorities shall not manufacture, shall confine their activities to their own areas and their own consumers, shall adjust the charges so as to cover all expenditure (including capital charges), and shall separately show the charges made for such work on demand notes, and the expenditure and receipts in their published accounts. Similar powers are conferred upon companies by another clause.

It will be seen that if these powers are granted, the local authorities will be enabled to enter into direct competition with the contractors, and the latter will oppose the clause on the ground that such competition, supported by the rates to which they contribute, is unfair. On the other hand, the municipalities will claim that, having been authorised by the State to embark upon the supply of electricity, they are entitled to the possession of full power to conduct the business on the most efficient lines, and not improbably the matter will end in a dead-lock, as usual. It is most unfortunate that this miserable controversy cannot be settled by agreement between the respective parties. We have often urged the desirability of compromise, and the fact that this can be achieved is strongly suggested by the harmonious co-operation which obtains in several towns where the municipality has succeeded in securing the powers in question. It is by no means too late to bury the hatchet even now, and we sincerely trust that the subject will be discussed by the M.E.A. with "Conciliation" as the text. Compromise demands concession from both sides. The contractors do not wish to clog the wheels of progress, and the municipalities do not wish to ruin the contractors. Surely they can agree as to their respective spheres, and arrive at a reasonable division of labour?

Another clause empowers the undertakers to provide showrooms, hold exhibitions, and carry on publicity schemes, all very laudable objects. It is alleged that the municipalities are at present unable to contribute to the funds of the Publicity Committee, for example, and that the latter is thereby crippled for lack of money. Whether this is the fundamental cause of the notorious failure of the Committee to exert any appreciable influence upon the progress of the industry is open to question; we fear the trouble lies deeper, and that the only remedy for the disease with which it is afflicted is that of dissolution.

Clause 4 authorises the sale of by-products, and Clause 5 the imposition of a minimum annual charge for a stand-by supply of energy. In other clauses power is taken to pay subscriptions to associations, such as the M.E.A., and the expenses of members attending conferences, provisions which are certainly highly desirable in the public interest. One clause deals with the allocation of surplus revenue to the purposes of the undertaking, instead of carrying it to the credit of the local rates; the intention is good, and the policy is one which we have long advocated—but surely an Act of Parliament is not necessary to allow it to be carried out. Other clauses facilitate the borrowing of money for working capital to a limited extent without the trouble and expense of an inquiry, and enact minor provisions in connection with the conduct of the business. The joint exercise of the powers to supply fittings, &c., and to carry on publicity campaigns with other bodies or persons is provided for, and this may contain the germ of a working agreement with the contractors.

## THE LEAD MARKET.

ONE of the most pronounced and striking features in the metal markets during the gloom in evidence last week was the firmness of lead, the price of which hardly flickered, even when tin and copper were pressed for sale at continually weakening figures. The reason was, of course, that the intrinsic position of the metal is one of wholly exceptional strength, the causes operating in connection with which place the article in a category by itself. The consumption of lead naturally increased in common with that of all other metals during the recent period of exceptional industrial activity, but for reasons quite apart from those operating elsewhere (except in a limited degree as regards copper), there has been a reduction in the output, and it is this factor which has placed lead on the very strong foundations seen to-day. The whole position practically arises out of the long-drawn-out revolutionary disturbances in Mexico. This country is reckoned as the fourth largest producer of the metal, occupying this position for a number of years up to 1911, the returns for which year are the latest at present available; the output for 1909 was 113,000 tons, for 1910 115,000 tons, and for the following year 118,000 tons.

What the production will prove to have been last year is merely a matter of surmise, but there is not the slightest doubt that this year it has been very seriously reduced, owing to the revolution, the railways being cut, the transport of fuel, ores, and general supplies to the smelters being stopped, and the forwarding of lead from the smelters to the coast for shipment to Europe being suspended, and these conditions still continue in practically full force. The troubles will also be reflected in a falling-off in the United States lead production, for very large quantities of lead ore and argentiferous lead are sent from Mexico to be treated at United States plants, the total in 1911 being about 75,000 tons in soft lead contents.

For a very long time now, the Mexican smelters in the Torreon district have been practically at a standstill, and even though a small quantity of metal was got through from Torreon to Tampico last week for shipment to Europe, the general situation gives cause for the utmost anxiety to those who have been relying upon the Mexican product for their supplies of raw material. The output of the largest smelter at Torreon is taken by a leading firm of British lead manufacturers, and their buying of metal to replace the Mexican supply, has at times had an important influence on prices in the London market. The restriction of supplies has, indeed, been felt very severely, and the position does not seem to be getting any easier, for every ton of lead is swept up as soon as it comes in; the prospect is exceedingly uncomfortable for those consumers who have not had the foresight, or the proper knowledge, with which to gauge the probabilities of market happenings. It is to be feared that there is too often, on the part of even large users of commodities, an indifference to the course of commercial currents directly affecting their interests, an indifference which at times involves them in difficulties which could have been avoided easily enough, but which if neglected prove costly, and on occasion impossible of repair. Ultimately, of course, the situation in lead will be relaxed, but that can hardly occur until the normal working conditions are restored in Mexico, and the date of that may be far off even yet, though one naturally hopes for the best. Meanwhile, consumers who have not provided for their needs stand in an unenviable

position, because lead for immediate and near delivery commands an almost prohibitive price.

Consumers are very distrustful of lead at £20 a ton and upwards, and truly that is a high price. The average price of soft foreign lead was £17 15s. 10d. in 1912, £13 19s. 2½d. in 1911, £12 19s. in 1910, and £13 1s. 8d. in 1909, but in 1907, the boom year, it was £19 1s. 9d., while in 1902 it was no more than £11 5s. 3d. The highest figure reached was £23 15s. a ton in September of last year, and the lowest £9 in 1894. This year's monthly averages work out as follows with comparisons for the two previous years.

	1913.	1912.	1911.
January ...	£17 1 11	£15 11 2	£13 0 8 a ton.
February...	16 8 5	15 13 9	13 1 11 "
March ...	15 19 8	15 19 8	13 2 11 "
April ...	17 8 10	16 6 6	12 18 5 "
May ...	18 14 3	16 10 2	12 19 2 "

No doubt the spirit of caution is a virtue, even with the Mexican trouble looming large, but the point must be kept in mind in considering the position that one of these days things in Mexico will settle down, and when the news comes that the country's political troubles are over, one of the first events will be a readjustment of lead prices in consonance with the altered position. For the time being, however, the consuming trades have been pretty hard hit, and in more than one direction a restriction of operations is now in force, users not having bought ahead or against contracts, in a measure sufficient to protect themselves, and being either unable or unwilling to purchase at current figures. The supplies coming in from abroad are very moderate, and neither Spain nor Australia is increasing output to an extent sufficient to fill the gaps left by the shortage from Mexico. Further, Australia has had labour troubles to face which have tended to accentuate the stringency of the position. Then, again, consumption has increased very largely in the Far East, and important quantities of lead which formerly came to London are now shipped direct from Australia to Japan and China, while a good deal of Russia's requirements is now dispatched direct from Spain to St. Petersburg, all of which tends to restrict the tonnage of material coming to this country. In the long run, it makes no difference to British consumers, but it does tend at times to narrow the market for buyers. If ever there were an excess of supplies shipped, it would no doubt be London which would provide the temporary home for metal waiting for a market, when prices would naturally be expected to suffer. The anticipation that a period of lessened stringency is not very far off is entertained, is shown clearly enough by the fact that while the price of June shipment lead is over £20 a ton, that of August is only £19 7s. 6d. The discount reflects the market's estimate of the chances of a restoration of reasonable working conditions in the areas of unrest. Viewing the metal markets as a whole the tendency at present appears to be towards a lower level, not only because trade is thought to be waning, but also because finance has developed some unsound spots, and because trouble of this kind always reacts immediately upon public confidence, and through this, on national spending capacity in every direction, both public and private. It is too much to hope when once fairly normal conditions are restored in Mexico, that lead will prove a law to itself. In any event, consumers regard lead at £20 a ton with a suspicion born of experience, and buying is restricted.

#### Guaranteed Wiring.

WE referred some time ago to a proposal of the Electrical Contractors' Association to guarantee the work of its members. The proposal has not yet been translated into a definite scheme, but a report has been made by a Sub-Committee of the Association formulating certain definite suggestions which it is proposed should be incorporated in the scheme.

Briefly, these are (1) that every member of the Association shall undertake to carry out all his indoor contracts within the British Isles in strict conformity with the rules

of the Institution of Electrical Engineers, except where some other standard is specified by the purchaser; (2) that the Association shall indemnify the employer of any member against bad workmanship or materials supplied by such member, subject to certain limitations; (3) that any member failing to remedy defective work after being called upon by the Association to do so shall at once cease to be a member of the Association.

A question which naturally suggests itself is, who is to be the judge? Many members might conceivably object to the judgment of a brother-member or a committee of members who might be competitors of his. This objection is met by the proposal of the Sub-Committee to appoint a competent engineer to inspect and report on work which is called in question. In the event of an adverse report, the costs of the inspection are to be borne by the defaulting contractor, whilst the employer is to pay if the report is favourable to the contractor.

It is considered in some quarters that the proposals aim at the elimination of slip-socket conduit, which, whatever its faults, has done a good deal to cheapen the cost of wiring and pave the way for screwed conduit, which is now regarded as an essential factor in really good work. Slip socket has, in fact, had its day, and few, if any, of the leading insurance companies look with favour upon it, although they possibly accept the risk in ordinary residential property.

There can be no doubt that one of the chief objects of the Electrical Contractors' Association, in formulating the proposals referred to, is to raise the general standard of wiring and to eliminate, if possible, the jerry wiring contractor, and these objects have our entire sympathy.

#### Expert Witnesses in America.

IT would seem that war is now being waged against the expert witness in the United States. According to a leaderette in the *Canadian Engineer* (May 22nd), a strong opposition to the present method of securing expert evidence in cases at law, and a growing feeling that expert witnesses should be designated by the Courts, led the American Institute of Consulting Engineers to hold a discussion on this subject a short time ago. The American proposal, apparently, is that in certain classes of cases which require expert testimony, such as the valuation of public utilities, conflicting claims of water-power companies, and the like, "time will be saved and cases will be better presented if studied from *ex parte* points of view before the action at law is begun. The appointment of engineer associates by the Court would probably be helpful in clearing up *conflicting and confusing testimony.*" (The italics are ours.) With all respect to the president of the American Institute of Consulting Engineers who put forward this view when summing up the discussion, he seems to us to beg the whole question. What is the "conflicting and confusing testimony" which the engineer associate of the Court is to pass in review? Surely it must be the evidence of other experts. We make bold to say that every proposal to abolish the expert witness in technical cases which has ever been brought forward in this country has always had a fundamental flaw: no efficient substitute has been suggested. We recall the *dictum* of a distinguished Cambridge scientific professor who was asked whether he favoured compulsory Greek. "No," he replied, "I am against it." "But will you vote against it?" was the next question. "Yes," he replied, "I will, as soon as you satisfy me that you are going to put something as good in its place." Who is to replace the technical witness in a complicated electrical patent case? The plaintiff and the defendant must both put their arguments before the Court; and the arguments of counsel can only be founded upon the opinions of experts—opinions which those experts are prepared to uphold in the witness box, subject to the searching criticism of cross-examination. True, the inquiry may be long and tedious, but the results are generally satisfactory. Nor are our judges wholly incapable of dealing with a purely scientific issue when instructed by the skilled testimony of the expert. He who commends the present system is no mere *laudator temporis acti*. It is the growth of hundreds of years.

# THE INSTITUTION OF ELECTRICAL ENGINEERS IN PARIS.

(Abstracts of Papers discussed in Paris at the Joint Meeting of the INSTITUTION OF ELECTRICAL ENGINEERS and the SOCIÉTÉ INTERNATIONALE DES ÉLECTRICIENS, 21st-24th May, 1913.)

(Continued from page 927.)

## The Electrification Schemes of the Chemin de Fer du Midi.

By MONSIEUR JULLIAN.

THE problem of the electric haulage of trains presented itself for the first time to the Compagnie du Midi in 1902 at the time when the concession for the development of the line from Villefranche-Vernet Les-Bains to Bourg-Madame in the Department of the Western Pyrenees was offered by the State. The conditions for the building of the line differ very considerably from those inscribed in the scale of rates of the Compagnie du Midi. Advantages were conceded because the line to be constructed was of narrow gauge, with sharp curves, and because the gradients were 80 mm. per metre.

The question of the electrification again presented itself to the Compagnie du Midi in 1907, when the State proposed granting it the concession for lines which it wished to construct in the region of the Central Pyrenees, including gradients up to 40 mm. and curves of radius less than 300 metres. At the moment of signing the convention relating to these lines, the State entered upon new negotiations for the line from Pau to Hagetmau.

The Compagnie du Midi made a new proposal with a view to reconciling the interests of both sides, and two agreements were signed in 1907 and 1908.

When all the lines comprised in these two agreements are working, the Compagnie du Midi will have a system of 622 km. of electrified lines, of which 112 will be double track, that is to say:

Lines actually working	... ..	327 km.
Line under the agreement of July 4, 1908	227	„
Lines crossing the Pyrenees	... ..	68 „

The equipment of the lines actually working is in course of completion, and will be finished in the month of July next, throughout about half of this length.

Another electrification has been undertaken for other reasons; this is the line from Perpignan to Villefranche in the Eastern Pyrenees. In 1911 the company equipped this line electrically for a length of 24 km. in order to make some tests in view of the electrification of the Central Pyrenees line.

Owing to the fact that the outlay for these tests has already been incurred, and that the volume of mineral traffic on this line is constantly increasing, there is no doubt that electrification will be advantageous.

The Company has also had in view the extension of the electrification of other parts of its system by prolonging the lines which have just been referred to. The preliminary investigation into these electrification schemes has been made with favourable results. The electrification is justified by the extremely advantageous economic conditions under which it will be carried out. It is also justified by the particular features of the system.

The lines to be constructed have steep gradients, which are one of the main factors leading to electrification. The lines now at work which are to be electrified run at the foot of the approaches of the Pyrenees, and often penetrate into the steep valleys. They have gradients of which the greater number lie between 15 and 32 mm. Except over the section in the neighbourhood of Pau the practicable speeds do not exceed 70 km. per hour, and the mean speed is rather nearer 60 km. per hour. These conditions are excellent for traction by electric motors. Finally, during a part of the year these lines have a heavy service of passenger trains, for the hauling of which electric traction will have some advantages.

The current used for the working lines is single-phase current at 16 periods and 12,000 volts. The frequency was fixed at 16 periods in order to secure the best working conditions for commutator motors of the series type. The engineers considered—and experience has justified them—that repulsion motors, although possessing a series characteristic, would not be suitable for working on so variable a load as required in this particular case of electric traction. The pressure on the working line was fixed at 12,000 volts for economic reasons.

It is intended to distribute energy by means of single-phase current at a pressure of 60,000 volts. The alternators at the station will generate current at 6,000 volts; the transformers will raise this pressure to 60,000 volts, and in the sub-stations the pressure will be stepped down to 12,000 volts for the supply of the overhead conductor. The distribution by means of simple alternating current is justified from the standpoint of economy.

In the experimental line from Villefranche to Vernet-les-Bains, six types of overhead equipment have been established: four of these belong to the simple catenary type, one to the double catenary, and one to the rigid type. The spans are 100 metres, 60 metres, or 50 metres, and the longer sections are provided with compensating arrangements.

It is clear from these tests that the simplest overhead equipment is the best, for almost all accidents are due to the faulty working or breaking of apparatus introduced to obtain a better compensation or a greater flexibility for the line, and the efficacy of such apparatus is in general very doubtful. To be precise, on the lines comprising fairly numerous curves of a radius lying between 350 and 800 metres, and worked over by trains at speeds

between 75 and 80 km. per hour, but not exceeding 90 km. per hour, the choice should fall upon the simple uncompensated catenary type for spans of between 50 and 60 metres, with pull-offs on the curves to bring back the overhead conductor towards the centre of the track when necessary. The catenary cable should in this case invariably be anchored to the insulator at each bracket.

Poles made of reinforced concrete are too expensive, and owing to their weight too difficult to erect for existing lines. The "Midi" type of pole, composed of old rails fastened together, is very suitable for single-track lines, even if it has to support high-tension cables, provided that these cables are spaced at equal distances with reference to the axis of the pole. They cost very much less than the other poles, are easy to erect, and do not sensibly obstruct the view.

For a double track with high-tension cables, the "Midi" pole made up of rails is not sufficiently strong, and lattice-poles must be used.

The overhead conductor is of red copper, 100 square millimetres in cross-section, of circular section, grooved for taking the suspension clamps.

The high-tension transmission comprises two lines, usually in parallel, each consisting of two aluminium cables, which have 131 square millimetres cross-section on the branches from Arreau to Pierrefitte, and 81 square millimetres cross-section on the other lines.

The insulators are of porcelain on the line from Lourdes to Pierrefitte, and of glass everywhere else. The high-tension insulators have been tested to 150,000 volts, and those for the overhead conductor at 4,500 volts.

Opposite each pole, to ensure that the rail shall not have a high potential with respect to the earth, the track rail and the pole are connected together and to earth. The rail joints are copper bonded.

On the first section, which is a single track, of which the length is 21 km., with a high-tension transmission line, the total cost amounted to 410,000 fr., including the equipment of the station sidings, except those at Lourdes, and all accessories. The equipment works out then at 19,500 fr. per kilometre.

On the sections from Tarbes to Lourdes, double track with high voltage transmission of which the length is 21 km., the cost of equipment reaches 450,000 fr. under the same conditions as those above. The equipment works out in this case at 21,500 fr. per kilometre.

The cost of equipment of large railway stations is not yet known; this will vary with each station in accordance with local conditions.

For the Central Pyrenees there will be two generating stations, at Soulem and Ejet. For the lines crossing the Pyrenees there will also be two generating stations, at Porte and Soussouéou. For the line between Perpignan and Villefranche the generating station will be at Fontpédrouse.

At the station at Soulem the work is in the most advanced state. The power continuously available amounts to a total of 10,300 h.p. This power, thanks to large reservoirs constructed at the head of the pipe lines, may reach 18,000 h.p. for periods sufficient to ensure the train service.

The four transmission lines leaving the station are protected by a large choking coil, an electrolytic lightning arrester, and a water-jet discharger. A Tirrill regulator is provided to keep the voltage constant in spite of the very considerable variations in load on the high-tension line.

It appears that the cost per horse-power installed will work out at about 500 fr.

The station at Ejet has not yet been started. It will have an output of about 18,000 h.p.

The sub-stations will be five in number, and are placed at Montréjeau, Lannemezan, Tarbes, Lourdes, and Pau. Their normal output is 2,500 k.v.a.; they will have an overload capacity of 3,750 k.v.a. for one hour, and of 5,000 k.v.a. for one or two minutes.

Work on the generating stations at Porte and Soussouéou has not yet begun. At Porte power to the extent of 3,500 h.p. will be continuously available.

The work at the generating station at Fontpédrouse is as advanced as that at the station at Soulem; the station will be put to work towards the middle of June. The continuous power available at the shaft of the turbines is 2,600 h.p., and this power may be increased to 3,600 h.p. for an hour and a half by making use of the storage water available at the head works and in the reservoir.

The rolling stock consists of locomotives and motor-cars. The locomotives are especially intended for the hauling of long goods trains coming from or going to non-electrified sections. The motor-cars are provided exclusively for branch lines and for trains working on the electrified section only. Chiefly for the purpose of gaining the necessary information to decide on the type of locomotives and motor-car, the Compagnie du Midi in 1912 arranged for the tests already mentioned on the line from Perpignan to Villefranche.

In these tests locomotives were employed capable of starting a 400-ton train on an up-grade of 11 mm. per metre, and in addition of hauling a train of 100 tons at a speed of 60 km. per hour, and a train of 280 tons at a speed of 45 km. per hour over the hilly section from Ile to Villefranche, which has long and numerous gradients of 17 mm. per metre and some even of 21 mm. On a down-gradient these locomotives were able to deal, by electric braking alone, with the same loads at speeds

capable of being regulated by the driver between the up grade speeds and one-half of those speeds. The electric braking can be obtained by returning the energy given out by the motors, either to the transmission (regenerative braking), or else to resistances.

The motor-cars can haul over the above gradients a train of 100 tons, motor-car included, at a speed of 65 km. per hour, and on the down grade electric braking occurs under the conditions indicated above, but without always returning current to the line.

Three of the locomotives tested satisfied the conditions imposed. These locomotives were constructed by the Ateliers de Constructions Electriques du Nord et de l'Est, by the Compagnie française Thomson-Houston, and by the Compagnie française Westinghouse. The motor-car constructed by this latter firm also satisfied the conditions. These tests are not yet concluded.

In the locomotive made by the "Ateliers du Nord et de l'Est" the torque of the motor is transmitted to the wheel by a pinion keyed to the motor shaft and a spur wheel driving the axle through a spring coupling.

This arrangement, demanding the use of at least one motor per axle, allows the power to be divided up among several motors, which simplifies their construction and also the design of the locomotive. But it has the drawback of lowering the centre of gravity of the locomotive, which results in punishing the track. The test locomotive weighs 86 tons, and current is taken from the line by two pantographs. Control is effected by means of an induction regulator, which allows of contactors being dispensed with. The working of this regulator gave satisfaction during the tests.

The motors are of the Latour series-repulsion type. They are designed to start as repulsion motors and to change to series motors automatically as soon as the speed reaches 25 km. per hour, which corresponds with synchronism. Each motor is able to develop 400 h.p. for 6 hours, and 500 h.p. for 1 hour.

During the repulsion working the stators of the three motors are connected in parallel, so that each rotor cannot take up a speed appreciably different from that of the other two. This provides an electric coupling which has given good results during the tests. Forced air ventilation of the motors is used.

For the regenerative braking the motors working as generators employ for their excitation current lagging 90 deg. behind the supply current. This current is furnished by a winding on the stator of the ventilating fan motors. After some initial trouble the regenerative working has given complete satisfaction.

On test this locomotive has hauled a train of 100 tons on an up-grade of 17 mm. at a speed of 60 km. per hour, taking from the station 860 kw.; a train of 280 tons on the same incline at a speed of 41 km. per hour, taking from the station 1,150 kw. The electric braking requirements on descending grades have been fulfilled, and the power returned to the line has often reached 350 kw. With regenerative braking the power factor is very nearly unity. The current given out by the motor may, in fact, actually be in phase with the pressure, or even leading in phase.

The Compagnie du Midi has ordered eight locomotives of this type, with the power increased to 1,500 h.p. continuously, or 1,800 h.p. for 1 hour, with a max. speed of 90 km. per hour. The repulsion working at starting is to be suppressed, and the electric coupling of the axles to be retained at all speeds. The locomotive to weigh 90 tons.

The locomotive made by the Compagnie française Thomson-Houston is equipped with two motors only, and the use of connecting rods has been unavoidable. The locomotive weighs 89 tons. The electric control is effected by varying the voltage supplied to the motors, requiring the use of contactors connected to tapings on the secondary of the main transformers.

The motors are of the series-repulsion type, and the connections are automatically made for repulsion working for speeds below 25 km. per hour. The working of this arrangement has given trouble. The makers are engaged on a new design.

The Westinghouse locomotive is equipped with two motors, requiring the use of idle shafts and connecting rods. The trial locomotive weighs 82 tons. The electrical control is effected by varying the voltage supplied to the motors by means of contactors. The motors are of the compensated series type and work in series all the time; they have forced ventilation, and can develop 600 h.p. for 6 hours, and 700 h.p. for 1 hour. The motors are not designed for repulsion working.

When a high-tension power transmission line and a telephone or telegraph line happen to run close together for a considerable distance, the former sets up induced electromotive forces in the latter, resulting in disturbances in the receivers. Disagreeable, if not dangerous, results may follow to workmen and to the public. These phenomena are produced with special intensity if the two lines are alongside railway track, and if alternating current is returned by the running rails. In such a case, the current instead of returning wholly by the rails returns in greater or less proportion through the earth, thus affecting the telegraph apparatus, which works with an earth circuit.

Up to the present the precautions taken to avoid these disturbances are neither completely efficacious nor practically realisable, owing to their cost. This applies to the replacement of the lines affected, and the use of telegraph circuits without earth connections.

It was considered better to find a solution of the problem by the use of apparatus capable of neutralising the effects of the disturbing currents. Among those which have been considered, that of M. Girousse has proved successful in the protection of Morse apparatus, as has been demonstrated in official tests. The company is about to apply these protectors in the first

place to the railway station apparatus on the line from Perpignan to Villefranche, and will bring them into general use, if required, on the whole of the electrified section. The Post and Telegraph Administration has decided to install this apparatus in such offices as are affected by the traction current.

In order to ensure satisfactory working of the telephone, the Administration is about to replace ordinary insulators by others of greater insulation resistance, to transpose the two lines every 300 or 400 metres, and to insert transformers between the lines and the receiving apparatus. This last arrangement, the object of which is to save users from dangerous or perhaps only disagreeable shocks, has the drawback of weakening the sound of the voice; it is the same fault which hitherto has prevented the use of protectors for telephonic apparatus. Nevertheless, experiments with these protectors have not been given up.

The Compagnie du Midi will probably have to try the cost of all this work. That will not prevent it from trying all suitable means for rendering the traction current as harmless as possible to telegraph and telephone lines. For this purpose the company contemplates the addition to the alternators and to the motors of arrangements for damping the high harmonics, to which the disturbing phenomena should be attributed to a large extent.

From the foregoing account it is clear that the electrification of a large railway system is to be undertaken by the Compagnie du Midi, under conditions as advantageous as possible.

### Petrol-Electric Motor-Vehicles.

By MONSIEUR J. B. G. DAMOISEAU.

Of the various heat engines capable of application to automobiles running on rails, the internal-combustion engine using liquid fuel—petrol or benzol—is the only practical type. Continuous current is likewise universally employed.

The design adopted for motor-vehicles using internal-combustion engines is necessitated by the limitations of these engines. Thus, as internal-combustion engines are unable to start under load, means must be provided for starting them light. Moreover, such engines give a practically constant torque, and to be economical should run at a speed below that corresponding with maximum power so as to prevent the engine being pulled up; but as they must operate somewhere near that critical speed, it follows that it is essential to introduce gearing between the engine and the axles so that the speed of the car can be varied whilst that of the engine remains uniform.

As the internal-combustion engine can work either at constant or variable power (by regulating the admission of the fuel), and the power required for traction is also variable, two distinct methods may be considered:—

(a) An arrangement comprising a means of storing energy and for dealing with the fluctuations in the demand for energy whilst the engine generates constant output. This method has the advantage of allowing the energy to be stored which is produced when the car runs down gradients, and whilst braking.

(b) An arrangement in which energy is not stored, and in which the engine supplies the power necessary for driving the vehicle.

There are at the present time automobiles with internal-combustion engines and mechanical, electrical, and mixed drive; but those with the mixed drive are the only ones in which accumulators are utilised. The present paper deals with motor-cars with internal-combustion engines and with electrical or mixed drive.

In 1904-5 the Société Anonyme de Locomotion Electrique, owners in France of the Heilmann patents, built a petrol-electric vehicle to demonstrate its practical value. At about the same period trials with motor-vehicles were being carried out in England by the North-Eastern Railway Co.; the petrol engine was constructed by the Welseley Tool and Motor-Car Co., and the electrical equipment was supplied by the British Westinghouse Electric and Manufacturing Co. These two cars were only test cars to prove the practical value of this form of traction.

The first exploitation of petrol-electric motor-vehicles dates back to the years 1905-6, and was undertaken by the Hungarian Arad Osnad Railway. This railway system has normal gauge and a length of 400 km. It was worked at first, as far as the passenger traffic was concerned, with 36 petrol-electric cars of two types. Those destined for slow trains had each a petrol engine of 30 H.P., and those for fast trains a 70-H.P. engine. The petrol engines and the generators of all these cars were supplied by the Société de Dion-Bouton.

As traffic increased in consequence of the introduction of this kind of traction, the railway company was induced, so that trailers could be added, to increase the equipment from 30 H.P. to 40 H.P. It was found essential to increase the power still more. A Hungarian firm, a branch of the Société Westinghouse du Havre, was asked to undertake this transformation, which is still being carried out. The cars at present in use are of 40 and 70 H.P. (Dion-Bouton) and 60 and 90 H.P. (Westinghouse). This is at present the most important application of this kind of traction in Europe.

The Dion-Bouton cars have each a petrol engine with four vertical cylinders driving through a flexible coupling a continuous-current compound-wound generator running at 500 volts. This group supplies electrical energy to two electric motors which drive the two axles of the car. A controller is fitted in the driver's cabin, with one handle for operating the car in either direction, and

connected for series-parallel working, the speed of the car being controlled in that way. This controller is fitted with four notches for forward running, and only one for reverse. The air required for the brake is supplied by an air compressor worked electrically and provided with an automatic pressure regulator. When the current is interrupted by means of the controller the engine runs at the reduced speed of 300 R.P.M. When the controller is brought into operation, the current supplied by the generator has the effect of opening gradually the regulating valve, consequently of increasing the speed and the power of the engine. When the speed of the engine is sufficiently high, the car starts, and its speed can be regulated by the controller.

The two four-pole motors are of the series type. The field coils of each motor are connected two in series, and each pair can be connected in series or parallel. In order to pass from one notch to another, whether for increasing or decreasing the speed of the car, the driver first operates the control valve so as to reduce the speed of the petrol engine, then places the controller in the position required for the desired speed, and finally brings back the control valve to its first position corresponding with normal speed. This method of working is to prevent the current being broken at the controller. The petrol engines have four cylinders, and run at 1,000 R.P.M.

The cars are heated by the water which circulates in the cylinder jackets, and are lighted by means of acetylene. The 40-H.P. cars provide seating accommodation for 42 passengers, and weigh 13 tons; the 70-H.P. cars seat 39 passengers, and weigh 16.5 tons. Each of these motor-cars is capable of hauling two trailers with seating accommodation for 96 passengers, and of a total weight of 12.6 tons.

The motor vehicles on the Westinghouse system are of two types. The first has a 60-H.P. petrol engine with four cylinders, and the other has a 90-H.P. engine with six cylinders. The engine is connected through a flexible coupling to a continuous-current generator with shunt excitation. The pressure of the generator can be varied between 300 and 550 volts by altering its excitation and the speed of the engine. The generator supplies current to the two electric motors driving the axles of the car. The electrical plant is always placed crosswise in the driver's cabin.

Each driver's cabin contains a special controller with two handles for connecting the motors in series or parallel, adjusting the excitation of the generator, varying the speed of the petrol engine and of the car in either direction: the air brake is generally fed by an electrically-operated compressor having an automatic pressure regulator.

The driver starts the car and regulates the speed by means of the controller, which connects the motors in series or parallel, and also varies the excitation of the generator. To vary the amount of air admitted to the carburetter, and thus the speed of the engine, the driver turns the port portion of the controller handle, which, by means of a connecting wire, acts on the governor of the engine. This control is, therefore, independent of the field circuit of the generator and the connections of the motors. If the stud in the handle is released the engine slows down, and the car stops. This contrivance operates, therefore, in the case of any failure on the part of the driver. The Westinghouse cars are able to haul one or two trailers.

The Prussian State Railway management in 1907 adopted some petrol-electric cars made by the Allgemeine Electricitäts-Gesellschaft and the Bergmann Electricitäts-Unternehmungen Aktien-Gesellschaft.

Each of the cars equipped by Messrs. Bergmann comprises an electric generating set, spring-supported, which rests directly on the two axles of one of the two bogies of the car, the other bogie carrying two electric motors, to which current is supplied by the generator. This arrangement facilitates the rapid replacing of the set, and avoids the transmission of the vibrations due to the engine to the body of the car. The body of the car is entirely distinct from the generating plant, the engine being covered with a removable hood. The benzol engine has six cylinders, and develops about 100 H.P. at 700 R.P.M. A centrifugal governor controls the admission of the gas, and is connected to the controller handle, so that the speed of the engine is reduced automatically to one-third when the engine runs without a load.

The engine is started by means of compressed air obtained from the reservoir for the air brake, the air compressor being driven by a benzol engine. The engine weighs 2,500 kilograms. The liquid fuel is stored in a reservoir, being covered with an inert gas under pressure, either nitrogen or carbonic acid gas being used; the latter are stored in a gas cylinder. The continuous-current generator, the pressure of which is varied by altering its excitation, is direct coupled to the engine, and is fitted with commutating poles and a compensating winding. It can develop continuously 66 kw. at 300 volts and 700 R.P.M. As the speed of the car is only controlled by varying the excitation of the generator, it is necessary to use accumulators to maintain a steady pressure for the electric lighting of the car, the electric alarm bell, the field windings of the motors, and for exciting the main automatic switch. By means of a special arrangement, this generator with its variable pressure can supply current to the auxiliary circuit for charging the battery.

Each of the two electric motors, which are of the series type and are fitted with commutating poles, can develop 85 H.P. for one hour. The controller is fitted with a push button, so that should the driver remove his hand from the controlling handle when the latter is on one of the forward notches, the whole of the current is cut off and the compressed-air brake is immediately brought into action.

This car, with accommodation for 100 passengers, weighs 47 tons, and reaches on a level a speed of 70 km. per hour.

The motor-vehicles supplied by the A.E.G. Co. for the Prussian State Railways are arranged to a considerable extent on the same plan as those of the Bergmann Co. The electric lighting of the car is supplied from the exciter and the battery, which are connected in parallel when the speed of the electric generator is 700 R.P.M. When the speed is below this, the exciter is automatically cut out of circuit and the lighting is obtained from the battery. The car provides accommodation for 95 passengers, weighs 55 tons, and has a speed on the level of 65 km. per hour.

The same company has built, for branch lines, another type of petrol-electric car of 55 H.P., which was recently placed in service on the East German railway system at Königsberg, East Prussia.

In the motor-vehicles of the General Electric Co., U.S.A., the two electric motors are lodged on the front bogie beneath the driver's cabin. The main set consists of a gasolene engine driving at one side an electric generator and at the other an air compressor. The auxiliary set comprises a petrol engine driving an electric generator and an air compressor.

The main engine has eight cylinders, and runs at 550 R.P.M. The generator has eight poles as well as commutating poles, and supplies 100-kw. continuous-current at 600 volts. The voltage of the generator varies from 260 to 800 volts, according to the power required for traction.

The two electric motors, which are fitted with commutating poles, are designed for a pressure of 600 volts and can each develop 100 H.P. for one hour.

The controller connects the motors in series and parallel and varies the excitation of the main generator.

The cars are constructed entirely of metal, having seating accommodation for 60 to 100 passengers, and weigh from 40 to 50 tons. They are capable of developing a draw-bar pull of about 5,500 kilograms, and a speed on the level of about 90 km. per hour.

The Great Western Railway Co. of England is at present experimenting with a motor-vehicle having only two axles, and the electric equipment has been supplied by the British Thomson-Houston Co.

The petrol engine of 40 H.P. drives a dynamo which supplies current to two electric motors, each of which transmits power to one axle. This car weighs 14 tons, and has seating accommodation for 44 passengers.

The petrol-electric motor-vehicles at present undergoing trials on the Swedish State Railways are the first to be equipped with Diesel engines for use on railways, to reduce the cost of fuel. Each motor-vehicle has a Diesel engine of 75 H.P. at 700 revs. per minute, coupled to a 50-kw. continuous-current generator feeding the two electric motors, each of 30 H.P. The Diesel engine used has six vertical cylinders, water-cooled, and a supplementary cylinder for supplying the compressed air necessary for starting the engine and for injecting the petrol for starting. The fuel consumption is said to be 225 grammes of oil per horse-power-hour at the full load of 75 H.P.

The generator gives a variable pressure from zero to a maximum of 440 volts according to the speed of the engine. It has commutating poles and is connected to the engine by means of a flexible coupling.

A battery of 23 cells and of 200 ampere-hours capacity is automatically connected with the generator when running without load, *i.e.*, when the car is at rest or running down an incline. This provides the lighting of the car, besides supplying the auxiliary apparatus used in working the car.

The speed of the engine is regulated by a small electric motor operated from the controller. No starting resistances are employed. When the normal speed of the engine is reached, the regulation of speed is effected automatically, the design of the generator and of the electric motors being such that the power taken from the petrol engine is remarkably constant and cannot exceed the maximum power that the engine can give.

The arrangement to ensure the greatest measure of safety in working is as follows, one attendant only being required: On the roof of the car and on each side wooden bars have been fixed for keeping a spring mechanism in position. If the car passes beyond a signal which is at danger, one of the bars strikes an arm fixed to the signal, opens a switch in the motor circuit, and puts the air brake in action, thus stopping the train.

These motor-vehicles seat 39 passengers, weigh 26 tons and are built for a maximum speed of 60 km. per hour. The electric equipment was supplied by the Allmänna Svenska Elektriska Aktiebolaget.

The automobiles on the Pieper system are of the mixed-transmission type, with energy storage and regeneration. In this system the internal-combustion engine drives the axles directly by means of a cardan shaft and bevel gear. A shunt-dynamo fixed on the engine shaft is connected to a battery of accumulators.

When the power of the engine is insufficient, the battery automatically supplies energy to the dynamo, which then operates as a motor. When the power given by the engine is in excess of that required for traction, or when the kinetic energy of the car can be recuperated, *i.e.*, when the car is slowing down or running down a gradient, the dynamo works automatically as a generator and charges the battery.

The admission of the gas to the engine is controlled by an automatic regulator consisting of a differential solenoid.

The driver starts the engine by sending the current from the battery into the dynamo, which is excited to the maximum. The engine having been started, the driver admits current from the battery gradually into the electromagnet clutch. This starts the car smoothly, and its speed is afterwards increased by gradually diminishing the excitation of the dynamo. Its control is afterwards effected automatically.

When the car reaches a gradient, should the resisting torque on

the wheels become greater than the turning moment of the engine, the speed of the latter diminishes, the voltage of the dynamo falls and becomes less than that of the battery. The battery then discharging into the dynamo produces a torque which assists that of the engine until it balances the resisting torque of the car. The assisting couple produced by the motor is, moreover, a maximum, since the admission of the gas, which is governed by the discharge current, is likewise at a maximum.

Similarly, when the car arrives on a gradient, if the resisting couple is less than the turning moment of the engine, the speed of the latter tends to increase, and the voltage of the dynamo rises so that the dynamo begins to charge the battery. This charging current passing through the regulator results in the rate of admission of the gas being reduced to the minimum and the torque of the engine becomes zero. For each section of the route, equilibrium is obtained between the three torques, viz., the torque of the car, the torque of the engine, and the opposing or motoring torque of the dynamo.

In order to slow down or accelerate at will the speed of the car, it is sufficient to upset this equilibrium. To slow down, the resisting torque must be increased; this is done by the driver increasing the excitation of the dynamo, which then begins to charge the battery. This charging current diminishes the rate of admission of the gas and consequently the driving torque. The kinetic energy stored in the car is thus restored to the battery. For accelerating purposes the driving torque must be increased, *i.e.*, the excitation must be diminished. When the car is at rest, the engine clutch is disengaged. The engine may then be either stopped or changed to low speed in order to charge the battery.

This description shows that the internal-combustion engine owing to its constant connection with the axles of the car, and owing to the fact of its being automatically governed, works with variable cut-off. This type of motor-vehicle, which requires accumulators, has also the advantage of storing energy when the car is slowing down or running down gradients. In the motor-vehicles in operation on the Pieper system in France, by the Compagnie des Chemins de Fer de Grande Banlieue, from Saint-Germain to Poissy, the generating set with its two clutches is suspended on springs by two longitudinal girders from the frame of the car, between the two bogies, below the luggage compartment. This set drives the extreme axle of each bogie through a cardan shaft and bevel gear. The engine has four cylinders, and uses benzol as fuel. The car has seating accommodation for 33 passengers and standing room for 16. It weighs 217 tons, and can haul two 10-ton trailers.

A motor-vehicle on the Thomas petrol-electric system, with mixed transmission, is in service on the Central South African Railway.\* This car has a petrol engine, epicyclic gear and two dynamos. The whole works on M. Gasmier's electromechanical method of varying the speed. The electric generating set is placed in the centre of the car, and drives through a cardan shaft and gear the extreme axle of each of the two bogies.

The dynamos are series wound, and are permanently connected in series. The car is started and its speed controlled by varying the excitation of the two dynamos. The engine develops 120 H.P. at 670 R.P.M.

The car has seating accommodation for 42 passengers, and weighs 215 tons; when running without a trailer a speed of 80 km. per hour was reached on the level, and with a 16-ton trailer a speed of 70 km. per hour.

The advantages of independent motor-vehicles, no matter of what type, depend essentially on the possibility of forming trains of less weight, and consequently of employing a greater number of trains than is the case with steam locomotives. This increase in the number and frequency of the trains should result, in general, in an increase in traffic, and consequently in the revenue, which would cover—supposing that the working expenses are not too high—the initial capital outlay of certain secondary or local lines which, if operated with steam locomotives, could not give such good results.

This use of independent motor-vehicles could even be extended to certain main lines of important railway systems, and would allow an increase in the actual overall speed of long-distance trains, by doing away with stops at the less important stations, such stations being served with independent motor-trains. This method of working, viz., separating the general traffic from the local traffic, would make it possible to do justice to the requirements of these two kinds of traffic, which requirements are at present so conflicting; and in that way it would bring about an increase in the speed and frequency of communication, both of which are so much insisted upon by the travelling public.

The introduction of petrol-electric cars has numerous advantages.

By using internal-combustion engines the car is always ready to start, and only a short time is required to take in fuel, &c., for long journeys. The start is as rapid as in the case of all vehicles adapted for electric traction, consequently the net speed is increased. One man only is required to drive the car, which is easy and safe to work. The driver can concentrate all his attention on the speed of the car, and on the track and the signals. The absence of smoke, and the fact that he stands at the front of the car, facilitate his observation of signals, &c.

The petrol-electric cars are very flexible as regards their operation, owing to the system of control employed. If the stops are of long duration the engine can be shut down and any waste of fuel thus avoided. The maintenance of petrol-electric cars can be attended to without interrupting the service. Repairs are rarely

necessary, and the removal from service for this purpose is, consequently, of short duration.

The use of two drivers' cabins dispenses with the necessity of turning the car at the terminus. The reduced weight of the petrol-electric cars and their smooth running reduce the wear of the rails to a minimum.

The cars can be coupled together by very simple contrivances to form trains, which can be operated from one of the driver's cabins, as is done in the case of multiple-unit electric traction.

Finally, the petrol-electric car, having no permanent mechanical connection between the engine and the axles, may be placed between any two carriages of a train hauled by a steam locomotive, and may be used as an ordinary carriage. At any point *en route* the petrol-electric car may then be removed and continue its journey in any desired direction by its own means of propulsion. In this way several distinct trains may be combined as one train, each section branching off as required.

The principal disadvantage of the petrol-electric car consists in the danger of fire, consequent on the use of a highly inflammable liquid fuel. However, this danger can be completely overcome.

The component parts are very simple, and the most complicated part, the internal-combustion engine, has been so extensively adopted that this point need not be discussed.

From a comparison of various systems it follows that the simplicity of the electric transmission and its flexibility justify its almost exclusive adoption.

The liquid fuels used for motor-vehicles are: gasoline or petrol (density, 0.680—0.720) and benzol (density, 0.885). In countries where there are no supplies of petrol, the present practice is to use benzol, which is a natural product distilled from coal-tar. These two fuels have practically the same calorific value, produce almost the same power from the engine, and can be used alternatively without any modification of the plant. When using benzol it is necessary to start with petrol because benzol requires a certain amount of pre-heating.

In France the price of benzol is about 0.25 franc per litre, whilst petrol, owing to the duty, costs 0.35 franc.

The cost of fuel could be very much reduced by using heavy oils derived from the distillation of petroleum or tar, the prices of which are at present relatively low. The price of the generating set is higher, both as regards the engine and the generator, on account of the lower speed.

The price of a petrol-electric car varies from 40,000 to 150,000 francs. A 90-H.P. car weighing 20 tons and having seating accommodation for 40 passengers costs about 50,000 francs. The 120-H.P. car of the type used on the Prussian State Railways, which weighs 50 tons and provides accommodation for 100 passengers, costs about 90,000 francs when fitted up for third and fourth-class traffic.

The motor-vehicle of the General Electric Co., weighing from 40 to 50 tons, with accommodation for from 60 to 100 passengers, costs from 100,000 to 150,000 francs according to the furnishing of the interior.

The consumption of fuel depends on many factors, and varies according to the traffic of the line on which it is operated. The consumption of fuel per ton-kilometre varies in practice between 15 and 30 grammes according to the profile of the line and the condition of the track.

Assuming that the fuel used is benzol, as is the case in France, the cost of running cars on the petrol-electric system is as follows, the figures being given per ton-kilometre:—

Fuel (benzol) ... ..	0.0042 fr. to 0.0084 fr.
Lubrication ... ..	0.0005 " " 0.0010 "
Repairs and maintenance ... ..	0.0015 " " 0.0040 "
Total running expenses ... ..	0.0062 fr. to 0.0134 fr.

The driver's wages may be taken as 0.0040 fr. per ton-kilometre.

Although the time that such cars have been in use is too short to allow the "wear and tear" and depreciation to be determined from experience, it appears that if we take 10 per cent. per annum of the value of the total equipment, including the car itself, this estimate is, if anything, rather too high. As an annual mileage of 50,000 km. may be expected per car, this means that "amortisation" represents about 0.005 fr. per ton-kilometre.

If interest on the capital invested is taken as 5 per cent., this represents 0.0025 fr. per ton-kilometre. Thus the total cost of running, if wages, "amortisation," and interest are taken into account, is 0.0177 to 0.0249 fr. per ton-kilometre.

Lines which can be worked by petrol-electric cars must have a relatively small traffic, because the working of a line by petrol-electric cars can only be economical with light trains; and relatively constant traffic, because the power of these cars does not allow heavy trains to be run. It is necessary for the goods trains to be hauled by steam locomotives.

The four types of independent motor-vehicles are at present steam, accumulator, petrol with mechanical transmission, and petrol-electric. Accumulator cars have, however, been abandoned, and as the petrol engine with mechanical transmission has not been found sufficiently flexible, there remain, therefore, at present only the steam motor-car and the petrol-electric vehicle. The characteristics enumerated for petrol-electric cars emphasise the shortcomings of the steam motor-car, and the conclusion may, therefore, be drawn that if the use of independent motor-vehicles continues to develop—and there is no reason why it should not—then petrol-electric motor-vehicles will preponderate.

\* This system was fully described in the ELECTRICAL REVIEW, May 5th and June 23rd, 1911, and September 27th, 1912.

## NOTES FROM INDIA.

[FROM OUR OWN CORRESPONDENT.]

*Dacca.*—The new company, called the Dacca Electric Supply Co., has begun to do productive work, and promises of success are assured. The managing agents in Calcutta, Messrs. Octavins Steele & Co., know how to make a sound bargain for their shareholders. They got the Provincial Government to guarantee a minimum consumption per annum, which will at least pay interest and standing charges, thus ensuring that all sales of current beyond this figure go towards net profit. The old Dacca Electric Lighting Trust, which has done good service for 10 years back, has been absorbed by the new company; as it had established a fairly large connection, this should automatically go over to the new company and become a valuable asset. In spite, therefore, of the degradation of Dacca from being the capital of a province to its present position as a provincial town, there is every prospect that the efforts of the promoters of this enterprising scheme will be rewarded by handsome dividends later on. Big developments are anticipated, and the time will perhaps come when Dacca may be justly called the Oxford of India.

*Madras.*—The Madras Electric Supply Co. has, for the second time since its opening, given notice that in certain districts its mains are fully loaded, and that the present machinery in its power house is not, until further extensions are carried out, able to cope with any more load. This points to wonderful and unexpected development, which should be pleasant news for the shareholders. Power users in and about Madras have been quick to realise the benefits of cheap power. The Madras Tramways Co., having scrapped or sold their old steam generating plant, now buy current in bulk from the supply company, with the result that even their shareholders have been experiencing profitable returns in the shape of a good dividend.

Electric street lighting has made great strides in Madras. A very few years ago it was usual to carry about with one after dark a Hink's or similar lantern as the street lighting was so bad; now some of the principal thoroughfares are well lit, and bear favourable comparison with those of any other city in India.

*Lahore.*—The Electric Supply Co. is daily adding new consumers to its mains and promises to show good financial results in the near future. Local power users, such as mill and factory owners, are beginning to see that there are many advantages to be gained by using electric power, and spurred on by the frequent visits of contractors' representatives, they are slowly but surely coming round to the inevitable opinion that the substitution of electric drive for expensive steam is good economy. With steam coal costing 24 Rs. a ton in Lahore this is not to be wondered at—by the way, good steam coal costs 5 Rs. per ton at the pit's mouth in Bengal, the balance is railway freight.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. on TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

## The Prevention of Accidents in Electric Lifts.

As active workers for many years in the field of invention for the above object, we are interested in the recent discussion on safety locks, and the more so as our work and published views have been referred to more than once.

Mr. W. J. F. Cooper leads off in his first letter with an attack on the character of all locks of a date prior to "a few weeks back," basing it on the admittedly hypothetical danger that the interlocking of the latch may never take place.

He supports his argument by pointing out that the motive power of most interlocks is gravity, or the recoil of a spring, which powers are alleged to be especially likely to succumb to rust and dirt.

He then claims to have seen a lock which avoids this risk and "overcomes all defects," &c. But he does not describe the mechanism of the lock, or give more than a hint of the methods adopted, so we are left to surmise.

By the context, however, we are bound to suppose that gravity and springs are barred; the motion of the cage is specifically barred; and turning to Mr. Cooper's second letter we find the only positive clue in the words—"No gate can be opened till the current has been cut off from the controller." Conversely we may therefore assume that the locking operation is effected by switching current on to the controller, and presumably through the intermediary of one or more solenoids or magnets.

In any case the duty of locking and unlocking is shifted to the controller, and, if so, why find fault with gravity and springs? Does Mr. Cooper know of any lift controller worked by switches which does not depend on gravity or springs for its motion in one direction?

But leaving the controller and coming to the solenoid which actually does the locking, is it seriously contended that the magical letters S O L E N O I D provide unlimited power to overcome dirt and rust.

Those who know most about them know that their power is limited as definitely as that of a spring or of a falling weight, by the conditions prescribed by the designer.

The secret of success in all three cases is the provision of an ample margin of power to overcome all reasonably contingent obstacles.

Mr. Carroll reminds us that springs break. Just so, and solenoids go to earth or short circuit and burn out—or get overheated and jib—or fail to get current at all through their switches.

As to the liability of a spring to break (its only tangible defect, in our recent work, not only in locks but in other directions) we have devised modifications enabling a spring fractured into several fragments to act as effectively as when intact.

So far as Mr. Cooper's description carries us, it is therefore difficult to see how the lock he writes of advances matters in the direction of security against the only danger he describes, that of the interlock failing to act. Solenoids will fail as often as springs from dirt and neglect, and will also suffer from troubles peculiar to themselves.

But Mr. Cooper's find does apparently prevent unfair interference with the lift when passing a floor by persons who have not called it. That, however, is not a question of safety, but purely one of removing a nuisance.

We hold no brief for the force of gravity or for springs—there is no need; the former has been working quite satisfactorily for much longer than "a few weeks," and the latter have been doing good service at least since the days of Archimedes.

Our object so far is merely to clear away some confusion of thought and false reasoning, as will appear below.

Mr. Cooper says he has "had every-day experience of lifts for many years;" later he quotes a specification of ours, dated 1905 (*eight years ago*), and says it "fairly represents modern practice." Is that quite fair? Or is it a compliment?

The facts are that in 15 years we have improved our lock 17 times, we have issued 18 distinct patterns, and the 1905 pattern referred to is known as our No. 9. In 1905, however, it stood for a long step in advance of all predecessors, and therefore appears in the Patent Office files.

Mr. Cooper states that the lock which he discovered "a few weeks back" produces the following results:—

"The gates must be electrically and mechanically locked (not merely latched) before any movement of the cage can take place, and the locking action depends in no way upon the motion of the cage. Also the gate cannot be opened while the cage is passing the floor, but only when the control current has been cut off by the operator or the control gear."

He also refers to it as "unique," "the only one," and as the "one type of lock" which solves the problems, and he, therefore, may be interested in the following additional information:—

One of our nine patterns introduced since 1905 accords precisely with the above quoted specification, and it was designed very much farther back than "a few weeks."

We have been acquainted for about two years past with two different systems in use in Continental cities, achieving the same results with more or less success. We have reason to believe that such apparatus is obtainable in this country from three separate sources.

There is, however, another point arising out of Mr. Cooper's letter. Unlocking the latch at the proper time is often more important than detecting the correct moment for locking it.

It is to be regretted that we are not told exactly how it is done. We know that it follows the cutting off of current to or from the controller, and may assume that only the latch on the floor for which the cage is destined will be released.

But suppose that for any one of a dozen possible reasons, current is cut off when the cage is between floors above or below its destination—will that predestined latch be released all the same?

It may be replied, "No, the cage must be opposite the floor." But what is meant by "opposite."

This question is not frivolous. Much play has been made by two writers on the fact that most interlocks act only after the cage leaves the floor. Whatever value there is in this point, exists equally when considering the question of unlocking.

Nothing could be more simple than to confine the unlocked zone to a space, say,  $\frac{1}{2}$  in. above and  $\frac{1}{2}$  in. below the floor. But even that done, with high-speed switch-controlled lifts, with a new boy in the cage missing the floor every time by 6 in., the apparatus would soon be scrapped.

But there is another condition to be considered. Lifts will overrun occasionally beyond normal limits, and the various safeties and limit switches need time and space in which to act, and the cage may be from 2 ft. to 3 ft. beyond the top or bottom floor when finally stopped. Obviously, the passengers would be alarmed, and if they could not, then instantly escape through an *unlocked gate*, the financial results to the owners might be emphasised.

Experience has, therefore, practically determined that an unlocked zone measuring about 2 ft. 6 in. above and 2 ft. 6 in. below the floors should be provided.

When that phase of the problem is faced, the designer is apt to find himself once more in close company with the despised inclined plane, spring and force of gravity, or some of them.

As a matter of fact, we never heard of any accident arising from the provision of an unlocked zone extending 2 ft. 6 in. in either direction, and the Duc de Louge's death was in no way connected with that feature.

Most of Mr. Carroll's points have been touched on above, but his ideal lock is worth summarising.

It is to be automatic, not to work by gravity, springs, or the motion of the cage, and it is to act before current is switched on, so that solenoids are ruled out. As an "ideal" we lift our hats to it, but fear it will remain in that stage for some time yet—though little is really impossible in "electrics" if purchasers will pay for it.

Mr. Carroll's last six lines read rather like a misconceived paraphrase of something we have often written. Our letter is already too long to correct this in detail, so we merely say that Mr. Carroll's words do not represent our views. It may be that we were not in his mind at all.

Smith, Major & Stevens, Ltd.

Northampton, June 2nd, 1913.

I have been extremely interested in the recent correspondence relative to the above, and have been expecting to find the matter taken up by some of our lift makers.

From an architect's point of view, the statements made by Mr. W. J. F. Cooper, supported by Mr. Carroll, are somewhat startling, and if correct, it behoves architects to hesitate before accepting the advice of lift experts when specifying. Surely the subject matter of your correspondents is not too trivial to be allowed to pass unchallenged by any of them?

One can only conclude that the letter has passed unnoticed, or that the alleged inefficiency of safety locking and lift control is a fact.

Generally speaking, it is not within an architect's power

to appreciate the technical details and working of these points, and he has to place reliance on lift makers.

It would be of interest to hear other opinions on this vital matter.

G. W. Newman.

Brighton, Sussex.

June 9th, 1913.

#### Electric Lighting Fittings.

Your correspondent, "R. E.," prefaces his letter with matter not likely to interest your readers, *to, personalities* aside, let us proceed.

No matter how efficient the form of reflector, there is no getting away from the fact that with indirect fittings the light is first projected from the lamp to the reflector, thence to the ceiling and back to the working plane, covering part of the distance for the third time, so that we get—

1. Loss from lamp to fitting.
2. Loss on first reflection.
3. Loss from reflector to ceiling.
4. Loss on second reflection.
5. Loss from ceiling to working plane.

I would again repeat that, in these days of competition, we cannot afford to entirely ignore efficiency. Surely the most efficient method of lighting is direct lighting, and if we can conceal our source of light and, at the same time, produce direct lighting, this must be the most common-sense method; to my mind it fulfils all the physiological points raised in "R. E.'s" letter. Is it not possible to fit the efficient reflector he speaks of, so as to reflect the light directly where it is required, and without the intervention of the ceiling, which, by the way, is not primarily designed for reflecting purposes? It should be an easy matter to interpose a small translucent or even opaque screen to protect the eye from the glare of naked lamps. This should render "R. E.'s visual activity" equal in both cases. I do not assume that it is impossible to direct the light with indirect fittings, but experience teaches that you cannot presuppose that every man who installs this system is a lighting expert, neither is the working plane for ever a fixed position. I take it that any alteration of this would mean a different set of reflectors and chain lengths, or would it be necessary to alter the height and contour of the ceiling, in order that the relative positions of the reflecting surfaces might remain the same? It certainly seems to open up prospects of good business for the consulting engineer.

I would ask "R. E." where I imply that indirect fittings are necessarily ugly. I think that even "R. E." himself will agree that some indirect fittings beggar description. Others admittedly look very nice in print, but in use the illumination of the fitting itself is such as to render its artistic design unnoticeable. In fact, its appearance with lamps burning resembles a big black patch, intensified by the white background.

Then there is the vital question of dust collection, which "R. E." does not touch upon. I have seen fittings which, after a month's use, cease to have any reflecting value whatever. No, "R. E.," I think you really admit to yourself in quiet moments, that indirect lighting leaves the Supply Co., and the lamp and fittings manufacturers, with a temporary increase of profit, which will rapidly disappear when the user awakens to the fact that he has been bluffed. Meanwhile, our competitors concentrate on efficiency and romp ahead.

H. A. W.

#### Long-Range Instruments.

Mr. Davies's last letter on this subject compels me to point out that Mr. Record did not write the article in *Electricity* which has been the *casus belli*. I might reasonably dilate upon the fact that it was hardly courteous of Mr. Davies not to have contributed his letters to *Electricity* as well as to the *ELECTRICAL REVIEW* and the *Electrical Times*. Without, however, going further into this matter, and without entering further into the discussion itself than to point out that the Record instrument possesses merits realised in no other *commercial instrument*, may I emphasise the fact that neither Mr. Record nor his representatives framed the article in question, which, moreover, they did not see till after its publication. The article was written after hearing

the inventor's views and thoroughly inspecting the instrument. As to the wording of Mr. Record's advertisements, I disclaim all responsibility. I do not propose to contribute further to this discussion should it be prolonged. My present motive for writing is to free Mr. Record and *Electricity* from an unjust imputation.

**The Writer of the Article.**

London, W., June 3rd, 1913.

I must apologise for again encroaching upon your valuable space to continue, as "Electricity" so aptly puts it, an "unnecessary correspondence," but when one's veracity is challenged, defence is advisable.

Mr. Davies now knows, to his discomfort, the result of his rashness in jumping to conclusions, and it only remains for me to repudiate the alleged inaccuracy of my firm's advertisement: "We are the only makers of long-scale instruments for direct current; all other long-scale instruments are for alternating current, and will not work on direct current." This announcement was not only correct, but justified.

Mr. Davies states it is erroneous in a twofold sense—first, because Messrs. Johnson & Phillips have produced a hot-wire instrument, and second, because "we have still our old friend the Cardew." To bring in the Cardew to give the lie to such an advertisement is ludicrous, and to bring in J. & P. for that end is unfair, because Mr. Davies must know that Messrs. Johnson & Phillips only brought their instrument to public notice for the first time three months after the introduction of my instrument, and after the appearance of my firm's advertisement, and Messrs. Gambrell have not yet done so. This disposes of Mr. Davies's unwarranted attack.

In conclusion, if M. Carpentier, followed by Mr. Davies, produced long-range instruments of the moving-coil type 20 years ago, succeeded by several years in which long-range instruments of the moving-coil type have been commercially unobtainable, it cannot be denied that the Record Electrical Co., Ltd., started with their unique instrument a new era in January, 1913, so far distinguished by the greatest anxiety on the part of those interested to make it appear that such instruments have always been available, coupled with frantic haste to develop rival articles to support the suggestion.

I wish to thank "Electricity" and the real "Writer of the Article" therein for their letter of June 5th, and for the high tribute they have paid to my instrument.

**J. Westmoreland Record.**

Broadheath, June 9th, 1913.

**The Mutual Protection of Engineers.**

Our suggestions towards the formation of the proposed Association will be submitted for publication in your next issue. A little delay is almost inevitable, the preliminary work being such that it can only be done slowly. The general opinion, so far, is keenly in favour of the Association. It is respectfully requested that reports be sent in as soon as possible, whilst progress would be facilitated if engineers in general would kindly canvass their friends with a view to our securing, at an early date, the number of those gentlemen who would be likely to give the Association their support.

**L. H. Fletcher,**

*Hon. Acting Secretary, Proposed Association.*

31, Queen Victoria St., London, E.C.,

June 9th, 1913.

I am not actively concerned with the formation of the suggested Association, but I have drawn my own conclusions as to the reason in pressing for combination. Nor am I sure that an Association could eliminate a case like my own; but I will give the facts just as they are.

Until about a year ago my career was all I could desire. My services were sought, and my salary was a good one. Then an important hitch arose a few months ago. I applied at once for another position with a competitive firm who had always been friendly towards me, and though I requested almost 50 per cent. increase in salary, the first interview was satisfactory.

It was at a subsequent interview that things were some-

what different. I was offered very little more than my old firm were paying me, and was told what that amount was to a shilling. My blank refusal to consider such a proposal might be expected; but at length I was led to suppose that the position would be offered me practically at my own terms when the preliminaries were completed.

About a week later, to my surprise, I was notified that the company in question had not been able to decide in my favour, and it now appears that each application I make to other firms gets only so far. I do not wish to publish my personal conclusions, but it is apparent that as engineers we are not to have a free hand in estimating our own commercial value. An Association might, therefore, well consider such cases, as they should concern every engineer who is an employé.

From every standpoint, however, I wish the proposed Association success, despite my doubts that my brother engineers will rally round it in time. We somehow appear to comprise so much of that unique stuff of which the middle-class man is made; and instead of asserting ourselves we plod on patiently, complaining only in secret. Those above and those below us are more than ever at pains to save their own skins, but we middle-class folk do nothing, unless it is to earn the contempt of the two sections of society between which we are situated.

We are subject to ever-increasing taxation for the benefit of the workman, the particular investments of our own class have depreciated, and the cost of living has risen, but we don't stir a finger for our own good. I add this, of course, because members of the engineering profession form so great a part of the middle-class, whose doom it is to be harassed, taxed, weighed down by increasing burdens, and left vaguely to mutter and grumble, wondering why someone—anyone but ourselves—doesn't do something.

It is not too much to suggest that the engineering profession represents the standard of ability in the country, and that brains were never of such account as now. As a body, we are therefore getting our deserts. It would appear that if we are to benefit ourselves to any extent the shackles of apathy and snobbery must at least be removed. We must adopt the team spirit—the spirit of cricket as opposed to that of golf. Indeed, it is not unlikely that we will soon have to go to Trade Unionism for our lesson, and, rejecting its glaring errors, adopt the obvious good points. Like the mechanic we would then learn to speak of "us," and not of "me."

If the Association will help to awaken our class to a sense of its duty to itself, I sympathise with those who are striving for its initiation.

**Salesman.**

You do well to call attention in your last issue to the absence of honours conferred upon those directly associated with engineering. Your article on "Municipal Parsimony" was likewise necessary, since such instances of municipal ignorance should be pointed out. Another such example was referred to in a recent issue of the *Manchester Guardian*, and should be of interest to those who are now endeavouring to improve the status of the engineer. The latter case concerned an advertisement inserted in the technical Press on behalf of the Sharnbrook Reformatory. This public institution is in need of a tall, smart, young engineer and electrician, apparently to look after its heating, lighting and power services. In addition, he has to assist with any other institution duties; which might mean anything from sweeping floors to teaching a class in grammar. He has also to be fond of boys (bad boys, presumably, since it is a reformatory), and able to play cricket and football well. In return for these varied services he will receive board and lodging, in addition to the princely salary of £40, rising to £48. Forty pounds a year seems to be about 16s. a week, but the advertisement also specified that the successful applicant should not have been guilty of the indiscretion of marriage.

Among other things, such advertisements serve to demonstrate the astounding conception which even public officials have of the status of an engineer. They also show how much skill is believed to be necessary to take charge of engineering plant and to perform all repairs, renewals, and modifications called for from time to time.

If an association were formed as suggested it might turn its attention to this question without delay. Perhaps it

might even be able in some way to render assistance to an engineer whose pecuniary circumstances tempt him to apply for such positions.

June 7th, 1913.

F. V. Robertson.

Having read and re-read the illuminating letter of "M.Sc." in your current issue, and being sufficiently an engineer to refuse to acknowledge myself beaten, I will be content with the non-committal comment of—"Exactly!"

To return to our subject, however, I am glad to note that the interest of the men concerned, and appears to have been awakened by the letters which have recently appeared in your hospitable columns, and I believe that the announcement promised by Mr. Fletcher, is being eagerly looked forward to.

I make no doubt that a very few years ago the idea of any combination of the members of the engineering and commercial staffs of our various industrial concerns on Trade Union lines would have been very repugnant, but there seems to be little question now as to its necessity and advisability. With a combination of masters on the one side, and of operatives on the other, we, the individuals (at the present stage), must be wary or the usual fate of the unconsidered trifles caught between the upper and the nether millstones, will be ours.

Combination of some kind is certainly necessary, and I believe any steps to this end will meet the hearty response of those whom it is intended to assist, provided only that it is carried out on satisfactory lines, and is used as a weapon of defence, rather than of offence.

Mac.

I send you my Play on this particular subject, together with a cutting from the *Daily Telegraph*, which recently reviewed it at length, and, as you will see, glowingly. Any electrical engineer who is interested in the idea of bettering the status of the *engineers' draughtsman* is invited to communicate with the Society of Engineers, 17, Victoria Street, and to apply for a copy of the book as a loan to read, as the library of that Institution has some 50 volumes in circulation and is doing its level best to create an interest in the subject. It is hoped that the Play will be produced later in one of the more important London theatres.

Lloyd St. Clare.

Twickenham, June 7th, 1913.

[The title of the play is "A Woman of Imagination."—Eds. E.R.]

#### The "Times' Time and Synchronising Turret Clocks.

With reference to the article in your issue of May 30th describing Mr. Kempe's method of keeping turret clocks to time, we would refer him to our well-known system which is working satisfactorily at the *Times* office and many other important buildings.

At the *Times* offices there are about 60 dials which receive an impulse every half-minute from a transmitter. The two turret clocks also work on the same circuit, being electrically escaped. The whole of the system has now worked many months without attention, and keeps time to within one or two seconds.

The recent reported failure of the bottom turret clock was due to a mechanical accident outside the clock, in which some of the wheels of this clock were smashed, but this accident is in no wise attributable to us.

The system is checked hourly by a signal bell actuated from Greenwich, and in view of your remarks under the heading of "The *Times*' Time," you may be interested in this statement, especially as this can be verified by reference to the engineering officials on the staff of the *Times*.

Gent & Co., Ltd. A. E. EATS, *London Manager*.

London, S.W., June 9th, 1913.

[As we understand the matter, Mr. Kempe's suggestions apply only to the synchronisation of ordinary existing clocks, whereas Messrs. Gent & Co.'s system relates to electrically-driven clocks—a totally different matter. We were not aware that their system was in use in the *Times* office, nor did we question the accuracy of the indoor clocks; our comments applied only to the public clock over the front door, the behaviour of which, until its recent repair, was very erratic.—Eds. E.R.]

## PARLIAMENTARY.

### Wood Green Electric Lighting Transfer.

MR. HERBERT CRAIG'S Select Committee of the House of Commons has passed the preamble of the Tottenham and Edmonton Gas Bill, which provides, *inter alia*, for the transfer to the company of the Wood Green Urban District Council's Electric Lighting Order.

MR. HONORABLE LLOYD, K.C., who appeared for the promoters, said that the electric lighting order was granted to the Wood Green Urban District Council in 1902, and it was at their suggestion that it should now be transferred by agreement to the gas company. In the early days of electric lighting the gas company contemplated seeking powers to supply electrical energy, and in 1897 they communicated with the various local authorities in their area to this effect. In the following year they obtained an Act which authorised them to apply for licences or provisional orders to supply electricity, and they intimated to the local authorities their intention to apply for provisional orders. On the local authorities intimating that it was their intention to make similar applications, the company abandoned their scheme. In 1902 the Wood Green Council obtained their electric lighting order, but although various schemes had been put forward, nothing had actually been done in the matter. In 1911 the Council approached the promoters and inquired whether they were still wishful to undertake an electric lighting scheme for the district, and after negotiations between the parties, the present Bill was agreed upon. The Bill contained the usual provisions for purchase under the terms of the Electric Lighting Act, and, in addition, there was a clause, by which the local authority could purchase the undertaking in 1925 by giving 12 months' notice, on payment of the capital expenditure plus 20 per cent.; in 1929 by payment of the capital expenditure plus 19 per cent., and so on for each succeeding year until 1948, when the Council would be able to purchase by simply paying the capital expenditure. The maximum charge for lighting under the proposed Order would be 5d. per unit; for power 2d. per unit; and for public lighting 2½d. per unit. Having cited instances to show that it was not a new idea to entrust a gas company with an electric lighting order, Counsel proceeded to deal with the opposition of the Printers' Almshouse Corporation, who alleged that the site for the proposed generating station would constitute a nuisance. Mr. Lloyd contended that the station would neither be a nuisance nor create a noise, seeing that gas engines were to be used for the generating plant.

After hearing evidence for and against the Bill, it was ordered to be reported for third reading.

**West Bromwich Corporation Bill.**—The Omnibus Bill of the West Bromwich Corporation which includes powers to provide and work trolley vehicles and motor omnibuses, make street improvements, &c., has been approved by the Select Committee of the House of Commons, presided over by Mr. E. Gardner. Mr. C. C. Hutchinson, K.C., who, with Mr. Jeeves appeared for the promoters, said the total tramway capital of the Corporation was £117,000. It was proposed to run trolley vehicles on six routes and the estimate for the proposed new trolley vehicles and equipment was £18,197 and for motor-buses £8,000. The new lines were intended to give a through means of communication to the workers in the industrial areas who had now to walk long distances between their homes and their work. Mr. H. Lloyd, K.C., appeared for the South Staffordshire Tramways Co., who are the lessees of the promoters, and who contended that if the powers were granted their traffic would be taken away. After a consultation with counsel, the Committee passed the Bill subject to the route from Greet's Green to Greet Bridge not being constructed or worked except with the consent of the lessee company during the unexpired term of the company's lease. The same condition was laid down in the case of the All Saints to Wednesbury and All Saints to Walsall routes.

**Various Bills.**—In the House of Lords on June 5th the Northern Counties Electricity Supply Bill, Chesterfield Corporation Railless Traction Bill, and Westgate and Birchington Gas and Electricity Bill passed second reading.

In the House of Lords on June 9th, the Dundee Corporation (Improvements and Tramways) Bill was read a third time and passed.

In the House of Lords, on June 10th, the Kent Electric Power Bill and the Rhondda Tramways (Railless Traction) Bill were read a second time. The Herne Bay Gas and Electricity Bill was read a third time and passed.

**Colinton Tramways.**—Mr. Jenne, Examiner, has found that Standing Orders have not been complied with in the case of the Colinton Tramways Bill, owing to the promoters not having obtained the consent of the Edinburgh Corporation, who are the road authority, to the proposed extension. The Bill will go before the Standing Orders Committee, who will decide whether it will be allowed to proceed.

**Leatherhead and District Electric Lighting.**—The opposition threatened to the Leatherhead and District (Extension) Order in the Electric Lighting Provisional Orders (No. 2) Bill has been withdrawn, and consequently the order to commit it to a Select Committee has been discharged.

**Electrical Exhibition in Spain.**—At a meeting lately held in Barcelona, at which representatives of about 300 firms were present, it was decided to organise an International Exhibition of Electrical Industries in that city. A syndicate was formed at the meeting to take the necessary steps to carry out the idea.

## LEGAL.

### THE NATIONAL TELEPHONE AWARD.

IN the House of Lords on Monday, June 3rd, an appeal was heard before the Lord Chancellor and Lords Loreburn, Atkinson, Shaw, Moulton and Parker in the case of the National Telephone Co. (in liquidation) and Another v. His Majesty's Postmaster-General. The appeal was from an order of the Court of Appeal, dated April 16th this year, whereby it was declared that the Court had jurisdiction to hear an appeal by the Postmaster-General from the Court of Railway and Canal Commission sitting under the authority of an agreement between the company and the respondent, dated February 2nd and August 8th, 1905, and the Telegraph (Arbitration) Act, 1909.

The counsel for the appellants were Sir C. Alfred Cripps, K.C., Mr. Danckwerts, K.C., and Mr. H. H. Gaine. Counsel for the respondent: The Attorney-General, the Solicitor-General, Mr. Buckmaster, K.C., Mr. Schwabe, and Mr. Branson.

The ATTORNEY-GENERAL said he desired to be heard on the preliminary objection that their Lordships' House had no jurisdiction to entertain the appeal. He submitted that there was an appeal from the decision of the Railway and Canal Commission to the Court of Appeal on the construction of the Act of 1909, but that their decision was final.

LORD LOREBURN: Can we properly hear your objection until we have heard Sir Alfred Cripps, whose argument, I understood, was to be that the Court of Appeal had no jurisdiction to make the order from which he now appealed?

The ATTORNEY-GENERAL: I am quite content that appellants' counsel should be heard. I only desired to make this point to your Lordships before you heard the appeal opened.

SIR ALFRED CRIPPS, K.C., then proceeded to open at some length the case of the appellants. He argued that if the Railway and Canal Commission had the power to entertain the arbitration it was apart from the provisions of the Arbitration Acts of 1873 and 1888. The right of appeal was a substantive right and not one of procedure. It was a right of legislation and jurisdiction. He went on to quote the sections of the Acts of 1873 and 1888 and also the Act of 1909 in order to support his contention. Next he read the judgments of their Lordships in the Court of Appeal, maintaining that there could be no proceedings under the Act of 1909 except by the consent of both parties, which the majority of the Lords Justices in the Court below had overlooked.

MR. DANCKWERTS, K.C., followed on the same side, elaborating the point that a right of appeal could not be derived by implication. That right could only be given by direct legislation, and there was no such authority here. Even if jurisdiction had been given to the Railway and Canal Commission, it did not necessarily follow that jurisdiction had likewise been given to the Court of Appeal.

The LORD CHANCELLOR said: Their Lordships were unanimously of opinion that the preliminary objection raised by the Attorney-General to this appeal being heard could not succeed, and that they were entitled to decide the appeal which had been opened and argued for the appellants. No case had been made out which rendered it necessary to hear the respondent in reply. They thought the appeal failed, and they would give their reasons in writing hereafter for coming to that conclusion. But as the case was one which ought to be disposed of at once, they proposed in order to save time at once formally to dismiss the appeal, with costs, and affirm the judgment of the Court below.

The LORD CHANCELLOR then put the motion from the Woolsack, which was agreed to.

Solicitor for the appellants, William E. Hart; for the respondent, the Solicitor to the Post Office.

### X. L. ELECTRIC CO. v. ARON.

BEFORE Mr. Justice Neville in the Chancery Division on Friday, June 6th, was renewed the motion by the plaintiffs in this action, by which they sought an interim injunction to restrain the defendant until the trial or further order from dealing with, or disposing of, certain patents relating to electric clocks, and from interfering with or withdrawing applications that were pending for protection for improvements in such patents, or for foreign protection.

MR. MORITZ, counsel for the plaintiffs, reminded his Lordship that in the previous week the defendant had given an undertaking and the matter had stood over for further evidence. They had just received an affidavit from defendant which dealt with several fresh matters, but with regard to the material part of the injunction the plaintiffs were asking for, he was quite prepared to go on with the motion. The position was that there were pending applications with regard to patents which came within the scope of the contract of the defendant with the company, and those applications he was threatening to interfere with. Clause 8 of the contract provided that if at any time the defendant should effect any improvements in the inventions relating to the patents he had assigned to the company, the patents for such inventions should be assigned to them they paying the necessary expenses incurred in obtaining protection. The defendant had made an invention which came within that clause before he quarrelled with the company and at the company's expense, and jointly with them he had applied for a patent. The Comptroller of Patents, in the exercise of the discretion vested in him, had declined to allow the application to proceed as an application for protection for an addition to a previous

patent, and had decreed that the application must be for a substantive patent. The only difference was a question of expense, and the company was quite prepared to proceed with the application in accordance with the Comptroller's ruling. The defendant had, however, threatened to withdraw the application for a patent altogether. The attitude he took up was that if he could not proceed with the application as a patent for an addition he would withdraw the application altogether, and he did not in his evidence deny that he had threatened to withdraw it. There was also a threat on the part of the defendant to interfere with the foreign protection the defendants were seeking to obtain, but without going into the matter, if the defendant would undertake that he would not until the trial withdraw any of the applications that were pending with regard to the English and foreign patents, the company would be content, otherwise he must proceed with the motion.

MR. SIMMONS, for the defendant, said he was not prepared to offer any undertaking.

MR. JUSTICE NEVILLE asked what was the defendant's point. MR. SIMMONS said that, with regard to the English patent, a time limit had been fixed, and subject to that time limit being extended his client was prepared to undertake not to withdraw the application; but with regard to the foreign patents, he could not give any undertaking, as he was merely a joint applicant. His Lordship ought to know that the defendant held two-thirds of the shares in the company.

HIS LORDSHIP asked who, under the agreement, had the conduct of these patent proceedings.

MR. MORITZ said that the action was undoubtedly in the hands of the company. Counsel then proceeded to read the affidavits filed in support of the motion, which set forth that the company was registered on November 28th, 1912, and was formed with a capital of £20,000 to take over the defendant's patents for an electrically-controlled clock, and up to the present time the defendant had refused to make any assignment of the patent.

MR. SIMMONS submitted that his client had not said that he would not carry out the agreement. The whole question was as to the manner in which the application for protection should be prosecuted. As to the assignment in an agreement for sale, it was always a condition that the vendor should have the goods to assign.

MR. JUSTICE NEVILLE said he was not deciding that point. What he had to decide was what was to be done with regard to the application for a patent. Where he thought the defendant was wrong was in thinking that he was entitled to have the sole right of saying how the proceedings with regard to the patent were to be taken. That was for the shareholders. They were the people who had control of the matter.

MR. SIMMONS: Your Lordship has heard how the shares stand. HIS LORDSHIP said he could not look at that. What he had to consider was what the rights of the company were.

MR. MORITZ submitted that it was to the interest of everybody that these patents should not fall to the ground.

MR. SIMMONS said that there was an application for a patent in the joint names of the defendant and Mr. Harrison. Mr. Harrison should be made a defendant. Mr. Moritz said that that was the first he had heard of such a patent having been taken out, and it would be in fraud of the company's rights.

MR. SIMMONS said that the company would be in a better position if they would abandon their present patent and take an interest in this new patent referred to in the affidavits. If that was clearly shown on the evidence, he submitted the Court would not interfere by interlocutory injunction. If the matter was allowed to stand until the trial, the defendant was willing to give any undertaking his Lordship might think right. With regard to the foreign patents, it was entirely a matter of policy, and there was no ground for an injunction, as the defendant had shown his good faith in making the application. With regard to the English patent, if it was allowed to go forward as a new patent, and not as an addition to the old patent, it would jeopardise a new patent which was now pending, and which, in the defendant's opinion, was much more valuable.

HIS LORDSHIP asked whether the company were prepared to undertake to pay the expenses of the pending applications.

MR. MORITZ said they were.

MR. JUSTICE NEVILLE: Then I need not trouble you further. In giving judgment, he said that on that undertaking he must grant an injunction restraining the respondent from withdrawing, or permitting to be withdrawn, any of the existing applications, and from opposing or preventing or permitting to be opposed or prevented any application in connection with the patent rights subject to the agreement made between the parties. The injunction would extend until the trial or further order, and the costs of the motion would be costs in the action.

**A Low-Compression Diesel Engine.**—A patent has been recently taken out by Mr. Heinrich Zoelly, of turbine fame, to enable much lower pressures than usual to be used in the Diesel engine. According to *The Motor-Ship and Motor-Boat*, the idea is to heat the mixture of fuel and air before it is injected into the cylinder and comes into contact with the compressed air, so that the temperature of the latter, or rather its pressure, need not be so high as the 500 lb. per sq. in. pressure usually adopted. The interesting detail of the proposed system is the provision of a small electrical heating grid immediately under the fuel inlet valve, to heat the fuel mixture as it passes through. If the idea should materialise, it would enable a lighter type of engine to be constructed.

## MINING MACHINERY EXHIBITION.

The Exhibition of Mining Machinery, which was held at the Royal Agricultural Hall from May 29th to June 7th, contained an unexpectedly large number of features of interest to electrical engineers. The collection of coal-cutters, both electrical and pneumatic, was exceptionally large and varied, and indicates the rapid progress that is being made in the adoption of up-to-date methods of coal-getting in our collieries.

No attempt was made by exhibitors of pneumatic coal-cutters to challenge the great economy effected by the use of electric transmission—practically all of them, in fact, showed electrically-driven machines. MESSRS. MAVOR & COULSON, Glasgow, had a very large exhibit, including their well-known Pick-quick bar coal-cutters, driven by three-phase and direct current and by compressed air; their Samson disk coal-cutters, and a variety of other mining apparatus. A special feature of novelty was the use of air-cooling tubes in the Samson disk small size three-phase machine, in order to get the maximum power with minimum height. The motor is completely enclosed, dust and flame-proof, and the stator is provided with groups of straight brass tubes extending through the shell internally from end to end. A fan on the motor shaft (outside the shell) propels air through the tubes, and another fan (inside the shell) circulates the internal air over the surface of the tubes, thus cooling it without allowing the external air to enter the interior of the motor shell. The gears in these machines are mounted on sleeves running on fixed shafts, so as to give a very long-bearing surface, which cannot be obtained when the shafts rotate in bearings fixed to the frame.

THE DIAMOND COAL-CUTTER Co., Wakefield, had a representative exhibit of their manufactures. Their 30-H.P. disk type longwall coal-cutter is fitted with an A.C. ball-bearing motor of the totally enclosed type; the gearing is all machine-cut, and mounted on substantial bearings, all end thrust being taken by ball bearings. A reversible valveless oil pump supplies oil to all bearings. The controller is of the drum type, worked by hand wheel from either end of the machine. A pivoted cable connector box of entirely new design is fitted, which, by releasing one thumb-screw, enables the adaptor to be swung round, thus ensuring a straight lead on the trailing cable. This prevents the cable having to be bent over when the machine is cutting back, and entirely obviates any risk of the cable being nipped between the machine and the props. The power factor of the motor is 0.82 at full load, and the efficiency is very high.

A bar type longwall machine was also exhibited, driven by a four-cylinder compressed-air engine, and a longwall chain machine, fitted with a 25-H.P. patented type D.C. compound-wound motor, having four main wound poles and two commutating poles, and ball-bearings. This is the firm's standard swinging jib pattern arranged to cut at floor level, and, like the other machines, is interchangeable for alternating current or compressed air.

A new gate-end winch for trailing cable, which should effect a great saving in the life of the cable, Blakett's patent coal-face conveyors driven by electricity and compressed air, and an improved friction clutch for use with A.C. motors, together with various patterns and sizes of this company's well-known safety type gate-end switch boxes and other accessories, were also shown.

MESSRS. ANDERSON, BOYES & Co., LTD., Motherwell, showed two disk longwall coal-cutters and one of the chain type, all electrically driven. One of the former was their latest pattern of three-phase machine, 8 ft. overall; the gear is very compact, and is provided with an exceptionally effective oil-thrower to render creeping impossible. Oil is pumped to the bearings. The shaft of the controller handle passes from end to end of the machine inside the frame; at the back end it can only be used to stop the machine, not to start it, so as to ensure safety to the men. The controller is of steel and mica construction, and the trailing cable plug is locked in place when the circuit is closed. Interlocking gate-end switch and fuse boxes were also shown.

MESSRS. A. HIRST & SON, LTD., Dewsbury, showed their "Crescent" machines, one of which was fitted with an electric motor. The insulation of the electrical parts of this machine is of mica, and flame-tight joints are employed throughout. Both D.C. and A.C. machines are made of the disk type. The drum controller in the former is provided with blow-out coils. Interlocking gate-end boxes and a coal drill were shown.

THE SULLIVAN MACHINERY Co., of London, though newcomers into this country, have many machines at work in the British Dominions, and have sold nearly 6,000 in all. The special feature of their three-phase coal-cutter was the small space occupied and the compactness of the motor, though the latter was rated at 30 H.P. for one hour continuously. The motor runs at 900 R.P.M. and is fitted with ball bearings; it is tested with a pressure of 5,000 volts A.C. The switchgear also occupies very little space, being simply a star-delta starting switch with no regulating appliances. The body of the machine is only 2 ft. 6 in. wide. The motor is started on light load, and is thrown into gear with a friction clutch, which is set to a predetermined maximum torque; a two-speed feed-gear is provided, giving a slow continuous feed for cutting and a fast speed (7:1) for "fitting," which renders the machine easy to handle quickly. A chain is used instead of a rope for the feed, and in the event of jamming in the cut the friction clutch protects the machine from damage. When a D.C. motor is used it is compound wound, preventing runaway. A reversing switch is provided, and all the controlling handles are close together at the front end of the machine. The feed can also be reversed without stopping the motor, and the machine can be run backwards without any delay. The friction clutch and change-

gear levers are interlocked so that the pull on the feed chain cannot be increased beyond the normal value. The change-gear has also a neutral position, and the cutter chain can be instantly stopped with a jaw clutch. Altogether the machine presents a number of interesting features not met with in British types. The exhibit also included a compressed-air machine and rock drills.

Turning next to miners' lamps, the "CEAG" ELECTRIC SAFETY LAMP Co., LTD., London, had a large exhibit of their lamp—the winner of the first prize in the recent competition set on foot by the Home Office. Equipments were shown for charging simultaneously 80, 40, 24, 12 or 6 "Ceag" lamps, with 110 or 220 volts, the smallest of these sets being constructed in the shape of a "rescue shelf" in accordance with the new Rules. Racks for 200 lamps each, with number plates, magnetos for opening magnetically locked lamps, motor-driven cleaning machines, lamp wagons, acid filling apparatus, &c., were exhibited, as well as new and improved designs for lamp cabins, facilitating the distribution and collection of the lamps. Several special types of "Ceag" lamps for officials, lamps fitted with bull's eyes, sinking lamps of 16 C.P., &c., were also shown. We understand that many thousands of the "Ceag" lamp have been supplied to British collieries, with satisfactory results, the maintenance costs (inclusive of labour, material, repairs and energy) being not more than 24d. per lamp per week—no more than for oil safety lamps. The works can turn out 3,000 lamps per week.

MESSRS. ACKROYD & BEST, LTD., Morley, showed amongst other lamps the Hallwood electric safety lamp, which is of the cylindrical type, with the lamp on the top. A single cylindrical accumulator cell is used, and the construction of the lamp is such that it is flame-proof, while it is easily opened for charging. A pneumatic or magnetic lock is provided, if desired. Special inspection lamps with lenses and reflectors are also made.

MESSRS. JOHN DAVIS & SON (DERBY), LTD., Derby, amongst a great variety of instruments and mining apparatus, showed the Gray-Sussmann type of electric lamp and lamp stands.

MESSRS. MANLEY & SANDY, LTD., London, were showing a new electric gas detector and indicator which they have devised. This is combined with a miner's electric lamp, and is housed within a small gauze cover on the top of the battery case; it is capable of detecting as little as 1 per cent. of gas, and can be adjusted in advance to a given percentage. The indication is produced by the catalytic action of a platinum salt, but does not depend upon current flowing through the platinum. An inspector's lamp is provided with a deflecting pointer, which shows the percentage of gas present (down to  $\frac{1}{4}$  per cent.) on a divided scale. The lamp gives 1.2 C.P., and the battery will serve for one or two shifts, according to size. Effective precautions are taken to provide against explosion. Charging switchgear and a special small-power gas engine for driving a charging dynamo were also shown.

MESSRS. JAMES KEITH & BLACKMAN Co., LTD., London, had a large exhibit of their fans and blowers, many of them directly driven by electric motors. One of these, a ship ventilating fan, was fitted with a special watertight motor to run on deck. In the small fans, the blades of the runners are spot-welded. A mining fan with a capacity of 240,000 cu. ft. per minute, at 6-in. water-gauge, was one of the exhibits, and at the other end of the scale was a little portable blower for cleaning motors, &c., which could be carried by hand. Forge blowers, portable and fixed, and a gas compressor for the Keith high-pressure lamps, were other items of the exhibit.

MESSRS. HOBDELL, WAY & Co., LTD., London, had a very varied exhibit of engineers' supplies, including "Kulite" cork heat insulation in slabs and sections of all sizes, "Dorite" belting suitable for the individual driving of looms, and for use in a moist atmosphere, conveyor belting, "Hobsleyte" asbestos sheets suitable for the cubicles of high-pressure switchgear and for roofing, and cork floor slabs for switch rooms. A special novelty was a tube scaler, consisting of four scrapers mounted on springs, which is driven by a flexible shaft, and in actual practice with water-tube boilers has been found to give exceptionally efficient results. The action is pure scraping without hammering, and the inside of the tube is left bright and clean.

MESSRS. BLEICHERT'S AERIAL TRANSPORTERS, LTD., London, showed a model of their ropeway in operation, as well as an electrical automatic telfer for conveying coal, &c. The whole of the control is effected from one spot, the tub being lowered or raised, and traversed, with only three wires. Very many such telfers have been erected, and the large ropeways have been built to carry up to 450 tons per hour.

MESSRS. JOHN DUGDILL & Co., Failsforth, showed a variety of their well-known patent movable fittings, and MESSRS. HANN AND INGLE, Manchester, their "Adaptable" earthing and continuity clips, which should be found very useful in mines.

MESSRS. HANS RENOLD, LTD., Manchester, had an exhibit of their silent, roller and block chains.

THE INGERSOLL-RAND Co., London, showed a large compressor driven by a Lancashire Dynamo and Motor Co.'s motor, and various rock drills, &c. A feature of the exhibit was the Temple-Ingersoll "Radialaxe" coal-cutting machine, which consists of a motor-driven pulsator connected to an air drill by two short lengths of hose. The air in the hose forms the medium by which power is transmitted to the drill, with perfect elasticity and high economy, as the air is never exhausted, but simply pulsates. The machine thus combines the advantages of electrical transmission to the working face and pneumatic operation of the tool. The whole equipment is mounted on a wheeled truck. The cutter is really a drill mounted on a special column, and, in fact, the parts are interchangeable with the company's rock drill.

MESSRS. W. & T. AVERY, LTD., Birmingham, exhibited a complete weighing and totalling machine, which automatically weighs

a constant length of the conveyor at suitable intervals, and records the total weight of material which has passed over the machine. The motive power is derived from the working of the conveyor itself. The machine was shown in operation with a Babcock and Wilcox gravity bucket conveyor.

MESSRS. REAVELL & CO., LTD., Ipswich, exhibited their axial type compressor, motor driven, with an oiler at one end of the main bearing, whence the oil is forced by a spiral groove on the shaft to the working parts. The quadruplex compressor is fitted with automatic positive lubrication, the oil being forced through a filter to a tank, whence it gravitates to the working parts. A reversible valveless self-contained pneumatic mining hoist, substation cleaning set, &c., were also shown.

MESSRS. G. M. CALLENDER & CO., LTD., London, showed bitumen sheathing, and "Bitusol" paint for the protection of iron and steel work.

THE ELECTRICAL APPARATUS CO., LTD., London, had an exhibit of their starters and switchgears: a novel feature in an automatic triple-pole oil switch was a patent oil level interlock, which prevents the switch from being closed if the level of the oil is so low as to expose the contacts. A new A.C. meter of the induction type was also on view.

THE UNION CABLE CO., LTD., Dagenham Dock, appeared to be the sole representatives of the cable makers, with an exhibit of all kinds of cable, including bitumen-insulated mining cables and boxes.

THE COVENTRY CHAIN CO., LTD., Coventry, showed samples of their noiseless and roller chains and gears, and MESSRS. DAVIDSON AND CO., LTD., Belfast, had a large exhibit of Sirocco fans.

An ingenious sprinkling shovel for hand-stoking was shown by MR. C. A. FEIL, of Dronfield.

## BUSINESS NOTES.

**Heavy Capacity Lampholders and Adaptors.**—We have received from MESSRS. G. ST. JOHN DAY (PATENTS) LTD., a letter referring to the letter in our issue of June 6th, by Mr. C. J. Stonier, Dundee, in which they inform us that their Mumps and one-part adaptors, &c., will, and do, carry the same current as their Mumps holders; they guarantee these holders and adaptors, when used together, to carry 10 amperes. The only difficulty they experienced with large current-carrying capacity holders, adaptors, &c., was the size of the conductors entering or connected to such appliances, which necessarily required large holes. This difficulty has been overcome, and we have before us a Mumps lampholder and one part adaptor, coupled and wired with 7/22 wire and 130/40 flex. The makers inform us that they have tested the holders and adaptor with 20 amperes passing continually for 18 hours without heating up. The holder sent us is provided with side channels in the barrel to observe the method of contact making, as well as for heat testing, and it occurs to us that these channels might be made a permanent feature of the holders to allow of the circulation of air.

**Electric Lamp Films.**—At the Blue Hall Cinematograph Theatre, 207, King Street, Hammersmith, during this week, at 8 p.m. daily, there is being shown a special film illustrating the operations at the Osram and Robertson lamp works, with views of the employés at work and at play.

**Dissolutions and Liquidations.**—JOHNSON-BILLINGTON ELECTRICITY METERS, LTD.—A petition for winding up this company, presented by Mr. W. H. Johnson, 62, Langham Road, Teddington, a creditor, is to be heard on June 17th.

**TRACTION SUPPLIES, LTD.**—Creditors should send particulars of their debts, &c., to the liquidator, Mr. T. Metcalf, 50, Frederick Street, Sunderland, by June 27th.

**ADAMSON, RAMSBOTTOM & CO., LTD.**—Creditors should send particulars of their debts, &c., to Mr. B. Cookson, 6, Castle Street, Liverpool, the liquidator, by July 31st.

**HALPIN'S PATENT THERMAL STORAGE, LTD.**—A meeting is called for July 16th, at 5, Coleman Street, E.C., to hear an account of the winding up from the liquidator, Mr. S. V. Tiddy.

**Bankruptcy Proceedings.**—J. G. M. HILTON, electrical engineer, 103, Exchange Buildings, Birmingham.—The first meeting of creditors herein was fixed for Wednesday of last week, at Ruskin Chambers, Corporation Street, Birmingham, but the meeting was adjourned in order to enable the debtor to formulate a scheme by which the creditors would receive a composition of 7s. 6d. in the £.

**W. LONGDON and V. G. COBB** (Longdon & Cobb, electrical engineers), Nottingham.—Also **W. LONGDON** (separate estate).—June 28th is the last day for receiving proofs for dividend. Mr. E. W. Humphreys, Official Receiver, 4, Castle Place, Nottingham.

**C. S. NORTHCOTE**, electrical engineer, Streatham.—A first and final dividend of 1/4d. in the £ is payable June 23rd, at 132, York Road, Westminster Bridge Road, S.E.

**Book Notices.**—*Reid's Handy Colliery Guide for Northumberland, Durham and Yorkshire*. Newcastle-on-Tyne: Andrew Reid & Co., Ltd. 2s. 6d.—This book opens with a large folded map of the district named in the title, showing the position of the collieries and the railways. It is largely a directory of colliery-owners, collieries, agents, managers and engineers. while

it also contains lists of associations and institutions connected with the coal trade, and names and addresses of H.M. inspectors and assistant inspectors of mines. The latter half of the book and more is occupied with copies of Acts of Parliament and Coal Mines Orders, also the special rules for the installation and use of electricity, Workmen's Compensation Act, miscellaneous information and mining statistics.

*The Practical Electrician's Pocket Book for 1913*. Edited by H. T. Crewe. London: S. Rentell & Co. Price 1s. net.—The little red volume, which comes before us fatter than ever, though some of the old sections have been omitted, is unusually late this time; it only reached us last week. The new matter deals with electrical coal-cutting machines, vacuum cleaners, generators and motors, control of lighting circuits, measurements, &c. The field covered by the book is so wide and varied that it resembles an encyclopaedia, and it is a mine of information in brief on electrotechnology.

*The Faraday House Journal*, Vol. V, No. 3, for June, which has just been issued, contains much information regarding the doings of old Faradians, as well as articles on the Dyott monoplane, Transformer Regulation on Inductive Loads, the Inductive Coupling of Oscillatory Circuits, and Electric Winding Plant for Collieries, with other matter, making it a very readable issue.

"Electric Wiring." By W. C. Clinton. Third Edition. 1913. London: John Murray. Price 2s.

"The Modern Bioscope Operator." 1913. London: Ganes, Ltd. Price 3s. 6d.

"Science Abstracts." Vol. XVI, Part 5, May 30th, 1913. Sections A and B. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Electricity in Mining." By Siemens Bros. Dynamo Works, Ltd. London: Charles Griffin & Co., Ltd. Price 10s. 6d. net.

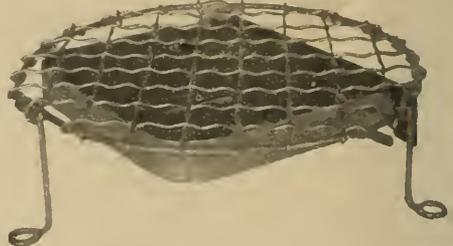
"Journal of the Institution of Municipal Engineers." Vol. IV, No. 16, May, 1913. London: The Institution. Price 1s.

"Journal of the South African Institution of Engineers." Vol. XI, No. 10, May, 1913. Johannesburg: The Institution. Price 2s.

"Journal of the United States Artillery." Vol. XXXIX, No. 3, May-June, 1913. Fort Monroe, Va.: Coast Artillery School Press.

"Proceedings of the American Society of Civil Engineers." Vol. XXXIX, No. 5, May, 1913. New York: The Society.

**New Electric Stove and Toaster.**—A new and cheap form of combined electric stove and toaster has just been placed on the market by MESSRS. F. A. WILKINSON AND PARTNERS, LTD., of Hatfield, Herts. The framework is



ELECTRIC STOVE AND TOASTER.

constructed of bright wire, attached to which is a polished aluminum tray containing a simple form of heating element. The consumption is 600 watts, and the apparatus is of high efficiency. A slice of bread can be toasted both sides in 1½ minutes, while 3 pints of water can be boiled in 22 minutes. Ordinary household utensils are employed, it being unnecessary to use those with flat bottoms.

**Catalogues and Lists.**—MESSRS. GRIFFITHS BROS. AND CO., Macks Road, Bermondsey. London.—36-page booklet containing much information relating to their various insulating varnishes and compounds (Ohmaline, Armaeol, Pakyderm, Insulderm, &c.) and the purposes to which they are applied.

MESSRS. VERITYS, LTD., King Street, Covent Garden, W.C.—Folder No. 746 illustrates and gives prices of "Aston" fireproof and insulated lampholders, house service boards, tumbler switches, automatic two-part lampholders, ceiling roses and other devices.

THE BRITISH ALUMINUM CO., LTD., 109, Queen Victoria Street, London, E.C.—8-page pamphlet (No. 133) containing fully illustrated information relating to the erection and jointing of aluminium bus-bars and connections; tabulated areas, weights and other particulars of aluminium rod, bar and strip, are tabulated. Leaflet No. 222A shows the use of aluminium feeders for railway electrification. A special binder file accompanies the lists.

THE SCHNIEWINDT ELECTRIC CO., 40 and 41, Staniforth Street, Birmingham.—Ten-page list, describing their electric stoves, in which Schniewindt resistance grids are used. Illustrations appear of some 17 designs, and prices, weights and dimensions are tabulated. Prices and particulars of the resistance grids are fully set forth.

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., 38 and 39, Upper Thames Street, London, E.C.—Leaflet relating to the "chain-pull" switch lampholder, and a supplementary price list of tumbler and other switches.

MESSRS. ROSS & CO., 62, Robertson Street, Glasgow.—Twenty-four-page illustrated wholesale and export price list of rubber

wires and cables, flexibles for lighting and motor-car service, bell, telephone, shot-firing and fuso wires, enamelled copper wires, cable sockets, sundries for dynamo repairs, &c.

MESSRS. MAGIC APPLIANCES, LTD., 6, Farringdon Avenue, London, E.C.—Folder, giving brief particulars, illustration and price of the "Magic" electric blower for factory and workshop service.

MR. FRED. J. DOWN, 6, 7 and 8, Crutched Friars, London, E.C.—Illustrated lists describing a spring hammer and drills for drilling holes in concrete, brick and stone. An extension for overhead drilling is shown, and typical ways of using the hammer are pictured. Other lists give particulars of gear shield—a graphite gear lubricant—such as is in use on a large number of tramways and railways.

THE ELECTRICAL CO., LTD, 122-124, Charing Cross Road, London, W.C.—Twenty-four page catalogue, illustrated, and giving prices, speeds, dimensions, weights, &c., of electric fans—ceiling, desk, porthole, swivel and trunnion, and other types.

MESSRS. KRUPKA & JACOBY, LTD., 26-36, Chapter Street, Westminster, London, S.W.—Illustrated and priced leaflet ("F") giving particulars of electric fans—universal joint, swivel and trunnion movement, ceiling, porthole, propeller and desk types; also a list of prices of small power motors.

MESSRS. E. BENNIS & CO., LTD., 28, Victoria Street, London, S.W.—28-page catalogue in a brilliant "fery cover," containing introductory comments on "cheap steam and a smokeless chimney," followed by a description of the construction and operation of the Bennis stoker. Tests results are tabulated both for a power-house and a cotton mill. Nine pages of interesting drawings follow showing the application and general arrangement of these stokers and furnaces to different types of boilers. One of the pictures shows the stoker arranged for gas firing as an alternative to coal firing; and another shows a Cheshire power station where 12 boilers are fired by the firm's machines, the coal used being a small slack.

THE STERLING TELEPHONE & ELECTRIC CO., LTD., 200, Upper Thames Street, London, E.C.—Folder (No. 210), showing their receivers for wireless telegraphy, and stating prices.

**Wheatstone Slip.**—We have received from MESSRS. H. ERHARDT & CO., LTD., of 9-10, Bond Court, Walbrook, E.C., a sample roll of their Wheatstone slip, which is said to be free from oil, grease and fluff, and to keep in condition for any length of time in any climate. The sample is strong and crisp, with a clean sharp edge, and should prove admirably adapted for use with telegraph and time recording instruments.

**Installation Contracts.**—MR. JOHN RICHARDS, electrical contractor of Burton-on-Trent, has a number of complete plant installations in hand, particularly for country houses and industrial works. The country house installations include Wychnor Park, Lichfield; Coton Hall, Sudbury; The Gables, Rangemore; and Croft House at Grendon, where he has recently completed the electric lighting of Grendon Hall. Other work now in hand includes the complete equipment of the Nestlé & Anglo Swiss Condensed Milk Co.'s new factory at Ashbourne, Derbyshire, with some 28 motors, 350 lights, intercommunication telephones, electric clocks, &c.; Messrs. Warwick & Richardsons' Brewery, Newark-on-Trent, with some 30 motors and 250 lights; Messrs. James Hole and Co.'s Brewery, Newark-on-Trent, with some 300 lights, besides numerous installations on town supplies.

**The British Engineers' Association and Merchant Firms.**—The Secretary of the British Engineers' Association (Caxton House, S.W.) writes to correct a misapprehension that the Association intends working against the interests of merchant firms. He thinks its existence is probably due to the Association having had to decline to elect a number of merchant firms of highest repute "simply because the membership is confined strictly to manufacturers." The Association being purely an organisation of manufacturers, a merchant or agent is not considered eligible. Its members are at liberty to deal with merchants as much as and however they choose. It is sometimes asked whether the Association is working with the merchants, but the secretary says that as an Association it cannot do so; its members, however, do as they please. The Association's aim is to influence trade for the benefit of its members, the latter taking orders through any channel they may find convenient.

**British Electrical Developments in China.**—While increased attention is being devoted to the Chinese market in the hope of preventing golden opportunities slipping past our manufacturers, both now and in the future, it is satisfactory to learn that the GENERAL ELECTRIC CO., LTD., whose efforts in China are not unfamiliar to our readers, are very satisfied with their experience there. The General Electric Co., of China, Ltd., report that recently they have secured several contracts for the supply of electrical machinery for the Chinese cities of Soochow and Changchow, in Kiangsu Province. All electrical plant and materials in these places will be of British make and manufactured at the works of the G.E. Co., Ltd., in England. For Soochow a Witton single-phase alternator, capacity 375 kw., with high-tension switchboard, is being supplied as an extension of the present generating plant. In the case of Changchow, which is a similar city, a Chinese company has been formed, and the contract secured for a Witton alternator of about 200 kw., complete with high-tension switchboard, Allen's engines, &c. Another contract recently secured has been for three Witton high-tension alternators, with 14-panel switchboard, for the lighting of Fatchan, in Kwangtung Province. The General Electric Co., of China, Ltd., was only established in 1911; its headquarters are at Shanghai, and sub-branches are located at Hong Kong, Tientsin and other places.

**Trade Announcements.**—We understand that some confusion and inconvenience has arisen owing to correspondents failing to address letters correctly for firms of somewhat similar title at Walsall. Readers are asked to take note that the address of the Walsall Electrical Co., Ltd., is 57, Bridge Street, Walsall, and that of the Walsall Hardware Co., who manufacture conduits and fittings, in the directories is Walsall only. Mistakes have also occurred in the correspondence of these two concerns and that of the Mechanical and Engineering Co. Each of these firms has lately received letters intended for one of the others.

THE HALLAMSHIRE ELECTRIC CO., LTD., has removed to 16, Carver Street, Sheffield.

THE BENJAMIN ELECTRIC, LTD., announce that their accounts and order departments are now managed at the company's works at 1A, Rosebery Avenue, E.C. (telephone No. "City 2407"), and all communications relating thereto should be sent to that address. The sales office and showrooms are still at 117, Victoria Street, S.W. (telephone No. "Victoria 1297").

MESSRS. FALK, STADELMANN & CO., LTD., have arranged for permanent showrooms at 107/111, Shudehill, Manchester, for the display of electrical fittings and accessories of every description, and a complete stock will be carried.

We understand that MESSRS. BAXTER & CAUNTER, of 219, Tottenham Court Road, W.C., are rearranging their switchboard department, putting it under new management, particulars of which will be duly announced. Mr. L. B. Best is no longer associated with the firm.

**Low-Water Alarm and Feed Regulator.**—We regret that the address of MESSRS. ELLEFSEN & CO., makers of this device, was wrongly given in our last issue. It is 26A, Silver Street, Bedford (not Bradford).

## LIGHTING and POWER NOTES.

**Ashford (Kent).**—At a meeting of the U.D.C. on June 5th, an application was received from the East Kent Electric Supply Co. for permission to use overhead wires for the supply of current under the order held by the company. The matter was referred to a Committee for the collection of further information.

**Banff.**—The Lunacy Board has under consideration the lighting of Ladiesbridge Asylum with electricity, at an estimated cost of £1,100. It is calculated that by adopting electricity a saving of about £100 per annum would be effected, as the gas installation costs a good deal annually for repairs.

**Barnstaple.**—The income from the electricity undertaking for the year ending March 31st, 1913, amounted to £5,400. The expenditure totalled £3,062. There is, therefore, a profit balance to carry forward of £2,337. The capital account shows an unexpected balance of £99, the expenditure being £33,385.

**Bedford.**—The L.G.B. has informed the T.C. that the inquiry into the application for a loan of £11,590 for additional plant at the electricity works will be reopened on June 18th by Mr. T. C. Ekin. There have been two previous inquiries concerning the loan, particulars of which have appeared in the ELECTRICAL REVIEW.

**Belfast.**—The two years' discussion on the proposed new power station does not appear to bring the matter any further towards a settlement. Mr. Bloxam's report upon the estimated comparative capital and working costs of the various sites has been issued, showing considerably in favour of the harbour sites in the matter of working expenses. The capital expenditure on an 18,000 kw. station, including over £100,000 for machinery, is estimated at between £183,000 and £202,000 according to the site selected.

For the year ended March 31st last, the Electricity Department shows a working profit of £34,947 carried to net revenue account, to which has been added £1,380 for bank interest, making a total of £36,327. After providing for fixed charges, amounting to £22,478, income-tax, &c., there remained to the credit of the new revenue account a disposable balance of £13,175. The appropriation of this sum will be considered at a later meeting of the T.C.

**Bradford.**—The city electrical engineer has been instructed to furnish members of the Electricity Committee with a copy of the report presented by him upon suggested extensions of the generating plant, together with an estimate of the capital cost involved. The Committee is to hold a special meeting at an early date, and to proceed to Newcastle, Manchester and other towns to inspect the electrical undertakings.

The electrical engineer has also been instructed by the Committee to proceed with the work of extending existing E.H.T. feeders at an estimated cost of £5,458.

**Burnley.**—A statement prepared by the borough treasurer and submitted to the T.C. shows that the actual profits from the electricity undertaking on the past year's working amount to £7,926. This is £3,133 more than the amount estimated.

**Bristol.**—In his annual report to the City Council, Mr. Proctor, the city electrical engineer, says the Electrical Committee has agreed to reduce the charge for public street lighting by £2,000 per annum and to give a supply of current free of all charge to numerous incandescent electric lamps on the line of route of the mains. Cooking by electricity has been introduced, and is rapidly becoming popular. The number of cooking stoves in use would have been appreciably larger, but for the difficulty experienced in obtaining sufficient deliveries from the manufacturers, who throughout the country are overcrowded with orders. The increase in the connections to the mains, reduced to the equivalent of 30-watt lamps, is 65,065. This is the greatest increase in any year since the commencement of the undertaking, except only the year 1908-9. The total connections to date amount to 639,523; 15,000 H.P. of motors on consumers' premises are now supplied, over 2,000 H.P. having been added during the year. The total sale of energy has increased 25 per cent. The total revenue from the current sold has risen from £73,335 to £82,130, an increase of £8,795, as compared with an increase of £5,072 for the former year. The gross profit on the year's working is £56,129. The Committee has opened a general reserve fund this year, to the credit of which it has placed the sum of £6,000.

**Burton-on-Trent.**—Application has been made to the L.G.B. for sanction to the borrowing of £5,000 for 25 years for mains and feeders, £1,500 for 15 years for services, and £2,000 for 15 years for transformers and sub-stations.

**Bury.**—Mr. S. J. Watson, the borough electrical engineer, in his just-published annual report, states that the total units sold for all purposes were 5,076,634 (of which 1,370,266 were for tramway purposes), as against 4,220,191 (1,340,355 for tramways) in the preceding year. The total generating costs were 55d. per unit sold, compared with 62d. per unit last year, and the average price obtained for the total output was 1'05d. per unit, compared with 1'10d. per unit for the previous year. After payment of all working expenses there was a gross profit of £10,577, equal to 6'49 per cent. on the average capital employed, compared with £8,472, equal to 5'65 per cent. on the capital for the previous year. The sum of £11,219 was required to pay interest on loans and sinking fund, leaving a debit balance of £642, which had been taken from the reserve fund. During the year £7,066 had been expended on new mains, services and transformers. Although a loss of £642 has to be recorded, adds Mr. Watson, the general position of the undertaking shows a marked improvement over the previous year, and the next accounts will probably show that the undertaking is once more established on a profit-earning basis. Commenting on the report at the T.C. meeting on June 5th, Councillor Jamieson said the capital charges and the working expenses had now reached a normal level, and all additional income would consequently yield a much larger percentage of profit.

**Canterbury.**—During the year ended March, 1913, the sum expended on capital account on the electricity undertaking amounted to about £766, making a total expenditure of £70,188 up to date. The income from sales amounted to £10,088, as against £9,557 in the previous year. An increase of 7 per cent. in private consumers is reported. The expenditure was £5,706, against £5,263; the gross profit of £4,954 shows a return of 7 per cent. The net profit, after providing for interest, income-tax, capital repayment, and sinking fund of £3,981, was £972; £174 had been expended for the purchase of the free wiring installations, and apart from that the profit would have amounted to over £1,000 during the year.

**Charnmouth.**—An electric lighting scheme for the village has been propounded by Mr. C. H. Steele, who proposes to use local water-power and to invoke the aid of the Dorset Electric Lighting Co.

**Cheltenham.**—The T.C. has applied to the L.G.B. for a loan of £2,000 for prospective mains extensions.

**China.**—According to the *Indian Textile Journal*, the Kwangtung Electric Co. is extending its lighting cable to Fati, on the other side of the Canton river. The town named is the terminus of the Canton-Samshui Railway and boasts of quite a number of European godowns and residences. To meet the new supply, two additional Diesel engines and dynamos of 300 kw. each are to be installed, capable of giving 30,000 lights. These additions will bring the company's plant up to 12 engines.

**Clacton-on-Sea.**—The U.D.C. has received from the L.G.B. sanction to a loan of £6,000 for electricity purposes, £5,390 being for a Diesel engine, and £610 for extensions to the generating station.

**Colne.**—The Corporation has received the sanction of the L.G.B. to the borrowing of £2,000 for the purpose of extending the electricity mains.

**Crewe.**—The T.C. has received the sanction of the L.G.B. to a loan of £430 for converting to electric lighting certain street lamps in the North Ward of the borough.

After paying all costs, there is a surplus of £1,329 on the electricity undertaking for the year ended March 31st. Of this amount, £600 is to be applied in aid of the general district rate for 1913-14.

**Bartford.**—The electrical engineer has been authorised to issue an illustrated pamphlet calling attention to the cheap rates at which energy is supplied to power consumers and to the advantages which the locality affords for the erection of factories.

**Budley.**—In connection with the sale of the Corporation's electricity undertaking, a deadlock arose owing to the limitation on both sides of the statutory powers; but, as a result of a special meeting of the Council in reference to this matter, all difficulties have now been overcome. Under the new agreement, as under the original one, all losses which the Corporation has sustained in connection with electrical supply will be refunded. A rearrangement of the working plant, to be carried out at a cost of £20,000, is to include the erection of transforming plant to give high-pressure current on, it is believed, more favourable conditions to consumers. It is understood that the sale can now be completed without any public inquiry.

**Dundee.**—Treasurer Soutar, dealing with the Corporation electricity accounts at a meeting of the Town Council, said the year had closed with a net profit of £7,028. Although this was fully £3,000 less than in the previous year, it was accounted for by the increase in coal cost and assessments. The total units sold were over 10,000,000, showing an increase of 1½ millions, and the total revenue was £52,390, an increase of £3,000, in spite of the fact of considerable reductions made in the price. Practically the whole of the increased units sold had been for power purposes, although there was also a gratifying increase in the units sold for lighting. The whole of the net profit had been placed to reserve fund, which now amounted to £21,781. Councillor Don congratulated Mr. Richardson, the Corporation engineer, and said the result was an ample answer to the complaints about continuous expenditure on capital account, and to the criticism which was offered when they decided to go to Carolina Port; he thought it was only after they had increased the power demand that they could hope to grant any advantage to the consumers for lighting. The accounts and estimates were approved, the charges remaining unchanged.

**Eastbourne.**—The annual report of Mr. J. K. Brydges, the borough electrical engineer, on the work of his department, shows that the income of the year was £27,860, the gross profit £14,476, and the net profit £2,495, which compares with £1,089 in 1911-12. The total energy sold was 1,620,648 units, as compared with 1,432,323 units in 1911-12.

**Eccles.**—In regard to the figure of £112, given as the net profit of the electricity department for the past year, Alderman Pearson explained to the Council last week that the sum was estimated at the time the price to be paid by Salford was in dispute. The Council had now practically agreed as to a price, and the profit would be £380. That, however, was a decrease on the amount under the old arrangement. Referring to the revenue account, he pointed out that, after paying for all working expenses, there was a gross profit of £4,193, which was slightly over 7 per cent. on the capital invested.

**Esom.**—The U.D.C. has decided to apply for sanction to a loan of £480 to carry electrical cables to the Woodcote Park Estate. If supplied with current, the Royal Automobile Club, which has premises on the estate, has guaranteed £60 revenue per annum for three years.

**Elland.**—The Council last week confirmed the recommendation of the Electricity Committee that in future electricity for public lighting be charged at the rate of 1½d. per unit. It was reported that the number of consumers was now 349. The total output for last month was 35,440 units, a decrease of 1,331 on the previous month, and an increase of 16,419 on the corresponding period of last year.

**Felixstowe.**—The U.D.C. has decided not to reopen negotiations with Dr. C. H. Lieberbrand on the subject of the transfer of the electricity undertaking, or to have any further correspondence with him on the matter.

**Gillingham (Kent).**—The T.C. has decided to supply electrical energy to the Admiralty for the Naval Hospital, for heating and cooking, at 1d. per unit on a guaranteed minimum consumption of 50,000 units per annum, or 1½d. per unit without such guarantee.

**Gloucester.**—Subject to a satisfactory agreement, the T.C. has decided to supply current for lighting and power to Messrs. Spillers & Bakers' flour mill. A cable will be run through a pipe under the canal.

**Halifax.**—At a meeting of the T.C. last week, the Electricity Committee recommended that the charges for electricity for lighting purposes be 4d. per unit for accounts up to 1,200 units a quarter and 2d. per unit for energy supplied in excess of that amount. The vice-chairman of the Gas Committee moved that the minute be referred back, and was supported by several speakers, including the Mayor, who said that competition between the Electricity and Gas Committees, if carried to extremes, would kill both departments. The chairman of the Electricity Committee, in answer to the Mayor, said the two Committees had already met, but had not been able to come to any agreement. The warfare between the Committees was ridiculous. The motion to refer back was carried.

**Hastings.**—At last Friday's meeting of the Corporation, the annual accounts of the electric light undertaking (up to March 31st) were submitted by the borough accountant, and showed that considerable progress had been made. From the time when the undertaking was purchased by the Corporation from a local company—in 1893—the financial position has been handicapped by the heavy capital involved.

The income for the year was £22,327, showing an increase of £1,719 on the previous year; the expenditure was £10,669 and

the gross profit £11,658. After meeting capital charges, the net profit amounted to £557, and compares with £90 in the previous year. Both these amounts were transferred to reserve.

**Hull.**—On June 5th a L.G.B. inquiry was held by Mr. Hooper respecting the application of the T.C. for a loan of £1,800 for electric light fittings for the new Guildhall. Mr. Hooper pointed out that the proposed outlay was very high, being £1 5s. per light, and it was intimated that, if necessary, the Council would try and reduce the cost.

**India.**—The chief engineer of the Karachi Port Trust has been instructed to estimate the cost of the general lighting by electricity of the Port Trust properties at Keamari from the board's own installation.—*Indian Engineering.*

**King's Lynn.**—The abridged returns of the Electricity Department for the last year's working show a total income of £7,314, and after meeting working expenses and financial charges, a net profit of £876 remains, as compared with £503 in the previous year.

**Kirkcaldy.**—The Electric Lighting Department returns show a loss of £37 on the last year's working. It was estimated, however, that the deficit would have been greater, but the raising of the rate for current supplied to the tramways from 4d. to 1d. per unit has considerably improved matters.

The Council proposes experimenting with a new type of arc lamp for street lighting, with a view to economising in that department.

**Korea.**—The total amount of capital invested in electrical concerns in Korea is about £1,225,000. Of this sum £980,000 is invested in concerns already working, and the balance in electrical works which are in course of construction. During the year several new companies commenced operations. One supplies the town of Gensan with light and power, and is the only hydro-electric company in the country. The other supplies light and power to the town of Taikyu. Eight more companies which have already received official sanction are expected to commence work during 1913.—*Board of Trade Journal.*

**Lelgh (Lancs.).**—It was reported last week-end that the profit on the municipal electricity department last year was £1,080, an increase of over £500 upon the previous year.

**London.**—STEPNEY.—The income of the electricity undertaking for the year ended March 31st last amounted to £78,431, being an increase over the previous year of £9,154, whilst the total expenditure amounted to £39,208, an increase of £8,123. This leaves a gross surplus of £39,226, as compared with £38,196, and represents a gross profit of 8½ per cent. on the capital employed, which, in view of the very low tariff in force, the Electricity Supply Committee deem satisfactory. There has been an increase in the number of units sold during the 12 months from 11,972,955 to 12,580,982. With reference to the net revenue account, the total income, including the balance from revenue account, amounted to £49,834, against which are charged £27,278 for loan charges paid, £600 for stand-by charges, £8 additional provision for accrued charges, and £441 for certain temporary work, leaving a balance carried to appropriation account of £11,507, as compared with £2,757 the previous year. As regards this latter account, the total amount available, including £11,507 from the net revenue account and £251 brought forward from the previous year, amounts to £13,760, and it is proposed to charge against this account the following:—£125, representing expenditure in the nature of capital net return by loan; £2,711 written out of the capital account in respect of assets (*i.e.*, machinery, meters and house services), now non-existent; and £8,443 transferred to reserve, carrying forward £1,482 to next year's account. The available balance on the reserve account was £21,193 (including £8,443 transferred from the appropriation account), against which has been charged £193 cost during the year of removing plant from Whitechapel to Limehouse, leaving £21,000 carried forward to next year's account. Of this latter sum, £1,000 is reserved in respect of bad and doubtful debts. The known bad debts have been actually written off. The capital commitments during the year amounted to £26,834, and new loans amounting to £23,250, were taken up to meet this. The aggregate capital expenditure amounted to £461,114.

**ST. PANCRAS.**—The terms upon which the Council is to enter into an agreement with the London Housing Society for a supply of current to its residences in Judd Street are to be altered so as to provide that no supply shall be given except on the understanding that no gas is to be used in the buildings for lighting purposes. The Council's opposition to the London Electric Railways Bill has been settled by an agreement being entered into by which the promoters promise to pay to the Council £300. The Electricity Committee anticipates that, when the plant for the further extension of the principal generating station is installed, it may be able to make a further favourable revision of charges.

**ISLINGTON.**—Application is to be made to the L.C.C. for sanction to borrow £10,000 required in respect of high and low-tension distributing mains, meters, services and transformers for the ensuing year.

**HACKNEY.**—In connection with the coal contracts to March 31st, for the first time alternative tenders were asked for "named" and "guaranteed" coal. The Electricity Committee, after analysing the tenders, feels obliged to recommend "named" coal, as in no case are the "guaranteed" coal prices sufficiently low, when the advantages for superiority to standard is taken into account. Offers by Messrs. Cory and Sons, at 16s. 7d. and 17s. 6d. per ton for "named" coal were accepted; the "guaranteed" prices comparable were 11d. and 17s. 1d.

**Manchester.**—The E.L. Committee has adopted the "Norwich" system of charging as an alternative rate (at the option of the consumer) to the existing tariffs for domestic supplies. The new rate is based on a fixed charge of 12½ per cent. on the net rateable value of the dwelling house, plus 4d. per unit metered for all supplies. The adoption of the new tariff is further contingent on the consumer agreeing to install for domestic power purposes a certain minimum number of kilowatts, according to the rateable value of the premises, in addition to the existing lighting requirements.

**Middleton.**—There is a loss on the year's working of the electricity department of £1,800, after allowing for £500 for depreciation. This is due chiefly to the high price of coal and to the breakdown which occurred. Although there is an increase in the number of consumers, the amount consumed has not increased, and the department has received £476 less for electricity supplied for traction purposes. The deficiency on revenue account is £1,124.

**Morocco.**—La Sociedad Hispano-Marroqui de Gas y Electricidad is the name of a company which has lately been formed, with a capital of £200,000, to acquire and carry on the central electric lighting station in the town of Melilla. The plant, which has a capacity of 800 H.P., is to be increased by the establishment of a new 600-H.P. station to enable current to be supplied to Nadar and other small towns in the district. A gas-works is also to be established at Melilla by the company.

**Nuneaton.**—The T.C. has reduced the price of current on the flat rate to 4d. per unit with ordinary meters, and to 4½d. per unit with slot meters.

**Rochdale.**—The Corporation Electricity Committee has under consideration the terms on which a bulk supply shall be granted to the Heywood Corporation.

**Rhosllanerchrugog.**—As the outcome of inquiries made by the local Traders' Association, the Welsh E.L. Syndicate has intimated that it is prepared to supply electricity to the town at 6d. per unit. Another scheme, whereby current could be obtained from Wrexham by means of overhead lines, has been submitted by the borough electrical engineer. The matter is being considered by a Lighting Committee appointed by the Association.

**Roscrea.**—The Council has granted to the Roscrea Co-operative Bacon Factory a lease for 21 years to put up poles and do other necessary work so as to supply the town with electric light and power, the factory to pay to the Council a nominal rent.

**St. Helens.**—At a meeting of the T.C., Sir Joseph Beecham, reviewing the work of the electricity department, said the income during the year amounted to £27,365, an increase of £1,339 over the previous year. On the expenditure side, the working expenses were reduced by £599 to a total of £13,344, so that the gross profit amounted to £14,821, which was a return of 7½ per cent. on the capital. After deducting capital charges, there remained a surplus of £1,629, compared with £518. The total number of units sold was 4,890,438, an increase of 73,506 units. The power units amounted to 2,998,830, an increase of 5½ per cent. over the previous year. In connection with the tramways supply, there was a decrease in the amount of energy taken of 57,609 units, or 4.2 per cent.

**Salford.**—At the T.C. meeting last week, the question of the public lighting of the borough was referred to the Lighting and Cleaning Committee for a report as to whether the lighting is efficient.

**Sheffield.**—The T.C. has engaged Mr. Haydn Harrison, of Westminster, at an inclusive fee of 100 guineas, to go into the question of the relative cost and efficiency of gas and electricity for street lighting.

**Siberia.**—According to a St. Petersburg paper, the Minister of Commerce has decided to equip the Port of Vladivostok with a number of electric cranes and other cargo-handling appliances, for which is allocated 1,000,000 roubles. A complete dredging plant is also to be acquired, at a cost of 300,000 roubles, for use at Ust-Kamchat Va, on the east coast of the island of Saghalin.

**South Africa.**—Relative to the supply of electric current by the Durban Corporation at reduced prices, with a view to encouraging its use for domestic heating and cooking, H.M. Trade Commissioner for South Africa reports that the efforts of the Corporation are meeting with considerable success, and that electric heating and cooking are now fairly well established in popular favour in Durban.

**Spennymoor (Co. Durham).**—By 10 votes to 6 the U.D.C. has decided to utilise electricity for public lighting, and the tender of the E.L. Co. at £2 10s. per lamp per annum on a three years' contract, has been accepted.

**Tilbury.**—The County of London Electric Supply Co., which is applying for a prov. order for electric lighting, has informed the U.D.C. that it cannot include in the order the conditions desired by the Council as to the payment of Trade Union rate of wages, as it considers it outside the scope of the order. The question of opposing the company's application will be considered at a future meeting of the Council.

**Wakefield.**—The City Council last week decided to make application to the L.G.B. for powers to borrow £12,806 for the purposes of extensions to the electricity undertaking. During the last two years, it was stated, the expansion of business had been greater than during any similar period in the life of the undertaking. The output rose from 1½ million units in 1911, to 2½ millions in 1912, and 3½ millions in the year just completed, and it was expected that the output would be at least 4 million units in the current year. The extensions consist of new generating plant, additional condensing plant, an additional boiler and the provision of a high-tension distributing station at the bottom of Kirkgate.

**Wallasey.**—The T.C. has adopted the recommendation of the Electrical Committee, referred to in our last issue, which proposes to construct a new three-phase power station at a cost of £65,000, near the Great Float, which offers facilities for obtaining both coal and water. The present generating station will ultimately be used as a transforming station and the Diesel engine set will be retained there for the time being.

**Walsall.**—The B. of T. has revoked the Midland Electric Power Distribution and Lighting (Extension) Order, 1901, for the Parish of Great Barr, in the Rural District of Walsall.

The sanction of the L.G.B. has been received to the borrowing of £3,000 in respect of prospective expenditure on mains.

**Warrington.**—At the T.C. meeting last week, Alderman Smethwick said the financial result of the working of the electricity department during the past year was very satisfactory, a profit of close upon £3,000 having been made. There had been a large increase in the consumption of energy for power and lighting, despite strikes and advanced coal prices.

**Watford.**—At the last meeting of the U.D.C. the Chairman of the Electricity Committee said that during the past year, though the charge for energy had been reduced ¼d. per unit, which represented a loss of £1,000, the profit for the year worked out at £1,110, and after giving £850 in aid of the rates, they had carried forward £261 to the reserve fund, bringing that fund up to £1,533.

**Wigan.**—The T.C. has decided to apply to the L.G.B. for sanction to borrow £6,700 for the purpose of meeting the expenditure estimated to be necessary for the installation of a new turbine and accessories at the electricity works. The Council was informed by the Mayor that, at the present time, the engines were running at their fullest load, and in view of the large consumers that were coming on, the Corporation had to make provision for an increased output.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—The revenue on the Corporation tramway system for the past year amounted to £80,150, an advance over the previous year of £2,970, and an increase in three years of £9,029.

At a meeting of the T.C., a scheme for an important development of the system was adopted, and it was agreed to borrow £50,000 to carry it out. Application will be made to Parliament for power to extend the track to the city boundary at Craiginches; to use railless trolley cars between Castle Street and York Place, and between Schoolhill and Forresterhill Road; and to use motor-omnibuses within and outside the city. It was also agreed that power be sought to apply one-third of the surplus receipts to the Common Good fund or towards the reduction of rates.

At a later meeting of the Tramways Committee, it was agreed to extend the route in the west end a distance of 1,263 yd. at a cost of £12,560. The Committee also recommended that the tramway manager's salary be increased by £50 to £450.

**Belfast.**—The amount at the credit of the tramway net revenue account for the last year was £28,801, and it has been agreed to apportion this as follows:—£13,000 to the depreciation fund, and £15,801 to the general purposes fund for the relief of rates. The city accountant also presented the accounts of the electricity undertaking.

**Birkenhead.**—It has been decided to add to the renewals fund of the tramway department the whole of the profits from the undertaking for the year ended March 31st, 1913.

**Black Country.**—With the object of averting a strike the directors of the various electric traction companies operating in this district—including the South Staffordshire Tramways (Lessee) Co., Ltd.; Dudley, Stourbridge and District Electric Traction Co., Ltd.; Wolverhampton District Electric Tramways, Ltd.; and Birmingham and District Power and Traction Co., Ltd.—have had posted in the depôts of the companies official notices authorising alterations and additions to be made to the terms offered to the men as set out in the notices of May 15th and 21st. The new terms came into operation on Saturday last.

**Burnley.**—The annual report of the Tramways Committee states that the year ended March 31st last has been the most successful on record in every respect. The number of passengers carried was 15,949,359, an increase of 1,481,128 on the previous year. The total revenue was £79,890, an increase of £7,181; working expenses amounted to £49,430, an increase of £3,973. The sum of £5,791 has been placed to the reserve fund, and £8,750 has been allocated to the borough fund out of the profits.

**Croydon.**—The Tramways Committee has under consideration the question of extending the tramways from Norwood to Addiscombe.

**Dewsbury.**—The Electricity and Tramways Committee has decided to sanction the proposals of the Dewsbury, Ossett and Soothill Nether Tramways Co. for the extension of double lines of rails, and application is being made to the L.G.B. for sanction to borrow £1,000 for this purpose.

**Dover.**—Our contemporary, the *Kentish Express*, draws the attention of the T.C. to what, if correctly described, must be a most extraordinary state of affairs in connection with the local tramway track. Thus we gather that on the Folkestone Road "there were no less than four pieces of the line missing, the lengths varying from a yard to a foot." A further reference, this time to Snargate Street, states that "three pieces of rail about a yard long were missing." Is it possible that our contemporary viewed the scene in the pale morning light—when repairs are sometimes carried out?

**Glasgow.**—This week the final adjustment of the balance-sheet in connection with the Glasgow Corporation's tramway department, for the year ending May 31st, was submitted to, and approved by, the Committee. The figures showed that the surplus over the year's working accounts to be handed over to the Common Good—a general fund which holds a lien upon the undertaking—was £33,003, as compared with £52,067 for the preceding year, and £68,678 for the year 1910-11. A number of factors contributed to the decreased surplus. These included the following increases in expenditure:—Wages of motormen and conductors, £6,190; wages of cleaners, £3,145; local rates, £7,615; maintenance of track, £17,207; fuel for Pinkston, £2,826; interest on capital, £6,681; sinking fund, £3,214; and renewal and depreciation, £2,053—a total of £48,931. On the revenue side the ordinary receipts showed an increase of £20,468, and the interest on investments an increase of £8,859—a total increase of £29,327. Deducting this from the excess of expenditure, the balance is a sum of a little over £19,000, which represents a shortage in the surplus as compared with the surplus of the preceding year. As already reported in the REVIEW, the traffic receipts exceeded £1,000,000 sterling; they amounted, in fact, to £1,007,652, a circumstance largely attributable to the working of the extended ¼d. stage. The total working expenses were £619,346; the balance carried to net revenue account was £392,196; this, with interest on investments, made a total of £450,827, from which are deducted rent of lines, capital charges, renewals and depreciation (£215,766) leaving the net surplus mentioned above.

**Hove.**—In connection with the trolley 'bus' question, the General Purposes Committee of the T.C., after considering a detailed report on the inspection of the systems of railless electric traction established in Bradford and Leeds, has decided that as the proposals for the trolley 'bus' system through Brighton and Hove were made in reliance upon licences being granted for the use of double-deck cars; and as the non-granting of such licences might seriously affect the success of the scheme, it is of opinion that before the Hove Corporation expends the large sum required for the installation of the trolley 'bus' system, it should be ascertained whether such licences will be granted, and that, if not, an opportunity should be afforded for reconsideration of the joint system to be adopted on the through routes. Also that it would be more satisfactory to the Hove Council if the original proposal of the Brighton Corporation to test the system in the first place upon a portion of the route only were carried out.

**Kirkcaldy.**—The returns of the year's working of the tramways show a profit of £1,370, as compared with £1,351 for the previous year.

**Leeds.**—Various developments are contemplated by the tramway authorities. The Tramways and Electricity Committee recently recommended an application for powers for tramway and railless traction extensions, but the Parliamentary Committee decided that it was inexpedient to attempt to promote a Bill in Parliament in the next session, and recommended the Tramways Committee to consider only extensions for which powers could be obtained by prov. order. This will limit extensions for the time being to within the city boundary, and will not include those beyond that limit which were thrown out of the Bill now before Parliament by a ratepayers' meeting last January. It is understood that 25 new cars are to be constructed in Leeds, and about a similar number are to be purchased elsewhere. Halfpenny fares are to be instituted on the Headingley, Chapeltown and Roundhay routes—the only routes which have not yet tried this system; the experimental trial of fare collecting on the platform is to be extended throughout the system, a six months' trial on all routes being given before finally adopting this arrangement.

**Liverpool.**—The Tramways and Electricity Committee has been instructed by the City Council to consider the practicability of utilising the tramway system for the conveyance of goods to neighbouring towns. Mr. P. D. Holt, who brought the proposal forward, said he thought that at least the experiment could be made at very little cost. Sir Charles Petrie did not oppose the motion, but pointed out that some few years ago the Corporation sought the co-operation of neighbouring towns in dealing with goods in this way. The unfortunate part of the business was that Bootle would under no circumstances allow them to draw goods traffic through the streets, and without the outlet at the north end they could not go on with the scheme, and the matter had to be dropped from the Parliamentary Bill.

**Sheffield.**—According to the statement of accounts the total expenditure of the tramway undertaking for the year ended March 31st last (including motor-buses) amounted to £207,689, or an average cost per car-mile run of 6'17d., compared with 6'11d. in the previous year. Against this total there was an income from both cars and buses of £362,127, leaving a gross profit for the 12 months of £151,303. After providing for various charges, interests, &c., there remains a balance of £77,296, which represents an increase of £8,561 over the previous year. This balance is to be appropriated as follows:—Street improvements, proportion of service of debt, £7,631; renewals fund (including interest on investment and bank interest), £30,186; special purposes fund, £2,000; accumulated surplus fund, £7,214; transfer to general district rate, £30,231. The amount to be transferred to the tramway renewals fund, &c., is to be increased from £30,000 to £35,000 per annum.

**South Shields.**—At a meeting of the T.C., on the 4th inst., Ald. Wylie moved the adoption of the annual report on the tramways for the past 12 months, and congratulated the Council on the success that had attended the system. The Committee's suggestion was that £500 should be paid to the insurance fund and the balance should go to the depreciation fund, and he said that it was essential that there should be a substantial reserve fund. Ald. Redhead moved an amendment to the effect that £1,600 of the profits should go to the relief of the rates. He pointed out that with the addition of the £4,217 that would be left, the reserve fund would amount to about £20,000, which he suggested was adequate. The amendment was, after long discussion, carried.

**Torquay.**—The T.C. has instructed the borough surveyor to make inquiries of certain towns where cliff lifts are installed, and to communicate with the makers, and report thereon. This has reference to the proposed cliff railway at Babbacombe.

**Warrington.**—The net profit on the working of the tramways, for the year ended March last, is £3,320, of which £1,500 has been handed over towards the relief of the rates.

**Wolverhampton.**—The annual report of the Tramways Committee for the year ended March 31st, on the working of the Corporation Tramways, shows there has been a gross profit for the year on electric traction account of £24,232. To this sum should be added the balance of £306 on motor-car-a-banc account, representing a total of £24,538, which has been disposed of in the following manner:—Interest on capital, £6,964; income-tax, £100; repayment of loans, £5,146. To the renewals account, £3,809; additions and improvements, £1,105. On account of extensions at car dépôt, 1913-14, £3,636; borough rate, 1913-14, £3,777. The sum of £50,220 now stands to the credit of the reserve and renewals fund. The traffic receipts for the year, the Committee states, have been highly satisfactory, and constitute a record in the history of the undertaking. The earnings have averaged over £1,000 per week. The total working costs per car-mile are 6'27d., or an increase of '05d. per car-mile over last year's figure. Taking into consideration the extra cost of material, as well as the concessions made to the employés during the year, this figure is considered quite satisfactory. With reference to the Fallings Park Motor Car-a-banc Account, the Committee considers the result satisfactory. The working costs, including depreciation, amount to 8'107d. per mile, which is a very favourable figure for operating motor bus services.

Martha will communicate with ships south of the Republic. The report of the Minister of Marine states that the naval wireless telegraph stations have worked with unflinching regularity. New Marconi stations have been purchased, and the good results obtained justify the adoption of the Marconi system in the Brazilian Navy.

**Cables and Trawlers.**—An international conference has been sitting in London since Thursday last week, to consider what steps can be taken to protect submarine cables from damage due to trawling.

**China.**—The Republican Government has appointed Mr. Nakayama Ryuji, an engineer attached to the Japanese Department of Communications, as Adviser of Telegraphs and Telephones in the Chinese Department of Communications.

**Formosa.**—It is reported that the Formosan Government is considering the question of laying a submarine cable between the Island of Formosa and Hong-Kong.

**Imperial Wireless System.**—(On Thursday last week, the Select Committee on the Marconi Contract examined Mr. F. S. Salaman, trustee of the estate of Mr. C. E. Fenner, a stockbroker, who appears to have absconded. His evidence showed that the Master of Elibank, who purchased 1,000 American Marconi shares from Sir Rufus Isaacs, also purchased 3,000 American shares through Mr. Fenner—2,500 on April 18th at 3½, and 500 on May 14th, 1912, at 2½. On Monday Mr. Percy Illingworth, Chief Government Whip, stated that he was informed on May 31st that Lord Murray (the Master of Elibank) had purchased these shares on behalf of the Liberal Party, while as Chief Whip he had sole control of the funds, but the shares had not been handed over to him. His name was associated with that of Lord Murray as co-trustee, but he had no knowledge of the purchase until the end of May. The chairman stated that Lord Murray in April, in answer to a telegram, replied that he could not return before July to give evidence before the Committee, owing to his business engagements. On Tuesday, Captain Murray, brother of Lord Murray, informed the Committee that the shares were left in his possession by Lord Murray, who said he had purchased them on behalf of the party, but proposed to keep them until the Marconi business was cleared up, so that nobody should be involved but himself. The Committee afterwards proceeded to consider the interim report.

On Wednesday a telegram from Lord Murray was read, stating that he had had no dealings in Marconi shares other than those mentioned above. He would make a sworn statement, or would return at once if the Committee desired it.

It is understood that the Committee on Wednesday rejected the chairman's draft report, and adopted a report declaring that Ministerial dealings in American shares did not concern the Committee.

**Libel Action.**—The result of the action brought by Mr. Godfrey Isaacs against Mr. C. Chesterton for criminal libel was that the defendant was found guilty and was fined £100 and costs. In passing sentence Mr. Justice Phillimore commented very severely on the cruelty of the charges, which, he said, were largely due to ignorance and prejudice on the part of the defendant.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—VICTORIA.—June 24th. H.D. copper wire, telephone parts and telephones, for the P.M.G. See "Official Notices" May 23rd.

July 1st. Telephone instruments and submarine cable, for the P.M.G. See "Official Notices" May 23rd.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" June 6th.

July 8th.—Rubber-covered wire, batteries, telephone switchboards, measuring instruments and telephone instruments, for the P.M.G. See "Official Notices" May 30th.

July 22nd.—Telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

July 29th.—Detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

August 4th. (a) Twin surface condensers, hotwells, piping and sundries; (b) air and water extraction pumps and motors; (c) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" to-day.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 30th and August 6th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

July 23rd.—Telegraph and telephone instruments, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telephone switchboards and parts, for the P.M.G. See "Official Notices" to-day.

July 30th.—Cable, switchboard, for the P.M.G. See "Official Notices" to-day.

## TELEGRAPH and TELEPHONE NOTES.

**A Bedstead Antenna.**—Mr. A. A. Campbell-Swinton, who recently discovered that various metal fittings in his house gave out telephonic vibrations, has continued his domestic investigations, and writes to *Nature* of June 5th to say that he finds that an iron bedstead with wire mattress on the top (fourth) floor of the house answers quite well as an antenna for the receipt of wireless signals. It is only necessary to connect the receiving apparatus, which includes a Brown relay, between the bedstead and the water-pipe to receive the Admiralty signals loudly, and others from various unidentified stations faintly but quite audibly. He finds, also, that with the bedstead antenna it is possible to get the time signals from the Eiffel Tower. The signals are not very loud, but are sufficiently audible to be recognised and read easily.

For a portable station we suggest that it may yet be possible to use an umbrella, connected to the nails in one's boots, thus approaching a step nearer to the vest-pocket apparatus foreshadowed, we believe, by Prof. Ayrton.

**Australia.**—Recent tests in Melbourne show that out of 338 calls from subscribers' premises, 80 per cent. were answered within 10 seconds; only 17 took over half a minute. Apparently, therefore, a marked improvement in the service has been effected.

Tenders involving an expenditure of £90,172 have been accepted by the Minister of Home Affairs for material to be used in the construction of a telegraph line along the route of the Kalgoolie to Port Augusta Railway. The greater portion of the amount is for the purchase of tubular iron poles and copper wire.

**Brazil.**—Government wireless stations are to be erected at Rio de Janeiro, Bauru and Porto Murinho, by Marconi's Wireless Telegraph Co.

These stations will enable communication to be established with the base of the Matto Grosso Squadron. Another station at Santa

**SOUTH AUSTRALIA.**—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

**NEW SOUTH WALES.**—July 9th. Switchboards, for the P.M.G. See "Official Notices" May 30th.

**Belgium.**—June 18th. The municipal authorities of Liège are inviting tenders for a large quantity of armoured cables required in connection with the electric lighting undertaking in the city. Particulars can be obtained from the Bureau des Adjudications (Annexe de l'Hotel de Ville), Liège.

The Belgian Telegraph authorities in Brussels have just issued a notice to the effect that early in August next they will be inviting tenders for the supply and laying of underground cables between Brussels and Antwerp, and between Ans and Verviers. Those interested in the matter are invited to at once commence their inquiries as to the requirements, particulars of which may be obtained from the 2me. Direction Technique des Telegraphes, Hotel Centrale des Postes et des Telegraphes (1er Etage, Local No. 32), Place de la Monnaie, Brussels.

**Carlisle.**—June 23rd. (a) Extensions to coal storage and conveying plant; (b) extensions to steam and water piping, for the City Electricity Department. F. W. Purse, City Electrical Engineer, Victoria Viaduct.

**Eccles.**—June 16th. Electricity Supply Committee. Coal and coke for 12 months. Borough Electrical Engineer, Cawdor Street, Patricroft.

**Elland.**—July 2nd. Street lighting lanterns, for the U.D.C. See "Official Notices" to-day.

**France.**—The municipal authorities of Foix, in the Pyrenees, are about to invite tenders for the concession for the supply of electric energy for lighting and power purposes in the town.

**PARIS.**—June 16th. The Administration des Chemins de Fer de l'Etat are prepared to receive tenders for two batteries of electric accumulators for the Garenne-Bezons lighting and power sub-station. Particulars from the Bureaux du Service Electrique, 1re Division, 43, Rue de Rome, Paris.

June 20th. Tenders are invited by the State Railway Administration for electric machinery equipment of the Meudon-Val Fleury traction sub-station. Particulars from the Bureaux du Service Electrique, 2me Division, 43, Rue de Rome, Paris.

**VERSAILLES.**—Shortly. The Conseil Général de Seine-et-Oise have decided to call for tenders for a concession for the establishment and working of a line of electric tramways from the station at Enghien to Ermont-Eaubonne, passing through Soisy, Audilly, Margency, Montlignon and Erbaucourt. Particulars from and tenders to M. Monet, ingenieur en chef des Ponts et Chaussées, 2 bis, Rue Colbert, Versailles.

**Germany.**—**BREMEN.**—The plans drawn up for increasing the accommodation at the port of Bremen contemplate the outlay of £260,000, part of which is allotted for electric grain loading and unloading appliances, electric cranes, and the erection of a power house. Particulars from the Deputation für Häfen und Eisenbahnen, Bremen.

**Leyton.**—June 24th. Electric lighting and hot-water heating for the new Church Road Schools, for the U.D.C. See "Official Notices" to-day.

**Limerick.**—July 3rd. Switchboard and gallery, battery, motor-driven booster, balancer, &c., for the County Borough Council. See "Official Notices" to-day.

**London.**—**L.C.C.**—June 24th. One 50-ton overhead travelling crane for Greenwich generating station. See "Official Notices" June 6th.

June 25th.—Electrical installation at Randall Place Elementary School, Greenwich, S.E. See "Official Notices" June 6th.

July 2nd.—Electrical installation at the Caldecot Road Elementary School, Denmark Hill, Camberwell (192 lighting points). See "Official Notices" to-day.

The Fire Brigade Committee is inviting tenders from selected firms for a motor-generator and switchboard for electric charging apparatus for use at the new Hammersmith fire station.

**HAMMERSMITH.**—June 18th. Air-cooled static transformers, for the Borough Council. See "Official Notices" June 6th.

**STEPNEY.**—The Electricity Committee invites tenders for two E.H.T. converting plants suitable for 6,000-volt three-phase A.C. to L.T., D.C., for Limehouse and Whitechapel stations. See "Official Notices" to-day.

June 30th. Arc lamp carbons, for a year, for the Borough Council. See "Official Notices" to-day.

**Newcastle-under-Lyme.**—June 21st. Supply and laying of cables, for the Corporation. See "Official Notices" June 6th.

**Newport (Mon.).**—July 1st. Refuse destructor for the T.C. Borough Engineer Town Hall.

**Rochdale.**—Cable. Mr. C. C. Atchison, Electricity Works, Dane Street.

**Rotherham.**—Annual supply of coal to the Electricity Department; also stores for the Tramway Department.

**Salford.**—June 23rd. 4,000 steel tie-bars, for the Tramways Committee. General Manager, 32, Blackfriars Street.

**Servia.**—**BELGRADE.**—Tenders are required for the supply of telephone apparatus and instruments—226 wall telephones à batterie commune, 200 portable and 200 table telephones.

**South Africa.**—**CAPE TOWN.**—July 4th. High-tension switchgear, feeder pillars and three-phase transformers, for the Corporation. Particulars from the City Electrical Engineer on payment of deposit of £1 ls. per section (three sections).

**Southampton.**—June 19th. Electric lighting of the old pavilions at the Infirmary, Shirley Warren. See "Official Notices" May 30th.

**Spain.**—The municipal authorities of Aldeamayor (province of Valladolid) have just invited tenders for the concession for the electric lighting of the town during a period of four years.

**MADRID.**—July 7th. The Minister of the Marine has been authorised to acquire, by way of public tender, from foreign manufacturers, two wireless stations of great range for installation on board the cruisers *Extramadura* and *Rio de la Plata*; also of two others for erection in the naval school.

**Sweden.**—June 16th. Tenders are invited by the Swedish State Railways Administration for the supply of (1) 206,700 arc lamp carbons, and (2) 44,100 electric incandescent lamps. Tenders, marked "Anbud a haglampskol" in the case of (1) and "Anbud a glödlampor" in the case of (2), to "Kungliga Järnvägsstyrelsens Förordsbjura," Stockholm, whence copies of the specifications and forms of tender may be obtained. Copies of the specifications and forms of tender (in Swedish) may be seen by manufacturers in the United Kingdom at the Commercial Intelligence Branch of the B. of T.

**Swindon.**—June 23rd. Cooling tower, water softening plant and flanged cast-iron piping, for the Electricity Department. See "Official Notices" June 6th.

**Torquay.**—The Electrical Engineer has been instructed to prepare a specification for illuminating the Pavilion and Gardens, and to invite local tenders for carrying out the work.

**West Hartlepool.**—June 14th. Two 300-kw. rotary converters, complete with transformers, switchgear, &c., for the Corporation. See "Official Notices" May 30th.

## CLOSED.

**Aysgarth.**—The B. of G. has accepted the tender of Messrs. Burton, of Askrigg, for installing the electric light at the Workhouse.

**Belgium.**—Eight concerns—two Belgian and six German—submitted tenders last week to the municipal authorities of Schaarbeek for the establishment of a low-tension network in connection with the municipal electricity supply undertaking. The lowest offer was that of the Société des Ateliers de Constructions Electriques, of Charleroi.

**Bolton.**—The Electricity Committee has accepted the tender of the Electrical Apparatus Co., Ltd., for the supply of 3 and 5-amp. direct-current meters.

**Bradford.**—Messrs. Roberts & Co., Ltd., whose tender had been recommended for acceptance for steelwork for workshop extensions at Thornbury tramway depot, withdrew their tender, owing to an alleged clerical error therein, and the Tramways Committee has decided to accept in lieu thereof, the tender of Messrs. Henry Barrett & Sons for the execution of the work, at £1,230.

The tender of Messrs. Beecroft & Wightman, Ltd., has been accepted, at £265, for a supply of hardwood paving blocks to the Tramways Department; also that of Messrs. John Brown and Co., Ltd., at £350, for 200 steel tramcar tires; that of Messrs. Collier Bros., at £408, for 4 miles of 0000 grooved copper trolley wire.

The following tenders for electric lighting at schools have been accepted by the Education Authority:—

Belle Vue Boys' Secondary School.—R. Crust, £222.  
Deaf and Cripple School.—R. Crust, £205.

The Corporation Libraries and Arts Committee has accepted the tender of Messrs. A. Ridgway & Co. for the installation of electric light at Manchester Road Branch Library, for £57, and at Gillington Branch Library, for £65.

**Burton-upon-Trent.**—The Gas and Electricity Committee has accepted the tender of Messrs. Salsbery & Wood for applying 1,000 tons of fine slack to the electricity works.

(Continued on page 989)

## NEW DIESEL PLANT AT KINGSTON-ON-THAMES.

ALTHOUGH the official programme of the Municipal Electrical Convention makes no mention of the new Diesel generating plant which is just being completed at the Kingston-on-Thames Electricity Works, yet we do not doubt that amongst the numerous visitors to the riverside borough on Thursday next, many will take the opportunity of inspecting this plant, which is practically the first of its kind to be installed in this country, being of the horizontal type.

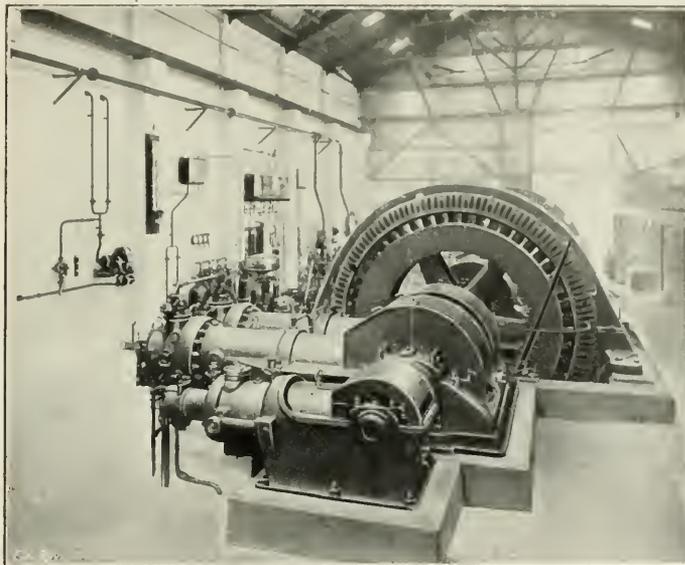
Two Diesel-engine units have been installed, one being of the four-cycle and the other of the two-cycle type; each is coupled to a 270-kw. Siemens alternator of the fly-wheel type, the contract for the complete plant having been entrusted to the Maschinenfabrik Augsburg-Nürnberg A.G., whose reputation for Diesel engines is of the highest.

house. Mr. J. E. Edgemo, the borough electrical engineer, therefore decided to have one four-cycle set with the lowest

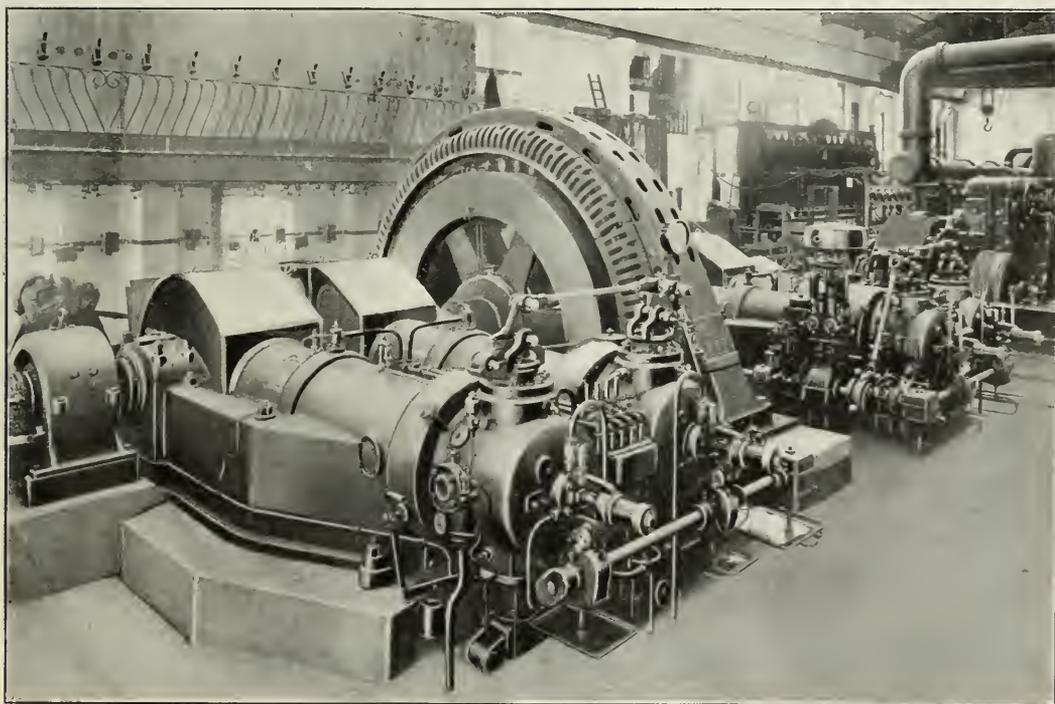
possible fuel consumption to take the whole load of the station for an average of 16 hours a day, and to shut down the boilers entirely during such hours.

Further, in order to obviate the risk of stoppage, it was decided to be less costly to install another Diesel set rather than to keep the necessary boilers banked during the day. This second set, in addition to its stand-by duties, will assist the steam plant on peak loads, and the less costly, though slightly less efficient, two-cycle engine was selected as the best for the purpose.

The views on this page are of the four-cylinder four-cycle engine, rated at 400 B.H.P., with a speed of 192 R.P.M. The alternator, to generate 2,100 volts, 77 cycles, single-phase current, is placed between the pairs of cylinders;



HORIZONTAL 4-CYCLE, 4-CYLINDER DIESEL ENGINE, KINGSTON-ON-THAMES; COMPRESSOR END.



HORIZONTAL 4-CYCLE, 4-CYLINDER DIESEL ENGINE, SHOWING CYLINDER HEADS, VALVE GEAR, &c., KINGSTON-ON-THAMES ELECTRICITY WORKS.

When the engines were ordered it was the intention to decrease both fuel costs and wages and repairs in the boiler

a 110-volt exciter is mounted on one extremity of the crankshaft and a direct-driven air compressor on the other.

The engine is all enclosed, and one governor controls the oil pumps for all the cylinders; the fuel injection valves are situated behind the cylinder heads, the air inlet valves on the top, and the exhaust valves underneath.

The air for combustion purposes is drawn through pipes from the crank chambers, entering the covers through small inspection doors. This arrangement not only provides for cooling the crank chambers themselves, but it also sucks into the cylinders oily fumes which would otherwise escape into the engine-room, and, moreover, is very silent in operation.

The valves and oil pumps are worked by small eccentrics on a lay shaft worm geared to the crankshaft.

The two-cycle two-cylinder engine, also rated normally at 400 B.H.P., has a speed of 165 R.P.M.; both alternator and exciter are mounted on one side, while at the other end of the crankshaft are a direct-driven compressor and scavenging pump facing each other on opposite sides of the shaft. In this engine the pistons are

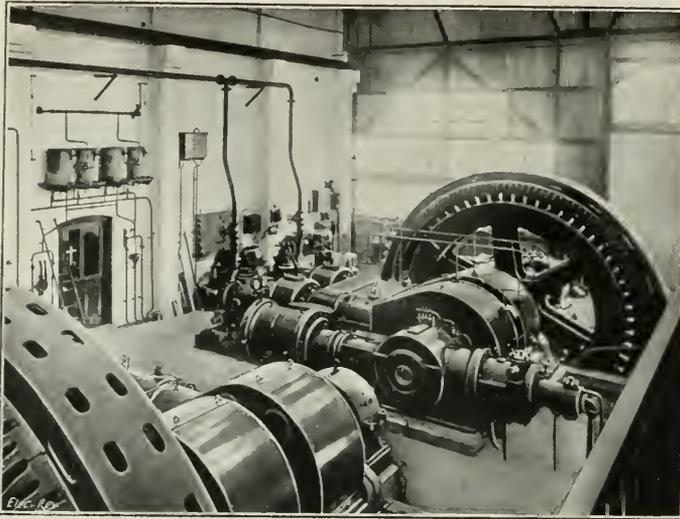
cooler, the cylinder jackets of the air compressors, the working cylinder jackets and cylinder heads in both engines, back to the river. For the piston cooling of the two-cycle set, however, small electrically-driven plunger pumps are

installed to force the water through the pistons. Duplicate pumps are installed in each case, but only one is normally in use. Both the compressors are provided with inter-coolers between H. and L.P. stages; two starting and two injection bottles are provided which are cross-connected to both engines.

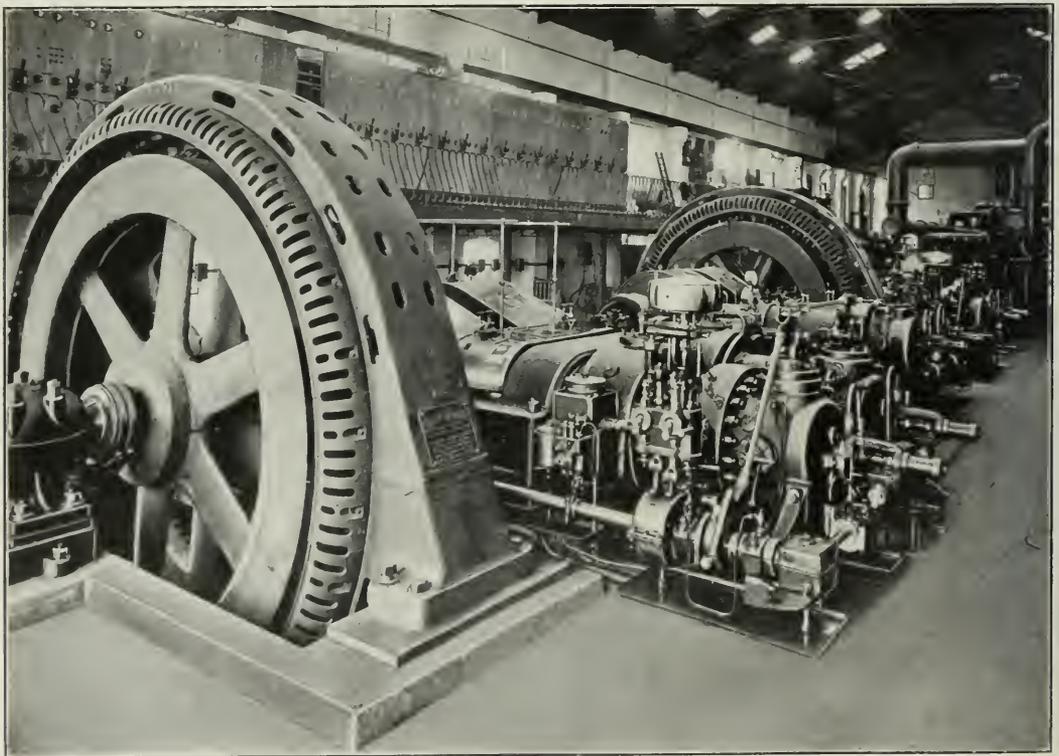
A central lubricating and oil-filtering plant is provided, and both gravity and forced lubrication are adopted in the engines.

Two 60-ton fuel storage tanks have been installed in the boiler house,

and these will be filled from tank barges in the Thames, 200 yards distant, by electrically-driven pumps, and will contain sufficient fuel to provide for average day and night load running of the 4-cycle engine for 20 weeks. From these tanks a small electrically-driven pump (with a stand-by



HORIZONTAL 2-CYCLE, 2-CYLINDER DIESEL ENGINE SET. KINGSTON-ON-THAMES ELECTRICITY WORKS.



GENERAL VIEW SHOWING THE NEW DIESEL PLANT AT KINGSTON-ON-THAMES.

water cooled. The cooling water system is of interest; river water is pumped, by means of small motor-driven centrifugal pumps, into an overhead 5,000-gallon tank, and from this flows by gravity through the compressed air inter-

hand pump) lifts the fuel oil into a service tank, which is subdivided to serve for both tar oil and crude oil residues, which latter is the so-called ignition oil when working with tar oil. From the service tank the fuel gravitates through filters to

the main fuel pumps, and smaller "ignition" oil pumps, which are provided to each cylinder, the former being governor controlled. The guaranteed fuel consumption of the 4-cycle engine on normal load is 41 lb. per B.H.P.-hour, and of the 2-cycle engine about 10 per cent. more.

In view of the high price of ordinary oil fuel, Mr. Edgcome proposes to use water-gas tar as a fuel, its cost being considerably less, and the engines being adapted for using either water-gas tar or coal tar oil in place of the normal oil fuel.

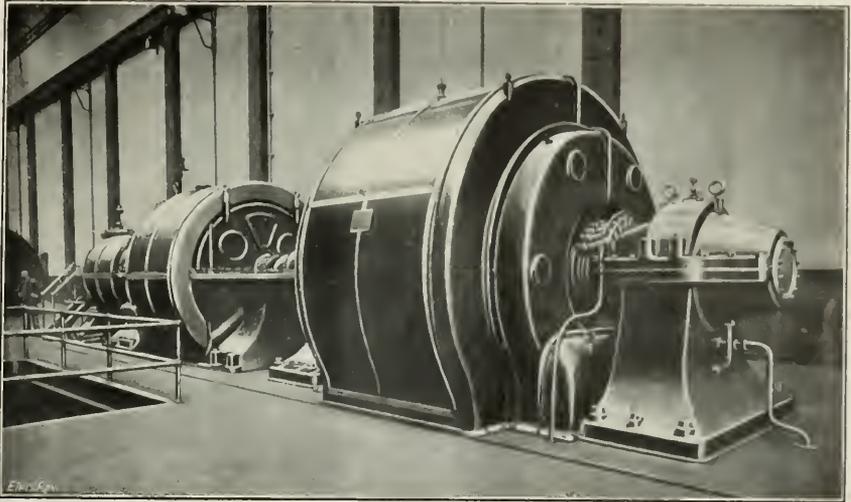
The two-cycle engine has a considerable overload capacity, equivalent to 25 per cent. for two hours.

As the horizontal Diesel engine will, no doubt, be viewed with critical eyes in this country, it may be worth while to point out its good features. These are mainly concerned with accessibility. It is possible to withdraw the piston from the crank end and without interfering with the cylinder head, which, necessary in the case of the vertical engine, means disturbing all the pipe connections. The whole of the valves are within easy reach, and more likely to receive regular supervision, and dismantling is a somewhat easier operation.

The cylinder heads are fitted underneath with blow-off valves which are opened every time the engine stops, allow-

### THE CHELSEA RAILWAY POWER STATION.

THE Chelsea power station of the London Underground Railways system, at Lot's Road, which will be visited by the Municipal Electrical Association during the forthcoming Con-



5,500-6,000-KW. PARSONS-WESTINGHOUSE TURBINE SET AT THE CHELSEA POWER STATION OF THE LONDON UNDERGROUND RAILWAYS.

vention, has long been a feature of electrical London, its size, constructional features, and the services which it is called on to render being matters of considerable interest to the engineering fraternity. The plant, which was very fully described and illustrated in our columns when first opened,<sup>\*</sup> supplies three-phase current at 11,000 volts, 33 $\frac{1}{3}$  cycles, for

transmission to rotary sub-stations on the routes of the Metropolitan District, with its connecting lines to Barking and *via* the recently-electrified East London Railway to New Cross, the Piccadilly, Bakerloo, and Charing Cross-Hampstead tubes, and the Kingston-Wimbledon sections of the London United Tramways. The accompanying views give a good idea of the modern Parsons-Westinghouse turbo-alternator plant installed in this station, the eight sets each having a normal rating of 5,500-6,000 kw.

These turbines exhaust into vertical condensers situated in a deep central pit running the length of the engine room between the lines of

turbines; the circulating water is drawn in through strainers and 66-in. pipes from the river Thames.

Each turbine consists of separate high and low-pressure sections, coupled through a steam chest below floor level. Solid forged steel H.P. rotors and built-up L.P. rotors are



GENERAL VIEW OF THE ENGINE ROOM, CHELSEA RAILWAY POWER STATION.

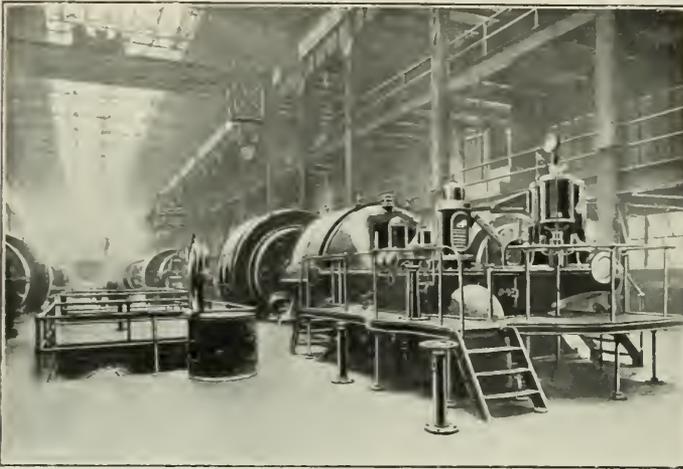
ing the deposit and grit to be blown into the exhaust piping, and incidentally enabling the pistons to be kept at work a much longer period than when this cannot be done. The makers claim a good many other advantages in addition to the above.

In conclusion, we are indebted to Mr. Edgcome for facilitating the preparation of this short description.

\* See ELECTRICAL REVIEW, June 9th and 16th, 1905.

fitted, while each section has its own thrust-block adjustment allowing of finer clearances being used in the H.P. sections.

Steam at 185 lb. pressure, superheated 150°, is admitted through a Ferranti-Hopkinson valve at the high-pressure



THE CHELSEA (LOT'S ROAD) RAILWAY POWER STATION.

end, into a steam chest which carries an emergency stop valve—automatically controlled by an auxiliary governor—the main governor-controlled stop valve and an automatic by-pass valve, spring controlled, which admits live steam to a second group of blades on the H.P. rotor, and thus enables the turbine to quickly follow sudden changes of load, such as may occur in a plant of this kind.

The turbines were, of course, built to suit existing foundations and to drive existing alternators (speed 1,000 R.P.M., efficiency 95 per cent.) and the steam consumption is 14 lb. per kw.-hour, with a 28-in. vacuum. The normal rating, as already mentioned, of the machines is 5,500-6,000 kw., but we gather that they periodically work up to 9,000 kw. or more.

According to report, it is intended to install a 15,000-kw. turbine unit at no distant date.

This turbine plant is supplied with steam by 64 Babcock boilers, arranged on two floors and equipped with economisers, chain-grate stokers, superheaters, &c. A very complete coaling plant is installed for filling the bunkers, of 15,000-tons capacity, from a barge basin on the river side, the coal being mostly water borne.

The chimneys, four in number, 19 ft. diameter internally and 275 ft. high, are familiar landmarks for miles round—indeed, their symmetrical arrangement on the boiler house, two and two, together with the projecting conveyor trunk at

the end of the building, has led some people not unmindful of the American features of the plant, to liken the station to a gigantic teddy bear upside down.

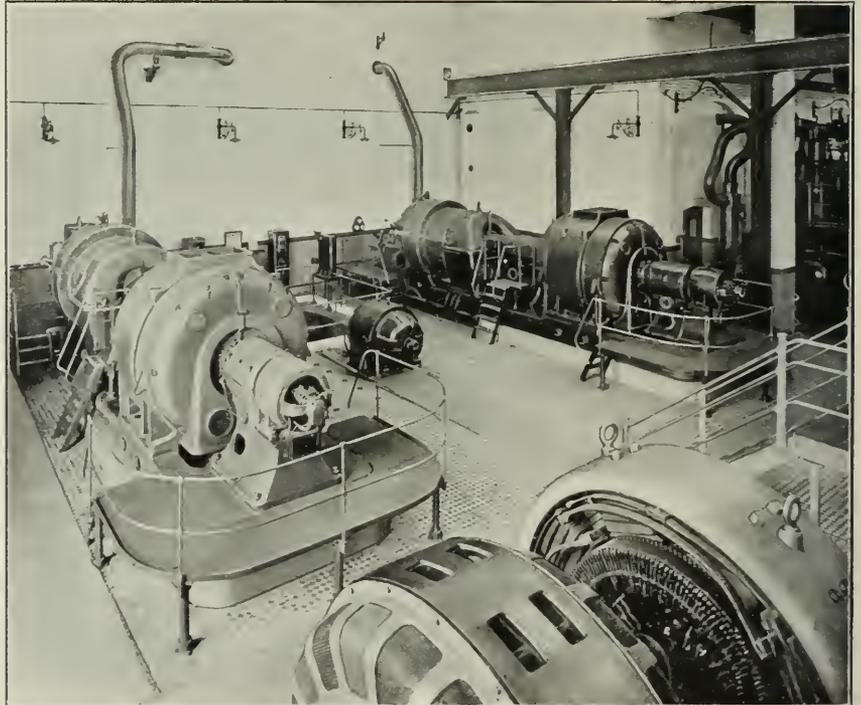
The H.T. switchgear, as shown in our view, is arranged on three galleries running along one side of the spacious engine house, while the auxiliary switchgear is installed on galleries at one end of the building. This was all supplied by the B.T.H. Co.

A feature of the station is the oil-cooling plant for a total capacity of 20,000 gallons: the station output amounts to about 150 million units per annum.

### NEW TURBINE PLANT AT POPLAR.

On Friday last we were privileged spectators at the official inauguration of the extensions recently carried out at the Poplar Borough Council's generating station at Bow. Prior to the actual starting up of the machinery, the assembled guests were welcomed outside by Councillor H. R. Barge, chairman of the Electricity Committee; Mr. Horace Bowden, the borough electrical engineer, briefly described the features of the new plant, while the Mayor (Councillor Aldrick), Ald. Bussey, and several others also spoke.

Though the showery weather somewhat damped the municipal eloquence which one naturally associates with an occasion of this sort, the new turbine sets subsequently got



3,000-KW. WILLANS G.E.C. TURBINE SETS INSTALLED AT THE POPLAR ELECTRICITY WORKS EXTENSION.

to work in a most businesslike manner, and the visitors were then free to explore the works.

The Borough Council's electricity undertaking was originally started in 1899, Mr. A. S. Blackman being responsible for the scheme, which was for direct-current supply; its limitations led in 1904-5 to the introduction of three-

phase alternating-current supply of 6,000 volts pressure, in connection with sub-stations which were established in the Isle of Dogs and near Victoria Park, and which contain motor-converting plant for the supply of direct-current at 460 volts. The last extensions which have now been brought into use add some 6,000 kw. of three-phase plant to the Council's resources, and in view of the fact that the output last year rose to 12,000,000 units, from 9,500,000 units in the previous year, it will be seen that this plant is a very necessary addition. Briefly, large additions have been made to the boiler and engine houses, the area occupied being some 8,000 sq. ft. The new boiler house is designed to accommodate four large boilers, of which two have been installed, together with a 400-ton coal bunker, ash hoppers, conveying plant, feed pumps, &c.

The boilers are of the Babcock marine type, each normally rated at 36,000 lb. per hour evaporative capacity, with a maximum of 41,500 lb.; each has a heating surface of 6,295 sq. ft., and an integral superheater of 1,108 sq. ft. One is fitted with two underfeed stokers giving 154 sq. ft. grate area, an air heater in the uptake to the steel chimney and a fan for driving the air through the furnaces; the other boiler has two modern Babcock chain grates, giving 224 sq. ft. grate area, and a Babcock feed-water heater below the chimney, which is equipped with the Prat induced draught. Both chimneys stand 91 ft. high above firing level. The boilers are designed for 200 lb. working pressure, but actually supply steam at 185 lb., and the two typical equipments provided, have, we understand, given some interesting comparative data, which as regards steaming power was apparently much in favour of the boiler equipped with the Prat draught system and chain grate stoker.

The coal conveyor has a capacity of 40 tons an hour, and together with an ash hoist, was supplied by the New Conveyor Co. Messrs. Weir supplied a "Rotofeed" turbine-driven single-stage feed pump, for delivering 10,000 gallons per hour, in which the steam consumption at full load is 60 lb. per w.h.p. per hour; a Boby Simplex continuous automatic water softener has been provided, which stands over a 14,000-gallon storage tank. The reagents used with this softener are distributed to the water in powder form.

The engine room plant, which we illustrate, consists primarily of two 3,000-kw. Willans-G.E.C. turbo-alternators, and a 1,000-kw. Peebles motor-converter, and a 1,000-kw. Westinghouse rotary together with switchgear by the Westinghouse Co., have also been installed.

The turbines are of the disk and drum type, with an overload capacity of 50 per cent. for half an hour and 25 per cent. for three hours; the guaranteed steam consumption is as follows:—

Load ...	5/4	4/4	3/4	2/4	1/4
Lb. steam ...	13'8	13'7	14'4	15'7	19'7 net

Steam pressure 180 lb., superheat 150°, and vacuum 28½ in.; with the higher steam pressure possible, correspondingly lower consumption figures would be obtained. The alternators are excellently finished machines, turned out at the Witton Works of the General Electric Co., and have the following guaranteed efficiencies:—

Load ...	5/4	4/4	3/4	2/4	1/4
Efficiency ...	94 %	93 %	92 %	89½ %	83 %

Each machine weighs, complete, 38 tons, and has an exciter mounted on an extension of the main shaft.

The Willans condensing plant is of normal type, arranged under the turbines, with triple crank single acting air pumps, direct-driven at 125 r.p.m. by 30-B.H.P. B.T.H. motors; the air pump discharges are measured by Lea recorders.

The circulating water for this plant is obtained from an adjacent canal, where a pumping plant has been installed 210 ft. distant from the engine room. The plant consists of three Rees Roturbo vertical spindle circulating pumps, each to deliver 4,800 gallons of water per min., when running at 625 r.p.m., and coupled to Peebles 100-B.H.P. motors. At full load the pump efficiency, w.h.p./B.H.P., is 0 per cent.

The pumps draw from a settling chamber where the water passes through C.I. screens; it is interesting to record that during the reconnection of the circulating water piping, which took 36 hours, the load of the station was taken up by the adjoining Stepney undertaking, in order to avoid

running non-condensing, thus proving the emergency value of the electrical linking up of the two concerns, which was originally engineered in 1908.

To return to the engine-room plant, both the Peebles motor-converter and Westinghouse rotary converter are rated at 1,000 kw., and installed for converting 6,000-6,500-volt alternating current to 470-540-volt direct current.

The former has guaranteed efficiencies of 92½ per cent., 91½ per cent. and 90 per cent. at full, three-quarter and half load respectively, these figures comparing with 91½ per cent., 93½ per cent. and 91½ per cent. overall efficiencies (including transformer) guaranteed for similar loadings in the case of rotary plant.

The Westinghouse rotary is a 12-pole compound-wound machine running at 500 r.p.m. (as against 375 r.p.m. in the case of the motor-converter), and is supplied with six-phase 350-volt current from an oil-insulated self-cooled transformer situated in the basement below the switchboard.

The business end of the new switchgear is placed in a disused battery room behind the switch gallery. The switches have a normal breaking capacity of 9,000 kw., and an emergency capacity of 18,000 kw.; the Stepney link, of 1,500-kw. capacity, is protected by Merz-Price relays and transformers, and the new engine room is spanned by a Royce 30-ton electric travelling crane. The extensions have been carried out by Mr. Horace Bowden, the borough electrical engineer, to whom we offer our congratulations.

## CONTRACTS CLOSED.

(Concluded from page 984.)

**Canterbury.**—The T.C. has accepted the tender of Mr. R. E. Connold, Canterbury, for electrical work for the ensuing half-year.

**Cheltenham.**—The T.C. has accepted the following tenders:—

Ferranti, Ltd., and British Westinghouse Co., Ltd.—Electricity meters.  
Geipel & Co.—Arc lamp carbons.  
Webster & Co.—Flame carbons.

E. Le Bas & Co.—Cast-iron pipes for new condensing plant, £65.

**Cleckheaton (Yorks).**—The tender of Messrs. F. W. Birkett & Sons, Ltd., has been accepted for the electric light installation at Whitcliffe Road Wesleyan Church.

**Croydon.**—The T.C. has accepted the tender of Messrs. Newbold & Co., of Sutton, for electric lighting installation at the fire station, at £216 10s., and at the Library, at £129 10s.

**Devonport.**—The Electric Power Committee of the T.C. has accepted the tender of Messrs. A. J. Smith & Co., of Bristol, for 6,000 tons of coal, at £1 0s. 2d. per ton.

**Doncaster.**—The Corporation Electricity Committee has considered tenders for generating plant for the electricity works, and recommended that the tender of Messrs. Siemens for the alternator be accepted, and that the order for the turbine and condenser be placed with Messrs. Willans & Robinson, Ltd., or Messrs. J. Howden & Co. These recommendations have been adopted by the Council, who agreed to leave the decision in the latter matter to the chairman and vice-chairman on the receipt of further particulars from the engineer.

The T.C. has accepted the tender of the Lancashire Dynamo Co., Ltd., for a dynamo, at £168.

**Dover.**—The T.C. has accepted the tender of the Featherstone Colliery Co. for coal for the electricity works, at 17s. per ton.

**Dundee.**—The offer of Messrs. Babcock & Wilcox, Ltd., at £2,510, for steam, feed and drain piping, &c., have been accepted by the Electricity Committee.

**France.**—The French Post and Telegraph authorities in Paris last week placed contracts as follows:—

La Société des Ateliers de Constructions du Nord et de l'Est, of Jeumont (Nord).—100 km. of single-conductor lead-covered telephone conductor; 80 km. ditto, with two conductors; 25 km. ditto, with seven pairs of conductors; 125 km., with two conductors.  
La Société des Tréfileries du Havre.—50 km. ditto, with single conductor; 40 km. ditto, with two conductors; 25 km. ditto, with seven pairs of conductors; and 125 km. ditto, with two conductors.

**Glasgow.**—The following contracts have been accepted by the T.C. Tramways Committee:—

Steel rails and fishplates.—Bolekov, Vaughan & Co., Ltd.  
Lighting fittings.—Drake & Gorbam, Ltd.

In connection with additional plant for Pinkston power station, offers have been opened for a 5,000-kw. turbo-alternator, and the estimate of the British Thomson-Houston Co. has been accepted.

**Haslingden.**—Mr. A. M. Cramp, of Haslingden, has secured the contract for the electric lighting and electric organ-blowing plant at the Trinity Baptist Chapel and Schools, Blackburn Road; also the order for an electric light and power and vacuum cleaning plant at Carr Hall, the residence of Mr. J. Lambert, and at "Knowl Gap," the residence of Councillor A. Bailey.

**Liverpool.**—A further order for 4,000 Robertson lamps has been secured from the Corporation by the General Electric Co., Ltd. We understand that these lamps have been specially ordered for the purpose of illuminating a certain part of the city in honour of the forthcoming visit of the King.

**London.**—L.C.C.—The Fire Brigade Committee received the following tenders for an electric lighting installation for the new fire station at Hammersmith:—

A. Hawkins & Sons .. .. .	(recommended) £205
Pinching & Walton .. .. .	218
W. C. Tackley & Co., Ltd. .. .	228
Electrical Contracts and Maintenance Co., Ltd. .. .	282
Engineer's estimate, £200	

The "Cedes" Electric Traction, Ltd., which recently received a contract for the supply of a petrol-electric motor chassis for converting a turntable ladder for motor traction, has been in communication with the Committee, as the result of which the Committee has rescinded its resolutions on the matter. It expresses the opinion now that an electrically-driven chassis would probably be more suitable than a petrol-electric one for the purpose.

In connection with the alterations required to the parapet lanterns on Westminster Bridge in connection with the conversion of the existing arc lighting to metallic-filament lighting, the following tenders were received:—

S. Pontifex & Co. .. .. .	(accepted) £72
John Biggs .. .. .	150
W. Sugg & Co., Ltd. .. .. .	216

**HACKNEY.**—The Electricity Committee recommends that the tender of Messrs. W. Cory & Sons, Ltd., for Cowdenbeath, Edinburgh and Hillhouse coals for nine months to March next, be accepted.

**POPLAR.**—The Electricity Committee recently reported that, in order to cope with the estimated demand, it was necessary that the order should now be placed for the remaining two boilers to equip the station. The firm price of £9,975 for the supply and erection of two boilers exactly similar to No. 10 boiler, already installed, had been obtained from Messrs. Babcock & Wilcox. Boiler shops were extremely busy, and any delay by advertising for and considering tenders would render it impossible to complete the installation next winter, whereas Messrs. Babcock & Wilcox promised completion in January next. In addition to the boilers, it would be necessary to obtain prices for the steam, feed and blow-down piping, and also for one additional ash hoist. The Committee recommended the acceptance of the offer of Messrs. Babcock & Wilcox, and this the Council agreed to.

The E.C. has received the following tenders for the supply of a 1,000-kw. converter at the Millwall sub-station:—

Siemens Bros. Dynamo Works Co., Ltd. .. .. .	£2,185
General Electric Co., Ltd. .. .. .	2,196
Bruce Peebles & Co., Ltd. .. .. .	(recommended) 2,285
Vickers, Ltd. .. .. .	2,473
British Westinghouse Co. .. .. .	2,507
British Thomson-Houston Co. .. .. .	2,516
Dick, Kerr & Co., Ltd. .. .. .	2,618

The Electricity Committee states that, in view of the small difference in price (£100) between the tender of Messrs. Bruce Peebles and Co., whose converters are already in successful operation in the Council's stations, and the lowest tender, it would be advantageous to the Council that such tender for a motor converter, identical with that supplied last year, should be accepted, and it has been decided accordingly.

**Manchester.**—The following tenders have been recommended for acceptance by the Corporation Electricity Committee:—

E. Green & Son, Ltd.—Replacement of No. 3 economiser.
S. P. Bidder & Co.—Repairs to chimney and exhaust pipe.
General Electric Co., Ltd.—Two 50-h.p. three-phase motors.
Aiton & Co.—P. steam and water pipes.
Siemens Bros. Dynamo Works Co., Ltd.—Switchgear, bus-bars, &c.
Holden & Brook, Ltd.—One electrically-driven boiler feed pump.
Sturtevant Engineering Co., Ltd.—Air filtration plant.
De Bergue & Co., Ltd.—Steelwork for foundations of 15,000-kw. turbo-generator.
Bruce Peebles & Co., Ltd.—Two 750-kw. motor converters.
British Electric Transformer Co., Ltd.—Requirements of 76-k.v.a. transformers.
W. T. Henley's Telegraph Works Co., Ltd.—L.T. cable and paper-insulated cable.
Electrical Engineering and Equipment Co., Ltd.—L.T. cable.
Charles Macintosh & Co., Ltd.—Rubber-insulated cable.

The Corporation Tramways Committee has recommended the following tenders for acceptance:—

Drake & Gorham, Ltd.—Traction type incandescent lamps.
Ester Bros.—Canopy trolley standards.
Bolckow, Vaughan & Co., Ltd.—Steel fishplates.
Bayliss, Jones & Bayliss, Ltd.—Steel tie bars.

**Rochdale.**—The Corporation is recommended to accept the tenders of the Vulcan Pump and Engine Co. and Messrs. Marshall, Osborn & Co. for the supply of boiler feed pumps for the electricity works.

**Salford.**—The tender of Mr. Bertram Thomas for copper strip required for the main lighting and power switchboard at the electricity station, at £302, has been recommended for acceptance by the Electricity Committee.

**Stoke-on-Trent.**—The T.C. has accepted the tender of Callender's Cable & Construction Co., Ltd., for feeder cables, at £500,

**Sheffield.**—The tenders of the Tinsley Park Colliery Co., Ltd., and Messrs. M. L. Burnby & Son have been accepted for an annual supply of washed coal to the Kelham Island power station, at 13s. 6d. per ton, and 13s. 2½d. and 13s. 5d. per ton respectively. For the erection of a building to house the new rotary converting plant at the Kelham Island power station, the tender of Messrs. W. & A. Forsdike, Ltd., has been accepted, at £3,210.

**Sunderland.**—The T.C. on Wednesday accepted the following tenders:—

Sturtevant Engineering Co.—Air filter for new alternator.
A.E.G. Co., Berlin.—Short-circuiting device for new alternator, also spare parts for alternator.
Dick, Kerr & Co., Ltd.—Spare parts for alternator.
Phoenix Dynamo Co.—Re-insulating one 750-kw. alternator.
J. Thompson & Co.—1,500 yd. wood troughing.
B.I. and Helsby Cables, Ltd.—4,000 yd. L.T. cable; 500 yd. E.H.T. cable.
Credwinson & Hardy.—1,250 yd. w.I. piping and bends.

**Tonbridge.**—The U.D.C. has accepted the tender of:—

Mirrlees, Bickerton & Day, for additional plant for the electricity works, £1,884.
Western Electric Co.—Cables.

**Walsall.**—The Corporation has accepted the tender of the British Westinghouse Co., Ltd., for a 100-kw. rotary converter at the Sandwell Street sub-station, including station transformer and other accessories, for £636, and for the erection of a high-tension feeder at the generating station, at £70 10s.

The tender of the Electrical Power Storage Co., Ltd., has been accepted by the T.C., at £26, for renewing the storage batteries at three stations. The price quoted is subject to an allowance of £12 10s. per ton for all old plates removed.

**Wimbledon.**—The tender of Messrs. E. Foster & Co. has been accepted by the T.C. for an annual supply of about 4,000 tons of Kingsbury Rider small nuts coal to the electricity works, at 17s. 10d. per ton.

**Wolverhampton.**—The Corporation has accepted the following tenders:—

Amies & Sharratt.—Additions to the electricity stores, £728.
Davies Bros. & Co., Ltd.—Materials required in the construction of safety guides for the bucket conveyor, £85.
Vaughan & Sons.—One 5-ton and one 3-ton overhead travelling cranes, £105.
Electric Construction Co., Ltd.—Direct-current switchgear for the converter plant, £172.

## FORTHCOMING EVENTS.

**Tramways and Light Railways Association.**—Friday, June 13th. At Black-pool. Annual Conference concludes.

**Physical Society.**—Friday, June 13th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Experiments on Tinfoil Contact with Dielectrics," by Mr. G. E. Baird. Paper on "A Method of Measuring the Pressure of Light by Means of Metal Foil," by Mr. G. D. West.

**North of England Institute of Mining and Mechanical Engineers.**—Saturday, June 14th. At 2 p.m. At the Wood Memorial Hall, Newcastle-upon-Tyne. General meeting.

**Municipal Electrical Association.**—Eighteenth Annual Convention. Tuesday, June 17th.—At 10 a.m. At the I.E.E., London. Opening by Mr. W. Duddell, F.R.S. Address of Mr. C. E. C. Shawfield. Paper on "Prime Movers for Electric Power," by Dr. S. Z. de Ferranti. At 2.30 p.m.—Leave for visits to Deptford power station and West Ham electricity works.

Wednesday, June 18th.—At 10 a.m. Discussion *in camera* (members and delegates only). Subjects:—(1) The I.M.E.A. Bill; (2) Heating and Cooking. At 2.30 p.m.—Leave for visit to Lot's Road power station, Chelsea. At 7 p.m.—Annual dinner at the Hotel Cecil (members, visitors and ladies).

Thursday, June 19th.—At 10.15 a.m. Meeting in the Empire Theatre, Kingston-upon-Thames. Address of welcome by the Mayor. Papers on "Air Filtration," by Mr. J. Christie, and "Electric Vehicles," by Messrs. W. H. L. Watson and R. J. Mitchell. Demonstration following. At 1.30 p.m.—Luncheon at Nuthalls, Ltd. At 3 p.m.—River trip. At 7.30 p.m.—Dinner at Nuthalls, Ltd.

Friday, June 20th.—At 10 a.m. At the I.E.E. Annual general meeting. Saturday, June 21st.—At 9.30 a.m. Leave for visit to Chingford reservoir.

**Electrical Contractors' Association.**—Tuesday, June 17th. Annual dinner at Erskine's.

**Institution of Electrical Engineers (Scottish Section).**—Tuesday, June 17th. Annual summer outing to Invernauld.

**Royal Society of Arts.**—Tuesday, June 17th. At 9 p.m. At the Natural History Museum, South Kensington, S.W. Conversazione and reception by Lord Sanderson.

**Chemical Society.**—Thursday, June 19th. At 8.30 p.m. Ordinary meeting.

## THE ELECTRICAL ENGINEERS (LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, June 16th.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 5th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m. Leaf Cup competition will take place on miniature range, commencing at 7 p.m.

Tuesday, June 17th.—"B" Company. Ditto. Advance party for Bers Island parade at Headquarters at 12 noon.

Thursday, June 19th.—"C" Company. As for 16th inst.

Friday, June 20th.—"D" Company. As for 16th inst.

Saturday, June 21st.—Main body for Bers Island parade at Headquarters at 12 noon. Headquarters will be opened for the transaction of regimental business from 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant.  
For Officer commanding L.E.E.

NOTES.

**Wanted—Three Hundred Pounds.**—We are pleased to be able to make two additions to the list of donors of £100 who desire to enable the Electrical Trades Benevolent Institution to take advantage of Mr. E. G. Byng's offer. Mr. Justus Eck, who has just returned to these shores from a lengthy tour in the Colonies, made it one of his first duties to communicate to the secretary his wish to co-operate to the full in this matter. Mr. Eck has done for this fund right from its very beginning more than many people can ever know, and he again shows the sincerity and zeal with which he regards his offspring by putting his name in the accompanying list. Mr. Dane Sinclair has also generously forwarded to us personally a cheque for £100, which we have handed on to the secretary. The deep concern with which Mr. Sinclair has noted our continued appeals for the fund, and his great desire to prevent the movement being unsuccessful, will appear from the following letter which accompanied his donation:—

"Dear Mr. Gatehouse.—Considering the best interests of the electrical fraternity in this country, I have been sorry to see that it has been necessary for the REVIEW to ask so often for the total of £1,000 to be subscribed to the Electrical Trades Benevolent Fund, and had hoped to see what one might term the more wealthy members coming forward and doing the necessary; but the time-limit is now approaching, and I should be sorry to see this good cause falling through for lack of funds, and have therefore pleasure in enclosing my cheque for £100. I shall be glad if you will add my name to the list of those who have already subscribed, and I trust that this week will see the full amount raised.

"I think the thanks of everyone are due to you for the trouble your paper has taken in this matter.—Yours faithfully,

"DANE SINCLAIR.

"June 10th, 1913."

Three spaces still remain open, and once again we renew our appeal to the large-hearted to phone or write to the secretary, or to us, under the first impulse that possesses them after reading this note. The position now stands as follows:—

1	Mr. E. G. Byng	...	...	...	...	£100
2	Mr. G. Sutton	...	...	...	...	£100
3	Mr. H. Hirst	...	...	...	...	£100
4	Mr. E. Garcke	...	...	...	...	£100
5	Sir W. H. Preece, K.C.B., F.R.S.	...	...	...	...	£100
6	Mr. Justus Eck	...	...	...	...	£100
7	Mr. Dane Sinclair	...	...	...	...	£100
8	* ...	...	...	...	...	...
9	* ...	...	...	...	...	...
10	* ...	...	...	...	...	...

It has been suggested that, as all the donations down to date are from individuals, the company contributions are long overdue. But then it takes longer to get a proposal passed by a board of directors than for a private gentleman to settle the matter with his own heart and conscience. After all, "company" proposals generally have an individual origin. We hope that both boards and private individuals will speedily find the remaining three hundreds.

**Foreign Trade in May.**—The returns published this week show that during the month of May imports advanced by 11·2 per cent. (nearly 6½ million sterling), exports by 12·9 per cent. (over 5 million sterling), while re-exports fell by 13·4 per cent. (nearly 1½ million sterling). The electrical and machinery figures for the month, and for the five months, are as follows:—

Imports.	Month of		Five		Inc.
	May	1913.	or	months	
Electrical goods and apparatus, excluding machinery and insulated wire ...	118,723	£	+18,576	£	624,868
Machinery ...	650,362	£	-18,623	£	3,162,493
					278,970
Exports.	Month of		Five		Inc.
	May	1913.	or	months	
Electrical goods and apparatus, excluding machinery and insulated wire ...	465,072	£	+163,595	£	2,381,357
Machinery ...	3,255,976	£	+496,550	£	15,190,633
					+2,060,971

**Tramway Appeal in the Lords.**—At the time of going to press, the appeal in the case of the Tottenham Urban District Council v. the Metropolitan Electric Tramways, Ltd., is being heard in the House of Lords.

**Lead Prices.**—The agreement as to lead quotations recently arranged by Hamburg manufacturers has now been extended to the whole of Germany under the following conditions:—The basis price for leaden articles is raised 150 marks per 100 kilog., the sale prices being as follows:—For the Rhineland and Westphalia, freight basis of Cologne, 45·10 marks; for South Germany, 45 marks, freight basis of Mannheim, Mayence and Strassburg; for Middle Germany, 44·50 marks, freight basis of Hanover and Hamburg; for Brandenburg, 44·60 marks, freight basis of Brandenburg; for Berlin, 40·50 to 43·50 marks, freight basis of Berlin—all per 100 kilog., payable within 14 days, with 1½ per cent. discount.

**Meeting of London Electrical and other Workers.**

—We are informed that a meeting of electrical workers was held at Caxton Hall on June 2nd, under the chairmanship of Mr. George Dew, L.C.C., the Secretary of the London Building Industries Federation, who hoped that that splendid gathering was an augury for a brighter future for the electricians of the Metropolis. Mr. Jack Potter, the district secretary, moved a resolution pledging the meeting to support the efforts of the London District Committee to secure an advance of wages and better working conditions for those engaged in the industry. He stated that some of the employers were making a very definite attempt to reduce the wages of the wiremen—a miserable 3½d. per hour. They were approaching the London County Council and the Government departments to get the schedule rates reduced, and unless the men put up a strenuous fight, they would go down. He appealed to the audience to go into the highways and imbue their fellows with the spirit of solidarity, so that they could stand shoulder to shoulder with the workers of other industries, to create a social order where poverty and low wages would be impossible. Mr. H. Roll, of the Electrical Trades Union, seconded the resolution. Other speakers were Mr. Ben Tillet, Mr. James Macdonald, the late secretary of the London Trades Council, and Mr. Jack Kinniburgh, the organiser of the E.T.U., who said it was a disgrace to the electricians that they were not yet on the move. The E.T.U. had raised wages in all industrial centres; London alone had not moved, but he hoped that that meeting would inspire them with the determination not to rest until they had secured more of the good things of this life. Mr. Harry Adams, of the Bricklayers' Society, promised the support of their members in whatever efforts were made, and Mr. Hugo Beazley, the organiser of the Plasterers' Union, thanked the electricians for the splendid support they had rendered the plasterers in their dispute with the master builders. A speech, urging the necessity of combination among all workers, from Mr. Fred Knee, the secretary of the London Trades Council, concluded the meeting, which, we are informed, carried the resolution unanimously.

**London Railway Contracts.**—The *Financial Times*

stated last Saturday that the contract for electrifying a portion of the London and South-Western Railway at a cost of just under £300,000 had been given to the British Westinghouse Electric and Manufacturing Co. "The order, it is stated, is the largest single one of its kind ever handed out, and the British Westinghouse Co. is to be congratulated on having secured it on terms, it is to be presumed, which will keep its plant profitably employed for a considerable period. The contract of a similar nature of the London and North-Western, involving a sum of £160,000, has gone to the Oerlikon Co., of Zurich. Great disappointment is felt in engineering circles that a British firm has failed to obtain this order, and private conferences are being held to discuss the causes of the unsuccessful tendering of home manufacturers. The two contracts alluded to do not include power stations, the details of which have not yet been settled, but relate solely to railway equipment."

Our contemporary added in its Monday issue:—"The contract for the construction of the necessary power houses has still to be awarded, and in engineering circles it is generally believed that this work also will be given to the British Westinghouse. The sum involved will be large, precisely how much cannot be stated, but probably over £200,000, and the contract will naturally be greatly sought after. Doubtless, however, the successful tenderers will come to terms with the rest of the trade, it being customary among the big engineering interests to sub-let portions of works of the magnitude of these railway electrification schemes."

The *Railway Times* says that the Oerlikon contract is for the electrical equipment of over 40 trains. We understand that the contracts for the boilers and rotary converters for the L. & S. W. Railway have also been given out.

**Association of Electrical Station Engineers.**—A

meeting was held at Birmingham on June 10th, at which Mr. McKee was in the chair, and a branch was definitely formed for the Midlands. Mr. E. A. Gordon was elected hon. secretary, and representatives from Worcester, Birmingham, Walsall, Wednesbury and West Bromwich were elected on the Committee. The hon. secretary was elected delegate for the Conference, and the meeting passed a few resolutions, which the delegate was instructed to put before the Conference. A similar meeting was held recently at Liverpool, when Mr. A. C. Black was elected delegate for the Conference. The date of the general meeting of the whole Association has been fixed for June 24th, to be held at Chandos Hall, Maiden Lane, W.C.

**Contracts and Fair Wages.**—In the House of

Commons questions, Mr. O'Grady asked the First Lord of the Admiralty whether he was aware that the firms of Spagnoletti, Ltd., Shepherd's Bush; Johnson & Phillips, Charlton, Kent; Keith and Blackman, Holloway Road; and Messrs. Crompton, Chelmsford, contractors to the department, paid instrument makers in their employ wages ranging from 7d. to 8d. per hour, the standard rate being 9d., and also employed a very large amount of boy labour on similar work at rates ranging from 2d. to 4d. an hour, thus enabling these firms to compete unfairly with firms employing adult labour; and whether he would make inquiry into the matter with a view to enforcing the provisions of the Fair Wages Clause. Dr. Macnamara replied that he was not aware of the circumstances referred to, but would have inquiries made. He might add that the Trade Union had recently instanced one of the firms named in the question as being a firm who paid 9d. per hour.

**Electricity Supply Rifle League.**—The following matches were decided during May:—Hackney (Smith 95), 550; Westminster (Wincombe, Herley 98), 567. Hackney (Hilling 96), 559; Shoreditch (East 99), 570. Shoreditch (Weeks 100), 578; Ilford (R. Tufnell 97), 556. St. James's (Green, Young 93), 521; Ilford (R. Tufnell, McKelvey 95), 553. Central (Law 97), 564; Westminster (Partridge 99), 576. Central (Rhodes 98), 575; Poplar (Mogg 93), 490. St. James's (Strange 98), 567; Stepney (Heavyside 96), 539. Stepney (Barber 98), 556; Brompton (Mugford 96), 559. Poplar, 507; St. James's (Hocking 96), 547.

The following are the positions to date:—

	Shot.	Won.	Lost.	Points.	For.	Against.
Shoreditch ...	6	6	0	12	3,441	3,278
Westminster ...	6	5	1	10	3,414	3,302
Ilford ...	6	5	1	10	3,383	3,210
Central ...	6	3	3	6	3,369	3,284
St. James's ...	6	3	3	6	3,196	3,265
Brompton ...	5	2	3	4	2,778	2,767
Stepney ...	6	1	5	2	3,256	3,190
Hackney ...	6	1	5	2	3,221	3,259
Poplar ...	5	0	5	0	2,264	2,767

**The Dumfries-London Electric Vehicle Trial.**—We understand that the 380-mile trial run of the Arrol Johnson-Edison battery vehicle, to which reference was made last week, terminated successfully on Wednesday. No electrical, mechanical or tire troubles were experienced; but due to adverse weather, and the limited maximum speed of the vehicle, which is fitted with a nominal 31-H.P. series motor, the run took rather longer than intended. It is, however, stated to be the first time that such a long run has been carried out by an electrical car in Europe.

**Annual Outings.**—For their annual outing on June 4th, the staff of the Guildford Electricity Supply Co., Ltd., went for a trip to Portsmouth. They were accompanied by Mr. H. L. Alderton, engineer and manager, and Mr. R. Harold Piper, secretary and accountant, together with several guests. Luncheon was served at Scullard's Victoria Hotel, Southsea, and later, trips were made to the Isle of Wight and other places in the vicinity of Portsmouth. In the evening the party were present at the Portsmouth Hippodrome.

**Institution and Lecture Notes.**—ASSOCIATION OF MINING ELECTRICAL ENGINEERS—EAST OF SCOTLAND BRANCH.—At the annual meeting of the branch held at Dunfermline, Mr. C. A. Carlow, of the Fife Coal Co., who has been the president of the branch since its inception three years ago, resigned, and Mr. H. G. Fraser, Leven, chief electrician to the Fife Coal Co., was nominated for the vacancy. Mr. R. W. Peters, electrician to the Lochgelly Iron and Coal Co. was appointed to the joint post of secretary and treasurer, and Mr. N. A. Wilkie, Cardenden, was elected as auditor. After the business meeting, the members were socially entertained by Mr. C. A. Carlow, the retiring president.

A meeting of the Association was held at Hedgesford, on Saturday. Mr. A. Hall was unanimously re-elected president for the ensuing year; Messrs. C. F. Jackson, M. J. Moffett, Chris Jones and J. R. English were elected vice-presidents. Mr. H. Arnoth was re-elected as secretary and treasurer. A discussion took place on Mr. Bolton Shaw's paper on "Notes on Colliery Generating."

**VICTORIAN INSTITUTE OF ELECTRICAL ENGINEERS.**—At the meeting of this Institute, held at Melbourne on May 1st, there was a discussion on the notes on his "Trip Abroad," read at a previous meeting by the hon. secretary, Mr. Westwood, and three 10-minute papers followed:—"Wire Drawing: A New Australian Industry," by J. K. McDougall; "Use of Aluminium Conductors," by G. B. Lincoln; "Fire Resisting Materials," by Noel Murray.

**PHYSICAL SOCIETY OF LONDON.**—At the meeting on May 16th a paper on "Some Experiments to Detect  $\beta$ -rays from Radium A," by Dr. W. Makower and Dr. S. Russ, was read by Dr. Russ. A paper on "Vibration Galvanometer Design," was read by Dr. Haworth. The author states that it is an advantage to be able to increase the useful power input per unit voltage. To do this the resistance of the instrument must be decreased. This can be done by leading the current in and out at the bottom bridge and short-circuiting the wires at the top bridge, and it results in a great increase of sensibility. At high frequencies the flux density required is large. In order to obtain this result economically it is convenient to make the depth of the poles small compared with the maximum length of the wires. The result is a very satisfactory instrument with a much flatter voltmeter-sensibility-frequency curve than obtained usually. Mr. W. Duddell remarked that if it was required to make a really efficient galvanometer for high frequencies it was best to redesign the whole instrument. When a very low resistance was wanted silver wires could be used. A strong field necessitated using an electromagnet, against which he had a prejudice, for vibration galvanometers. Mr. A. Campbell pointed out that in some cases it was current sensitivity that was required. This depended upon the bridge the galvanometer was used with.

At the meeting on May 30th, a paper on "Electro-thermal Phenomena at the Contact of Two Conductors with a Theory of a Class of Radio-Telegraph Detectors," was read by Dr. W. H. Eccles. The paper is a purely theoretical one, and deduces mathematically the laws connecting the current and the applied E.M.F. in a circuit containing a light contact of two conductors. The bulk of the wireless telegraphy of the world is carried on by such contacts as these, and the present paper, therefore, constitutes a theory of the action of these detectors. It is shown that, in general, when

a contact is used as a radiotelegraph detector, there may be some coherer action mixed up with the thermoelectric "rectifying" action; and that, whether there is or is not any coherer action, the principal features of the characteristic curve connecting current and E.M.F. are determined by the Thomson rather than by the Peltier effect. Dr. J. A. Fleming communicated a statement to the effect that a large number of measurements of characteristic curves of his valves and other detectors had shown that there were sudden changes of curvature in them. The results did not, however, fall in with any very simple theory of such rectifying detectors.

**INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS' SECTION).**—The officers of the Students' Section for the session 1913-14 are as follows:—Chairman, Mr. S. M. Hills; vice-chairman, Mr. R. E. Dickinson; hon. secretary, Mr. E. T. Driver; hon. assistant secretary, Mr. R. A. McMahon.

**NEWCASTLE LOCAL SECTION.**—The report of the Committee for the session 1912-13 states that the total membership of the Section is 319, a decrease of two on last year's figure. The full members, associate members, associates and graduates have increased by 47, and the student members decreased by 49. The average attendance was 52. The Tees-side members have held several meetings in Middlesbrough, under the direction of a Local Subcommittee. This activity has been much to the advantage of that district and also of the Institution, as its membership has thereby materially increased. There are now about 56 members in the Tees-side District. The Student Section has done good work, and two of the students have been awarded premiums for papers. The Committee has some prospect of concluding arrangements by which the members will be at liberty to attend the ordinary meetings of other Societies in exchange for similar privileges. The officers and Committee for the ensuing session are as follows:—Chairman, Mr. C. Vernier; vice-chairmen, Messrs. P. V. Hunter and J. H. Holmes; past chairmen, Messrs. C. Faraday Proctor, C. S. Vesey Brown and W. C. Mountain. Committee, Messrs. W. McLellan, R. P. Sloan, C. Turnbull, G. Stoney, A. H. Marshall, J. R. Andrews, Wm. Thornton, H. Stroud, J. R. M. Elliott, A. P. Pyne, G. L. Drury, J. A. Anderson, C. H. Davidson, and E. Fawcett. Hon. treasurer, Mr. W. A. Clatworthy; hon. secretary, Mr. H. W. Clothier; assistant hon. secretary, Mr. W. G. Guns; hon. auditors, Messrs. H. L. Riseley and F. O. Hunt.

The Committee of the NEWCASTLE STUDENTS' SECTION reports that the membership at the end of the session 1911-12 was 151. During the past year there have been 29 additions, but owing to the large number of removals and transfers the total has decreased to 102. It has been thought that the Committee of the Students' Section in London is officially in a somewhat false position. Recent correspondence suggests that the "London Students' Section" is to be so named, and that a satisfactory definition of the functions of the "London Students' Committee" has now been made. The Students' annual tour this year is to take the form of a visit to Newcastle from July 3rd to 5th. The officers for the new session are Messrs J. Hacking (chairman), E. Wyatt (vice-chairman), H. V. Henniker (hon. sec.).

**IRON AND STEEL INSTITUTE.**—The preliminary programme of the Brussels meeting, from September 1st to 4th, has been issued. A number of papers are to be read and discussed; Ghent Exhibition is to be visited; and there are to be excursions to Liège and Charleroi, where important works will be visited.

**ILLUMINATING ENGINEERING SOCIETY.**—The report of the Council for the session to May, 1913, refers to the effective co-operation of the Society with other bodies, and to its growing prestige on the Continent. Dr. R. T. Glazebrook has been nominated a Vice-President. The membership of the Society now exceeds 400. With the co-operation of the Society, a similar association has been formed in Germany, supported by the Reichsanstalt, and has made good progress. The finances of the Society are in a satisfactory condition.

**Strikes.**—The *Times* on Monday stated that the works of the General Electric Co. at Witton had been closed down for a week, the office staff taking a holiday. The firm were willing to concede the minimum wage, but would not consent to wipe off the debts which the employes had accumulated in connection with their work. The total amount of the debt was said to be at least £1,000, and the individual sums ranged from £3 to £50.

**Appointments Vacant.**—Assistant lecturer in electrical engineering, Manchester School of Technology (£200); sales engineer, for the York electricity department (£120); foreman electrician and electrical foreman, for locomotive workshop power house (Rs. 250 per mensem), for the South Indian Railway; mechanic and blacksmith, for the Watford U.D.C. (32s.). Twenty electrical fitters are wanted for I.M. Dockyard at Devonport (38s.); assistant superintendent for Sheffield installation and motor department (£150). See our advertisement pages to-day.

**Batti-Wallah River Trip.**—The motor-boat *St. George*, which took the Batti-Wallah party on their down-river trip, came to grief by colliding with some floating wreckage off the Ovens Buoy. One of her planks was knocked in and she sank in 7½ minutes. The engine kept going until half-submerged, assisted by the crew paddling with floor boards, &c., and the party reached shore in 4 ft. of water. We understand that interesting photographs will be exhibited to those forming the Up-River party on 28th inst.

## OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

**Central Station Officials.**—On leaving the generating station, Gloucester, for a position in Canada, Mr. T. H. MORRIS was presented by the chief engineer, on behalf of the staff and workmen of the department, with a suit case.

Our Cape Correspondent writes: "The town clerk of Port Elizabeth has received a cable stating that Mr. H. J. HOLDER, the municipal electrical engineer, who is at present on leave in England, met with a serious accident, as a result of which he has been unconscious for a week. The cable stated that an operation had been successfully performed on the skull, but that a further operation might be necessary."

The Leck U.D.C. has increased the salary of Mr. CARR, electrical engineer, by £25 a year.

The electric supply and tramway staff at Ipswich have presented an oxidised silver table standard lamp with silk shade, to Mr. GEO. L. GARTON, who has charge of the installation department, on his marriage. From the workmen, &c., of the installation department, Mr. Garton received a tea service.

Mr. S. T. ALLEN, late city electrical engineer at Carlisle, on leaving to become electrical engineer at Wolverhampton, has been presented by the staff with a gold watch and oxidised silver inkstand.

The Elland U.D.C. has increased the salary of Mr. WM. C. KNOWLES, chief electrical engineer, from £150 to £165 per annum.

Mr. T. R. STANCOMBE has resigned his position of installation superintendent to the York Corporation Electricity Department, and has been appointed engineering representative for power purposes to the Bristol Corporation Electricity Department.

**Tramway Officials.**—The members of the Metropolitan Association of Electric Tramways Managers, are entertaining Mr. H. E. BLAIN to dinner on Friday, the 4th prox., at the Municipal and County Club, Whitehall, on his resignation as tramways manager at West Ham, and also as Chairman of the Association.

**General.**—Mr. JUSTUS ECK, whose departure we announced last October, has now returned to London, after many months spent in visiting Australia, Tasmania, New Zealand, Canada, and the United States, in the interests of the Union Electric Co., of Southwark. During his visit to Melbourne he read a paper on "Indirect Lighting by Arc Lamps," before the Victorian Institution of Electrical Engineers, and received an invitation from the Engineering Society of Queensland, to read a paper before that body. Unfortunately, lack of time compelled him to decline. Mr. Eck expresses himself satisfied in every way with his tour, and particularly with the cordial reception universally extended to him by members of all branches of the electrical industry.

Canada states that the HON. ADAM BECK, chairman of the Ontario Hydro-Electric Power Commission, arrived in London last week.

Mr. W. P. BURTON, who has been invited by Sir T. Lipton to command the new America Cup Challenger, is the vice-chairman of the Ipswich Electric Supply and Tramways Committee. He is also the Master of the East Suffolk Foxhounds and Master of the Staghounds.

Mr. W. HAYES has resigned his position in the Supply Department of British Westinghouse Co., Ltd., Manchester, and has joined the staff of Messrs. Falk, Stadelmann & Co., Ltd., as outside representative for their new branch establishment, now open at 107-111, Shindhill, Manchester.

The marriage took place at St. Matthew's Church, East Croydon, on June 3rd, of Mr. JOHN W. HOLDRON, only son of the late Mr. John Holdron, of Holdron & Son, electrical engineers, of Market Street, Ashby-de-la-Zouch, and Miss Marguerita Pullen, youngest daughter of the late Mr. John Pullen, of East Croydon.

A marriage took place at St. Gabriel's Church, Cricklewood, London, on June 4th, of Mr. ROBT. BARRON, electrical engineer, of Fleetwood, and Miss Winifred Baxter. Mr. and Mrs. Barron were the recipients of a large number of presents, including silver plate from the bridegroom's Fleetwood employes, and a clock from the members of the Fleetwood Canine Society, of which the bridegroom is hon. secretary.

Mr. J. E. SPAGNOLETTI has severed his connection with the firm of Spagnoletti, Ltd.

DR. CARL HERING is at present in London from the States on a business trip.

Mr. W. LEWIS has been presented with an illuminated address on his retirement from the secretaryship of the sick benefit society founded by the employes of Messrs. Spagnoletti, Ltd., Shepherd's Bush. Mr. John Griffiths made the presentation at a large gathering of the staff.

Mr. M. N. JACKS, director of Messrs. Humphreys, Ltd., and Mr. J. NORMAN AMBLER, have joined the board of Scholey and Co., Ltd.

**Obituary.**—Mr. J. W. COURTENAY.—We deeply regret to learn of the death, which occurred very suddenly at his residence at Stevenage, on Sunday, June 1st, of Mr. James Watts Courtenay. The deceased gentleman was better known to that section of our readers who are interested in tramway matters by reason of his being managing director of our esteemed contemporary, the

*Tramway and Railway World.* For many years he carried on business as a tramway advertising contractor with branches in various cities, but in 1892 he associated himself with others in the establishment of the paper mentioned above, subsequently acquiring a controlling interest and becoming its managing director. The Tramway and Light Railway Exhibitions held some years ago at the Agricultural Hall, Islington, were mainly due to his enterprise and organising genius, and in other connections both the Municipal Tramways Association and the Tramways and Light Railways Association have paid a tribute to the useful services rendered by Mr. Courtenay to the tramway industry. For some years he had suffered from a heart affection, but he bore up under this burden with remarkable bravery. For years he had faced this imminent death without the least complaint. Lately, however, he had appeared to be in better health, and his death at the age of only 56 years, came as a shock to all. Those who were long associated with him in the offices of our contemporary will greatly miss a personal friend, for he was a man of exceptional charm to his intimates. To these we extend the sympathy of *conferres*. We understand that Mr. Courtenay's death will not entail any change in the policy or staff of the paper, and that his advertising business had recently been converted into a limited liability company, under the style of J. W. Courtenay, Ltd., and it will be continued as before.

A number of our readers will, we are sure, desire to associate themselves with us in expressing sympathy with Mr. W. S. Foale, engineer and manager of the Portsmouth Corporation electricity works, in his bereavement. His wife passed away on Monday last, after an illness of some weeks.

## NEW COMPANIES REGISTERED.

**Electrical Engineering and Motor Co. (Carlisle), Ltd.** (129,218).—This company was registered on May 28th, with a capital of £3,000 in £1 shares, to carry on the business of automobile engineers and store and garage keepers, suppliers of electricity and other motive power for motors, motor-engines, motor-boats, flying machines, carriages, &c., and to adopt an agreement with C. Armstrong Lamb and W. R. Armstrong Lamb. The subscribers (with one share each) are:—C. Armstrong Lamb, Lowther Street, Carlisle, electrical engineer; W. R. A. Lamb, Lowther Street, Carlisle, electrical engineer; A. Castigbone, Lowther Street, Carlisle, motor engineer. Private company. The number of directors is not to be less than three or more than five; Armstrong Lamb is first managing director. Solicitors, E. and Kighley J. Hough, Carlisle. Registered by Morrison & Powell, 5, Raymond Buildings, Gray's Inn, W.C.

**Beatson & Co., Ltd.** (129,208).—This company was registered on May 28th, with a capital of £8,000 in £1 shares, to take over the business of an electrical engineer, carried on by H. Beatson at 14, Waingate, the field, and 76, Frederick Street, Rotherham. The subscribers (with one share each) are:—H. Beatson, 50 Overton Green, Sheffield, electrical engineer; H. A. Holliday, 8, Park View Road, Sheffield, secretary. Private company. The number of directors is not to be less than two or more than five; the first are H. Beatson (permanent) and others to be appointed by the subscribers; qualification, £50; remuneration as fixed by the company. Solicitor, E. Aryton, 17, Bank Street, Sheffield. Registered by Jordan & Sons, Ltd., 116-17, Chancery Lane, W.C.

**Wireless Electric Light Co., Ltd.** (129,284).—Registered May 30th, by H. G. Campion & Co., 25, Old Broad Street, E.C. Capital, £75,000 in 70,000 ordinary "A" shares of £1 each, and 100,000 ordinary "B" shares of 1s. each. Objects: To carry on the business of electric lighting and general engineers and contractors, suppliers of electricity, manufacturers of and dealers in electric, magnetic, galvanic and other apparatus, &c., and to adopt an agreement between O. Markiewicz, M. J. Stoeck, and R. H. Markiewicz of 1, The Waldens, Croydon, and J. L. Gilmore of the other part. The signatories (with one share each) are:—E. Wilding, 22, Midway Chambers, 7, Union Court, E.C., chartered accountant; J. L. Gilmore, 6, Broad Street Place, E.C., merchant; R. Lee, Belagh, Westbourne Road, Purley, engineer; L. Perry, 16, Sunderland Terrace, Westbourne Gardens, W., engineer; E. R. Baines, Green Street Green, Orpington, accountant; W. B. Baanerman, 4, The Waldens, Croydon, secretary; T. H. Brown, 23, Old Broad Street, E.C., electrician. Minimum cash subscription, 100 ordinary "A" shares. The first directors (to number not less than three or more than seven) are E. Wilding, J. L. Gilmore, and M. Stoeck. No qualification required till nine months after statutory meeting; afterwards £100 (managing director excepted); remuneration (except managing director), £200 each per annum (chairman, £250), and 25 per cent. of the net profits, after 10 per cent. dividend is paid, divided between them. Registered office, 6, Broad Street Place, E.C.

**Morris & Lister (London), Ltd.** (129,269).—This company was registered on May 30th, with a capital of £3,000 in £1 shares, to carry on the business of agents for, and dealers in, electrical and engineering machinery and plant, electricians, engineers, suppliers of electricity, &c., and to adopt an agreement with Morris & Lister, Ltd. The subscribers (with one share each) are:—F. J. Bakewell, Northcliffe, St. Margaret's Bay, Dover, engineer; P. A. Lambach, 26, West End Lane, West Hampstead, N.W. Private company. The number of directors is not to be less than two or more than three; the first are F. J. Bakewell and D. J. Morris. Registered office, 3 and 4, Palace Chambers, Bridge Street, Westminster.

**W. E. L., Ltd.** (129,282).—This company was registered on May 30th, with a capital of £2,000 in 1s. shares, to carry on the business of electric lighting and general electrical engineers and contractors, suppliers of electricity, carriers of passengers and goods, &c. The subscribers (with one share each) are:—J. L. Gilmore, 6, Broad Street Place, E.C., merchant; E. Wilding, 22, Midway Chambers, 7, Union Court, E.C., chartered accountant. Private company. The number of directors is not to be more than five; the first are not named; remuneration, £10 each per annum (chairman £15). Registered office, 6, Broad Street Place, E.C.

**Magnetaire, Ltd.** (129,366).—This company was registered on June 4th, with a capital of £100 in 1s. shares, to take over the business of therapeuticists and manufacturers of and dealers in electrical and magnetic appliances carried on by W. Light and A. W. Light, as "C. G. Pison, Garratt and Co.," at 11 and 13, Finsbury Square, E.C. The subscribers (with one share each) are:—W. Light, "Lutterworth," Burrendon Road, Brighton, publisher; A. W. Light, 8, Priory Road, West Hampstead, N.W., medical electrician. Private company. The number of directors is not to be less than two or more than five; the first are W. Light and A. W. Light. Registered office, 11 and 13, Finsbury Square, E.C.

## CITY NOTES.

**Bombay Electric Supply and Tramways Co., Ltd.**

THE directors report that the total revenue for the year to December 31st from all sources, including the amount represented by sale of current to the tramways, amounted to £256,699, an increase of £17,391, or 7.27 per cent. over the previous year. The total expenditure (says the *Financier*) amounted to £128,017, an increase of £2,292, or 1.82 per cent., compared with 1911. The net profit from the year's working, which aggregated £123,682, shows an increase of £15,101, or 13.28 per cent. After deducting interest on the debenture debt, amounting to £36,452, placing £22,000 to depreciation account, and £6,548 to sinking fund for capital redemption, there remains £63,682, plus £7,385 brought forward, making an available total of £71,067. The directors recommend that this sum should be applied to dividend on the 6 per cent. cumulative preference shares, and a dividend on the ordinary shares at the rate of 5 per cent. per annum, £30,000, leaving to be carried forward £5,072. The tramway traffic receipts, which amounted to £161,013, compare with £157,807 for the previous year. The working expenses in Bombay amounted to £78,842, against £74,449. The balance of receipts over expenses in respect of the year's working is £84,820, compared with £86,074 for the previous year. The tramway receipts for the previous year received an abnormal increase from the additional traffic which resulted from the Royal visit to Bombay in December, 1911. The receipts for the last three months of 1912 suffered from the refusal of the Corporation to continue the increase in some of the long-distance fares to which it had accorded temporary sanction during the preceding 2½ years. On the other hand, the expenses in 1912 were swelled by the thorough overhaul of the company's rolling-stock then undertaken. The gross receipts from electric supply for the year, including the amount represented by the sale of current to the tramways, amount to £91,413, compared with £76,530 for the preceding year. The working expenses were £45,883, against £48,264 for the previous year. The receipts, exclusive of the revenue represented by the current supplied for the tramways, amount to £61,462, compared with £47,895 for 1911. The balance of £45,730, as the result of the year's operations, compares with a balance of £28,266 for 1911.

**Aluminium Corporation, Ltd.**

THE directors' report for the 12 months ending December 31st, 1912, states that the operations of the company were subject to many adverse factors, but a net profit is shown for the first time in the history of the company. The coal and transport strikes caused very serious inconvenience and loss, and the abnormal depression in the price of the metal which prevailed until towards the end of 1912, naturally militated against a more successful working. The completion of the new carbon works at Dolgarrog has been considerably retarded by the difficulty of obtaining the necessary building material. The machinery and plant having been maintained in a high state of efficiency out of revenue, it is not deemed necessary in the present accounts to make any provision for depreciation. An arrangement has been completed with the British Aluminium Co., Ltd., whereby that company has acquired a substantial interest in the Bauxite Refining Co., Ltd., and it is believed that the extensions at present being made to these works will prove to be of considerable advantage to the Corporation. Mr. A. F. Bott was appointed a member of the board in January last.

**Stock Exchange Notices.**—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Consolidated Diesel Engine Manufacturers, Ltd.—Further issue of 4,413 shares of £1 each, fully paid (Nos. 594,547 to 598,959); and 100,000 vendors' shares of £1 each, fully paid (Nos. 427,077 to 527,076).

Consolidated Gas, Electric Light and Power Co., of Baltimore.—Further issue of \$404,000 general mortgage 4½ per cent. 30-year gold bonds of \$1,000 each (Nos. 9,362 to 9,765).

London and Suburban Traction Co., Ltd.—1,411,409 ordinary shares of £1 each, fully paid (Nos. 1 to 1,411,409); 1,018,178 5 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 1,018,178); and £144,444 4½ per cent. first mortgage debenture stock.

River Plate Electricity Co., Ltd.—Further issue of £30,000 ordinary stock. Underground Electric Railways Co. of London, Ltd.—21,000 additional shares of £10 each, fully paid (Nos. 7,201 to 8,200 and 26,793 to 46,792).

Victoria Falls and Transvaal Power Co., Ltd.—£1,000,000 5½ per cent. second mortgage debentures, Series "A" (Nos. 1 to 9,610 of £100, and 9,611 to 11,440 of £20 each), in lieu of the scrip.

Applications were made to the Committee (1) to appoint a special settling day in and to grant a quotation to:—

Brazilian Traction, Light and Power Co., Ltd.—100,000 6 per cent. cumulative preference shares of \$100 each, fully paid.

And allow the following to be quoted in the Official List:—

Montreal Tramways Co.—Further issue of \$2,890,000 first and refunding mortgage 5 per cent. 30-year gold bonds, Nos. D1,047 to 1,246 (\$500) and M9,923 to 12,712 (\$1,000).

**India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.**—A half-yearly meeting will be held at 106, Cannon Street, E.C., on 21st inst., at 11.30 o'clock a.m. Dividends are proposed as follows:—Preference shares, 5s. per share, less income-tax, being half-yearly dividend due on July 1st, at the rate of 5 per cent. per annum. Ordinary shares, 5s. per share, free of income-tax, being an interim dividend of 2½ per cent.

**Provincial Tramways Co.**—An interim dividend of 8d. per share on the ordinary shares is announced for the half-year ended March 31st.

**The American Westinghouse Electric and Manufacturing Co.**—The report for the year ended March 31st, 1913, as abstracted in the *Financial News*, states that the sales billed for the year were in excess of any previous year in the history of the company. The ratio of manufacturing profit to sales billed increased over last year, but unusually keen competition in all the company's activities prevailed and still continues. The value of unfilled orders as of March 31st, 1912, was \$8,137,961 and as of March 31st, 1913, \$12,061,473. The surplus as of March 31st, 1912, was \$6,648,964. This balance was increased, by the net income for the year and various items detailed in the statement of profit and loss, to a gross surplus of \$9,932,203. Against this surplus have been charged dividends declared during the year on the preference stock at the rate of 7 per cent. per annum (\$279,909), three dividends of 1 per cent. each, aggregating \$1,053,666, on the common stock, and miscellaneous charges totalling \$283,187. These charges reduced the surplus to \$8,315,442, against which depreciations of investments, aggregating \$966,919 were written off, leaving the surplus as of March 31st, 1913, shown in the same balance-sheet, of \$7,348,522. So far as the foreign companies are concerned, while further depreciation is possible in some of them, it will probably be more than offset by the appreciation of others: so that, after the final adjustment resulting from liquidation of the Russian company, it is believed that, under existing conditions, their aggregate book value will be a fair actual value. The four-year notes issued under the plan for the discharge of the receivers of the company matured January 1st, 1913, and were paid.

**Electric and General Investment Co., Ltd.**—The directors recommend the following dividends for the year-ended May 31st:—Ordinary shares, the full dividend of 2s. per share, being 10 per cent. per annum, of which 1s. per share was paid on account in January, leaving 1s. per share to be now distributed; deferred shares, a dividend of 6d. per share.

**J. G. White & Co., Ltd.**—The directors have declared a dividend of 6 per cent., less income-tax, on the cumulative preferred shares for the half-year to February 28th, making 12 per cent. for the year, and a dividend of 6 per cent., less income-tax, on the ordinary shares for the half-year to February 28th, making 12 per cent. for the year, and an extra dividend of 10s. per share, less income-tax, on the ordinary shares for the year to February 28th, making a total of 62 per cent. on the ordinary share capital.—*Financier*.

**Prospectus.**—*Midland Electric Corporation for Power Distribution, Ltd.*—The list was to close yesterday in an issue of £400,000 5 per cent. first mortgage debenture stock, which is guaranteed absolutely as to principal and interest by the British Insulated and Helsby Cables, Ltd. The matter was referred to in the report of the meeting of the latter company recently. The present issue is made to replace the whole of the company's outstanding debentures, amounting to £250,000, and to provide the additional capital required for its extended and rapidly-extending business. After providing for the replacement of such debentures, and for the payment to the British Insulated and Helsby Cables, Ltd., of £92,000 or thereabouts (being the estimated cost up to June 30th, 1913, of the new turbo and other extensions), the present issue will provide £58,000 in cash for the general purposes of the company, including further extensions, and for the expenses of this issue.

**Pulford Bros., Ltd.**—The fifteenth annual meeting was held at the office, 108, Whitechapel, Liverpool, on June 5th. We are informed that Mr. Egerton G. Pulford, who presided, reported that the business during the past year again showed a satisfactory increase. Resolutions declaring a dividend of 30 per cent., free of income-tax for the year ended March 31st last, and carrying the balance to reserve account, were passed. The chairman also reported that a contract had been signed to purchase 106 and 108, Whitechapel, with a view to rebuilding the premises to suit the growth of the company's business. At an extraordinary general meeting held immediately afterwards it was resolved to increase the capital by issuing 3,000 6 per cent. cumulative preference shares of £1 each.

**Bahia Tramway, Light and Power Co.**—Sir Wm. Plender presided at a meeting of the holders of the 5 per cent. 50-year first mortgage gold debentures held at Winchester House, E.C., on 5th inst., when the contract for the sale of the company's properties to the municipality of Bahia was ratified. Bondholders receive approximately £58 for each \$500 debenture.

**Official Announcements re Companies.**—The following companies have been struck off the Register, and are accordingly dissolved:—

Bartons Light Cure Institute.  
Carnarvonshire Electric Traction Syndicate.  
Empire Electric Light and Power Co.  
Improved Electric Supplies.

Unless cause is shown to the contrary, the following companies will be struck off the Register at the expiration of three months:—

Haste Pump Co.  
Midgley's Electro-Therapeutical Co., Ltd.  
Motor Traction Co. (1905), Ltd.

**Victoria Falls and Transvaal Power Co., Ltd.**—The directors have declared a dividend on the preference shares at the rate of 6 per cent. per annum for the year ended December 31st, 1911.

**Western Telegraph Co., Ltd.**—Third quarterly interim dividend of 3s. per share, free of income-tax, for the year ending June 30th, 1913, being at the rate of 6 per cent. per annum.

### British Electric Traction Co., Ltd.

The directors' report, which is to be submitted at the annual meeting at the Holborn Restaurant, on Monday, June 16th, states that during the year ended March 31st, 1913, good progress has been made by the Associated Companies in regard to tramway traffic, the sale of electricity for light and power purposes, motor-omnibus services, and in other respects. The total traffic receipts on the lines which were in operation both last year and the preceding year show an increase for last year of £61,467, and the number of passengers carried an increase of 13,607,818. The aggregate traffic receipts were £1,749,246, as compared with £1,770,748 for 1911, a decrease of £21,502. The aggregate of passengers carried also shows a small decrease, but these decreases are due to the company's interest in several undertakings having been disposed of. The electricity supply receipts amount to £353,002, an increase of £35,564 as compared with 1911. The directors consider that the increases in the gross receipts from both the traffic and electricity supply branches of the business are satisfactory, but they regret that the net profits of the Associated Companies have not increased proportionately to the larger volume of business. The coal strike, the strike of transport workers and other labour troubles, have abnormally increased the cost of fuel, materials and stores of all kinds.

"The directors have for some time past felt that the advent of the modern and improved motor-omnibus would still further discourage the extension of tramways and light railways in Great Britain, and in some cases would have an important bearing on the profits of existing undertakings. There is a large scope for the employment of motor-ombuses, especially in London, where the tramways do not, as is the case in provincial towns, serve the central and most populous areas, while in the provinces the cost of permanent way for tramways to serve outlying and sparsely populated places is not justified under existing legislative conditions. The Associated Companies have accordingly taken steps to provide a number of motor-ombuses for working in connection with their tramways, and the British Automobile Traction Co., which is practically owned by this company, is establishing and developing motor-omnibus systems in districts not served by tramways and light railways. It is the policy of that company to assist local undertakings and to work in co-operation with local authorities and railway companies." The directors go on to refer to arrangements made with the L. G. Omnibus Co. in regard to motor-omnibus and other traction business in London and the provinces, and to the formation of the London and Suburban Traction Co.

The last-named company will control 123 miles of line, and several important electricity supply undertakings, and will operate, either directly or through its Associated Companies, about 380 motor-ombuses. The British Automobile Traction Co. is also operating a fleet of motor-ombuses in London and the suburbs.

The British Canadian Power Co., in which as stated in the last report the company had taken an important participation, has during the year been amalgamated with the Northern Ontario Light and Power Co., by means of an exchange of bonds and common stock of the British Canadian Power Co. for bonds, preference stock and common stock of the Northern Ontario Light and Power Co. The latter company has an issued share and debenture capital of over 11,500,000 dols., and is the only company supplying electric power, compressed air and electric light in Cobalt and the surrounding districts. The yield on the company's holding shows a good return on the cost at which it stands in the books of the company. Arrangements have been completed for the formation of a syndicate, in which the company has retained a substantial participation, for providing additional capital for the Maritime Coal Railway and Power Co. in the Province of Nova Scotia. The reports of the company's representatives and other experts who have examined the property are favourable. The company has in conjunction with Brazilian interests formed the Rio Grandense Light and Power Syndicate, Ltd., with a subscribed capital of £100,000. The syndicate has contracted to purchase the concession for electric tramways, lighting and power in the town of Pelotas in the Province of Rio Grande do Sul, Brazil, and the works are now under construction. The syndicate has also obtained options upon other electric undertakings in the same district.

Negotiations are proceeding with regard to the establishment of other undertakings in England and abroad. The cost of these negotiations has been included in the expenses of the year and debited to revenue account.

The Electrical and Industrial Investment Co. is now established with a subscribed share and debenture capital of £480,000.

Increased dividends have been paid by the following companies, viz.: Airdrie and Coatbridge Tramways, Auckland Electric Tramways, Birkdale District Electric Supply, Birmingham District Power and Traction, Bombay Electric Supply and Tramways, Devonport and District Tramways, Gateshead and District Tramways, Greenock and Port Glasgow Tramways, North Metropolitan Electric Power Supply, Tramways and Light Railways Estates, and Yorkshire (Woolfen District) Tramways, and several other Associated Companies show improved results. There are, however, few companies which show diminished profits. The investments and undertakings of the company have in several instances been materially improved as the result of negotiations and agreements with local authorities and in other ways which are not reflected in the present accounts. The work done by the Federation for the Associated Companies is proving of great advantage in such matters of common interest as mutual insurances, rating and assessments, collective purchases of stores, the securing of advertisements on cars and the development of parcels carrying business. During the year the company's interest in the Leamington and Warwick Electrical Co. has been sold for cash, and the Hartlepool

Electric Tramways Co. has been liquidated on sale of the tramways to the Corporation. The difference between the amounts at which the investments stood in the books of the company and the proceeds of these sales has been debited to reserve.

The gross profit for the year amounts to £210,880, as compared with £195,040 for 1911-12. After deducting management expenses and other charges, including the expenditure during the year on surveys and negotiations in regard to new business, there remains a balance of £189,712 plus £10,751 brought forward. After deducting debenture stock interest, £91,407, there remains a balance of £108,657. The revenue account has been debited with £7,732, being the amount reserved against or written off various assets. This includes £1,000 in respect of goodwill, which item now disappears from the accounts, and £1,500 in respect of previous expenditure on surveys and negotiations, reducing that item in the balance-sheet to the nominal amount of £1,000. The directors have in addition placed £40,000 to reserve for depreciation, and they recommend the payment of the dividend for the year upon the 6 per cent. cumulative preference stock and a dividend of 3 per cent. upon the 7 per cent. non-cumulative preference stock, together amounting to £48,431, carrying forward £12,193. During the year the directors purchased in the market and cancelled £5,100 5 per cent. perpetual debenture stock and £18,265 1½ per cent. second debenture stock of the company. The outstanding debenture stocks have been reduced by these amounts and the difference of £4,368 between the nominal value and the purchase price has been added to reserve. Investments and undertakings, after deducting the reserve for depreciation, stand at £4,696,053. The yield for the past year was 4.11 per cent. as compared with 3.77 per cent. for the preceding year on £4,695,103. Investments which stood in the books at March 31st, 1912, at a cost of £472,994 were realised during the year, while investments were acquired during the year which stand in the books at £404,185.

The reserve against depreciation of investments has been increased by £4,368 in respect of debenture stocks purchased and cancelled; by £9,115 profit on sale of sundry investments, and also by £40,000 transferred out of the profits of the past year. The reserve has been debited with £124,759, being the deficiency in book value on realisation of the Leamington and Hartlepool undertakings above referred to, sale of Consols and other investments, and sundry investments written off. The balance at credit of this account is now £552,457, which amount is shown in the balance-sheet as a deduction from the amount at which the investments and undertakings stand in the books. There are additional reserves against specific assets of £64,299, and a balance carried forward amounting to £12,493. The reserves of the Associated Companies, including the balances carried forward, amounted at December, 1912, to £1,128,444.

### Imperial Tramways Co., Ltd.

The directors report as follows for the year ended December 31st last.

Middlesbrough, Stockton and Thornaby Electric Tramways.—The gross receipts were £56,719, as compared with £56,686 for the preceding year, an increase of £33. Passengers carried were 11,214,750, against 11,221,628, a decrease of 6,878. Net profit £17,413, as compared with £13,305. The work of reconstructing the permanent way has been continued, with the result that during the last two years two-thirds of the track has been re-laid. The reconstruction of the remaining portions is being proceeded with, and it is expected that the work will be completed by the end of the summer.

The working of the Corris Railway Co.'s undertaking shows an increase in net profit of £34.

The scheme for the consolidation of the interests of the London United Tramways with those of other companies is referred to.

The opportunity having offered of disposing of a portion of the company's investment in the London United Tramways, Ltd., the directors decided to reduce the holding in that company by selling 20,000 shares out of the 44,446 5 per cent. £10 preference shares. They hope to obtain an improved return upon the re-investment of the sum thus realised, whilst it is anticipated that the amount remaining in the London and Suburban Traction Co., Ltd., will contribute its quota to the future revenue.

The scheme of arrangement has received the sanction of the High Court, and accordingly the arrears of dividend on the preference shares to December 31st, 1911, have been cancelled and the ordinary shareholders have relinquished their exclusive rights to the ordinary shares dividend fund, which will in future form part of the dividends equalisation fund applicable to maintenance of the dividends on both preference and ordinary share capital. It has been deemed advisable to write down the investment in the London United Co., and £85,000 has been transferred from the reserve fund for renewals and contingencies for that purpose. The reserve funds will therefore now stand as follows:—For renewals and contingencies, £23,872; for Middlesbrough S. & T. renewals fund, £11,500; for dividends equalisation fund, £29,750.

In view of the various changes, information will doubtless be desired as to the future prospects of the company, and the directors therefore state that in their opinion the shareholders may now look for the regular payment of the preference dividend and the maintenance of at least 4 per cent. on the ordinary share capital, and in arriving at this conclusion they have only taken into account the receipt of dividends on the preference portion of the holding in the London and Suburban Traction Co., though there is no reason to doubt the statement made by the new company that there will also be a fair return upon its ordinary share capital.

The revenue account for the year shows an available amount of £24,256, and after payment of interest on debenture stock for the whole year there is a balance, including £7,678 brought forward, of £19,221, which the directors recommend should be appropriated as follows:—Dividend at 6 per cent. for the year on the preference capital, £11,300; dividend at 4 per cent. for the year on the ordinary capital, £7,533, carrying forward £388.

**United Electric Tramways of Monte Video, Ltd.**

THE directors' report for the year to March 31st, 1913, contains the following particulars of results of the operation of the tramway system for the year to October 31st, 1912 (the fiscal year of the Uruguayan Co.)—

	1911-12.	Increase over 1910-11.
Gross receipts .. .. .	\$1,627,696	\$224,436
Operating expenses .. .. .	794,852	140,160
Net receipts .. .. .	\$892,784	\$84,276
At exchange of \$47 to £. . . . .	£147,401	£17,991
Passengers carried .. .. .	40,736,202	6,074,064
Car-miles run .. .. .	7,079,175	721,118
Percentage of operating expenses to gross receipts .. .. .	57.44	'81

The increase in the ratio of working expenses to gross receipts is partly accounted for by the increase in rates of wages granted by the company having been in operation during the whole year, as compared with a period of about five months of the previous year. Fuel costs were also increased as a result of the coal strike in this country. The results for the year, however, again show satisfactory expansion. The extension of the Colon line was completed during the year under review, and has been in operation since June 20th, 1912. This increases the total mileage of the system from 86½ to 88½ miles of single track. The additional rolling stock has been in use since December, 1912. Sites have been secured for the erection of two sub-stations, and the necessary plant has been ordered. To increase the accommodation for rolling stock, a new car-shed is in course of erection. The existing central car-shed is also being extended, so as to provide additional space for repair and paint shops. Considerable expenditure will be necessary during the next year or two in connection with an extensive scheme for repaving of streets which has been commenced by the Municipality of Monte Video. These works will cause a temporary interference with some of the company's services. The amount received from La Sociedad Commercial de Monte Video in respect of dividend and interest was £138,084. The profit and loss account for the year, after providing for administration expenses, and charging £44,440 for debenture interest, shows a credit balance of £87,721. Adding £13,467 brought forward there is a total to be dealt with of £101,188. The following amounts have been set aside:—For redemption of debenture stock, £2,810; for redemption of the preference and ordinary share capital, £2,500; for renewals and contingencies, £30,000. Interim dividends were paid in December at the rate of 6 per cent. on the preference and 6 per cent. on the ordinary shares, absorbing £24,041. The directors now recommend dividends for the half-year to March 31st, 1913, on the preference shares, at the rate of 6 per cent. per annum (£12,712), and on the ordinary shares, at the rate of 8 per cent. per annum, making 7 per cent. for the year (£15,104), leaving to be carried forward £14,020.

The meeting will be held in London on June 16th.

**STOCKS AND SHARES.**

Tuesday Evening.

STOCK Exchange markets are passing through an extremely uncomfortable—not to say grave—period, and although the sentiment alters a little from day to day, for the last week it has leaned strongly to the side of flatness. Put in a nutshell, the causes of the trouble are nothing more sensational than our old friends the Balkans War and new issues, although arising out of these there are a variety of minor reasons which have contributed to the slump in speculative departments. On all hands one hears the question asked whether or not the Stock Exchange is drifting towards panic; and, viewed with what impartiality can be expected from members of the House, the position is generally declared to be one which is susceptible of being weathered without panic supervening. For all that, brokers and jobbers alike will sleep more comfortably in their beds after the turn of the present week.

The markets with which these notes are concerned have suffered in company with the rest of the Stock Exchange. The slump in Home Rails swept Metropolitan to 45½, a fall of 3½ on the week. Surplus Lands stocks losing 1 at 62. Districts fell 2½, Great Northern and City Preferred ½ to 2, Central London Preferred 4, the Ordinary and Deferred 2 points apiece. It is not as though the falls were confined to this week's list of prices; they follow upon heavy declines previously, and it is this cumulative flatness which weighs so heavily upon the markets. Various causes are assigned to account for the various falls. In Metropolitan, for instance, the weakness is said to be due to the opposition that is to be offered to the company's absorption of the Great Northern

and City line, though a little reflection would, no doubt, remark as anomalous the drop in the shares of both companies concerned.

The truth of the matter is that in any stock where a "bull" account exists, stale holders have been doing their best to get out while they were able. The news that the London and South-Western electrification is about to be taken in hand made no difference to the prices of the stocks of that company; while the issues of the British Westinghouse Company, which has secured the contract, are unchanged. Possibly the sharp improvements of the past fortnight in Westinghouse may be due to advance buying on the expectation that the company would be given this important work.

It is not only ordinary stocks which have given way amongst Home Rails, but a number of the more gilt-edged varieties are down also, as may be seen by a reference to our lists. British Electric Traction are reasonably steady on the issue of the report, but three of the stocks are ½ to 1 lower.

The market for English Electricity Supply shares is weak, for no reason other than that money has to be provided by the sale of actual investments in order to pay for other obligations. The dullness this week has affected more particularly the preference shares of the various companies, losses being sustained by those issues in the Westminster, Metropolitan, Edmundsons' and City of London Companies. "City Lights" ordinary have dropped to 15½, the other ordinary shares in the catalogue maintaining their quotations with a good deal of firmness. One or two of the Debenture stocks, however, show small falls; and, like a good many investment securities round the Stock Exchange at the present time, it is difficult to deal readily in some of those stocks where the market is not distinguished for its freedom in the ordinary way. The prospectus of the Debenture issue by the Midland Electric Corporation is out this week; advance particulars were given here last month.

The report of the Bombay Electric Tramways Company caused some little disappointment. It had been thought from the dividend announcement, which raised the rate from 3 per cent. to 5 per cent., that a better showing would be made. Perhaps the optimists expected a little too much, for certainly the company is doing very well; and it is remarkable in these days, when securities are offered to pay such big rates of interest, that Bombay Tramway should stand at 13½, at which the return is but 3½ per cent. on the money. The 6 per cent. Preference pay 5½ per cent.; but as the part of the recent buying of the Ordinary came from India, evidently the local investors have a high opinion of the undertaking.

The Anglo-Argentine Tramways group is a little dull, the last-issued Debentures showing slight falls, while City of Buenos Ayres Trams are ½ lower. No change occurred in United Electric Tramways of Monte Video upon the appearance of a report showing fine progress. Para Electric Trams are easier, both as regards the Ordinary and Preference.

News from Mexico is not bad, but the market in Mexican Power and similar concerns remains subservient to the depression prevailing through the rest of the House. In consequence of this, Mexican Light and Power Common show a loss of 5, and the 5 per cent. Mortgage bonds are down 2½, the yield at their present quotation being over 5½ per cent. on the money. In view of the security which these offer, the return looks tempting, for the lately-issued report was quite a good one. In view of the fact, however, that the Mexican Government itself is about to issue a 6 per cent. loan at 96½, upon which the return, taking redemption into account, will work out to 6½ per cent., it is not surprising that bonds in the utility companies should suffer by comparison. At the same time, some investors take it as axiomatic that a well-secured bond from an industrial corporation may in some circumstances form a better security even than that offered by the loans of the country itself in which the company's works is situated.

Montereys are a point down, and Mexico Trams lost 2. A decline of 10 is marked in Montreal Light and Power shares, Shawinigan Water fell 4, Canadian General Electrics 3, these high-priced shares offering a target for the sellers. Brazil Traction Ordinary have undergone sharp changes during the past few days, and at 88, the price is 4 points down on balance, while Rio Tramways Second Bonds are 3½ lower at 90. The Victoria Falls Power report failed to realise some of the "bulls'" anticipations, and the price is dull at 17s. 6d. sellers.

The Telegraph market is troubled by realisations of actual stock on behalf of people who want money. The Eastern group is depressed, and Western Telegraphs are ½ down. New York 4½ per cent. bonds shed 1. The quotation for West India and Panama shares is broadened by the dropping of the lower price. United River Plate Telephones have gone back to 63; and the Anglo-American Telegraph division continues to shrink. Marconi were, of course, unaffected by the decision in the Chesterton case. The price has again dwindled, Canadians going back to 10s., Americans to 13s. 9d. Men in the market were not the only ones to be amused by the tone of Lord Murray's replies to Sir Albert Spicer's invitation to come back before July in order to give evidence before the Marconi Commission.

The Manufacturing section presents few alterations. Castner-Kellners are a little easier, and it has already been remarked that the British Westinghouse issues retain their previous rises. Opposition is offered to the Edison & Swan scheme. The price of the "A" shares is nominally nothing to ½, but some of the shareholders have been trying to rid themselves of the liability by offering to give money, if they can find a buyer who will take it, with their shares. The Rubber department is as weak as the rest of the Stock Exchange; and it is noteworthy that the issue of Preference shares by the Armstrong, Whitworth Company the other day resulted in the underwriters being left with 55 per cent. of their obligations,

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for	Closing Quotations June 10th.	Rise or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for	Closing Quotations June 10th.	Rise or Fall	Present Yield p.c.	
Bournemouth & Poole, Ord.	10	1911. 5	93-104	..	2 5/8	Kensington & Knightsbridge, Ord	5	1911. 8	71-72	..	5 1/2	
Do. 4 1/2 % Pref.	10	4 1/2	83-94	..	4 1/4	Do. 4 % Deb.	5	4	90-92	..	4 5/8	
Do. Second 6 % Pref.	10	5	10-10 1/2	..	5 1/4	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 1/2	78-80	..	5 1/2	
Do. 4 1/2 % Deb. Stock	Stock	4 1/2	86-98	..	4 11/10	London Electric, Ord.	8	2 1/2	14-17	..	4 7/8	
Brompton & Kensington, Ord.	5	10	4 1/2-4 3/4	..	5 6/8	Do. 6 % Pref.	6	5	5-5 1/2	..	5 1/7	
Do. 7 % Cum. Pref.	5	7	8 1/2-8 1/2	..	4 0/0	Do. 4 % First Mort. Deb.	Stock	4	4	90-98	-1	4 6/1
Central Electric Supply, 4 % Guar. Deb.	100	4	84-97 1/2	..	4 2/0	Metropolitan	5	4	41-42	..	5 6/8	
Charing Cross, West End & City	5	5	4-4 1/2	..	5 11/1	Do. 4 1/2 % Cum. Pref.	5	4 1/2	41-42	..	4 17/4	
Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2-4 1/2	..	4 17/4	Do. 4 % First Mort. Deb.	Stock	4 1/2	92-102	..	4 8/8	
Do. "City Undertaking" 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2-4	..	5 12/0	Do. 3 1/2 % Mort. Deb.	Stock	8 1/2	80-83	-1	4 1/4	
Do. Do. 4 % Deb.	100	4	91 1/2-93 1/2	..	4 5/7	Midland Electric Corporation	100	4 1/2	101-104	..	4 6/7	
Chelsea, Ord.	5	5	4 1/2-4 1/2	..	4 15/8	4 1/2 % First Mort. Deb.	100	5	93-101	..	4 19/0	
Do. 4 1/2 % Deb.	5	4 1/2	95-99	..	4 10 11/11	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	5	93-101	..	4 19/0	
City of London, Ord.	10	8	15-16 1/2	..	5 9/10	Notting Hill, 6 % Non-Cum. Pref.	10	6	8-10 1/2	..	5 11/7	
Do. 6 % Cum. Pref.	10	6	11 1/2-12 1/2	..	4 10/10	Oxford	5	12	6 1/2-6 1/2	..	5 18/9	
Do. 5 % Deb.	Stock	5	116-120	..	4 8/4	St. James' and Pall Mall, Ord.	5	10	10 1/2-10 1/2	..	5 12/8	
Do. 4 1/2 % Second Deb.	100	4 1/2	100-102	..	4 8/8	Do. 7 % Pref.	5	7	7-7 1/2	..	4 18/8	
County of London, Ord.	10	6	10 1/2-10 1/2	..	5 10/4	Do. 3 1/2 % Deb.	100	8 1/2	8 1/2-8 1/2	..	4 0/6	
Do. 6 % Pref.	10	6	11 1/2-12	..	5 0/0	South London, Ord.	5	6	2 1/2-3 1/2	..	7 7/8	
Do. 4 1/2 % Deb.	Stock	4 1/2	104-106	..	4 5/0	Do. 5 % First Mort. Deb.	100	5	98 1/2-101 1/2	..	4 18/6	
Do. 4 1/2 % Second Deb.	Stock	4 1/2	98-101	..	4 9/1	South Metropolitan, 7 % Pref.	1	7	7-7 1/2	..	5 17 11/11	
Edmundson's, Ord.	23	Nil	..	..	Nil	Do. 4 1/2 % First Deb. Stock	100	4 1/2	96-100	..	4 10/6	
Do. 6 % Cum. Pref.	5	Nil	..	..	3 6/8	Urban, Ord.	23	Nil	..	..	..	
Do. 6 % Non-Cum. Pref.	100	4 1/2	83-85	..	5 4/8	Do. 5 % Cum. Pref.	5	2	1-2 1/2	..	..	
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	83-85	..	5 4/8	Do. 5 % Deb. Stock	100	4 1/2	81-87	..	5 3/6	
Folkestone	5	5	4 1/2-5	..	6 0/0	Westminster, Ord.	5	10	10-10	..	5 14/8	
Do. 5 % Cum. Pref.	5	5	4 1/2-5	..	5 0/0	Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2-5 1/2	..	4 5/9	
Do. 4 1/2 % First Deb.	100	4 1/2	90-92	..	4 17/10							
Hove	5	9	7 1/2-7 1/2	..	5 16/2							

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	5-5 1/2	..	6 14/8	Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	6	79-82	-1	6 2/0
Do. 5 % Pref.	5	5	4 1/2-5 1/2	..	5 17/3	Montreal, Lt., H. and Power	\$100	8	9 1/2	210-220	-10	4 1 1/10
Calgary Power, 1st Mort. Bds.	100	5	95 1/2-96 1/2	..	5 6/8	Northern, Lt., Powers and Coal, 5 % 1st Mort. Bonds	\$600	5	5 1/2	15-25	..	..
Canadian Gen. El. Com.	\$100	7	118-123	-1	5 13/10	River Plate, Ord.	Stock	10	10	207-217	..	4 8/0
Do. 7 % Pref.	\$100	7	118-123	-1	5 13/10	Do. 6 % Non-Cum. Pref.	Do.	6	6	102-107	..	5 9/1
Coroiba Lt., Power and Tl., Ord.	100	5	94-96	..	6 4/2	Do. 5 % Deb. Stock	Do.	5	5	100-102	..	4 18/0
Elec. Lt. and P. of Cochabamba, 3 % Bonds	100	6	95-97	..	6 3/4	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	4 1/2	100-102	..	4 8/3	
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	90-93	..	5 7/6	Shawigan Water, Capital	\$100	5	5	129-133	-4	8 15/2
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5	93 1/2-95 1/2	..	5 4/9	Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	107-103	..	4 11/9
Georgetown Elec. P. and Lt., Ord.	10	Nil	..	..	Nil	Do. 4 1/2 % Per. Deb.	Stock	4 1/2	4 1/2	97-100	-1/2	4 10/0
Do. 6 % Pref.	1	6	..	..	10 13/4	Toronto Power, 4 1/2 % Deb.	Do.	4 1/2	4 1/2	99-101	..	4 9
Kaminitiquila Power, 5 % G. Bs. Madras, Ord.	\$500	5	100-102	..	4 18/0	Vera Cruz Lt., P. and Tl., 5 % 1st Mort. Deb.	100	5	6	93-95	+ 1/2	5 5/5
Melbourne, 6 % 1st Mort. Deb.	100	5	108-106	..	4 14/4	Victoria Falls Power, Pref.	1	11 1/2	17 1/2	..	..	
Mexican El. Lt., 5 % 1st M. Bds.	100	5	80-83	..	5 16/1	West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106-108	..	6 11
Mexican Lt. & Power, Common	\$100	4	67-70	..	6 13/4							
Do. 7 % Cum. Pref.	\$100	7	96-102	..	6 17/3							
Do. 5 % 1st Mort. Gold Bds.	..	6	87-90	-2 1/2	5 11/1							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4 1/2	67-73	..	6 2/0	Monte Video Telephone, Ord.	1	6	6 1/2	1-1 1/2	..	5 6/8
Do. 5 % Deb. Red.	Stock	5	5	87-99	..	6 1/0	Do. 6 % Pref.	1	5	5	3-3 1/2	..	5 14/8
American Teleg. & Teleg., Cap.	\$100	8	8 1/2	129-132	-2	6 1/2	New York Teleg., 4 1/2 % Gen. Bds.	100	4 1/2	4 1/2	96 1/2-97 1/2	-1	4 13/4
Do. Collat. Trust	\$1000	4	4	82-94	..	4 5/1	Oriental Teleg. and Elec.	1	8	10	1 1/2-1 1/2	..	5 10/2
Anglo-American Telegraph	Stock	8	8	61-64	..	4 13/9	Do. 6 % Cum. Pref.	1	6	6	1 1/2-1 1/2	..	4 16/0
Do. 6 % Pref.	Do.	6	6	107 1/2-109	-1	6 10/0	Do. 4 % Red. Debr.	Stock	4	4	88-90	..	4 8 11/11
Do. Def.	Do.	80 1/2	30 1/2	23 1/2-24	..	6 5/0	Pacific and European Tel., 4 % Guar. Debr.	Do.	4	4	98-100	..	4 0/0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	104-106	..	4 15/3	Reuter's Submarine Cables Trust	10	10	10	10 1/2-10 1/2	..	9 0
Chill Telephone	5	7	8	7 1/2-7 1/2	..	5 1/1	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	Cerb.	6	6	124-127	..	4 14/6
Commercial Cable, 8 1/4 % Deb.	Stock	4	4	84-86	..	4 13/0	United River Plate Telephone	5	8	8 1/2	6 1/2-7	..	5 14/4
Cuba Telegraph	10	6	6	84-84	..	6 6/4	Do. 5 % Cum. Pref.	5	5	5	6 1/2-6 1/2	..	4 9/0
Do. 10 % Pref.	10	10	10	15 1/2-15 1/2	..	5 19/4	West Coast of America	2 1/2	2 1/2	2 1/2	1 1/2-1 1/2	..	4 7/0
Direct Spanish Telegraph, Ord.	5	4	4	81-82	..	5 8/8	Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel.	100	4	4	96-99	..	4 0/10
Do. 10 % Cum. Pref.	5	10	10	62-72	..	6 12/0	West India and Panama Teleg.	10	1 1/2	1 1/2	2 1/2-3	..	4 3/4
Direct United States Cable	10	5	4	5 1/2-6 1/2	..	6 5/6	Do. 6 % Cum. 1st Pref.	10	6	6	3 1/2-10	..	6 0/0
Direct W. India Cable, 4 1/2 % Reg. Deb.	100	4 1/2	4 1/2	99-101	..	4 9/0	Do. 6 % Cum. 2nd Pref.	10	6	6	6 1/2-9 1/2	..	6 0/0
Eastern Telegraph, Ord. Stock	Stock	7	7 1/2	123-131	-1	5 6/10	Do. 5 % Debs.	100	5	5	10 1/2-10 1/2	..	4 17/1
Do. 8 1/2 % Pref. Stock	Do.	8 1/2	8 1/2	7 1/2-7 1/2	..	4 11/6	Western Telegraph, Ltd.	10	7	7 1/2	12 1/2-13 1/2	..	4 5/8
Do. 4 % Mort. Deb.	Do.	4	4	90-92	..	4 7/0	Do. 4 % Deb.	Stock	4	4	92-94	..	4 5/1
Eastern Extension	10	7	7 1/2	123-128	..	5 11/0	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	4 1/2	90-93	..	4 16/9
Do. 4 % Deb.	Stock	4	4	92-94	..	4 5/1							
East and S. Africa Tel., 4 % Mt. Db. Maritime Sub.	26	4	4	98 1/2-100 1/2	..	3 11/7							
Globe Telegraph and Trust	10	6	6 1/2	11 1/2-11 1/2	..	5 3/3							
Do. 6 % Pref.	10	6	6	12 1/2-12 1/2	..	4 13/2							
Great Northern Telegraph	10	18	20	30 1/2-32 1/2	..	6 8/1							
Indo-European Telegraph	25	13	13	56-58	..	5 12/1							
Mackay Companies Common	100	5	5	83-86	..	5 16/3							
Do. 4 % Cum. Pref.	\$100	4	4	69-72	..	6 11/1							
Marconi's Wireless Telegraph	1	20	..	..	..	6 1/7							
Do. 7 % Cum. Partic. Pref.	1	17	..	..	..	6 9/8							

\*Unless otherwise stated, all shares are fully paid. † Interim Dividend. 8s. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical railways and tramways in the home market. Columns include Name, Stock or Share, Dividends for, Closing Quotations June 10th., Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations June 10th., Rise or Fall, Present Yield p.c.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical railways and tramways in colonial and foreign markets. Columns include Name, Stock or Share, Dividends for, Closing Quotations June 10th., Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations June 10th., Rise or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table listing manufacturing companies. Columns include Name, Stock or Share, Dividends for, Closing Quotations June 10th., Rise or Fall, Present Yield p.c., Name, Stock or Share, Dividends for, Closing Quotations June 10th., Rise or Fall, Present Yield p.c.

\* Unless otherwise stated, all shares are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

## THE PROGRESS OF THREE-PHASE TRACTION ON RAILWAYS.

BY "DELTA."

The first practical application of three-phase A.C. for electric traction was the equipping of the Lugano tramways in 1895-6 by Messrs. Brown, Boveri & Co., with three-phase induction motor equipments.

Since that time, the three-phase system has made slow but steady headway, especially in its application to heavy traction and railways. Several small lines were electrified in and around Switzerland, but the adoption of three-phase working by the Italian State Railways for nearly 150 miles of track on their various lines, immediately followed by the successful application of the system in the Simplon Tunnel in Europe and the Cascade Tunnel in America, seems to indicate that it deserves, and will hold, a high place in railway electrification of the future. Wherever the system has been tried it has proved highly satisfactory in operation.

It is the author's intention to set forth the main points to which the induction motor and the three-phase system in general owe their success in the electrification of railways, and, further, to briefly deal with the applications of the system up to the present date.

The relative advantages claimed by the three-phase system of railway electrification may be enumerated:—

1. No commutators are required whatsoever, and all commutation difficulties are obviated. The majority of induction motors used for traction are of the slip-ring type, but the more recent locomotives of Messrs. Brown, Boveri & Co. employ squirrel-cage motors, thus dispensing with everything of the nature of a moving contact.

2. The induction motor is capable of exerting two or three times its full-load torque for starting. The G.E.C. motors for the Cascade Tunnel of the Great Northern Railway Co., of America, are designed to exert three times full-load torque at any speed from standstill to within a few per cent. of synchronism.

3. The efficiency, power factor and speed are constant for a considerable range of output.

4. High voltages are employable on the motors themselves; thus there is no necessity to load up the locomotives with transforming plant. Up to the present, 3,000 volts has only been exceeded in Europe in one case—the Gergal Sante Fe line in southern Spain, which operates on 5,500 volts, but the Cascade Tunnel line in America is supplied from 6,000-6,600-volt trolley wire. The standard voltage adopted by the Italian State Railways is 3,000 volts at 15 cycles.

5. Electrical braking and regenerative control is possible since the motors may be made to run as generators, with their rotors excited from low-voltage D.C., and supply current back to the line. The speed of the motors is then limited to approximately that of synchronism, and this may be made considerable use of, especially on mountain lines and very heavy grades. The tendency to limit the speed should not be affected by the removal of one bow or trolley from contact with the overhead wire.

6. When squirrel-cage motors are used there are no rheostatic losses at starting, and the starting efficiency may be brought up to 97 per cent.

7. By a suitable arrangement whereby resistances may be inserted in the rotor circuits, lost time may be made up on down grades.

8. The comparative cheapness of three-phase generating plant and sub-station plant in comparison with low-tension direct-current plant is yet another advantage of the system under some circumstances.

The advantages of the induction motor system are thus seen to be many, and although the control systems now in use for three-phase work appear to be elaborate, the following table shows them to be comparable in weight with the D.C., and superior to the single-phase equipment.

The disadvantages of the system are:—

1. The necessity of employing two overhead wires which, to some extent, limits the voltage allowable owing to the difficulty of insulating one from the other, especially in tunnels where there is much moisture present. The two

overhead wires are also liable to short-circuit at cross-overs.

2. The increased rail drop consequent on the use of any A.C. system presented another difficulty, which has been, however, largely overcome by the use of a low frequency. The frequency employed on the earlier three-phase railways ranged round 40 cycles. In recent practice 15 and 16 cycles are more generally adopted, as in the case of the Simplon tunnel line.

3. Where heavy trains are employed and two locomotives are used for hauling, it is essential that their wheel diameters should be identical, otherwise they will not share the load.

Both the Italian Westinghouse Co. and Messrs. Ganz and Co. have an ingenious method of overcoming this difficulty by the use of a water resistance in the rotor circuit, in which the water level can be automatically controlled by compressed air.

Yet another feature, repeatedly put forward as a disadvantage, is that induction motors require a very small air-gap to maintain a decent power factor. In the old type 150-H.P.

TABLE I.

Railway.	Weight of loco.	H.P. of loco.	Weight of motors.	Weight of control.	Loco. weight in tons per H.P.	Controller weight in tons per H.P.	System.
Pennsylvania ...	418	4,000	40	17	'037	'0042	D.C.
Detroit River Tunnel	90	1,200	18'8	6'2	'085	'0052	D.C.
New York, New Haven and Hartford ...	90	1,000	26'4	22'1	'090	'0221	1 ph.
Lötschberg Tunnel ...	86	2,000	19'6	22'4	'043	'0112	1 ph.
Simplon Tunnel ...	68	1,700	24'5	10'5	'040	'0062	3 ph.
Valtellina* ...	62	1,500	13'1	18'9	'041	'0126	3 ph.

\* This includes weight of twin L.T. motor for starting.

motors of Messrs. Brown, Boveri and Messrs. Oerlikon the gap was  $\frac{1}{16}$  in. on a 24-in. diameter rotor. In the G.E.C. motors for the Cascade Tunnel  $\frac{1}{4}$  in. air-gap has been allowed, and yet the power factor has been kept up to 80 and 86 per cent. It is obvious that  $\frac{1}{4}$  in. air-gap will allow for a great deal of bearing wear and of the rough usage a railway motor is bound to encounter in the shape of sudden and heavy starting strains. The actual motors, taken all round, are well suited to traction work. This may also be said of the control systems. The series parallel arrangement in direct current work only allows of two economical speeds in which to run the motors:—(1) Full series; (2) full parallel.

This is not the case with induction motors. By suitably arranging the poles so that they may be changed in number, three and four synchronous speeds may be obtained. This is also true where the cascade or concatenated arrangement of motors is used. Hence the induction motor may be provided with two, or more than two, economical working speeds in excess of those which the ordinary D.C. series motor possesses. There is a considerable amount of choice in the control system for induction motors. The simplest is that employed on the earlier locomotives in Europe and more recently on the locomotives in the Cascade Tunnel. This consists of the ordinary secondary rheostatic control, where resistances are placed in the rotor circuit at starting and cut out as the speed increases. Such an arrangement possesses but one economical working speed and allows heavy rheostatic losses.

The next system was that employed in the Simplon Tunnel locos, and also by Messrs. Oerlikon, of changing the number of stator poles as the speed increased. Thus a motor would be started up in the usual manner with control through rotor resistances and run up to full speed as a 16-pole motor. The pole-changer would then change it to an eight-pole motor and re-insert the resistances, which would again be slowly cut out till the motor ran at full speed as an eight-pole motor. Messrs. Oerlikon have in some cases constructed motors capable of four arrangements of poles, thus giving four speeds. For lines where there are frequent stops the arrangement allowed of heavy rheostatic losses as before mentioned, hence Messrs. Ganz & Co. developed the cascade arrangement of motors to suit traction work. They arranged to insert a separate low voltage motor in series

TABLE II.—THREE-PHASE RAILWAYS IN OPERATION.

Railway.	Firm.	L'gth.	Date.	Volts.	Freq.	Locos.	Motor-cars.	H.P. per motor.	No. motors	W'ght.	Max. speed.	—
Burgdorf Thun ...	Brown, Boveri	M. 25'2	1899	750	40	2	—	150	2	30	11'2/22'4	Squirrel-cage four-speed motor, with pole-changing device.
Valtellina Railway ...	Ganz & Co.	65'8	1902	3,000	15	2	—	225	4	46	21	Loco. B-B.
			1903			3	—	750	2	62	42	Loco. 1-C-1 Cascade motors
			1905			4	—	1,500 &	2	62	42	Loco. 1-C-1. See text.
			1907			2	—	1,200	2	60'2	30	Loco. -E-. See text.
Simplon Tunnel ...	Brown, Boveri	4'3	1906	3,000	16	2	—	10	2	53	43	Loco. 1-C-1 pole-changing device, 16 and 8-pole and rheostatic control. Loco. D. See text.
						2	—	850	2	—	43'6	
Brunnen Morschbach ...	Oerlikon	1'7	1906	750	50	1	—	85	2	—	—	—
Cascade Tunnel ...	American G.E.C.	3'6	1907	6,000	25	4	—	325	4	104	16	Loco. B.B. rheostatic control.
Santa Fe Gugal (Spain) ...	Brown, Boveri	15	1908	5,500	25	5	—	160	2	26	7'8/15'6	Squirrel-cage locos, coupled in pairs.
Campasso Bussala ...	Westinghouse (Italian)	13	1911	3,000	15	40	—	1,000	2	60'2	—	Loco. -E- similar to later Valtellina locos.
Savona Guiseppe ...	Westinghouse	13'5	1911 &	3,000	15	15	—	1,000	2	60'2	—	Same as above.
			1912									
Modane Bardonnuchia Busselero (Tunnel).	Brown, Boveri	32'2	1912	3,500	16½	—	—	—	—	—	—	Loco. at present borrowed from Campasso Bussala line.

with the H.T. motor rotor in starting. This gave an additional economical speed to the loco. Originally, the low voltage motor was built into the same frame as its high voltage companion. The arrangement was used in the earlier Valtellina locomotives with great success, as it gave the locomotive two economical speeds. (1) Full cascade connection; and (2) full short-circuited rotor connection of the H.T. motor. This success led Messrs. Ganz & Co. to still further develop their system. The more recent locomotives of the Valtellina line are equipped with two motors each, one an eight-pole motor and the other a 12-pole motor, each capable of working the train alone, and thus giving two synchronous speeds to the locomotive. A lower synchronous speed is attained by placing the 12-pole motor in cascade connection with the eight-pole machine. Using the H.T. 12-pole motor for cascade connection necessitates its being arranged to work at a reduced voltage. This is done without the aid of any auxiliary transformer by changing the stator windings from their H.T. arrangement of three coils in each phase in series, with the phases star connected, to the lower tension arrangement of three coils in each phase in parallel, with the phases mesh connected.

This cascade arrangement gives a speed equivalent to that of a 20-pole motor. In each arrangement the rotor resistances are cut out in the usual manner, giving a fine regulation of speed. This is done with water resistances instead of rheostine wire, as in the original locomotives. These locomotives then have speeds corresponding to 20, 12 and eight-pole motors, at which they can operate with perfect economy. These actually correspond to 16.26 and 40 M.P.H.

The induction motor for traction is very similar in construction to the ordinary motor used for other commercial purposes. Where the motors have to be placed within the wheel truck, it is necessary to employ recessed bearings. The frame for carrying the laminated core is made as light as possible.

Messrs. Ganz & Co. found they had not room to spare for the slip-rings inside the frame, since it was more necessary to bring the cranks as near the motor as possible, hence the slip-ring leads were carried through the crank to a set of rings outside the frame of the locomotive.

Having dwelt on the most prominent points in connection with the three-phase system, the author will briefly deal with three of the most important undertakings now in operation.

The Valtellina line runs along the shores of Lake Como between Lecco and Callico, with branches to Sondrio and Chiavenna. The electrical equipment is by Messrs. Ganz & Co., and on the motor-cars consists of four motors per car—two high-tension 3,000-volt, 200-H.P. motors and two low-tension 300-volt motors for cascade connection in starting. The frequency is 15.

Three locomotives were also supplied, in the first instance, of the four-axle type, and having a speed of 18½ M.P.H., equipped with two 750-H.P. motors.

Soon, however, some 1,500-H.P. locomotives were added, which had two speeds of 20 and 40 M.P.H. In these locomotives the motors were mounted high up in the cabs, thus securing a higher centre of gravity and also allowing the use of fewer and larger motors. This latter is a great advantage, since, in all traction work, the weight per H.P. of a large motor is always much less than that for an equivalent output in smaller motors.

The power is transmitted to the driving wheels through a form of scotch yoke. Three pairs of 59-in. drivers are coupled together. The yoke which transmitted the power from quartered cranks on the motor shafts, drives down on to the middle pair of drivers through a special sliding bearing which will allow for the vertical movement of the axles independently of the locomotive main structure. Connecting rods to the two other pairs of drivers are taken from the yoke at points near this bearing. This arrangement has proved light in construction and very successful in operation. The control systems have already been dealt with.

2. Following the Valtellina line, the Simplon Tunnel was electrified with three-phase A.C. by Messrs. Brown, Boveri at their own risk, and proved so successful that the international authorities controlling this important line have taken over the system to work the tunnel permanently.

The original locomotives are practically identical in construction with those of the Valtellina line, both being built to the designs agreed upon by the engineers of the governments and firms concerned.

The mechanical construction is by the Swiss Locomotive Co. of Winterthur. These motors had two synchronous speeds of 22 and 44 M.P.H., and employed the usual pole-changing apparatus. Rheostine wire resistances in the rotor circuit allowed speed regulation. The rated output was 1,100 H.P.

Later, Messrs. Brown, Boveri put some further locomotives in service, which have four pairs of drivers and no pony wheels. These are rated at 1,700 H.P., and employ two motors. The motors have no slip rings, and no rotor resistances are used. The stators are capable of having their windings arranged so that speeds corresponding to 16, 12, 8 and 6-pole motors are obtained. This is done by a compressed air operated pole-changer, which, together with an auto-transformer for reducing the heavy current at starting, constitutes the whole of the control apparatus.

3. Outside Europe, little three-phase work has been done, but the Cascade Tunnel of the Great Northern Railroad of America, equipped by the G.E.C., is the exception. These locomotives develop 1,900 H.P., and are operated from 6,000-

4,600-volt overhead lines. However, in their construction simplicity seems to have been the great aim, and economy in service was set aside to gain this.

The motors operate at 500 volts, and the loco. therefore carries transformers to step the line voltage down to this value. The frequency is 25 periods and the speed about 15 M.P.H.

From this summary of the progress of three-phase traction it appears the system is becoming more popular, and the author ventures to predict that the electrification of the future will find the high-tension direct-current and the three-phase systems occupying higher places as rivals to the single-phase system. One advantage of the H.T. D.C. is the great ease with which the voltages may be varied from H.T. in country districts to L.T. in the towns, and yet permit the use of the same equipments. This is not so easily accomplished with the three-phase, and is perhaps one of the greatest limitations of the system. On the other hand, the direct-current system does not allow of so many economical working speeds as the induction motor fitted with pole-changing gear does. This may be a disadvantage in the D.C. system.

Some authorities pay more attention to economy in the construction and operation of the plant up to the trolley wire rather than the actual rolling stock. In this respect the three-phase system possesses many advantages. For any given output the cost of generation and of generating stations is approximately equal, but the three-phase railway sub-station is simply a transformer house, whereas with D.C. it is necessary to employ rotating converting plant often in conjunction with transformers. However efficient these sets may be, they must constitute an additional source of expense. Whether this expense is justified by the simplicity of rolling-stock equipment secured with D.C., is a debatable point beyond the scope of this article.

## ELECTRICAL HEATING.

[COMMUNICATED.]

THE writer's attention has been drawn by the ELECTRICAL REVIEW to the increasing prominence given every year to questions concerning the application of electricity to domestic uses, such as heating and cooking. Almost every electric supply company or Corporation realises the advantages it will reap if only it can popularise the consumption of electricity in this direction, and the larger supply companies and Corporations now give annual exhibitions, with the view of educating the general public to the possibilities and advantages of electricity in the home. There is no doubt that, due to these exhibitions and also to the lower rates per unit now being charged for energy used for this purpose, electricity is being adopted on a larger scale every year by ordinary domestic consumers in this connection. Is this progress as rapid as it might be? Most people will agree that it is not. It is true that supply authorities have to overcome a prejudiced public, which cannot be done in a day, but the lack of progress is also due to the unscientific manner in which the subject has been tackled both by the manufacturers and by those engineers who advocate its use. It is the object of this article to give to those who are interested in this question the conclusions arrived at by the writer as a result of his investigations in this field.

A few years ago the writer had occasion to carry out some research work to investigate the respective merits and demerits of various makes and types of electrical heating apparatus then on the market. The great argument then in favour of electrical heating apparatus was that all the energy expended in the different apparatus was turned into heat, and therefore the heater had an efficiency of 100 per cent. At first sight this argument seemed quite plausible to those who had not given much thought to the question, but it must have occurred to many that it was at least curious that every electrical apparatus, quite irrespective of design, could possibly be equally good and efficient, and that it only remained for the manufacturers to turn out reliable and attractively-designed heaters.

Before going any further it would, perhaps, be just as well if the term "efficiency," as applied to electric heaters

(or any heater, for that matter), were defined. Efficiency used in this sense should be represented by the following equation:—

$$\text{Efficiency} = \frac{\text{Useful heat developed.}}{\text{Heat absorbed in the heater.}}$$

The denominator of this equation is easily determined, as the heat units absorbed per hour is simply the number of B. of T. units consumed multiplied by 3,112. The numerator, on the other hand, is not so easily defined, and can only be arrived at as the result of experiment.

It would appear that manufacturers start away with the idea that the efficiency of any electrical heater is 100 per cent., and that it only rests with them to introduce cheap and attractive designs. This is, of course, a mistake. It is possible to conceive of a convector (non-luminous radiator) placed on the floor of a room in such a position relatively to a ventilator that the convector would take the place of an exhaust fan, and tend to cool the room rather than heat it. For instance, a popular way of testing a convector is to sprinkle some charred paper over the top of the convector and observe whether the paper is blown up to the top of the room or not: if the paper is carried up, the convector is supposed to be very good, as it produces a strong circulation of hot air. Now, imagine there is a ventilator in the ceiling immediately above the convector which can produce this supposed desirable circulation of air: it would be found if the paper test were applied that the paper would be blown to the top of the room and out at the ventilator, and so also would the hot air which was intended to heat the room. A heater of such a type and placed in such a position relatively to the ventilator would be worse than useless.

The foregoing remarks prove pretty clearly that the question of heating cannot be considered apart from the ventilation scheme, that is to say, if it is to be carried out successfully and efficiently. This applies to all heating systems, but especially in the case of electric heating, because if electric heating is to compete successfully with coal and gas fires as to running costs, it must necessarily be run efficiently. We may safely say therefore that electric heaters should be chosen with due regard to the ventilating scheme. As a rule, in most dwelling rooms and offices there is no definite scheme of ventilation, and in such rooms where artificial heating is resorted to a cold draught of air along the floor results.

The next question to be considered is what we mean by an ideal system of heating. It will be generally admitted that the ideal would be a room evenly heated throughout, and thus free from cold draughts, due regard, of course, being given to the ventilation. The temperature in the room should not be any higher than is necessary, in order to keep the body comfortable. Most people will agree that if one's feet are warm, it is a simple matter to keep the rest of one's body warm. A heating system should be such, therefore, that the hottest part of the room is near the floor and not the ceiling. With such a system the rest of the air in a room could be kept at a minimum temperature, which, from a health point of view, is very desirable, as one would not run the same risk of catching a chill by going into the cooler outside atmosphere that one would if the room temperature were excessively high. A heater that can be made to perform the above functions is much to be preferred to one that, however it may heat the air of the room near the ceiling, induces a cold draught near the floor, as this means "hot heads and cold feet." The writer arrived at the above conclusions after carrying out a number of experiments with various kinds and types of electric convectors and radiators. The tests, which were carried out in a small room, consisted of placing a number of thermometers (about 14) in the room in different positions and at different heights, and observing the temperature rise of each after stated intervals, and so determining the manner in which each different device heated the room. None of the heaters which were experimented with heated the room efficiently: some of them heated the ceiling first, and others concentrated the heat too much in one part of the room. After due consideration the writer came to the conclusion that his ideas could only be successfully carried out by means of luminous radiators, as the difficulty with convectors was that it was not possible to direct the heat where it was wanted, whereas radiant heat could by means of suitable reflectors be directed to any part of the

room without difficulty. Some people are inclined to imagine that a certain amount of power is wasted in a luminous radiator because it gives off light: this loss of power is so small, however, that it can be neglected, and is more than counterbalanced by the cheerier appearance obtained.

In order to carry the above ideas into practice a luminous radiator was designed which consisted of an ordinary horizontal radiator lamp having a consumption of 250 watts, placed horizontally and at the focus of a parabolic reflector. The lamp and the reflector were fixed relatively to one another and the reflector which held the lamp was supported on a frame which stood some 12 in. off the floor. The reflector was held in such a manner that it could be tilted so that the heat rays given off could be directed at practically any desired angle with the floor. As the rays given off by such a reflector would be in parallel lines, by tilting the reflector any desired heat density could be arranged. The radiator was purposely designed in small units so that by placing these at suitable points round the room concentration of all the heat at any one point was avoided. In the subsequent tests with this form of radiator, the heaters were placed in such a position, and the reflectors tilted at such an angle, that the floor appeared to be equally well covered by luminous heat. The results obtained were almost exactly what might have been anticipated. *i.e.*, the atmosphere throughout the room was very nearly uniform whilst the hottest part of the room was the floor which was in direct contact with the radiant heat rays. The tests were particularly satisfactory, as they showed that it was possible to utilise all the power absorbed by the radiator as useful heat. Very little heat was given off from the radiator by convection, the reflectors remaining practically cold after the heater had been on for some hours; it was, therefore, safe to assume that all the heat given off was in the form of radiant heat, and as this was all reflected on to the floor the heat was all turned to a useful purpose.

One of the great advantages of radiant heat, apart from its pleasing effect, is that it is not necessary to switch on the radiator for any length of time before using a room, as its full heat becomes apparent directly one comes in line with the heat rays.

One of the chief arguments put forward by opponents to electrical heating (although they admit the system is feasible) is that it is much too costly for the ordinary man in the street. Any such statement can safely be refuted provided that electricity can be obtained at 1d. per unit, as against gas at 2s. 6d. per 1,000 cb. ft., as if electricity is properly applied it is just as cheap as gas.

To take a concrete case where a man has a small office in which he spends most of his time sitting at a roll-top desk; one radiator such as described above placed in the knee hole, screwed to the back and at the top, the reflector being tilted to reflect the heat on to the floor, should prove ample to keep that man warm. The cost per hour with electricity at 1d. per unit is only 1d., and it is doubtful whether either a coal or gas fire could show such good results at the price.

A room having a floor area of 200 sq. ft. should not require more than a unit of electricity per hour to heat it under ordinary winter conditions in England, provided, of course, the heat is used to the best advantage.

The scheme the writer would like to see adopted, and, no doubt, it will some day come along, is that every house should have a proper system of ventilation. A very good form of ventilation to adopt with a heating system such as outlined above, is to draw fresh air in and along one side of the room near the top, and expel the vitiated air by means of an exhaust fan placed in the opposite wall and at the same height. Suitable convectors could be placed in the air inlet, which could be switched on in very cold weather to augment the heat given off by the radiators.

## AGREEMENTS FOR "HIRE" AND "HIRE-PURCHASE."

By "EXCELSIOR."

It is generally recognised that, where the law permits, electrical undertakings should have a department for hiring out motors and other consuming devices whose purchase prices are high. It is incumbent on these undertakings also to see that their interests in this connection are safeguarded from unscrupulous consumers, by having definite regulations laid down for the operation of these appliances, and to have concise terms formulated, so that no dubiety can possibly exist in the consumer's mind as to the conditions under which the "hire" or "hire-purchase" is granted. It is necessary, therefore, that an agreement should be drawn up in each case so that the obligations of both parties may be clearly set forth before the hiring is commenced.

An agreement has been defined as "An act in the law whereby two or more persons declare their consent as to any act or thing to be done or forborne by some or one of those persons for the use of the others or other of them." Some Corporations and Borough Councils are content with the hirer's simple note of hand, while others draw up elaborate instruments and have them embossed with 10s. seals to ensure their legality in case of disputes arising between the hirers and the supply authority.

The validity of an agreement does not, however, depend on the seal which it bears. If it is a simple unsealed document, there must be some worthy consideration for the promises made by either party to the agreement before it can be held as valid; while an agreement under seal is binding even without any consideration. It is not necessary, therefore, to affix a seal to an agreement for the "hire" or "hire-purchase" of a motor or cooker, as both parties have certain obligations to fulfil. A hire agreement, written, printed, or partly written and partly printed, will be held as quite satisfactory in a court of law, provided a sixpenny stamp has been cancelled on the agreement form. The wording should be almost always of a formal nature, expressing the intention of the parties in correct legal language, and avoiding punctuation as much as possible.

The commencement of the agreement should be "An Agreement made," and then the date should follow. After an accurate description of the parties, including the names, residences and occupations, each party may be subsequently indicated by reference to the character in which they enter into the agreement, as "the owners" or "the hirer." The order in which the parties are placed at the beginning should be maintained throughout the document. With regard to the remainder of the agreement, brevity and simplicity will be attained by following the order in which the subject-matter would seem naturally to fall: for example, after the introduction and particular promises of both parties have been set forth, the agreement should wind up with general provisions relating to valuations, arbitration, &c.

In drafting agreements for "Hire" or "Hire-Purchase," extreme conciseness is required, and as far as possible, avoidance should be given to the words "reasonable" and "proper," as these, in many cases, leave the matter open to question as to what is reasonable or proper? In certain instances, however, these terms may be used where the intention leaves no room for doubt. The signatures of both parties should be appended to all agreements, as difficulties often arise in proving assent by the non-signing party. It is not essential that the signature of a party should be attested by a witness, but a testing clause may be added as follows: "In witness whereof the said (parties) have hereunto set their hands the day and year first above written."

An adhesive stamp of the value of sixpence should be cancelled by the person by whom the agreement is last signed. A full inventory of the apparatus supplied on "Hire" or "Hire-Purchase" should be included in the form, and reference to the details should be made in the agreement. If, through any special circumstance, marginal additions or corrections require to be written on the printed form, the initials of both parties must be placed in proximity to the additions or corrections to show their respective concurrence in the alterations. It is better that two copies

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**Electricity in Agriculture.**—The *Fruit Grower* states that very careful trials in electro-culture are being carried out this year at Dumfries and Balmakewan, as well as by the U.S.A. Department of Agriculture, to which a set of Lodge high-tension discharge apparatus has been supplied. The Egyptian Government Department of Agriculture has also a set on order.

of the agreement be made and signed by both parties, each party retaining a copy in his possession. This arrangement is, of course, quite arbitrary, but the consumer considers himself in a safer position when he can refer to the signed agreement should he be in doubt about his obligations at any time.

The following form of agreement has been drafted for the guidance of supply authorities who let out motors and other appliances on "Hire" or "Hire-Purchase" terms. With little correction it may be adapted to suit the requirements of many undertakings whose conditions of hire vary from the conditions given in the specimen form.

HIRE OF \_\_\_\_\_.

An agreement made the \_\_\_\_\_ day of \_\_\_\_\_ between \_\_\_\_\_ (hereinafter called the owners) of the one part, and \_\_\_\_\_ (hereinafter called the hirer) of the other part. Whereby it is agreed as follows:—

1. The owners will let to the hirer a \_\_\_\_\_ (hereinafter called the \_\_\_\_\_) detailed in the schedule hereunder written, to consume electricity from the owners' mains, and on or before the \_\_\_\_\_ day of \_\_\_\_\_ to be placed in the premises occupied by the hirer, situate at \_\_\_\_\_, for the term of one year from the \_\_\_\_\_ day of \_\_\_\_\_ next, at the yearly rental of \_\_\_\_\_, payable quarterly in advance on the \_\_\_\_\_ day of \_\_\_\_\_, the \_\_\_\_\_ day of \_\_\_\_\_, the \_\_\_\_\_ day of \_\_\_\_\_, and the \_\_\_\_\_ day of \_\_\_\_\_, the first payment to be made on the \_\_\_\_\_ day of \_\_\_\_\_ next.

2. The owners will supply and fit up the \_\_\_\_\_ on a foundation to be prepared and paid for by the hirer. The cables, tubing, switches and cut-outs between the owners' service fuses and the \_\_\_\_\_ shall also be provided and paid for by the hirer, and the work will be subject to the conditions and regulations issued by the \_\_\_\_\_ for the wiring of consumers' premises.

3. The owners will, during the period of hire, inspect and examine the \_\_\_\_\_ from time to time, and will replace, on request, such part of the said \_\_\_\_\_ as shall be worn out or destroyed or damaged by damp, or by the use and wear thereof be rendered unfit or unsuitable for the use of the hirer.

4. The owners will indicate by a plate affixed to the \_\_\_\_\_ that the same is the property of the owners, and the hirer shall not remove the plate without the written consent of the owners.

5. The hirer will pay the said rent without any deduction, keep the said \_\_\_\_\_ clean and in good order and condition (in which he admits the same now to be), and preserve the same from injury, except such as may be occasioned by damp or by the use and wear thereof, and deliver up the said \_\_\_\_\_ to the owners, or to such other person as they shall by writing appoint at the end of the hirer's tenancy, clean and in good order and condition.

6. The hirer shall pay the cost of all lubricating oil and carbon brushes, which must be purchased from the owners.

7. The hirer shall permit all servants of the owners to have access to, and inspect, the \_\_\_\_\_ at all reasonable times, every such servant producing to the hirer on demand a card authorising him to inspect the said \_\_\_\_\_.

8. The hirer will not remove all, or any part of, the said \_\_\_\_\_ to any other place or places without the consent, in writing, of the owners, nor without such consent underlet or otherwise part with the possession thereof to any other person or persons whomsoever, unless by law required so to do.

9. In case the said \_\_\_\_\_, or any part thereof, shall be damaged by fire or water, or negligently or wilfully destroyed or rendered useless by the hirer, the hirer will within \_\_\_\_\_ days next after such destruction or damage respectively, either replace the \_\_\_\_\_ or part thereof with a similar article of equal value, or pay unto the owner the full value of such article or articles as shall be so destroyed or damaged.

10. The owners may determine the agreement and take possession of the said \_\_\_\_\_ and for that purpose enter upon any premises on which the same shall be if default is made for \_\_\_\_\_ days in payment of any instalment of \_\_\_\_\_ after the same is due or if the hirer commits any breach of any stipulation hereby made binding upon him.

11. The hirer may determine the hiring at any time by requiring in writing the owners to remove the said \_\_\_\_\_ at his risk and cost and paying up all payments which, at the date of such removal, have accrued due hereunder.

12. The determination of the hiring by either party shall not affect the right of the owners to recover from the hirer all rentals which shall have accrued due at the date of such determination and damages for the breach of this agreement.

In witness whereof the said \_\_\_\_\_ and \_\_\_\_\_ have hereunto set their hands this \_\_\_\_\_ day of \_\_\_\_\_ in the year \_\_\_\_\_.

Signature of Owners .....  
Signature of Hirer .....  
6d. Stamp.

SCHEDULE ABOVE REFERRED TO.

Table with columns for Type of, Maker, H.P., Volts, Amps, R.P.M., Diameter of pulley, Slide rails or bedplate, Type of starting switch, and other appliances.

The "Hire-Purchase" Agreement will be almost identical to the "Hire" form, with the following exceptions:—In Clause No. 1 the words "one year" will be altered to suit the period of hire-purchase, and a conclusion to this clause appended as follows:—

"Upon payment by the hirer of \_\_\_\_\_ quarterly payments of \_\_\_\_\_ each to the owners the said \_\_\_\_\_ shall become the absolute property of the hirer, but until such payment has been made the \_\_\_\_\_ shall remain the sole property of the owners."

In Clauses 4 to 9 inclusive, the phrase "during the period of hire-purchase" should be inserted at a suitable place in the composition. The word "rentals" in Clause 12 should be replaced by the expression "hire-purchase instalments."

Under the Electric Lighting (Amendment) Act, the proprietor's power of distraint does not apply to electrical apparatus on "hire" or "hire-purchase" in a consumer's premises, so that it is not absolutely necessary to obtain the proprietor's signature to the agreement.

The proprietor's consent to the placing of the motor or cooker in the premises should, however, be obtained in writing, and it will add to the effectiveness of the document if a note regarding his power of distraint is also inserted in the proprietor's memorandum. A suitable form is given below:—

PROPRIETOR'S MEMORANDUM.

\_\_\_\_\_ the undersigned, hereby agree to the installation of a \_\_\_\_\_ in the premises at \_\_\_\_\_ occupied by \_\_\_\_\_ and \_\_\_\_\_ also agree that should the tenancy of the within mentioned hirer become determined at any time the within mentioned owners shall be at liberty to enter the said premises and remove the said \_\_\_\_\_ and \_\_\_\_\_ further agree that \_\_\_\_\_ powers of distraint shall not apply to the said \_\_\_\_\_.

Signature of proprietor } .....  
Or agent } .....  
Address .....  
Date .....

Worm-Gear Testing.—A paper read recently by Mr. F. W. Lanchester referred to a new method of testing introduced in a machine built, to the author's design, by the Daimler Co. With its efficiency tests can be made with great accuracy, the average error being probably less than one-tenth of 1 per cent. The National Physical Laboratory certifies the accuracy as within one-fifth of 1 per cent. In the course of his remarks, the author said that many facts of importance had been elucidated by the new method, among them that the loss of efficiency at reduced speeds is far less than previously supposed—in motor-car work it rarely falls below 94 per cent. The importance of lubrication was shown; mineral oils were found inferior to others, the viscosity of the oil is no guide to its suitability, and too much lubricant lowers efficiency. The heavier loads are carried with the best results at high speeds of revolution.

Booming the Electric Motor Vehicle.—Further evidence of the activity of the Electrical Vehicle Association of America in booming the use of electric motor vehicles was seen in the two-day Congress just held in Boston, when about 1,000 central station men were present. Among the papers read was one on "The Growing Popularity of Electrics," by Mr. H. H. Rice; another on "How a Central Station can develop its Electric Vehicle Load," by Mr. W. C. Anderson, and one on "What Service should the Central Station furnish Owners of Electric Cars," by Mr. L. R. Wallis.

Canadian Tariff on Electric Stoves.—The Canadian Customs authorities have lately given a decision to the effect that the duty to be imposed on electric stoves is at the rate of 27½ per cent, ad valorem, under the general tariff, 25 per cent. under the intermediate, British goods being, however, dutiable at only 15 per cent.

## TRADE STATISTICS OF EGYPT, 1912.

THE following statement, showing the imports of electrical and similar goods into Egypt during the year 1912, is taken from the recently-issued trade statistics. The figures for 1911 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1911.	1912.	Inc. or dec.	1911.	1912.	Inc. or dec.
	£E.	£E.	£E.	£E.	£E.	£E.
<i>Steam engines, including boilers, &amp;c.—</i>						
From Great Britain ...	91,000	97,000	+ 6,000			
" Germany ...	15,000	15,000	—			
" Belgium ...	1,000	—	— 1,000			
" France ...	5,000	4,000	— 1,000			
" United States ...	—	1,000	+ 1,000			
" Holland ...	5,000	2,000	— 3,000			
" Italy ...	8,000	8,000	—			
" Switzerland ...	4,000	5,000	+ 1,000			
" Austria-Hungary ...	3,000	15,000	+ 12,000			
" Other countries ...	—	3,000	+ 3,000			
Total ...	132,000	150,000	+ 18,000			
<i>Electric machinery (including gas engines and petrol engines).—</i>						
From Great Britain ...	62,000	78,000	+ 16,000			
" Germany ...	32,000	32,000	—			
" Austria ...	2,000	9,000	+ 7,000			
" Belgium ...	3,000	3,000	—			
" United States ...	2,000	7,000	+ 5,000			
" France ...	8,000	6,000	— 2,000			
" Italy ...	13,000	12,000	— 1,000			
" Switzerland ...	28,000	32,000	+ 4,000			
" Other countries ...	—	2,000	+ 2,000			
Total ...	150,000	181,000	+ 31,000			
<i>Other machinery (except agricultural).—</i>						
From Great Britain ...	116,000	88,000	— 28,000			
" Germany ...	41,000	49,000	+ 8,000			
" Austria ...	3,000	4,000	+ 1,000			
" Belgium ...	3,000	4,000	+ 1,000			
" United States ...	48,000	42,000	— 6,000			
" France ...	37,000	39,000	+ 2,000			
" Italy ...	4,000	3,000	— 1,000			
" Switzerland ...	10,000	4,000	— 6,000			
" Turkey ...	2,000	2,000	—			
" Other countries ...	1,000	3,000	+ 2,000			
Total ...	265,000	238,000	— 27,000			
<i>Railway and tramway carriages.—</i>						
From Great Britain ...	1,000	22,000	+ 21,000			
" Austria ...	19,000	42,000	+ 23,000			
" Belgium ...	11,000	28,000	+ 17,000			
" Other countries ...	—	7,000	+ 7,000			
Total ...	31,000	99,000	+ 68,000			
<i>Lamps of all kinds.—</i>						
From Great Britain ...	8,000	7,000	— 1,000			
" Germany ...	24,000	20,000	— 4,000			
" Austria ...	36,000	32,000	— 4,000			
" Belgium ...	—	1,000	+ 1,000			
" France ...	7,000	11,000	+ 4,000			
" Italy ...	1,000	1,000	—			
" Sweden ...	10,000	6,000	— 4,000			
" Other countries ...	3,000	1,000	— 2,000			
Total ...	89,000	79,000	— 10,000			
<i>India-rubber and gutta-percha, raw or manufactured.—</i>						
From Great Britain ...	7,000	8,000	+ 1,000			
" Germany ...	15,000	16,000	+ 1,000			
" Austria ...	7,000	4,000	— 3,000			
" France ...	13,000	12,000	— 1,000			
" Italy ...	4,000	3,000	— 1,000			
" Switzerland ...	—	1,000	+ 1,000			
" Belgium ...	1,000	1,000	—			
" Other countries ...	2,000	1,000	— 1,000			
Total ...	49,000	46,000	— 3,000			
<i>Electric, telegraphic and telephonic apparatus.—</i>						
From Great Britain ...	50,000	57,000	+ 7,000			
" Germany ...	22,000	20,000	— 2,000			
" Austria ...	19,000	26,000	+ 7,000			
" Belgium ...	11,000	5,000	— 6,000			
" United States ...	1,000	1,000	—			
" France ...	20,000	13,000	— 7,000			
" Italy ...	2,000	3,000	+ 1,000			
" Sweden ...	7,000	5,000	— 2,000			
" Switzerland ...	6,000	3,000	— 3,000			
Total ...	138,000	133,000	— 5,000			
<i>Scientific instruments.—</i>						
From Great Britain ...	19,000	17,000	— 2,000			
" Germany ...	20,000	16,000	— 4,000			
" Austria ...	2,000	1,000	— 1,000			
" United States ...	2,000	2,000	—			
" France ...	14,000	13,000	— 1,000			
" Italy ...	2,000	1,000	— 1,000			
" Switzerland ...	1,000	1,000	—			
" Other countries ...	—	2,000	+ 2,000			
Total ...	60,000	53,000	— 7,000			
<i>Rails.—</i>						
From Great Britain ...	66,000	35,000	— 31,000			
" Germany ...	22,000	60,000	+ 38,000			
" Belgium ...	21,000	21,000	—			
" France ...	5,000	—	— 5,000			
Total ...	114,000	116,000	+ 2,000			
<i>Copper, hammered, drawn or sheet.—</i>						
From Great Britain ...	218,000	160,000	— 58,000			
" Germany ...	7,000	11,000	+ 4,000			
" Belgium ...	1,000	2,000	+ 1,000			
" France ...	10,000	11,000	+ 1,000			
" Other countries ...	2,000	—	— 2,000			
Total ...	238,000	184,000	— 54,000			
<i>Copper manufactured.—</i>						
From Great Britain ...	13,000	17,000	+ 4,000			
" Germany ...	14,000	16,000	+ 2,000			
" Belgium ...	1,000	1,000	—			
" France ...	17,000	18,000	+ 1,000			
" Italy ...	6,000	7,000	+ 1,000			
" Other countries ...	5,000	2,000	— 3,000			
Total ...	56,000	61,000	+ 5,000			

£E = £1 0s. 6½d.

## THE ELECTRICITY SHOWROOM.

By "ATTENDANT."

OF all places of interest and amusement none can compare with an electricity showroom.

Designed entirely for the purpose of advertising the supply company, the showing of new electrical appliances and fittings, and for advocating the general use of electricity, it becomes by force of circumstance converted into a haven and refuge from the weather, an inquiry bureau for any and every subject under the sun, a receiving office for complaints, and has even been used as a medium for practical joking.

The writer, in this short article, is endeavouring to interest his readers by recalling a few of the most amusing incidents which it has fallen to his lot to hear of or to witness.

It has been stated above that the showroom is looked upon by some as a haven in the storm, and it is indeed a fact that not only travellers and contractors, but the public generally often use it for that purpose. Some of these people even go so far as to say that they have just dropped in till the rain has ceased, while others, not so straight-forward, proceed to occupy the attendant in some conversation until the weather outside is more inviting. It is needless to add that these people can always be distinguished from genuine inquirers, for their conversation usually lags, and more often than not bears on any subject other than electricity. Possibly they are under the impression that the duties of an attendant are merely to attend, and they little think that while they are so wasting his valuable time he has other more important matters to deal with.

Sometimes, by way of a change, persons having no intention of purchasing fittings, or even installing electricity at all, will bounce into the showroom with a question such as this: "Is this the only showroom that you have, or is there another upstairs?" Or they will ask, "Do electric heaters give out heat?" and forthwith proceed to warm their chilled bodies. You can nearly always rely on these people being weather-bound, and, the storm having passed over, or they themselves having been sufficiently warmed, they proceed on their journeys feeling, no doubt, a sense of satisfaction at having patronised the Electricity Department, by visiting their showroom and learning a little of the great value of electricity.

It is, however, as an inquiry bureau that the showroom is at its best. Here are a few of the inquiries, some by personal investigation, others over the 'phone:—

A lady called in a certain showroom one afternoon to inquire if they had any houses to let. Still another lady wanted to know if they sold wedges for windows.

By way of variation, a gentleman rang up to know whether there was any electrical means of maintaining a gas flame at a definite height, and how many heat units there were in a unit of electricity. These may be fairly sensible questions, but they are rather a tax on the average showroom attendant.

Another gentleman called in to know "why two lamps burning in series consumed less electricity than one in parallel." He had in this case been instructed by a local contractor, who merely knew that it was so, but could not give the reason. When the absurdity of the proposition was pointed out to him and the true facts were given, he would not believe it, because he said the company did not like series wiring owing to its economy, and, moreover, it was not to the advantage of the contractor to deceive him.

A "Ratepayer" called in one day, and asked, "Is the electricity undertaking run for the benefit of the ratepayers?" On being told that it was so, he wanted to know why there were no mains in the particular street in which he lived. He was then told that the Council did not lay mains for the mere fun of the thing, and could not undertake to do so unless they received some sort of guarantee that it would not be wasted expenditure. He was not satisfied however. He seemed certain that the Council had some ulterior motive in refusing to lay mains except on these terms, and went away in a wrath promising the attendant that he would hear more of the matter. As it was just before the Council election it seems probable that the gentleman wanted his information for some party purpose, but whether that be so or not, no more was heard of a "Ratepayer."

"Do you want to buy a second-hand gas-engine cheap?" Such was the question that fell on the startled ears of an attendant on one occasion. He replied that the showroom was the property of the Electricity Supply Co., and that they did not deal in gas-engines, much preferring electric motors. But the inquirer was unabashed. "I thought perhaps you could use it to drive some of your electrical motors with," he replied, much to the amusement of the man in charge.

The persons who come to pay the gas account or who want a wick to fit the top of some particular make of oil lamp are innumerable; but there is another type of inquirer who pesters the life out of the average showroom attendant.

The showroom is usually situated in some conspicuous place, and it is, perhaps, for this reason that it becomes the happy hunting ground for so many professional canvassers or cadgers, whichever you like to call them. In any case, they number occasionally anything up to six per day, inquiring "would you like to subscribe to this or that?" As the attendant has to keep up a good personal appearance, it may be that he looks wealthy and prosperous; and if that reason suits the case we have, at least from the attendant's point of view, a sound argument in favour of the simple life.

One naturally expects complaints in a showroom, but some of those received can only be described as exceeding the limit. Take the following as an instance:—A reverend gentleman complained one day that the company in laying the electric light next door had broken the flag at the gateway, thereby causing the gate support to tilt over, so that he (the reverend gentleman) could not open or shut his gate. The attendant thought it unlikely that their workmen had been guilty, since, as he pointed out, they did not in any way touch the stone, but simply ran through under it, at a distance of some 3 ft. below it. But the reverend gentleman persisted; he had, in fact, been pointing it out to everybody, telling them "that is what the electricity people do for you," for quite a long time. On asking what his reverence meant by a long time, the attendant was very surprised to hear that it occurred 10 years ago. The chief engineer, who happened to be standing in the showroom, overheard the remark and took up the case, pointing out that it was hardly in keeping with the gentleman's profession to "slang" the Supply Co. for 10 years, and then ask them to repair what might have been an accident on their part.

Almost as curious was the complaint of the lady who wanted the Supply Co. to alter their voltage to suit a kettle she had picked up cheaply. "Why did not all the companies work at the same voltage?" she asked, and indeed why?

There is plenty of scope for practical joking in a showroom, but the following is an example of the worst kind.

A "lady" one day called at one of our suburban showrooms and giving an address in Park Lane ordered a large quantity of elaborate fittings and appliances, none of which were in stock. The attendant, however, was a bit suspicious, and did not get the goods, and it was as well, for although the "lady" promised to look in again on the following Tuesday, she was neither seen nor heard of afterwards.

The following, although it was taken as a joke, was probably not intended as one. A lady called in with a box containing a small bell and battery which she wanted repaired. She was informed that work of that nature was not undertaken by the department, but out of kindness the attendant offered to look at the job, and finding that it required a new battery told the lady to go to a contractor who would supply her with one. Judge of his astonishment when, a little later in the day, he received the following note: "Mrs. ——— regrets that he ——— Borough Council is not capable of mending her small bell."

The writer has endeavoured to select the best out of an almost limitless supply of incidents, but without doubt there are many more favoured persons who could give experiences which would provide even more interesting reading than the examples selected here. However that may be, no one will venture to dispute that the Electricity Showroom is one of the funniest places ever invented.

## PROCEEDINGS OF INSTITUTIONS.

### Röntgen Society.

A GENERAL meeting of the RÖNTGEN SOCIETY was held on June 3rd, when PROF. C. G. BARKLA delivered a lecture on X-ray reflection. This line of work was started, he said, by Friedrich, Knipping, and Laue some months ago in Germany, and these physicists proved that when a beam of X-rays was transmitted through a crystalline structure impressions were obtained on a photographic plate, not only of the direct beam, but of a large number of faint secondary pencils, resulting in a complete interference pattern, as though it might have been produced by a beam of light passing between a series of regularly spaced obstacles. After recounting the work of Bragg, father and son, and others along this line of investigation, Prof. Barkla said that in his own experiments he had used X-rays emerging from a pinhole aperture and projected them through a sheet of rock-salt, 2 mm. in thickness, placed some 40 or 50 cm. from the anticathode. By the effects obtained on a photographic plate after the X-rays had passed through the crystal, he was able to demonstrate that the laws of regular reflection were observed by the Röntgen rays. The reflections obtained were due to the vibrations set up by the impinging waves upon the constituent electrons within the molecules of the crystal surfaces, and from this point of view a crystal surface was different from a surface of mercury or of any polished metal. The X-rays were not reflected regularly from a surface of mercury, because such a surface, although appearing to be a plane, had in reality irregularities of molecular structure which were large as compared with the wave-length of the Röntgen radiation. Every molecule in a surface, on being submitted to the X-ray beam, sent out a train of rays: but unless certain relations held as to the distance between molecule and molecule, there would be destructive interference, with consequent effacement of the effect. In a crystal, however, the molecules were arranged perfectly in definite planes, giving a surface of sufficient regularity to produce regular reflection. Prof. Barkla showed a large number of photographic results with selenite, tourmalin and other crystals, and pointed out the arrangement of the numerous secondary pencils around the central opaque patch, which was due to the direct beam. The intensity of these secondary reflection effects was in no case, he said, near 1 per cent. of that of the primary, but the phenomena were sufficient to prove that the X-rays were regularly reflected exactly like light from the planes in the crystal. Dr. R. W. A. Salmond also read a short paper on a cognate subject, expressing the view that in crystallography was to be found the most promising field for X-ray investigation, and the chairman (Mr. Duddell), in summing up the discussion, said that, it having been proved that X-rays could be reflected, they would probably be found capable of being refracted, approximating to light in their properties, so that there would be no further need to call them "X"-rays.

### Municipal Tramway Managers.

#### ANNUAL CONFERENCE AT SUNDERLAND.

THE annual Conference in connection with the Managers' Section of the Municipal Tramways Association, was held in the Town Hall, Sunderland, on Thursday and Friday last week. Between 50 and 60 delegates attended the opening session, which was presided over by Mr. A. R. Fearnley. A detailed description of the methods under which the Sunderland system is worked was given by the general manager (Mr. A. R. Dayson), who, at the close of his address, was closely questioned in regard to transfer tickets, which are extensively used in all sections of the system. During the debate, it transpired that not more than 8 per cent. of the municipal tramway systems in the kingdom utilise the transfer ticket, and the general opinion of the Conference was against any further extension of its use on the ground that it tended greatly towards the encouragement of fraud both on the part of conductors and passengers.

A paper on the "Interim Report of the Rail Corrugation Committee," read by Mr. R. H. WILKINSON, was discussed at considerable length. The general trend of opinion was that the vibration theory would prove the most likely in regard to the cause, and the Special Sub-Committee dealing with the question was requested by resolution to pay particular attention to this phase of the problem.

Under the presidency of the Mayor (Alderman Richardson), the delegates were entertained to luncheon, and in replying to the toast of the "Municipal Tramways Association," MR. FEARNLEY said that that body fully realised the responsible position they now filled. They represented a capital of 55 millions sterling invested in municipal tramways, which were returning an aggregate revenue of 12 millions per annum. A few years ago the numbers of passengers carried by railways and tramways were about equal, but last year the latter carried double the number of passengers accounted for by the former.

A sea-trip along the coast of Durham and Northumberland followed, after which the delegates were landed at South Shields, and there the delegates partook of tea in the Town Hall as guests of the Mayor (Councillor J. W. Henderson). In the course of a brief speech his WORSHIP illustrated the advantage of a municipal tramway service over one controlled by private enterprise, so far as the community were concerned, by quoting the experience of South Shields. In the early days of their system they received invaluable advice and assistance from the neighbouring borough of Sunderland, which could not have been given or expected had the tramways there

been in the hands of a private company. A cruise up the Tyne, past the Elswick Works of Armstrong, Whitworth & Co., concluded the day's entertainment.

Practically the whole of Friday morning was devoted to the discussion of a paper by the secretary, Mr. C. J. Spencer (Bradford), on "Petrol and Trackless Trolley Vehicles." At the outset Mr. Spencer said he tackled the question with an absolutely open and unprejudiced mind. It was common ground that some cheap form of transit was needed in many districts where tramways proper were prohibitive owing to the heavy capital expenditure. That fact was amply proved by the great number of applications before the current session of Parliament for railless trolley and motor-omnibus powers in various parts of the country, even having full regard to the uncertainty of the law on the question of who was to bear the full burden of road maintenance. He did not doubt for a moment that if that question could be satisfactorily settled without any very serious burden being thrown upon either motor-omnibus or railless trolley operators, there would be an enormous development of these means of transit throughout the country. Speaking from the public point of view regarding both railless trolley vehicles and motor-omnibuses, he would wipe out of consideration the experiences with the very early types and consider what they might reasonably expect with vehicles constructed in the light of modern experience and capable of efficiently providing public service. The modern motor-bus certainly did not run so smoothly as a rail-borne-car and could not be expected to do so. With the motor-bus the noise of moving machinery was reduced to a minimum, and with proper maintenance and care should not exceed the tramcar in that respect. But whatever might be the case at present, it should be possible to construct railless trolley vehicles to run more quietly and with less vibration than motor-omnibuses. The absence of spur-gearing, or chains, in the case of future railless trolley-cars was bound to result in less vibration and noise, and consequently smoother running, than could possibly be the case with the internal-combustion types. On the other hand, the motor-omnibus had no trolley pole, and consequently no hissing noise from that source, and it might be admitted by even the railless trolley bigoted expert that the petrol omnibus did not need to stick to a silly groove, but could wander over fields, hedges and pavements at its own sweet will. With regard to convenience and facility of operation, it had been argued that there was a considerable advantage in a railless trolley extension system in connection with an existing tramway system of considerable size, on account of the fact that after all a railless trolley-car was little more than a tramcar running on road wheels, the overhead equipment being the same. On the other hand, if a small number of motor-buses were purchased the position was altered; their design was altogether different from a tramcar, their inspection and maintenance were of a far higher order and quite another type of fitter and staff was required to handle them, and where their number was small, it was difficult to get the fullest economy and efficiency from a special staff. In regard to traffic expenses, he submitted that an average figure in a semi-industrial area would be 2'67d. for the motor-bus and 2'5d. per car-mile for the railless-trolley vehicle, the extra 1'7d. in regard to the motor-bus being for lubrication. Under the head of general expenses they might fairly assume that, with two exceptions, all were common to both. As the law stood at present the rates on railless trolley-cars were in excess of those paid for omnibuses. So far as his knowledge went, the railless trolley-car would be rated on its revenue-earning capacity and the petrol omnibus on the rateable value of the garage. What the ratio of these two figures really was he could not say. On the other hand, he thought it might be fairly argued that the liability to accident with a railless trolley-car was less than with a motor-omnibus, and certainly the amount paid for fire insurance would be higher in the case of the motor-omnibus. After discussing general repairs and maintenance, which he estimated at 1'79d. for the railless trolley-car and 2'2d. for the motor-omnibus, and power at 2d. per car-mile for petrol and 1d. for electric energy, he summed up the total cost per car-mile of running the respective vehicles as 6'09d. for the railless trolley-car and 7'71d. for the motor-omnibus. Turning to capital costs, he argued that the petrol vehicle was, and would continue to be, the most expensive, and if they took its useful life at 100,000 miles and the capital cost at £850, with a life of five years, they would have to pay a sum of 2'27d. per car-mile for interest and depreciation charges. In the case of the railless trolley £750 should be a fair cost of the vehicle, and with a life of 10 years, or 200,000 miles, the cost per car-mile in interest and depreciation charges would be 1'09d. Thus they had a total cost, including capital charges of 9'98d. for the motor-omnibus and 7'18d. for the railless trolley car.—Mr. J. W. Hame next submitted a paper on "The Standardisation of Specifications for Tramcar Equipments," after discussing which the Conference terminated with a brief meeting of the Executive Council.

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"ANXIOUS" writes:—"I am desirous of erecting private overhead telephone wires in a town, but am informed that it is necessary to obtain permission from the Postmaster-General. Will you kindly say if such is the case, and if so, is it necessary to pay an annual wayleave?"

"\* It is well-settled law that the telephone is part of the monopoly of the Postmaster-General, and that it can only be used under licence from him. Even the late National Telephone Co. were his licensees. The only exception to the rule is that a man may sometimes have a private telephone between one part of his business premises and another, or between his house and his business premises; but in that case he must obtain wayleaves from private persons over whose property he carries his wires.

"UNIT" writes:—"I received an order for a small plant complete with wiring for a certain number of lights. During the progress of the work additional lights were added, by the client's instructions, to quite twice the original number. This necessitated a larger engine, dynamo and battery, which was put in also to the client's verbal instructions, and now that the account has been sent in he refuses to pay. I might say that the account is quite twice the amount of my original estimate. I am quite agreeable to have an independent valuation made, but this the client will not entertain."

"\* It is not easy to give a satisfactory answer to this query without access to the documents. Assuming, however, that a certain number of lights of a certain candle-power were specified, it is manifest that "Unit" was only obliged to provide an engine, dynamo and battery of sufficient capacity for the purpose. If, as is apparently the case from the statement of the facts, the employer not only ordered the extra lights, but the engine, &c., of greater power, it is clear that a new contract has come into existence, which "Unit" can enforce, by suing on what the lawyers call a *quantum meruit*. It should be observed that the mere assent of an employer to alterations is not generally sufficient. So in the case of *Lovelock v. King*, 1831, 1 Mov. and Rob. 60, a carpenter had agreed to alter certain premises for a fixed sum. Considerable deviations were made from the original plan, which it was alleged the employer had seen and not objected to. The carpenter sued for the "measure and value" price of all the work done. It was laid down that the employer was not liable for any larger sum than that paid by the contract, by reason of his assenting to deviations, unless he was expressly or impliedly informed that such deviations would increase the cost.

"TROP" writes:—"The supply of energy over a considerable area is controlled by a public supply company; this company supply to a works in a village about 6 miles distant a load of about 200 kW., where it is transformed and converted to 220-volt D.C. and 440 A.C. The village authority are taking up the question of lighting the streets, and are met at the outset by a rival company promoted by certain officials of the works mentioned. The Council maintain that the works supplied by the supply company, who would thus become secondary supply authority, would be benefiting themselves on account of lower price obtainable for larger quantity of power passed through. Do you consider it would be within the legal right of the Council to insist on the supply authority giving a supply independently of the works mentioned, and is there a statute price of current which the suppliers (whoever they may be) are bound to accept?"

"\* This is a problem which, in one form or another, has frequently been discussed in this REVIEW. It is evident that those who control the works in the village intend to take current at one price from the supply authority and farm it out in the village at a profit. It is very much in doubt whether this is legitimate, but it appears to be a question as between the supply authority and the works, not as between the village Council and the supply authority. If the latter body is not sufficiently vigilant to prevent a supply being transformed and used in this way, that appears to be a matter for the shareholders or ratepayers to take up.

As to the second question put by "Trop," this is clearly answered by Sec. 19 of the Electric Lighting Act, 1882, which provides that "where a supply of electricity is provided in any part of an area for private purposes, then except in so far as is otherwise provided for by the terms of the licence, order, or special Act authorising such supply, every company or person within that part of the area shall on application be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under similar circumstances to a corresponding supply."

**Oxygen and Hydrogen.**—Referring to the article in our issue of May 16th on "The Commercial Production of Oxygen and Hydrogen" with the I.O.C. electrolytic plant, the British manufacturers, MESSRS. ARTHUR LYON & CO., ask us to state that their address is 608, Caxton House, Westminster, S.W.

**Anglo-German Exhibition.**—The Lord Mayor of London opened this Exhibition at the Crystal Palace on Wednesday.

**The Holidays.**—THE GREAT EASTERN RAILWAY CO. have issued a handbook, "On the East Coast," giving prominence to some of the less known parts of East Anglia and to the country between the Cromer and Hunstanton coast and the Norfolk Broads. The book, which is attractively illustrated in colour, can be obtained free from the superintendent of the line, Liverpool Street Station, London, E.C.

**FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.**

**AMENDMENTS.**

**TRINIDAD AND TOBAGO.**—In accordance with the terms of the Canadian-West Indies Treaty, it is proposed to revise the Tariff of Trinidad and Tobago for the purpose of establishing a system of preferential duties on British (and Canadian) goods as against foreign goods. The new Tariff will come into force at a date to be fixed later, and the following are some of the new rates which will affect readers of the ELECTRICAL REVIEW:—

	Preferential tariff.	General tariff.
Glass and glass ware, lamps, &c.	8 % ad val.	10 % ad val.
Electric machinery not provided for below, and electric dental appliances ... ..	8 % "	10 % "
Iron wire... ..	8 % "	10 % "

The following are to be admitted free of duty:—  
Articles imported by or for the use of the Colonial Government; electric lighting and power plant on estates or mines; plant for railways and tramways on estates or mines, including rails and rolling stock; mining plant of all sorts, including machinery and pipes for the sinking of oil and artesian wells.

**CANADA.**—The Canadian Customs authorities have issued revised regulations as to the Customs treatment of samples imported into the Dominion which it is intended subsequently to re-export. These revised regulations read as follows:—

1. Samples of dutiable goods, solely for use in taking orders for merchandise, imported temporarily into Canada direct by non-residents from any British country, may be admitted upon deposit of a sum equal to the duty, to assure the re-exportation of such samples within one year.

2. A temporary entry of such samples, in duplicate, with certified invoices annexed in the usual form, shall be presented to the collector of Customs at the port of entry.

The importer shall make and subscribe to a declaration on the face of the temporary entry that the goods described therein are *bond fide* samples for use only in taking orders for merchandise and to be re-exported within 12 months.

3. When the samples are marked by a Customs officer for identification and the temporary entry duly completed, the collector may issue his permission for the release of the samples, upon receiving from the importer a sum of money equal to the duty, so as to assure the re-exportation of all the samples.

4. The permission for the release of the sample goods shall be in duplicate, with a notation thereon that the money deposited with the temporary entry of samples shall be returned to the importer, provided the whole of the said samples be exported within 12 months from the time of entry, with proof of such exportation furnished to the satisfaction of the Collector.

One copy of the temporary entry, with invoice and permission annexed, shall be delivered to the importer, so that the same may be presented to the Customs Officer when samples are re-exported.

**NOTE.**—The foregoing privilege does not extend to articles which, owing to their quality or value, or which, owing to their nature, could not be identified upon re-exportation.

**UNITED STATES.**—With reference to the recent decision of the United States Customs authorities regarding the admission free of duty of materials for the construction or repair of vessels built in the United States, and of all such materials as are necessary for the building or repair of their machinery, it has now been decided that electric light bulbs and fixtures for vessels, and ship telegraph and signalling apparatus and telegraph and telephone apparatus on naval vessels for controlling gun fire, constitute articles of outfit and equipment which are admitted free of duty.

14,704. "Electric lamps." H. BREMER. July 17th.—Electrodes are made of carbon mixed with large proportions of salts of calcium, magnesium, strontium or other metals, to increase the production of light, and such that the electrodes contain at least 5 per cent. of fluorine, iodine or bromine to form fusible slags with the bases, which fall off in small drops near the arc. Calcium fluoride and cryolite are most suitable.

16,418. "Electric conductors." H. EMMERTS. July 27th.—Conductors are coated with spirals of paper, and are finally saturated with a mixture of sealing and waterproofing compositions. Coverings of braided jute, &c., or flax coverings may also be employed. The paper spirals employed are saturated with (1) a sealing or waterproofing composition consisting of a mixture of resinous matter, such as copalony, and oxidized oil, such as blown vegetable or fish oil, and (2) an oily matter, such as a heavy mineral oil, with or without mineral wax.

16,005. "Incandescent lamps." A. SWAN. August 6th.—Bulbs are attached to stems carrying the leading-in wires and filaments, and their necks are expanded either in moulds so that they will fit caps, or directly in indented caps, by the machine described in the specification.

16,960. "Rheostats and switches." C. DE KANDU. August 21st.—A liquid resistance is controlled pneumatically, together with a short-circuiting switch. Electrodes are fired in a vessel, in which is a bell, the vessel and bell normally communicating through a valve, so that the reservoir liquid stands level in them, below the electrodes. Compressed air may be admitted from a reservoir, to close the piston valve in opposition to a spring.

16,951. "Electric tramcars, &c." C. DE KANDU. August 21st.—Relates to electric motors or motor casings for tramway vehicles and the like in which the motors are disposed on the wheel axles. While retaining the largest possible diameter for the rotating parts in order to preserve a high circumferential velocity, the motor casing is brought within the limited space allowed between the lower part of the car and the rails by official regulations by forming or cutting it non-circularly.

17,580. "Electric switches." M. GUETT. August 25th.—Switches giving a quick make and break. The contact lever carrying the contacts is pivoted at one end, and is formed with shoulders c<sup>1</sup>, c<sup>2</sup>. The tumbler-lever is formed with two shoulders c<sup>1</sup>, c<sup>2</sup>, the former engaging with the contact-lever, and the latter with a spring, which also embraces the shoulder c<sup>1</sup>. On moving the handle the spring is put in tension until the shoulder c<sup>1</sup> clears the shoulder c<sup>2</sup>, when the spring snaps the switch off. The shoulder c<sup>1</sup> then passes sufficiently below the shoulder c<sup>2</sup> to hold up the contact-arm.

17,786. "Telegraphic apparatus." S. G. BROWN. September 2nd.—Relates to translating or receiving telegraph apparatus in which the periods of + and - currents received in submarine telegraphy are broken up into their initial impulses for retransmission either directly with or without curb currents, or by means of a perforated strip, the strip being the form in which the message is received.

18,457. "Tramcars." J. TIDSWELL. September 18th.—Obstruction removers for electric and other tramcars. Should the hinged "feeler" meet an obstruction a pivoted catch is released, and allows a bell crank to lower the spring tender close to the track. The "feeler" is reset by depressing a pedal.

20,655. "Electrical conduits, drain pipes, &c." ALBION CLAY CO. and R. LAWTON. October 14th.—Relates to apparatus for moulding the spigot and socket ends of drain pipes and multiple conduits. The spigot end of the conduit is inserted in a mould mounted on a base-plate, and a core is lowered down on guide rods into the centre of a socket. Bituminous composition or cement is then introduced between the mould and core and the ends of the pipe to form a spigot and socket accurately in line with one another.

21,354. "Electric winding-mechanism." H. ARON and ARON ELECTRICITY METERS, LTD. October 25th.—Relates to improvements in mechanism for winding up, or giving tension to, driving-springs. The arm carried by the swinging armature and insulated from it, is provided with two pins. The driving-spring is connected to one pin and conveys the current from the energising coil. The other pin makes and breaks the circuit. An adjustable cylinder fixed by a screw, serves to adjust the tension of the spring, and thereby control the play of the return stroke of the armature.

21,855. "Electricity measuring." H. ARON and ARON ELECTRICITY METER, LTD. October 25th.—Work supplied on a four-wire three-phase alternating system is measured by a pendulum or motor meter in either of two ways. The mains may be connected in any way, and unequally loaded. In one arrangement, the three principal mains contain stationary coils a, b, c, influencing two pendulums, which carry coils connected between the two mains a, b, and the fourth or "neutral" mains; the effects of the coils a, b on the pendulums are annulled, but the middle coil c is placed and connected so that it reduces the effects of both coils a, b.

21,657. "Electric lamps." H. BREMER. October 30th.—Rods are made of angular sections of mixtures of powdered carbon with large proportions of powdered metals or metallic salts, to produce incandescent vapours, and with the addition of 1 per cent. or more of boron, liquid fluorine, or other material to render metallic accumulations sufficiently fusible to drop off the edges of the rods. The light may be coloured by a further addition of 25 per cent. of fluorine, bromine, or iodine, or magnesia. Opposite edges of the rods may be notched at intervals to cause the breaking off of projecting corners, if the arcs burn inward.

(To be continued.)

**NEW PATENTS APPLIED FOR, 1913.**

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

**PATENTS EXPIRING IN 1913.**

(Continued from page 964.)

13,646. "Electric motors." T. D. HOLLICK. July 1st.—Relates to means for stopping, starting, reversing, and varying the speed of electric motors used for driving cranes, hoisting-gear, and other machinery, or for electric traction. The armature and field magnets are arranged so as to rotate in opposite directions, the field magnets being supported by a sleeve on the armature spindle. The gearing is such that if the field magnets are stopped by applying a brake to the drum, the armature will drive the pulley at half its own speed. Similarly, the armature may be stopped by a brake acting on a drum, in which case motion in the opposite direction is derived from the field magnets.

14,904. "Motor road vehicles." W. P. THOMPSON. (Cantono, E.) July 11th.—Relates to the application of electric motors to automobile vehicles, especially motors, in which the power is regulated by varying the excitation of the field magnets. The invention comprises a series-parallel controlling system, a switch acting in conjunction with both the electric controller and the mechanical means for operating the fore-carriage, and a resilient worm driving gear for facilitating the starting of heavy vehicles without shock.

14,703. "Electric lamps." H. BREMER. July 17th.—Electrodes are made of carbon uniformly mixed with luminiferous matter, such as alkaline earths or calcium carbonate, fluoride, or silicate, to increase the production of light, and are coated with material adapted to form a fused slag therewith, this dropping off near the arc. The coating also protects the carbons from the air. Suitable coatings are produced by electroplating with metal or by dipping red-hot carbons in fused boric acid, borax or a neutral or acid borate or alkaline silicate.

12,208. "Electrolytic cells." E. C. R. MARES. (Hooker Electrochemical Co., United States.) May 20th. (Complete.)

12,218. "Means for automatically operating electrical switches for stopping and starting motors for compressing air and other fluids into cylinders and other receivers." T. C. WALTER and DISPLAVER CO., LTD. May 26th. (Complete.)

12,235. "Electrically-driven automatic lathes." H. KIENZLE. May 26th. (Complete.)

12,238. "Extensible electric light fixtures." F. GARRECHT. May 26th. (Complete.)

12,246. "Electric sashron." W. H. DALTON. May 26th. (Complete.)

12,253. "Metal filament incandescent electric lamps." EHRLICH & GRAETZ. (Convention date, April 4th, 1913, Germany.) May 26th. (Complete.)

12,311. "Magnetic separators." H. H. THOMPSON and A. E. DAVIES. May 27th.

12,335. "Telephone receiver or transmitter." E. RYAN and H. W. BROWN. May 27th.

12,368. "Magnetic separators." H. J. H. NATHORST. (Convention date, June 4th, 1912, Sweden.) May 27th. (Complete.)

12,377. "Manufacture of stable boron nitride." BRITISH THOMPSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 27th.

12,404. "Means for securing shades, reflectors or other attachments to electric lampholders and the like." G. ST. J. DAY. May 28th.

12,417. "Wire-drawing apparatus." G. WATSON, and W. and D. HOUGHTON and Co., LTD. May 28th. (Complete.)

- 12,421. "Manufacture of tungsten metal bodies." C. GLADITZ. May 28th.
- 12,423. "Machine telephony switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, United States.) (Divided application on 15,952, 1912, July 8th.) May 28th.
- 12,424. "Machine telephony switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, United States.) (Divided application on 15,952, 1912, July 8th.) May 28th.
- 12,425. "Machine telephony switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, United States.) (Divided application on 15,952, 1912, July 8th.) May 28th.
- 12,426. "Machine telephony switching systems." WESTERN ELECTRIC CO., LTD. (F. T. Woodward, United States.) (Divided application on 15,952, 1912, July 8th.) May 28th.
- 12,428. "Automatic electric contact apparatus." V. VON VANGEL. May 28th.
- 12,437. "Means for electrically indicating or counting revolutions of shafts, axles and the like." SIEMENS BROS. & CO., LTD., and F. HIRD. May 28th. (Complete.)
- 12,444. "Electric furnaces." COMPAGNIE POUR LE TRAITEMENT DES METAUX ET DES MINERAUX PAR L'ELECTRICITE. (Convention date, January 19th, 1913, France.) May 28th. (Complete.)
- 12,461. "Electric radiator." A. H. BRAUKENSIECK. May 28th.
- 12,463. "Reflectors for electric lamps." C. C. REGNART. May 28th.
- 12,471. "Vapour electric devices." F. CONRAD. (Convention date, June 21st, 1912, United States.) May 28th. (Complete.)
- 12,477. "Governing mechanism for engines." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) May 28th.
- 12,499. "Means and method of changing the frequency of alternating currents." A. M. TAYLOR. (Addition to 8,538 of 1911.) May 29th.
- 12,527. "Means for indicating or recording or indicating and recording when a storage battery has been charged or discharged to a desired limit." R. RANKIN and ELECTRICAL POWER STORAGE CO., LTD. May 29th.
- 12,544. "Shade or globe for electric light bulbs." N. S. CORNEY. May 29th.
- 12,565. "Inductance coils for telephone or other circuits." SIEMENS and HALSKE AKT.-GES. (Convention date, May 29th, 1912, Germany.) May 29th. (Complete.)
- 12,566. "Circuit arrangements for telephone systems." SIEMENS BROS. and CO., LTD. (Siemens & Halske Akt.-Ges., Germany.) May 29th. (Complete.)
- 12,575. "Electric arc lamps." SIEMENS BROS. DYNAMO WORKS, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) May 29th. (Complete.)
- 12,578. "Electrical regulating systems." W. J. MELLERSH-JACKSON. (United States Light and Heating Co., United States.) May 29th. (Complete.)
- 12,587. "Method and means whereby equalisation of light from an artificial illuminant is obtained." S. MADDICK. May 30th.
- 12,628. "Automatic electrical advertising writing reproducer." L. J. COLAROE. May 30th.
- 12,635. "Arrangements for eliminating irregularities in electric signalling." A. ORLING and ORLING'S TELEGRAPH INSTRUMENTS SYNDICATE, LTD. May 30th.
- 12,638. "Apparatus for transmitting synchronous movements by rotating magnetic field." R. FEDERICO and L. SEGALIN. (Convention date, May 31st, 1912, Italy.) May 30th. (Complete.)
- 12,639. "Apparatus for use in charging electric accumulators." H. LEITNER. May 30th.
- 12,651. "Circuit arrangements for telephone systems." SIEMENS & HALSKE AKT.-GES. (Convention date, July 8th, 1912, Germany.) May 30th. (Complete.)
- 12,653. "Automatic light-extinguisher." H. RADET. (Convention date, July 17th, 1912, France.) May 30th. (Complete.)
- 12,670. "Means for adjusting the accumulators of electric safety lamps on charging benches." P. WOLF. May 30th. (Complete.)
- 12,672. "Means for and methods of changing the frequency of alternating currents." A. M. TAYLOR. (Addition to 8,535/11.) May 31st.
- 12,695. "Electrical switches." A. P. LUNDBERG, G. C. LUNDBERG, P. A. LUNDBERG and G. PEGG. May 31st.
- 12,710. "Circuit breakers and the like for the protection of alternating-current induction electric motors." G. ELLISON. (Addition to 13,285/67.) May 31st. (Complete.)
- 12,723. "Testing insulation and other purposes." EVERSHED & VIGNOLES, LTD., and S. EVERSHED. May 31st.
- REMOTE CONTROL FOR ELECTRICALLY-OPERATED APPARATUS. W. P. THOMPSON. (Ateliers de Constructions Electriques de Charleroi.) 11,537. May 15th.
- DEVICE FOR SETTING THE SELECTIVE CONTROLLING APPARATUS ON A MOVING AUTOMATIC GOODS CONVEYOR OR TRUCKER FROM A FIXED STATION. L. ROTTENBURG and NEW TRANSPORT CO. 11,681. May 16th.
- ECONOMISERS OR SHIELDS FOR MULTIPLE ARC LAMPS. Ges. fur Maschinen- und Metall-Industrie. 11,812. May 18th. (May 19th, 1911.)
- ARRANGEMENT OF RECEIVING STATIONS FOR WIRELESS TELEGRAPHY. Capt. Z. DAN and G. ROTHLENDER. 12,414. May 25th.
- TESTING OF ENGINES. Electric and Ordnance Accessories Co. and J. EICHELLS. 13,362. June 13th.
- METHOD OF, AND APPARATUS FOR, THE PRODUCTION OF ALTERNATING CURRENTS OF HIGH FREQUENCY. H. SEITON-JONES. (Ges. fur Drahtlose Telegraphie.) 11,890. June 13th.
- MEANS FOR OBTAINING TWO SEPARATE AND OPPOSITE DRIVERS FROM A SINGLE ELECTRIC MOTOR. H. T. HOLMES and J. KEMP-WELCH. 14,550. June 21st.
- HOLDERS FOR ELECTRIC INCANDESCENT LAMPS. R. WACHMÜLLER. 14,760. June 24th.
- LEADING-IN CONDUCTORS FOR SEALING INTO ELECTRICAL APPARATUS. British Thomson-Houston Co., Ltd. (General Electric Co.) 15,832. July 1st.
- PHOTOMETERS. Siemens Bros. Dynamo Works, Ltd., and S. H. CALLOW. 15,660. July 4th.
- FIRE ALARMS. A. KIRK and C. J. BAKER. 15,676. July 4th.
- ELECTRIC SWITCHING DEVICE FOR AUTOMATIC TELEPHONE SYSTEMS AND THE LIKE. Telephone Apparat Fabrik E. ZWIETUSCH & Co. Ges. 16,151. July 10th. (January 18th, 1912.)
- APPARATUS FOR PROJECTING ON TO A SCREEN IMAGES OF OBJECTS WHICH MAY BE OPAQUE TO LIGHT. W. H. S. MATTIOTT. 16,542. July 15th. (Cognate application No. 123 of 1913.)
- LOCK-SPEAKING ATTACHMENT FOR TELEPHONES. H. W. FRANCE. 17,357. July 26th.
- COMBINATION OF SUBSTANCES FOR USE AS CATTLE FOOD, OR FOR INSULATING PURPOSES, AND FOR THE PREPARATION OF COATED FABRICS AND ARTIFICIAL BOARDS. A. S. ROWE. 17,564. July 29th.
- MARINERS' COMPASSES. L. W. P. CHETWYND. 17,768. July 31st.
- ELECTROLYTES FOR USE IN ELECTROMETALLOGY. N. H. M. DEKKER. 17,836. August 1st.
- ELECTRICALLY-HEATED KETTLES, SACCPANS AND THE LIKE. G. H. COLLINS and H. F. COLLINS. 18,911. August 19th.
- INCANDESCENT ELECTRIC LAMPS. C. Joly. 20,361. September 6th.
- CALCULATING APPARATUS PARTICULARLY ADAPTED FOR RECKONING OCT CHARGES FOR THE USE OF ELECTRICITY, GAS, WATER and SO FORTH. H. BRUCKMANN. 21,445. September 20th.
- DYNAMOS. J. POLKEY and GEORGE POLKEY, LTD. 22,500. October 3rd.
- LEAD ALLOYS FOR TAPES. Western Electric Co. (Western Electric Co.) 25,690. November 1st.
- BOUNDS FOR CABLES FOR TELEGRAPH OR TELEPHONE CONDUCTORS. R. SCHAFFER. 25,419. November 6th.
- SUPPORTS FOR COLLECTOR POLES FOR USE WITH AERIAL CONDUCTORS. C. L. DELACHAUX. 25,577. November 7th. (December 4th, 1911.)
- ELECTRIC ELECTRODE FURNACES. Jössingford Manufacturing Co., A/S. 26,165. November 14th. (April 14th, 1911. Divided application on No. 8,193 of 1912. April 4th.)
- TILTING ARRANGEMENT FOR METALLURGICAL FURNACES. Jössingford Manufacturing Co., A/S. 26,166. November 14th. (April 4th, 1911. Divided application on No. 8,193 of 1912. April 4th.)
- APPARATUS FOR USE IN FORMING JOINT ENDS ON ELECTRICAL CONDUITS, DRAIN-PIPES and THE LIKE. R. LAWTON. 27,510. November 29th.
- ELECTRIC INCANDESCENT LAMPS. M. SIDON. 27,813. December 1st.
- APPARATUS FOR COOLING INCANDESCENT WIRE and LIKE ROLLED GOODS. G. MÖLLER and J. KÖNIG. 27,950. December 4th. (December 4th, 1911.)
- NON-SHUNT ELECTRIC ARC LAMPS. W. RODGERS and G. ROWE. 28,627. December 12th.
- MANUFACTURE OF NEGATIVE ELECTRODES FOR SECONDARY ALKALINE CELLS. H. P. R. L. PORSCHKE and J. A. E. ACHENBACH. 29,815. December 27th.
- METHOD OF REFORMING, VULCANISING and SIMILARLY TREATING INDIA-RUBBER. T. GARE. 8,554. April 11th.
- APPARATUS FOR THE PRODUCTION OF OZONE. W. DUBILIER. 11,090. May 9th.
- MANUFACTURE OF ELECTRIC RESISTANCE BODIES. G. COOPER. 11,880. May 13th.
- MEANS FOR STARTING INTERNAL-COMBUSTION ENGINES (MORE ESPECIALLY THOSE OF MOTOR-CARS OR THE LIKE) and FOR GENERATING ELECTRICITY FOR LIGHTING or OTHER PURPOSES. W. H. SCOTT. 11,888. May 13th.
- SYSTEM OF FIRE CONTROL FOR SELF-PROPELLED TORPEDOES. H. W. SHONNARD. 11,459. May 14th.
- METHOD OF, AND MEANS FOR, CLOSING ELECTRIC CIRCUITS. G. C. PILLINGER and L. SUNDERLAND. 11,466. May 14th.
- ELECTRIC SWITCHES. P. V. HUNTER and W. L. SHAND. 11,586. May 15th.
- VAPOUR ELECTRIC APPARATUS. E. E. DARMOIS and M. A. E. LEBLANC. 11,570. May 18th.
- TELEPHONE SYSTEMS. E. A. MELLINGER. 11,964. May 20th.
- MERCURY VAPOUR LAMPS. P. G. TRIQUET. 12,270. May 23rd. (August 30th, 1911.)
- CAB and TRACK SIGNALING APPARATUS. J. TREACHER. 12,538. May 26th.
- RAILWAY SIGNALING APPARATUS. J. SITT. 12,649. May 29th.
- BI-POLAR FORM-WOUND ROTOR WINDINGS FOR DYNAMO-ELECTRIC MACHINES. H. SCHNEIDER. 12,766. May 30th.
- AUTOMATIC ELECTRIC THERMAL CONTROL. S. L. R. PRICE. 15,178. June 28th.
- ELECTRIC HEATER. H. W. PURLE. 15,429. July 2nd.
- PRODUCTION OF MAGNETIC OR ELECTRIC FIELDS APPLICABLE FOR CHANGING THE FREQUENCY OF ALTERNATING CURRENTS and FOR OTHER PURPOSES. M. PöHL. 15,774. July 5th. (July 11th, 1911.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

### 1912.

- SYSTEM FOR THE ELECTRICAL REGULATION OF CLOCKS AND THE LIKE. L. J. ARON. 23,690. October 16th. (October 16th, 1911.)
- RECEPTION OF ELECTRIC WAVES IN WIRELESS TELEGRAPHY. R. GOLDSCHMIDT. 23,784. October 17th. (October 14th, 1911.)
- ELECTRIC HEATING UNITS. E. C. R. MARKS. (Länders, Fray & Clark.) 24,776. October 29th. (Divided application on No. 10,029 of 1912, April 27th.)
- IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. E. PODLESK. 25,646. April 30th. (Divided application on No. 10,209 of 1912, April 30th.)
- POCKET IONIZERS. L. JABREISS. 26,861. November 16th.
- THEFT ALARM BOXES and THE LIKE. R. M. BRYDONS. 27,002. November 23rd.
- ELECTRIC LAMPS FOR AUTOMOBILES. J. GALLAY. 27,783. December 3rd.
- SIGNAL LAMPS FOR AUTOMOBILES and THE LIKE. W. J. MELLERSH-JACKSON. (Wright.) 29,074. December 17th.
- PRIMARY GALVANIC CELLS. J. A. E. ACHENBACH. 29,847. December 27th.
- METHOD OF, AND MEANS FOR, HEATING WATER and OTHER MEDIA OR FLUIDS. G. G. BELL. 2,873. February 3rd.
- ELECTRIC RAILWAY SYSTEMS. K. E. STUART. 2,957. February 5th.
- ELECTRIC LAMP-HOLDERS. H. HALE. 7,552. March 29th. (September 30th, 1912.)
- REGULATION OF THE FREQUENCY PRODUCED BY POLYPHASE INDUCTION GENERATORS. Siemens-Schuckertwerke Ges. 6,670. April 3rd. (April 3rd, 1911.)
- METHOD OF, AND APPARATUS FOR, MOLDING SILICON and SILICON ALLOYS, and the APPLICATION OF THE PRODUCTS AS ELECTRIC RESISTANCES and HEATERS. G. GUALTIEROTTI. 10,657. May 4th.
- MEANS FOR ESTABLISHING ELECTRICAL COMMUNICATION BETWEEN SHIPS and OTHER VESSELS and THE SHORE. A. G. POSSOLO. 10,701. May 6th.
- ELECTRIC INCANDESCENT LAMPS and LAMP-HOLDERS. J. STONE & Co., Ltd., and A. C. T. MYERS. 10,959. May 8th.
- ELECTRIC SWITCHES. A. H. F. PERL. 11,751. May 9th.
- ELECTRIC ARC WELDING. A. P. STROHMMEYER. 11,079. May 9th. (Addition to No. 1,274 of 1912.)
- GRADED SERVICE AUTOMATIC TELEPHONE SYSTEM. H. BRON. (Heimann) 11,261. May 11th.
- ELECTRIC MEASURING APPARATUS OF THE MOVING COIL TYPE. W. H. APTHORPE and Cambridge Scientific Instrument Co., Ltd. 11,279. May 11th.

### 1913.

- ELECTRIC FURNACES FOR FIXING NITROGEN FROM THE AIR. G. HARKER and E. K. SCOTT. 866. January 11th.
- APPARATUS FOR CONTROLLING MOTION FROM A DISTANCE, APPLICABLE MORE PARTICULARLY TO THE CONTROL OF SEARCHLIGHTS or PROJECTORS, STEERING GEAR and THE LIKE. Siemens-Schuckertwerke G.m.b.H. 1,077. January 14th. (July 24th, 1912. Addition to 966 of 1912.)
- INSULATING SECTIONAL IRON MASTS. Siemens Bros. & Co., Ltd., and G. W. PERRY. 1,899. January 23rd.
- RAILWAY or LIKE SIGNALING or INDICATING SYSTEMS and APPARATUS THEREFOR. K. P. STURM. 3,528. February 5th. (Divided application on 2,957 of 1912, February 5th.)
- FIELD MAGNETS FOR DYNAMO-ELECTRIC MACHINERY. Siemens-Schuckertwerke G.m.b.H. 8,627. February 12th. (February 17th, 1912.)
- ELECTRIC REGULATING LIQUID RESISTANCES. II. C. E. BOUTARD. 8,855. February 14th.
- TRANSMITTERS FOR USE IN WIRELESS TELEGRAPHY. J. BABULKA. 6,479. March 15th. (March 16th, 1912.)
- ELECTRIC MOTOR METERS. II. ARON Elektricitätszählerfabrik Ges. 792. January 10th. (August 28th, 1912.)
- DISTRIBUTOR FOR ELECTRIC IGNITION IN INTERNAL-COMBUSTION ENGINES. Firm of Robert Borch. 5,632. March 5th. (April 12th, 1912. Addition to No. 9,816 of 1911.)

# THE ELECTRICAL REVIEW.

Vol. LXXII.

JUNE 20, 1913.

No. 1,856.

## ELECTRICAL REVIEW.

## CURRENT TOPICS AT THE I.M.E.A.

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THE proceedings of the Municipal Convention this week have been favoured with ideal weather—weather most appropriate to the discussion on "Heating and Cooking," which is in progress as we write these lines—and the conditions generally are conducive to the most satisfactory and successful results. The cool rooms of the Institution of Electrical Engineers afford a welcome and refreshing shelter from the solar rays, and dispel the languor which might otherwise hamper the eloquence of speakers.

The unabated energy and zeal of Dr. Ferranti must surely inspire enthusiasm in the hearts of his hearers. With a prophetic vision reaching far beyond their view, and a breadth of ideas which embraces the whole field of the electrical industries, he continues to preach the doctrine of "Progress"—downwards as regards the price of energy, but upwards as regards the prosperity of the industry and of the whole nation—which he so ably expounded from the Presidential chair. We are glad to see that Mr. Shawfield, ex-Presidential author of the Presidential address, strongly supports a similar policy. He firmly believes that there is room for drastic reductions in price, and that the outcome of such a policy would be prosperity to the municipal undertakings and to the community in general—a view which we have consistently favoured for some years.

The trouble is that, unlike Dr. Ferranti, the managers of electricity works are far too prone to confine their consideration to the needs and prospects of the immediate future. We do not forget that they unfortunately have to bear in mind the limitations imposed by their committees (though this excuse is wanting in the case of the company undertakings, which, strange to say, are even more timorous than their municipal *confères*)—but enthusiasm is contagious, and a man who is really earnest and enthusiastic can carry with him his associates. We could instance striking examples of success resulting from a policy which, at first sight, might be stigmatised as not merely bold but reckless.

In this connection it is significant to note that whereas at the formation of the "Point Fives" at Harrogate last year but seven were mustered, at the meeting on Tuesday evening held under the auspices of this young Association, no fewer than 120 persons were present, and the proceedings were marked by the greatest interest and enthusiasm. Although the Association numbers only 15 actual members, it has accomplished splendid work in less than 12 months—and on what basis?—the adoption of the charge of one halfpenny per unit for heating and cooking. We have heard that all the manufacturers of apparatus for these purposes are "full up" with work, and there can be no doubt that the movement has acquired an impetus which will carry it far beyond our wildest dreams of a year ago. Such men as Dr. Ferranti and Mr. Chattock thought it worth their while to attend the meeting; we have already mentioned that the former continued his campaign in favour of the lower price, and he also expressed the view that the policy of the "Point Fives" should be energetically pursued in order to *extend the market* for the apparatus employed, and thus bring about the much-to-be-desired reduction in manufacturing costs. To improve the load factor he advocated the adoption of thermal storage, but we fear that, in view of past attempts, this is not a proposition likely to evoke enthusiastic support. But this is, of course, only one of many ways to fill up the load curve. Why not charge storage batteries—the batteries of electric vehicles? In view of our incessant advocacy of the adoption of these, we are almost afraid, though by no means ashamed, to return to the subject: but, fortunately, the exhaustive paper on "Electric Automobiles," read by Messrs.

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION.

**H. ALABASTER, GATEHOUSE & CO.,**

4, Ludgate Hill, London, E.C.

Watson and Mitchell, under the aegis of Mr. A. Hugh Seabrook (who is also a confirmed advocate of electric vehicles), relieves us of the responsibility. We cannot help feeling that this question is one of the utmost importance to the supply industry, and is bound to compel close attention to its merits in the very near future; and we are glad to learn that active steps are in progress to bring the matter to a head.

Considerations of space preclude further comment on the doings of the M.E.A., but the indications are that this year's meeting will reach the high-water mark of enjoyment, profit and success.

#### The Endowment of Research.

A FORTNIGHT ago Mr. Balfour opened the new buildings of the medical school at Guy's Hospital, and gave an address, in the course of which he touched upon the

subject indicated in the title of this article.

There can be no possible divergency of opinion as to the necessity for research in every scientific profession or industry. The question that arises, however, when the subject is considered, is: Who is to do the work? The ordinary professional or business man in active practice cannot spare the time from his customary avocations. The professor or teacher has more opportunity, but in this country administrative and detail work takes up the greater part of their time. So we see at once that we must have men for this work who are not bound to mix it with other work—not unimportant, but distracting, and fatal to that activity of mind and brain, that clearness of perception and mental vision, which are, perhaps, more vital to achievement in discovery than to success in any other direction. The investigator must, in Mr. Balfour's phrase, possess that kind of originality which will enable him to point out in what direction the next advance should be made, and where progress might be expected, "and who could, by a happy inspiration of genius, perhaps suggest a solution of some long-standing difficulty which might throw light on a multitude of apparently separate phenomena and suggest one line of successful investigation."

Such a man must live, and must be sure that, in turning his talent to the work in which he is able to excel, he is not prejudicing his worldly prospects or sacrificing the interests of those who look to him for support.

The employment of researchers in industrial undertakings, and notably in electrical concerns, has made much more progress in Germany than here. Moreover, the encouragement given to research in educational institutions by manufacturers has been greater. This part of the question was thoroughly ventilated in an important article by one of the professors of Manchester University, in the *Manchester Guardian* of November 20th, 1912. His opinion is that Germany has here got so far ahead that this country can never hope to make up the leeway.

The endowment of electrical research is not unknown here, but is in much the same position as any other privilege in which electricity is concerned. The wealthy world cares for none of these things. It is notorious that, on every occasion on which an honours list is published, electricity and engineering hardly figure in it at all. The services, politics, the law—these are the favoured professions. The moneyed classes turn their sons into them, and maintain them until they can look after themselves—that is to say, they endow them. The average electrical man, with very few exceptions, starts right in on the bread-and-butter tack as soon as he has had a couple of years at college. How, then, can he afford time or money for investigation?

In any scheme for the endowment of research care must be taken that the right men are aided. Every earnest student thinks he would like to be a researcher, but it would never do merely to provide a man with means whereby he should be enabled to loaf away his time in a laboratory.

Why is it that our great concerns find it so difficult to pay their way? Many will jump up at once with suggestions,

but the fact is that the difficulty is cumulative. Lack of money gives rise to lack of educational facilities, and especially to lack of facilities for research. Lack of educational facilities reacts upon the financial question. The work of research and the establishment of laboratories for experiment are the last things thought about—if, indeed, they are considered at all. Plenty of skill, plenty of thought, plenty of energy, are devoted to office organisation, order-getting, and so on, but it is not yet properly realised that the investigator and experimenter is as great an asset to a business concern as the most successful salesman or accountant.

Mr. Balfour appealed to the liberality of the general public on behalf of a true organisation of medical research; and, if the general public is wise, it will respond, because medical research repays the community a thousandfold in the lessening of suffering. It would pay equally well to develop the application of electricity by the organisation of electrical research, for none can deny that the increased and increasing use of electricity has tended in the past, is tending now, and will tend in the future, to the greater happiness of the nations.

#### The Position of Rubber.

THE price of crude rubber is now getting very low, standing as it does in the neighbourhood of 3s. per lb. for the best plantation grades. This figure is considered far more representative of actual market conditions than the rather fictitious and artificially high quotation of hard Para, which shows a premium over the former of about 9d. per lb.

Plantation rubber has now a very free and wide market, and with the method of selling in vogue at the auctions, at which increasingly larger quantities have been handled of late years in consequence of the rapid expansion of the output in the Middle East, trade buyers have been enabled to secure supplies at constant concessions. Yet the expansion of the world's consumption has been fully as great as that of the output, thanks to the steadily increasing uses for the product at the persistently falling prices. Indeed, consumption and production have since 1911, the year of the big boom, been running together pretty closely, hence the statistical position of rubber appears to be healthy. The huge quantities which have become available this season have been remarkably well absorbed by manufacturers in spite of the unusually adverse conditions which have confronted the market.

Notwithstanding the severe political and financial difficulties and the set-back in the American manufacturing trades through labour troubles and the damage wrought by floods, the absorbing power of the market has been really wonderful, and there is certainly no reason to despair of the future of the plantation industry, whose extension will probably be at a much slower rate in a few years' time. This season's Brazilian harvest, now nearing an end, will show a surplus of roughly 3,000 tons over that of the previous season, while the 1913 output of Malaya alone is expected to show an increase of nearly 10,000 tons, making a total surplus of 13,000 tons apart from the notable increase from the Ceylon and other Eastern plantations.

Yet the available stocks of crude rubber are apparently a good deal less than two years ago, the visible supply of Para grades being actually 50 per cent. smaller. About the same increase as for 1913 is looked for in the output of the Malay peninsula for each of the next three years, but in view of the low prices ruling, the prospective increase—assuming that normal progress is not interfered with by unforeseen causes—may be easily taken care of by the rapidly increasing outlet for the product. The steady growth of the electrical trades and other manufacturing branches largely using rubber is calculated to ensure a constant expansion of consumption. During the great boom of 1911 the price of fine plantation rubber rose to 12s. 10d. per lb.; it has since been brought down to about 3s. per lb., and it may possibly dip temporarily to 2s. 6d. per lb., pending a further increase in consumption, but stocks do not accumulate at the present low level.

## THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION'S ANNUAL CONGRESS.

### BLACKPOOL.

#### WHERE HEALTH AND HAPPINESS JOIN HANDS.

Such is the legend which first meets the eye on opening the official guide to the Queen of West Coast Watering Places. However, one in the throes of an acute bronchial attack does not quite appreciate the joining of hands at its true worth. But all's well that ends well, and although we missed the lovely country and picturesque scenery in the neighbourhood of last year's gathering, for nothing will grow in or near the town, there is no doubt about Blackpool being an ideal meeting-place for the members of the Tramways and Light Railways Association, and the record in point of numbers attending the Convention was attained. The sources of Blackpool's witchery are its resources. It is well served by railways, no praise of Blackpool as a health resort can be over-stated, it possesses a record of municipal achievements unequalled by any corporate body, and it combines all the good points of other watering places without any of their faults, and, as Mr. G. R. Sims has it, it strikes the top-note of human happiness.

After the Reception on Thursday morning by the Mayor and members of the Corporation, and Boards of the Blackpool and Fleetwood, and Blackpool and St. Anne's Companies respectively, most of the delegates settled down to the discussion of the papers presented by Mr. E. H. Edwardes and Mr. Fred Bland.

After luncheon, the party left the Imperial Hotel in special cars provided by the general manager of the Blackpool, St. Anne's and Lytham Tramways Co., for Lytham, a delightful journey of 7 miles along the sea coast. The day was perfect, and we all appreciated the trip to the full, for at every turn we were met by objects of interest and, after a time, with pleasing scenery. During a long run through golf links and sandhills we passed the Thursby Holiday Home for Children, where poor boys and girls from Manchester were enjoying themselves to their hearts' content, and looking the picture of health and happiness. How they must have blessed the founder, Sir John Thursby, of Burnley.

Lytham, the terminus of the tramway, is a sweet old town, well wooded, abounding in delightful walks, and having a long stretch of greensward on the front, where we were glad to stretch our legs after a long spell on the cars. Returning, we broke the journey at St. Anne's, another charming and peaceful resort, where the company had very thoughtfully provided an elegant tea for the delegates and their ladies in the imposing and splendidly appointed Imperial Hydro. In 1875 the site of St. Anne's was a waste of sandhills, overgrown with starr grass and wild flowers. Now there is a residential population of 11,000 to 12,000, and a visiting population of 30,000 in the summer months. This and Lytham appear to be ideal places for a quiet holiday, amidst beautiful surroundings and health-giving air.

In the evening we were entertained to dinner at the invitation of the Mayor of Blackpool, Councillor Milton G. Wilde, J.P. The banquet was most choice, excellently served, and reflected much credit upon the management of the Imperial Hydropathic Hotel. The speeches, too, were of unusual merit for post-prandial efforts, especially those of the Hon. Arthur Stanley, M.P., Chairman of the Association, Mr. Harry England, Mr. Alderman Brodie, the genial and breezy chairman of the Blackpool Corporation Tramways and Electricity Committee, Councillor Collins, the ex-Mayor, in the absence of Mr. Alderman Heap, and Sir Edward White, chairman of the L.C.C. Highways Committee.

In speaking of the L.C.C. tramways, Sir Edward deplored the unfavourable returns—we had not then seen the result of the year's working—but he hoped that the falling-off in revenue, owing to motor-bus competition, was only temporary. The wish is, no doubt, father to the thought, but if we are not mistaken, the excessive outlay on the conduit will prove to be an insupportable burden on the finances of the undertaking, and the policy advocated by the ELECTRICAL REVIEW years ago will be amply vindicated. As Alderman Brodie said, the conduit system was a costly affair, though

London had seen fit to adopt it, but the only system that would pay at the present time was the overhead.

The Mayor, in submitting the toast of the Association, referred to the pioneer efforts of Mr. Holroyd Smith, which brought back to us many old and half-forgotten reminiscences of the early days of electrically-propelled tramcars.

The contributors to the musical programme were Madame Susie Higson, Miss Eccleston, Mr. Crumblehulme and Mr. Ben Adams (humorist), with Mr. W. P. Young at the piano, an instrument which, we imagine, he cursed for all he was worth! In the notice to members concerning the arrangements of the Congress it was hoped they would bring their wives. Many did so, and we are fain to believe that much heart-burning resulted amongst the ladies, who had to seek their own amusements during the time the male things were engaged in the gentle art of gastronomy. Perhaps the size of the dining-room was the cause, but as they joined the delegates at dinner last year at the Mumbles, it seemed too bad that they should be deprived of the same privilege on the present occasion.

The next morning, Friday, was devoted to the papers of Mr. Harry England and Mr. A. V. Mason, and then special cars conveyed the members and their ladies to the Norbreck Hydro, for lunch as guests of the Blackpool and Fleetwood Tramroad Co.; thence to Fleetwood to board the steamer *Lady Moyra*, for Barrow and Furness Abbey, returning to the Imperial Hotel for the members' supper and dance.

Not all of us, however, were allowed to remain to listen to the eloquence of those who discussed the papers, for the ladies were bound for the south shore "Pleasure Beach," and Alderman Brodie commanded the great majority of the male persuasion to accompany them to "The Sands of Pleasure," where all the fun of the fair was at their disposal upon presentation of their badges. The representation of the naval battle between the *Monitor* and the *Merrimac*, showing the first engagement between ironclads, was a marvellous spectacle, but this was only the central attraction in the midst of water chutes, scenic railways, river caves, switchbacks, and innumerable other side shows, which made one think of the White City, Earl's Court, and the Crystal Palace rolled into one.

To us, and to several of our intimates who are not votaries of Terpsichore, the ball room of the Imperial offered no attraction, so we quietly wandered down to the Tower, and later sauntered through the ferneries, floral halls, and palm houses of the wonderful Winter Gardens, finally finding our way to the Empress Ballroom, where we discovered an elderly Councillor in full evening warpaint of "clean billed rags and claw-hammer," who had evidently wandered from the fold, footing it merrily with the ladies of his choice. He hails from the outskirts of London, but wild horses would not drag his name out of us. We watched him for some time, and concluded that he was making the best use of the privileges his badge conferred upon him, as the Gardens afford an unlimited range of entertainments to "Improper Peter."

A courtesy which was most acceptable was that extended by the directors of the Athenæum Club, offering us the use of the club premises during our stay in the town for the most successful conference yet held.

Invitations from the management of the Tower, the Palace, the Opera House, the tramway systems and the South Shore Golf Club were also generously proffered to the delegates and ladies.

To Mr. Brodie, whose acquaintance we first made some 18 years ago, we owe our thanks for many kindnesses, and each succeeding year only gives us a higher appreciation of the sterling qualities of Blackpool's popular Alderman. To the Mayor, whom we visited in the Town Hall Council Chamber, and to the Blackpool Corporation, to Mr. England, to Mr. Furness, who was here, there and everywhere, to those who offered us their hospitality at St. Anne's and Norbreck, and last, but not least, to Mr. de Turkheim, the tactful, energetic and ever courteous secretary we wish to make our salaams.

No wonder that the Hon. Arthur Stanley should conclude his speech by hoping that the Association would be invited to Blackpool on many other occasions of the kind, and be given the same good cheery welcome, to which we will add, may we be there to see!

REPORT OF THE PROCEEDINGS.

The fifth annual Congress of the Tramways and Light Railways Association took place at Blackpool on Thursday and Friday of last week, and was highly successful, both from the standpoint of interest in the papers and discussions, and from the standpoint of enjoyment of the social functions and outings arranged for the delegates. The business proceedings took place in the handsomely-appointed ball-room of the Imperial Hydro Hotel.

The Chairman of the Council (the Hon. Arthur Stanley, M.P.) was unable to be present at the opening, and Mr. Harry England (the Vice-Chairman) occupied the chair. He was supported by members of the Council, Mr. A. de Turckheim (Secretary), and other officials, and nearly 200 members were present.

A very cordial official welcome to the town was extended by the Mayor (Councillor M. G. Wilde), who incidentally paid tribute to the excellent management of the local tramway undertakings; and Mr. R. B. Barningham (Director of the Blackpool and Fleetwood Tramroad Co., Ltd.), and Mr. C. E. Riding (Secretary of the Blackpool, St. Anne's and Lytham Tramways Co., Ltd.) also offered words of welcome.

The CHAIRMAN made a suitable response on behalf of the members. Proceeding to open the business proceedings, the chairman referred in sympathetic terms to the death of Mr. Courtenay, through whose assistance the Association, some years ago, was able to tide over a period of difficulty, and become firmly established as a sound and vigorous body. He suggested that a resolution of condolence should be sent to the bereaved family, and the members agreed, rising in their places.

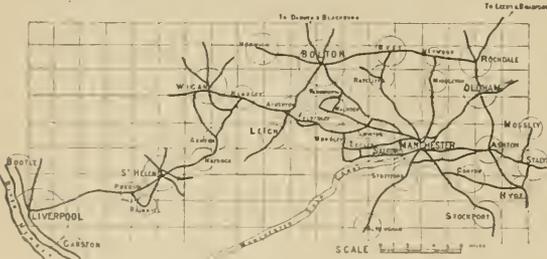
In calling upon Mr. E. H. Edwardes to read his paper the CHAIRMAN mentioned that the Liverpool Corporation, at a forthcoming meeting, was to consider a motion with reference to the possibility of using the tramways for the conveyance of goods to neighbouring towns.

Mr. E. H. EDWARDES, A.M.I.E.E., general manager of the Lancashire United Tramways Co., then read a paper on "The Possibilities of Increasing Profits on Inter-Urban Tramways," pointing out that many such lines had been constructed which presented little prospect of dividends, so that economies were essential. The cost of electrical energy could hardly be reduced, nor could the wages of employes be altered, but the author considered an elaborate uniform unnecessary.

The chief maintenance charge was the maintenance of cars: these were often gorgeously painted and decorated, with unnecessary brass hand railing and other superfluities. An absolutely plain car, built mainly of iron and painted plainly was all that was requisite in the country, as a tramcar was an object of utility and could never become a thing of beauty.

The wear of track and paving was largely due to the ever-increasing motor traffic, which favoured the tramway track. The electrical equipment of the lines was cheap and satisfactory, but could be made a source of unnecessary extravagance. Ornamental bases and collars, massive finials, elaborate scroll work were costly to maintain and were not needed. In the author's experience, a 10 or 20 minutes' service was better than 7½ or 15 minutes, simply because the former was an easier multiple of time.

The carriage of goods offered an important opening for increased receipts, besides tending to diminish the use of the track by motor lorries. On one road alone between Bolton and Manchester, 150 motor lorries passed daily, and 50 per cent. of them had trailers. The carriage of goods by motor-lorry cost about 4½d. per ton per mile, and the cost was likely to increase, owing to the rising price of petrol. An efficient system of electric wagons with two or three trailers carrying about 8 tons each would enable them to improve on this figure and make a considerable profit. Most of the haulage would have to be done at night, and the electrical plant would then be working throughout the 24 hours, improving the load factor. The tramway systems of South Lancashire, shown in the figure, offered extraordinary possibilities for the carriage of goods.



PLAN OF INTERCONNECTED ELECTRIC TRAMWAY SYSTEMS OF SOUTH LANCASHIRE.

At present, owing to the enormous congestion of traffic, the railway companies could not cope with the demand, and delays of a week or 10 days took place before the mills could obtain goods from the docks. Therefore the shippers and manufacturers would welcome any such proposition. It would not pay to lay a siding into every mill, but central goods yards could be established in the manufacturing areas and the goods shipped to lorries for delivery. Such a scheme would offer a fair return on the capital outlay, and would diminish the motor traffic over the tramway tracks. It could only be carried out by co-operation between the various adjoining tramways.

From the statistics of 12 typical undertakings, the author showed that the average cost of energy was 31.6 per cent.; wages (including uniforms), 40.1 per cent.; maintenance and cleaning of cars, 18.2 per cent.; maintenance of track, 6.9 per cent.; maintenance of electrical equipment, 2.9 per cent. of the total. Two of the above were private companies, and the statistics showed that their cost of energy was 33 per cent. less, wages 10 per cent. more, and maintenance of track 75 per cent. more than the above average.

MR. PARIS (Heavy Woollen District Tramways), in opening the discussion, remarked that running costs were practically standardized to a certain extent, but when they came to be divided under five headings, as was done in the paper, there were found to be many discrepancies, although the totals might almost approximate. In the case of electrical energy generated by a company or a corporation, the charge was 1d. to 1½d. lower than his company had to pay to some four local authorities in whose districts their cars ran. If his company were able to produce their own electricity, they would effect a saving of from £4,000 to £6,000 per year, or from 2 to 3 per cent. on the capital expended on the undertaking. That, of course, was a very big thing. In regard to the heading of wages, they were now in a very unhappy position. All their employes were wanting more money. They had had to face the question, and increase the wages. He did not see finality in it; he was afraid the wages bill was going to be still higher, and they had to consider how they could recoup themselves. As to maintenance of cars, he thought Mr. Edwardes's remarks were quite right. The question of track was a very serious item. Tracks got older and more dilapidated, and road traffic increased. The Act of 1872 made the undertakers repair the track, but in the days when that Act became operative, the cars were drawn by horses, and the track was naturally destroyed by them. Nowadays, the tramway companies and undertakings did not destroy the track. They only used the lines. Yet they went on, year after year, promoting Bills with all the old-fashioned "liabilities" hanging on to them. Why should they have to pay for the track that they did not wear out? Fortunately, a prominent electrical engineer, Mr. Hamilton, who, no doubt, knew their needs and requirements, had just been returned to the House of Commons, and he hoped that his knowledge of all the disabilities with which the electrical and tramway industries of this country were saddled would lead him to make a firm stand on their behalf. He had ruminated over the problem of the carriage of goods on the tramway systems for the last ten years, but could not see his way out of it. In the district that he represented they had no fewer than four different gauges—4 ft. 8½ in. in Leeds, Wakefield, Ossett and the Yorkshire Woollen district; 4 ft. 7½ in. in Huddersfield; 4 ft. in Bradford; and 3 ft. 6 in. in Halifax. How were they going to run through cars? Through goods traffic in the way suggested would be impossible in the West Riding. On the other hand, it seemed to be the ideal thing in Lancashire, and ought to be done.

ALDERMAN SMITH (Liverpool) remarked that the figure of 4½d. per ton per mile was given as the cost of carriage of goods by motor lorry. If they could put three tons of goods upon an electrically-hauled truck, and convey them at the rate of about 1s. per mile during the night time, it appeared to him that it would be quite as good as the carrying of passengers on some of their best lines during the day time. They would be making a decent income. There were difficulties in regard to the extraction of goods from the docks, and certain other difficulties had been touched upon in the paper, but he thought these might be overcome.

MR. W. CLOUGH (Bury) said that with regard to the maintenance of car bodies, even in the Black Country it might be more economical to have the interiors of cars finished with what the author of the paper described as "finest figured wood." Then they only required to be periodically cleaned and varnished, which was much less costly than repainting in the style he recommended. To some extent this applied to the outside panels. The fact that the bodies were well finished in the painting and varnishing rendered the nightly cleaning much cheaper. He had taken out the figures for both classes of work, and he found that the reduction in cost which Mr. Edwardes suggested was small in comparison with the extra cost of maintenance and cleaning which would be entailed. He could not agree that a 10 or 20 minutes' service was better than a 7½ or 15 minutes' service, simply because the former was an easy multiple of time. The author ought to look for some other cause for the increase in receipts. A 20 minutes' service might be altogether insufficient, and 10 minutes' service might be too frequent. He would not allow the difficulties to prevent his arranging the exact time-table which the traffic required—run with the least possible number of cars and with the least possible running time. The author suggested that the carriage of goods on tramways could help them in two ways—by increasing the receipts, and by driving off the road motor vehicles which did so much damage to the tracks. They should look at the difficulties they had to overcome before they could secure those advantages. There was no prospect of getting suitable trucks and overhead equipment installed in the dockyards and railway sidings, or in the mill yards and warehouses. Seeing that the tramways would approach this matter as competitors with railway companies, the latter could not reasonably be expected to give the tramways any facilities. If, however, the railways and tramways were prepared to work a combined scheme, it would be possible to devise a means of conveying a railway wagon direct from the sidings to the mills and warehouses. In fact, at the present moment he had under consideration the conveyance of coal wagons from a private siding to a proposed coal yard, a distance of five miles. It was proposed to construct a tramway track as a short extension of the railway track, but at a lower level, and to run the

railway wagons on to the shallow tramway trucks, and so convey the railway wagons along the tramway. Co-operation between railways and tramways was out of the question; therefore, as the author said, it would be necessary to have central goods yards in the various towns. Suppose the tramway authorities formed a joint board with goods warehouses throughout the manufacturing district of Lancashire. The tramway companies would be in the same position as the railway companies were in to-day. On the one hand they would have a set of warehouses or depots connected by tramways. On the other hand they would have a set of warehouses connected by railways, with the admitted additional advantages, in the case of the railways, that there existed facilities for the exchange of goods, and they were able to get into the warehouses alongside the docks. The only way in which the tramways could possibly secure any advantage would be in the cost of haulage. Could the tramways carry goods at a cheaper rate than the railways now charged? The railway company was asked to convey 25 tons of cotton goods from Bury to Liverpool, a distance of 35 miles, and quoted a rate of 10s. per ton, station to station. The total cost was £12 10s. To convey those 25 tons by tramway they would require three vehicles, for they must remember the bulk, as well as the weight of the materials. One vehicle fitted with electrical equipment would cost, say, £750, and the other two, without electrical equipment, would cost £500 each, a total of £1,750. Giving a 10 years' life, and the money borrowed at 3½ per cent., the annual charge of £236 5s. for interest and depreciation, provided the vehicles were in use six days per week, equalled 15s. 9d. per day. The wages and expenses of two men taking the vehicles to Liverpool would be 7s. 6d.; the cost of electrical energy, 1 unit per vehicle per mile at 1d. per unit would be 8s. 9d.; the maintenance and repair of vehicles at ¼d. per mile run would be 6s. 7d.; the mileage to be paid to other authorities, say, 6d. per car-mile, which was sufficient to cover wear and tear and renewals of track and overhead equipment, was £2 12s. 6d.; making a total cost of £4 11s. 1d., provided there was a return load. If the vehicles had to return empty there required to be added:—Wages, 7s. 6d.; energy, 8s. 9d.; maintenance and repairs, 6s. 7d.; and mileage £2 12s. 6d., which amounted to £3 15s. 4d., or to a total of £8 6s. 5d. Compared with the present charges of the railway company this left a balance of £4 3s. 7d., with which to pay for the cost of warehousing at each end of the line. Now take the case of the goods carried by motor. At the author's figure of 4½d. per ton per mile, this equalled £16 8s. 1d., but for this amount the goods were conveyed direct from the mill at one end to the shipping warehouse at the other. Therefore, to compare the costs there must be added on to the tramway costs the expense of carting and handling at each end of the line. One mile of carting at each end would be a fair average, and that would amount to £2 10s. The tramway cost would therefore be increased to £10 16s. 5d., and, compared with the motor, this left a balance of £5 11s. 8d. in favour of the tramway, plus any advantage from a return load. There would scarcely be time, he thought, to travel the 70 miles of the return journey between the hours of 11 p.m. and 4.30 a.m., but this difficulty could be overcome by an exchange of crews, which would be possible if worked under a joint control. He believed, with the author, that now that railway rates had been so much increased, and with the increasing cost of petrol, the tramways were to-day in a position to compete with railways or motor haulage, and he would be prepared to meet any others to consider whether a joint board could be formed to take up this question of additional means of revenue. One of the first questions they would have to ask would be whether the tramway authorities had power to enter into this traffic. In the case of his own system, they had power provided that not more than 4d. per ton per mile was charged.

Mr. J. W. DUGDALE (Oldham) said it was quite feasible to arrange for a board to deal with this traffic. He represented the important spinning town of Oldham, where there were 89 cotton mills, with 6,250,000 spindles. In Oldham and district there were 197 cotton firms, with 14,750,000 spindles. The amount of raw material used in Oldham was 5,000 tons per week. There were 1,700 tons of raw material brought by road from Manchester to Oldham, and the total quantity of yarn dispatched by road from Oldham to various places amounted to 2,500 tons per week, the quantity to Manchester being 1,000 tons per week. There was a great field there for them.

Mr. C. D. STANLEY (St. Helens) said the statement had been made that "Bright, nicely-painted cars attracted traffic." In an industrial town in Lancashire the one thing that attracted traffic was a good and convenient service. To spend 15s. on elaborate decoration of each tramway pole per annum was not only wasteful but artistically wrong. A tramway pole was for use, and should be strong, plain and straight; elaborate work was out of place. In regard to tramway services, on one of their routes they had recently discontinued a 15 minutes' service, and had put on a 20 minutes' service instead, with the result that the service was actually more popular, and there was an increase in receipts. Very largely the reason was that the loops were in very bad places, and the 15 minutes' service did not run well, whilst a 20 minutes' service happened to fit. As to the carriage of goods, he thought a scheme could be devised by which a railway and a tramway could co-operate, just as railway companies and other haulage firms co-operated at present. The carriage of goods on the tramways between Liverpool and the manufacturing districts of Lancashire was bound to come.

Mr. EDWARDES, in the course of his reply upon the discussion, said the difficulties in the way of the carriage of goods were increased enormously when all the gauges in a district were different. Fortunately, in Lancashire they were not different. As

to the car decoration, if the inside of a car was lined with deal and stained and varnished, it was equally as good as three-ply maple and figured oak. It was quite as easy to clean, and, in regard to the outside, it was the varnish that simplified the cleaning, not the brightly coloured paints and transfers. Clean cars did attract traffic; beautiful cars did not—at any rate in Lancashire. He thought the difficulty of running trucks on railway lines could be overcome. At Liverpool he believed the lines at the docks were owned by the Dock and Harbour Board, and, therefore, they would not have to ask the railway companies for their lines. Another point was that the railways did not run sidings into the Lancashire mills.

(To be continued.)

## NOTES FROM INDIA.

[FROM OUR OWN CORRESPONDENT.]

*Lahore.*—It was obvious from the beginning that an electric supply company would be a success in this very important capital of the Punjab. The capital has been subscribed by a coterie of local Indian magnates—men of shrewdness and enterprise, who foresaw a good return for invested money. New consumers continue to be added to the mains daily, both for lighting and power purposes, and most of the Government buildings have been or are being electrically wired. Hence local wiring contractors have been reaping a good harvest, and it is to be hoped that they will continue to do so for some years to come as the mains are extended. A good few motors have been connected on to the system; and these are being watched with considerable interest by some of the more conservative steam users in local mills and factories.

*Lahore. North-Western Railway.*—Mr. Cardew, who for some years held the important post of Electrical Inspector to the Madras Government, has been recently appointed Chief Electrical Engineer to the North-Western Railway, whose headquarters are at Lahore. His predecessor, Mr. G. H. Wright, who held the position for many years, has retired—youth in years, robust in health and, rumour has it, robust in wealth to boot.

*Amritsar,* close to Lahore, and remarkable for its wonderful Golden Temple of the Sikhs, sent out inquiries not long ago, through its enterprising municipal engineer, for schemes for electric lighting and power. Much money and labour were spent by several firms of contractors both in Bombay and Calcutta in planning out suitable schemes and estimates; but so far, nothing seems to have resulted. The pity of it is that, when lighting and power schemes of this nature are contemplated, the authorities concerned do not either appoint a reputable consulting engineer for a fixed fee to draw up plans and specifications, or appeal to Government to help by lending one of their many capable electrical engineers to do so. This, of course, would be a business-like way of doing things, but—we are in India.

*Nagpur.*—Messrs. Crompton & Co., of Bombay, who are the main contractors for the electrical equipment of the Nagpur Electrical Supply Co., are proceeding with the work in not too rapid a manner. It was hoped at one time that possibly current might be available for at least some fans for this hot weather, but according to the look of things this will not be so. Contracts have not as yet been given for the wiring of the many Government buildings, current for which will at first go to form the major portion of the power house load. Several Bombay and Calcutta firms have put in tenders, varying from £1 to £1 10s. per point, including drop pendants, and prices for fans vary from £5 10s. to £6, with regulators thrown in. As there is no official electrical engineer yet in the Central Provinces, the responsibility of deciding on the above varying figures may be the cause of the delay.

*Port Trust, Calcutta.*—Messrs. Pyne, Hughman & Co. recently obtained a contract for supplying 13 electric 2-ton lifts, at a cost of just under one lac of rupees, for the new extensions at the Port Trust. This very enterprising young firm is forging ahead rapidly. On most of the large new buildings in Calcutta their name-boards testify that they have almost a monopoly of passenger lift work.

"Henley's metal-covered wire" system has caught on rapidly, and is being generally specified for important buildings. It is cheap, fairly easily fixed, and when carefully put up looks neat and does not interfere with decorative schemes of interiors. If it is found to be *lasting* in our Indian climate it should eventually oust from the market most of the other "systems" which have held the field for years back; but its lasting qualities have still to be proven. In India one has to hasten slowly with innovations, be they ever so certain in their behaviour at home.

### CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

#### The Prevention of Accidents in Electric Lifts.

Whilst agreeing with several points put forward by Messrs. Smith, Major & Stevens, Ltd., in their letter dated June 2nd, I think they have misunderstood my idea of an ideal lock. To make matters more clear, I should have added that though gravity or springs may take a part in the operation of the lock, should these fail the gate or door shall not open unless the car is at that floor. This, I contend, is not the case with the most up-to-date locks fitted by different makers at the present day—not even with the locks manufactured by Messrs. Smith, Major & Stevens, Ltd. As a matter of fact, within the last two months, I have on two occasions experienced failures of their lock patent No. 2,766, fitted to the doors of a totally enclosed well of a push-button lift installed in a private house in the West End of London. On the first occasion the butler telephoned up in much alarm, he having found that the door on the ground floor could be opened whilst the lift was away from that floor. On the second occasion, I discovered the defect whilst inspecting the lift. In both cases broken springs were the cause of failure, and marred what was otherwise a very efficient lock. This lift was installed two years ago, and is therefore practically up to date. I do not quarrel with the use of long inclined planes in order to give a good margin for the unlocking of gates. What I do raise objection to is the fact that owing to the interlocking device being independent of the switch and latch, there is the possibility of the gate or door not being securely locked without interfering with the running of the lift. At the time of writing, I have been brought into touch with the inventor of a lock which, strange to say, as far as I can at present see, practically covers all the requirements of my ideal lock, but not as yet having seen one in actual use, I cannot state definitely whether, to my mind, the absolutely safe lock has at last been invented.

W. H. Carroll.

London, E., June 16th, 1913.

The attempt made by Messrs. Smith, Major & Stevens, Ltd., in your last issue to clear away "confusion of thought and false reasoning" in the very clear remarks of Mr. Cooper, appears to be singularly unfortunate.

Referring to the sentence: "No gate can be opened until the current has been cut off from the controller," your correspondent's assumption that the locking and unlocking is shifted to the *controller* is surely without good ground, as there is no necessary connection.

As regards types of locks in use at present, it will, I think, be admitted that any lock which is operated by an inclined plane or tappet of any kind fixed to the cage, and which is locked after the cage leaves the landing, by any means whatever, must possess that element of danger which Mr. Cooper claims is overcome in the new lock in condition (1): "Cage cannot move until the gates are both mechanically and electrically locked." That Messrs. Smith, Major and Stevens have not successfully provided against the above-mentioned point is clear from their argument as to the necessity for an unlocked zone extending about 2 ft. 6 in. above and below each landing.

As to the passengers becoming alarmed owing to the lift stopping between floors, and their not being able to escape from the cage, surely this is better than risking their lives by providing inefficient locking systems.

The assumption that even this last point is not provided against in the new lock is characteristic of Messrs. Smith, Major & Stevens's adventurous methods of discussion.

Helicon.

London, June 16th, 1913.

We have been reading with considerable interest—not unmixed with some amusement—the correspondence in your columns in reference to the above, but we had not proposed to intervene for fear it should look as if we were endeavouring to obtain an advertisement for our manufactures.

In view, however, of the letter by Mr. G. W. Newman, written from the architect's point of view, we should like to ask you to allow us to make a statement which is the result of our very large experience, as we have fitted some hundreds of automatic lifts, which we regularly inspect and maintain, and are, therefore, thoroughly familiar with all the points in connection with the same. From this experience we should have no hesitation whatever in assuring architects that the automatic lift, as now supplied by us, reaches all the requirements of practical safety, and that the locking gear which is fitted to our lifts, on the design and manufacture of which we have spent a large amount of time, meets all likely contingencies.

In reference to the point raised by Mr. Cooper, while, in the ordinary way, it is frequently possible for a landing gate to be opened at the moment the cage is passing, this would have the effect of stopping the travel of the lift, which would therefore necessarily cover the opening produced by the removal of the gate, and, consequently, there would be no real danger of accident from this cause, although there might be some inconvenience to the person travelling in the lift. It is, however, quite easy to overcome this, and we have done so in some cases, by fitting an additional electrical attachment, which prevents the gates being opened until the lift has been stopped, or by another arrangement by which the gate lock will be released at the floor at which the lift is intended to stop. This is, of course, an advantage so far as the convenience of the lift is concerned, and can be fitted in any case where it is desired.

It is necessary, however, to bear in mind that all these additional precautions involve additional complications, and therefore add to the possibility of getting out of adjustment and stoppage of the lift.

For R. Waygood & Co., Ltd.

H. HARMSWORTH,

Director and Sales Manager.

London, S.E., June 17th, 1913.

#### Bedstead Antenna.

In connection with the note under the above heading on page 983 of your current issue, I enclose herewith an extract from the "London letter" of the *Yorkshire Observer* for the 16th inst., in which the writer states that the even burning of arc lamps in London has been affected by the time signals from Paris.

Do you know if there is any truth in this statement? It seems scarcely credible!

W. H. B.

#### Long Scale Instruments.

It was somewhat with surprise that I read Mr. J. W. Record's last communication to you. I should be the last to wish to charge him with the intention to mislead, but I can show you a price list of the Davies instrument, which was published at the time when Mr. Record was in his electrical short clothes. It is consequently quite possible that he is not aware of the whole history of the subject, though, making the claims he has done, he ought to have acquainted himself with this history, and not ask the public to believe *ex parte* statements which are not warranted by facts. His *ex parte* statements do not confer upon him any right to

claim originality for long-scale moving-coil instruments in the way he has done, by ignoring the previous work of Mr. Davies and others.

You can, by referring to your advertisement columns of the same period, see advertisements by Messrs. Muirhead offering the Davies long-scale instruments, not once but many times, and they had a sale.

I enclose my card, and have the honour to subscribe myself as

**An Electrical Instrument Maker  
who has some Knowledge of the History  
of the Trade.**

#### The Electrical Industry in China.

In reference to my recent articles on the future of the electrical industry in North China, I enclose a letter received by my Chinese engineer relative to his son's progress whilst serving his apprenticeship in one of the big German electrical firms. You will see that the letter is written in perfect English, and first flatters the boy's father with a position he doesn't hold, and then tells him of the curriculum, which begins with six months' instruction into "German business life," "German custom" and "how to make himself understood in the German language."

The letter itself is exceedingly interesting as to the size of the undertaking, and the cloven hoof is only exhibited in the last sentence, where, through services rendered, orders are respectfully solicited. Have we in England any manufacturing firm as enterprising as this?

**Alfred R. Sillar, M.I.E.E., M.I.Mech.E.,  
Engineer-in-Chief.**

Peking, *May 27th*, 1913.

In compliance with your request, I am glad to inform you that your son is going on with his study quite satisfactorily. When he first came over to Berlin, he was for about six months in our office (foreign department), which is one of the largest offices here in Germany. The reason for this was to give him at first an insight into German business life and German customs, as without this knowledge it would have been quite impossible for him to continue his studies. After he had gathered a fair general knowledge, and knew how to make himself understood in the German language, he attended a technical college for about a year, and for the last about six months he has been in our machine factory as an apprentice, so as to obtain a practical knowledge of all the work required for his future career.

In order to give you an idea of our machine factory, I would mention that this one department only employs about 15,000 workmen.

I take it that you have received likewise reports from your son, and I hope that you will be quite satisfied when he returns to China.

*As far as business is concerned, I regret to say that I have heard nothing from your company for some considerable time, but I hope you will do your best in the interests of — and Messrs. — as soon as business in our line should turn up.*

With kindest regards,  
I remain,  
Yours faithfully,

#### The Mutual Protection of Engineers.

It is gratifying to see the letter of Mr. Frank Gill in your issue of the 6th inst., proposing that engineers should have a body to do for them what the British Medical Association does for the medical profession. There is a very general feeling abroad to this effect which augurs well for the success of such a movement if engineers are prepared to forego a little of their individualism and become more cohesive. They must also be prepared for long and hard work to attain the desired end. Lastly, these things cannot be done free of cost, and a subscription of probably a guinea per annum or more will be necessary. The British Medical Association has about 27,000 members, and yet their subscription of 25s. is found scarcely large enough. A very great deal can be done by such a voluntary body, as, for example, was made very evident in connection with the Insurance Act. Many think that the success of the work of the British Medical Association is due to the Statutory Registration of medical men. This does no doubt assist them, but the principal Medical Acts (which deal with registration) are those of 1858 and 1886, whereas the B.M.A. was started in 1832. I am pleased to say the

Society of Engineers (Incorporated) is at work at the subject, and feel sure they would be glad of any assistance that engineers can give them in the matter of information, experience, and suggestions.

More societies are not required. No profession can have more societies connected with it than engineering. What is wanted is the hearty support by engineers of those bodies which are trying to raise the status of the profession in the manner that the B.M.A. has raised that of medicine.

A. S. E. Ackermann.

London, S.W., *June 12th*, 1913.

#### Proposed British General Engineering Staff Association.

Your correspondents and readers will be glad to learn that it is definitely proposed to form a new and separate association for the Mutual Protection of Engineers. So far, indeed, the movement has met with every encouragement. Those representative gentlemen who have most keenly considered its inception are now hoping for general support.

You will recollect that a recent correspondent referred to the "trust" which, it would appear, has been formed already by our large employers. It was suggested that this powerful body has as one of its main objectives:—"The prevention of an engineer—who may have displeased those in authority—from obtaining employment in any constituent firm; the regulation of interchange of staff, should an engineer endeavour to improve his position; the extension of the hours of staff employment; the reduction in holidays, with abolition of payment for that period; and the general lowering of the status of engineers."

Such charges are, of course, most serious, and may or may not be disproved. The certainty is that manufacturers, being primarily concerned with profit-making, could mutually deem it to their monetary advantage to impose such conditions upon us. And it must also be admitted that, without organisation, our position is a perfectly helpless one.

This latter fact is demonstrated once more by the result of a recent dispute between the directorate and staff of one of our principal companies. Into the offices of this company has been introduced a system to which a large proportion of the staff openly objected. The outcome at best may be simply a formal "Staff Protest," directed to the board, and summarised as below:—

"Whilst reluctantly accepting the uncompromising ruling of the directorate, we regretfully enter this our deliberate protest against the enforcement of a system which impairs the cordial relationship hitherto existing between the management and the staff."

The position is surely one of failure—dismal and undignified. Yet little other than this was expected. Most of us feel that it is almost futile to insist upon the maintenance of our professional status at present. We lack the support of an association which would represent the engineering staff throughout the country as a whole.

It is proposed that membership of such an institution should be opened to all engineers—mechanical, civil, electrical, &c. The Official Committee of the Association will undoubtedly confirm that decision later. The widespread conclusion of the moment is that the new Association itself is an absolute necessity, especially as the existing institutions—the I.C.E., I.M.E., and the I.E.E.—are concerned solely with the purpose of promoting and furthering the technical aspects of engineering.

The aims of the suggested federation are practically obvious. One need merely say, therefore, that its members would co-operate for the maintenance and furtherance of their economic and social interests. And this object could, perhaps, be attained as follows:—

(a) By the study of social-economic questions, and by the development of the spirit of unity.

(b) Through the medium of statistical information and extensive inquiries into existing conditions of employment (including remuneration), with a view to their regulation.

(c) By the systematic airing of grievances in the Press.

(d) By means of monetary assistance to members.

(e) By the aid of vacancy lists.

(f) By means of free advice in law cases of professional interest, with partial or total assistance in defence.

(g) By free advice in connection with patents.

(h) By influencing the framing of laws, in so far as they concern members of the Association; and

(i) By means of local branches of the Association.

Such, of course, are mainly the aims of the German Bund der Technisch-Industriellen Beamten. In fact, those who are interested will find the current report of that Society most instructive. It readily convinces one that co-operation alone is of mutual advantage. As an instance of its utility, during 1912—the year on which the report is based—the German Institution concerned itself with almost every kind of legal action. Such actions were fought mainly with the object of eliminating inferior working conditions, systematic overtime without extra remuneration, and adverse clauses in contracts, and of procuring employment references and salaries wrongfully withheld, &c. And no less than 70 per cent. of these “defensive actions” and 85 per cent. of the “actions for improvements” appear to have been successful.

It is hoped that the proposed British Association will soon be established on equally progressive lines, and that its work will ensure its rapid growth. As many as 250 members of the staff of one firm alone have already signified their approval of the society, and reports from various quarters are similarly gratifying. The engineers attached to the largest companies are specially in favour of the movement.

Meanwhile, each gentleman who is interested, or each intending member, is kindly requested to send his name, with that of his employer, to the undersigned, supplemented by any suggestions he may care to offer. Every communication will, of course, be treated as perfectly confidential and private. It is also important that the Association be given as much publicity as possible.

L. H. Fletcher,

*Hon. Acting Secretary, Proposed Association.*

31, Queen Victoria Street, London, E.C.,  
June 16th, 1913.

#### Agreements for “Hire” and “Hire-Purchase.”

Although not a practical electrical man, but only a practicing solicitor, I am a constant reader of the ELECTRICAL REVIEW in its less technical, and especially in its legal parts. I was much interested in “Excelsior’s” article with the above title in your issue of June 13th. It is a thoroughly useful article, and contains nothing to mislead the practical man (except possibly on the question of stamp duty), but will, on the contrary, prove exceedingly helpful to “Owners” and “Hirers” alike. Such documents, although always described as agreements, were not always reckoned agreements for stamp duty purposes. With the probable exception undernoted, they are now liable, if under hand only, to the agreement stamp duty of 6d., and if under seal, to the deed duty of 10s., like any ordinary agreement; but that is only in virtue of the provisions of Sec. 7 of the Finance Act, 1907, a comparatively recent Act. Previously to the coming into force of that Act, such documents were dealt with as follows:—If merely for “hire,” they were not considered by the revenue authorities to be liable to agreement duty, not even to lease duty, as one might suppose would be the case, but to bond or covenant duty, which in cases where the payments were to continue for a definite period, so that the total amount to be ultimately payable could be ascertained, was the same as mortgage duty (2s. 6d. per £100), and in cases where the period was indefinite, was 2s. 6d. per £5 of the sum periodically payable. I am rather inclined to think (differing apparently on this point from “Excelsior”) that mere “Hire Agreements” are still liable to the bond or covenant stamp, for the proviso in the Finance Act of 1907 refers only to agreements “whereby the goods in consideration of periodical payments will or may become the property of the person to whom they are supplied.” If for “hire-purchase,” it depended on the terms of the document whether it was liable to duty or not. If it contained a proviso that the article supplied was to remain the property of the owners until full payment had been made, it was reckoned a bond or covenant, and held liable to a duty of 2s. 6d. per £100

on the total amount of the purchase price. I have before me, as I write, a “hire-purchase agreement,” dated in 1902, relating to printing machinery, on which the duty is adjudicated by the Inland Revenue at 2s. 6d. per £100 of the total amount payable in hire before the machinery could become the property of the hirer. If, however, the document implied an out-and-out sale, the price being payable by instalments, with or without a clause of forfeiture in the event of default in payment of the instalments, it was reckoned an agreement for the sale of goods and so exempt from any duty, by virtue of a proviso in the Stamp Acts to that effect, which is now repealed so far as hire-purchase agreements are concerned by the section of the Finance Act of 1907 above cited.

It may be useful to many of your readers to know that in Scotland a document “under hand” means a document without a consent to registration, and that a document “under seal” means a document with a consent to registration. “Registration” means registration in the Books of Council and Session. Registration in those books involves the giving-up of the deed to be preserved in the archives of Scotland and gives the “extract” or office copy issued in lieu of the original the effect of a decree of the Supreme Court of Scotland. In Scotland, therefore, it may be well worth while to spend the extra 9s. 6d., and put a consent to registration into the document, because in the event of its being necessary to enforce the “agreement,” that can then be done without the delay and expense of bringing an action in Court.

W. P. M. Black.

Glasgow, June 16th, 1913.

#### Heavy Current Lampholders.

With reference to your remark on page 978 of the current issue, June 13th, 1913, under “Heavy Capacity Lampholders and Adaptors,” namely, “it occurs to us that these channels might be made a permanent feature of the holders to allow of the circulation of air,” we wish to point out that we build our lampholders so that they will not heat up with the current they are guaranteed to carry, and we do not require or rely upon any auxiliary means to keep the contacts cool. As it is just possible some of your readers may, through your remarks, think our lampholders are deficient in construction or liable to heat up, we shall be obliged if you will make the above point clear.

With regard to permanent holes in the cases of lampholders, these holes would have to be much smaller than those in the sample you sent, otherwise there is a danger of shock and shorts to persons handling same.

We can, of course, supply holders with ventilating holes if required; but we do not think they are necessary.

Per Pro. G. St. John Day (Patents), Ltd.  
G. ST. JOHN DAY, Director.

Oldham, June 16th, 1913.

A letter has come to hand from “W. E. P.” without the writer’s name enclosed. Owing to pressure on our space, several letters have been held over to our next issue.

## LEGAL.

LUND v. EXCELSIOR CHEMICAL CO.

IN the City of London Court, on 13th inst., before Judge Rentoul, K.C., Mr. Richard Lund, carrying on business as Lund Bros. & Co., motor and electrical engineers, 78, Queen Victoria Street, E.C., sued the Excelsior Chemical Co., 20, Old Church Road, E., for £6 9s., balance of account amounting to £27 10s. for work done in wiring and fixing a 20-H.P. motor for the defendants for use in their factory in driving machinery.

MR. H. GORNBLEET, who represented the defendants, said that the balance was not due. The work was included in the £17 estimate for wiring and installing the whole apparatus connected with supplying a motor, cleaning and reversing it.

MR. KUHN, plaintiffs’ counsel, said that the defendants made an arrangement with Messrs. Pooley & Austin to do the work, and Messrs. Pooley & Austin employed plaintiffs to carry it out.

Mr. WOOD, plaintiffs' manager, said that after the work was done he went over with the Borough Council's engineer. The engineer suggested that there should be extra fuses placed on the motors, one on the motor already running at the defendants' works, and one for a new 20-h.p. motor which they were putting in, and which the plaintiffs wired for them. The engineer said he could not pass the work unless the fuses were fixed. He told the defendants it was outside their contract to supply the fuses, and the defendants gave them an order accordingly and the work was done.

Mr. GOHNBLEET said that the defendants were not electrical engineers, and it was no use for the plaintiffs to fix a motor unless it was workable according to the regulations of the Borough Council.

Mr. WOOD added that one motor was passed by the Council. It was the other which they supplied fuses to that had to be passed by the borough engineer. They could not supply the fuses for the original price.

Mr. HAMMOND, in the plaintiffs' service, said he found that the defendants' motor was running in the wrong direction, and he was told to remedy that.

JUDGE RENTOUL said that what Messrs. Pooley & Austin ordered plaintiffs to do the defendants were responsible for, as they were their agents. Judgment for the plaintiffs, with costs.

#### MONTREAL TRAMWAYS AND POWER CO.

IN the Chancery Division, on 13th inst., Mr. Justice Warrington heard a motion in the matter of the Montreal Tramways and Power Co., Ltd., to extend the time for registering two debentures.

The defendant company, Mr. GORE BROWNE, K.C., explained, was registered in England in December, 1910. In 1912 the company made two issues of stock notes, which were secured by a deposit of a number of Stock Exchange securities. The company was advised in Canada by two King's Counsel that it was not necessary to register the notes, as they were not debentures within the meaning of the Act. The transaction went through, but afterwards the English solicitor, on hearing that the notes had not been registered, informed the company that, according to English law, it was necessary that they should be registered, because they were, in fact, debentures.

His Lordship granted an extension of time for 30 days from that day.

#### JOHNSON-BILLINGTON ELECTRICITY METERS, LTD.

A PETITION, presented by Mr. H. Johnson, for the winding-up of this company, was before Mr. Justice Neville, sitting for the disposal of company business, on June 17th.

COUNSEL for the petitioner, however, stated that evidence had been filed against the petition which he desired to answer, and the hearing was accordingly adjourned for a week.

### PARLIAMENTARY.

#### Mexborough and Swinton Railless Traction Bill.

AFTER a hearing extending over a fortnight, the Select Committee of the House of Commons, presided over by Sir Ivor Herbert, has come to a decision on the Bill promoted by the Mexborough and Swinton Tramways Co. for the construction of railless traction along several routes.

Mr. E. H. LLOYD, K.C., who appeared for the promoters, explained that they had already constructed tramways in Swinton and Mexborough running to Rotherham, and they now asked for powers to construct railless traction from Swinton to West Melton, from Mexborough to Ardwick; and from Conisborough to Mexborough. These routes were  $3\frac{1}{2}$ , 1 and  $1\frac{1}{2}$  miles respectively. Borrowing powers to the extent of £35,000 were sought. The Mexborough Urban District Council, who opposed the Bill, alleged that the financial position of the promoters was unsound, but as a matter of fact they were earning enough to pay 3 per cent. on the total cost of construction, and were beginning to reap the benefit of their past efforts.

Mr. D. L. WINTER, a director of the company, gave evidence in support of the Bill, and was cross-examined by Mr. FITZGERALD, K.C. (for the Urban District Council), at considerable length, with regard to the financial position of the company. He said the original capital was £180,000, but he did not know that £825 was paid in cash and the rest of the shares were issued as fully paid. Mr. Binns was the original promoter, and he sold the undertaking to the New Traction Co. He was not aware that on April 19th, 1905, the New Traction Co. sold the undertaking to Mr. Godfrey Isaacs, or that on May 4th Mr. Isaacs sold it to another company. The National Construction Co. was connected with the present company as undertakers. It was proposed to raise the £35,000 by debentures.

Mr. W. B. COWNIE, another director, gave evidence, and said the company were prepared to be put under an obligation to construct within two years.

In cross-examination by Mr. WEDDERBURN (also appearing for the Urban District Council), Witness said that the syndicate

bought the undertaking from Mr. Godfrey Isaacs for £11,000 in cash and £11,000 in shares. He did not think Mr. Isaacs made anything out of the transaction.

A number of local witnesses were called in support of the scheme, who said that the tramway company had fulfilled a public service. One witness, Mr. H. G. BAKER, of Swinton, as a large ratepayer, said he was simply appalled at the idea of the municipality undertaking any such scheme.

Mr. F. E. STANLEY, chief engineer of the National Construction Co., gave evidence as to the populations in the districts proposed to be served, and said the total cost of actual construction, exclusive of the cost of the Act, would be about £22,637. He estimated that 133,500 car-miles would be run per year, which, putting the earnings at 10d. per car-mile, would produce £5,562 10s. The estimated cost of working was 6½d. per mile, leaving a balance of £1,946, out of which any contribution towards road maintenance would have to come. They were willing to pay £210 for road maintenance.

Mr. E. CROSS, electrical engineer of Rotherham, gave it as his opinion that the earning power of the cars would be 10d. per mile. The Rotherham trolley system had proved a good feeder to the tram.

Mr. E. MARTIN, borough engineer, Rotherham, gave evidence as to the developments of the South Yorkshire coalfields. He did not think the promoters should be called upon to make any contribution towards road improvement, as the damage would be recouped by increased rateable value. If the powers were not given to the company, it would mean the introduction of motor-buses, and then the local authorities would get no contribution.

Mr. J. E. WALLER, consulting engineer, also gave evidence in favour of the Bill.

Mr. KEEN addressed the Committee for the Swinton Urban District Council, and contended that whilst further travelling facilities were undoubtedly needed in the district, the proper way of meeting the want was for the local authorities to join together and provide a comprehensive scheme. He objected to the proposal of the promoters as being a bad one.

Mr. S. C. WARD, chairman of the Highways Committee of the Swinton District Council, was called in support of counsel's contention. In cross-examination, he admitted that, in his opinion, trolley vehicles would pay in the district.

The Hon. J. D. FITZGERALD, K.C., on behalf of the Mexborough U.D.C., urged that the scheme should be rejected as being unsatisfactory, and also that the financial history and position of the company was unsatisfactory.

Several witnesses were called for the Mexborough U.D.C., who generally opposed the promoters' scheme as being defective, and supported the contention that the matter should be left to the local authorities.

The Committee found the preamble of the Bill proved with the exception of the proposed route from Swinton to West Melton, which they did not consider was well planned. Further, they decided that the promoters should pay one-third of the cost of adapting the roads to the traffic, such sum not to exceed £350 per mile, and thereafter to pay ½d. per car-mile for the maintenance of the roads.

#### Leicester Corporation Bill.

THE Select Committee of the House of Lords, presided over by Lord Clinton, has passed the preamble of the Bill of the Leicester Corporation, which seeks to extend the existing tramway system, to extend the area of supply for electrical purposes, and to run motor-buses.

Mr. H. LLOYD, K.C., who represented the promoters, explained that most of the opposition to the Bill had been withdrawn. The main purpose of the Bill was to extend the tramways within the borough, and to this there was no opposition. The tramway undertaking of the borough had been carried on for many years and had been very successful. By clause 15, power was asked to run motor-buses partly inside and partly outside the city and the routes proposed were: (1) from the tramway terminus in Melton Road to Thurmaston; (2) from the tramway terminus in Groby Road to Anstey; and (3) for the London Road tramway terminus to Oadby. For years there had been a demand for increased travelling facilities in these districts, and some ten years ago the County Council asked the Corporation if they would take a lease of tramways in the districts if the County Council constructed them. The Corporation felt that tramways were impossible, and that motor-buses would best meet the needs, and hence the question of the contribution which the Corporation should pay to the cost of upkeep of roads would come in. In previous Bills Select Committees had fixed the contribution at three-eighths of a ½d. per car-mile, and the Corporation considered that this would be reasonable. The Corporation were asking also for authority to extend their area for electric lighting purposes. At present they supplied in the borough, and by their 1909 Act they had power to come to the Board of Trade and the Local Government Board if they wished to supply outside districts. They now asked to be allowed to supply within the parish of Birstall, the parishes of Humberstone and Evington, and the parishes of Oadby and New Parks. The only petitioners against the Bill were the County Council, in respect of the contribution towards roads, and the Leicestershire Power Co., who had powers to supply the areas scheduled in the Bills. He submitted that the Power Co. would not be interfered with under the Bill.

Mr. A. MACONACHIE, on behalf of the Power Co., offered to withdraw the opposition if this was made quite clear.

After consultation, the Committee decided to insert a clause offered by Mr. Lloyd, to the effect that nothing in the Bill should

be deemed to give the Corporation the right of an exclusive supply in the districts in question; and on the point of the contribution to the cost of the roads used by motor-buses, they inserted a clause to the effect that for three years from the running of the buses the Corporation should pay to the County Council three-eighths of a penny per car-mile; and at the end of three years the matter should be submitted to an arbitrator, who should decide what extra cost had been involved by the running of the buses, and the Corporation should then contribute one-third of such extra cost.

### Huddersfield Corporation Bill.

LORD CLINTON'S Select Committee of the House of Lords has had under consideration the Bill promoted by the Huddersfield Corporation, which, amongst other things, proposes an extension of the tramway undertaking to Slaithwaite and Marsden along the Manchester Road, and to extend the Birchcliffe route to Elland and Greetland. There were also a number of proposals for diversions of authorised lines. Mr. Balfour Browne, K.C., Mr. Harper and Mr. Jeeves, appeared for the Corporation; and Mr. Freeman, K.C., and Mr. Tyldesley Jones, for the Yorkshire Electric Power Co., who opposed the proposed extension to Greetland.

Mr. BROWNE, K.C., contended that what the opposition of the Power Co. amounted to was that if the Corporation made the line it must buy its electric current from the company. Elland had its own electric lighting order, and Greetland had a lighting order which it was bound to transfer to a company, which appeared to be an offshoot of the Yorkshire Power Co. In Greetland, however, there were already tramways worked by the Halifax Corporation and supplied by Halifax. The Huddersfield Corporation merely proposed to do the same thing as the Halifax Corporation was doing.

Mr. K. CAMPBELL, borough engineer, of Huddersfield, stated that the cost of Huddersfield's electric current delivered on the trolley wires did not exceed 62d. per unit. He was informed that the Power Co. was supplying electricity in bulk at 1½d. a unit to Sowerby Bridge from an electric main crossing the projected tramway route. The Corporation used direct current, whilst the Power Co.'s current was alternating, and would need transformation. He considered that the extra cost of the company's power would eat up all the profits of the tramway.

Evidence was called from the localities affected in favour of the extension.

Mr. TYLDESLEY JONES stated that the real objection to the company was to the wording of Clause 15, under which it seemed to them the Corporation might seek to supply tramways in other districts adjacent to those named.

Mr. BALFOUR BROWNE said that was not the intention of the Corporation, and he was prepared to amend the clause so as to make it clear.

Subsequently the Power Co. withdrew their opposition, and the Committee passed the preamble of the Bill.

### Morley Corporation Bill.

THE DUKE OF BEDFORD'S Select Committee of the House of Lords has passed the preamble of the Bill of the Morley Corporation, which deals with railless traction and the gas and water undertakings. The only part of the Bill which was opposed was that relating to trackless trams.

Mr. BALFOUR BROWNE, K.C., represented the promoters, and said the West Riding County Council opposed, and contended that as the trolley-cars would run over main roads, the Morley Corporation ought to contribute to the cost of extra wear and tear. Some of the original proposals in the Bill had been dropped, and it was now proposed to run the cars through Drighlington, Gildersome, Morley and East and West Ardsley, the local authorities of which districts were in favour of the scheme. It had been agreed that the Leeds Corporation should work the system, and should pay to Morley Corporation a rent sufficient to meet the interest on capital expended and the sinking fund.

Subsequently Mr. HUTCHINSON, K.C., who represented the County Council, announced that an agreement had been arrived at, by which Morley should contribute to the cost of main roads at the rate of 3d. per car-mile.

The Committee thereupon inserted a clause to this effect, and ordered the Bill to be reported.

**Folkestone, Hythe and Sandgate Railless Traction.**—It is understood that the Bill of the Folkestone, Hythe and Sandgate Tramways Co., to provide a system of railless traction between these towns, has been withdrawn.

**Various Bills.**—In the House of Commons on 16th inst., the Metropolitan Railway Bill was read a second time.

In the House of Lords on June 12th, the City and South London Railway Bill and the Central London Railway Bill passed their third reading.

In the House of Lords on June 16th, the Metropolitan Electric Tramways (Railless Traction) Bill was read a second time, while the following Bills passed third reading: Richmond (Surrey) Electricity Supply Bill, the Cleveland and Durham County Electric Power Bill, and the Northern Counties Electricity Supply Bill.

**Post Office (London) Railway Bill.**—In the House of Commons last week, there was some criticism offered regarding certain points in this Bill, the second reading of which was moved by the Postmaster-General. The second reading was carried by a majority of 170, and the financial resolution in connection with the Bill (£1,100,000) was also passed. Mr.

H. Samuel, in the course of his reply to criticisms and questions, said that the power for working the railway would be obtained from the Post Office station at Blackfriars, which could be extended at a comparatively small cost.

**Porthaw and District Gas Bill.**—This Bill has passed the Unopposed Bill Committee of the House of Commons, but the electricity clauses have been dropped. It was originally proposed to erect a generating station and supply electricity.

### THE I.M.E.A. CONVENTION, 1913.

This year's Convention of the Incorporated Municipal Electrical Association, the eighteenth in the series, was opened on Tuesday morning last at the Institution of Electrical Engineers, London. Excellent weather conditions prevailed, but despite external attractions, the large lecture theatre of the Institution was well filled with members, delegates and visitors—many of the latter being ladies—when Mr. W. Duddell, the President of the Institution, rose to welcome the visitors. It was very right, he considered, that such an important body, so closely allied to the I.E.E., should meet in their building, and the Council welcomed them and would do anything it could to assist them in their work.

Subsequently Mr. J. E. Edgcome (Acting President, I.M.E.A.) explained the circumstances under which Mr. C. E. C. Shawfield, who was originally elected President of the Association for the year 1912-13, had had to resign office, and how he (the speaker), as a Past-President, had been selected to fill the office for the remainder of the year. Mr. Shawfield was not able to be present, but he had prepared an address, which the speaker subsequently read.

In his preliminary remarks, Mr. Edgcome urged the necessity of forming an information bureau, a matter which he had brought forward seven years previously during his period of office as president: unfortunately he afterwards found, in his capacity as treasurer, that there were no funds available for such a purpose. He suggested that this matter should be considered afresh, and that its cost could be defrayed by subscription.

He further referred to instances of age limits being imposed by some municipal authorities when appointing new engineers, which was a mistaken policy. Experience and age were interdependent, and a Council should always exercise its discretion in regard to age when selecting a candidate.

Mr. Edgcome then read the Presidential Address, which we abstract elsewhere, and the usual vote of thanks was awarded to Mr. Shawfield. Dr. Ferranti then gave an interesting *résumé* of the principal points covered in his paper, the greater portion of which, together with the interesting discussion, we give below.

The paper, as Dr. Ferranti mentioned in his opening statement, deals with the general question of prime movers, the conclusion arrived at being all in favour of the steam turbine for the near future, with coal as a fuel in any case. Needless to add that while he found a considerable majority in support of his conclusions, there were those present who disagreed with him and emphasised the attractions of the Diesel and producer gas engines.

To some extent we believe this criticism to be due to lack of comprehension of Dr. Ferranti's ideal big power station of the future, heartily agreeing, as we do, with one speaker, that one of the greatest faults of the past has been the inability to look ahead in the electrical industry.

Indeed, when one remembers the number of turbine sets of 10,000 to 20,000 kw. output in actual use on the Continent and in America and turns to what is being done in this country, it seems certain that very few of our central station engineers, with big industrial loads to develop, are looking ahead to the extent which circumstances appear to justify. Nothing can shake Dr. Ferranti's sanguine views as to the great future before the electrical industry, and we would that there were more practical evidence of our leading engineers sharing in this optimism.

The question of the sufficiency of oil fuel raised by one speaker is of considerable interest; we have never gathered that there was likely to be a permanent shortage, but rather that the possibilities of rigging the market were such as to render the price uncertain.

At the conclusion of the meeting, the members adjourned for luncheon, many of them, however, paying a visit to the interesting exhibit of cooking, heating and other electrical appliances which has been gathered together by several well-known firms in the Common Room of the Institution.

The afternoon was spent in visiting the Deptford and West Ham generating stations, while the event of the evening was undoubtedly the meeting of the "Point Fives" at the "Delico" electric restaurant, where, after an informal dinner, the enthusiasts and their friends, numbering about 120, spent a busy evening discussing the pros and cons of electric cooking and heating.

Prominent among the numerous speakers was Dr. Ferranti, who, amongst other matters, referred to the urgent necessity of cultivating a 24-hour load, hinting at the possibility of devising electrical heat storage apparatus towards this end, with a view to filling up the gap in the load curve which occurs in the small hours of the morning.

We would emphasise the fact, however, that the early morning load is already to hand in the shape of vehicle charging, while the heat storage problem still awaits practical solution. In view of the fact that one half-ton electric may take 25 units a night, and larger sizes up to 75 units a night for a 5-ton vehicle, it is clear that the battery vehicle will materially assist in the problem.

As to the proceedings of the rest of the week, including the annual dinner on Wednesday evening, and yesterday spent at Kingston-on-Thames in discussing the electric vehicle and admiring the scenic beauties of the river, we must refer our readers to our next week's issue.

#### Abstract of Address.

By MR. C. E. C. SHAWFIELD, Ex-President, late Chief Electrical Engineer to the Corporation of Wolverhampton.

IT IS, I believe, the first time in the history of your Association that the opening address at the annual Convention has been given by other than the President for the time being, and I deeply appreciate the compliment which your Council have paid me. It was with very real regret that I found myself compelled to lay down the reins of office, owing to my vacating municipal service.

One of the most curious anomalies of the present position of the public supply of electricity in this country is that whilst a municipality is empowered to generate and distribute electricity throughout its area, and to make contracts with consumers as to the terms and conditions of supply, it is practically debarred from installing in a consumer's premises the apparatus which is necessary to enable that consumer to utilise the electricity which the municipality has for sale.

In London, and in a few of the larger provincial towns, this necessity can be, and is, to a large extent provided by private enterprise, but many of you who are associated with stations in smaller communities know only too well that the average wiring contractor has not the capital or the staff, and too frequently also has not the ability, to adequately supply the requirements of consumers. It is true that some municipalities have been fortunate enough to obtain, by means of private Acts, full powers to carry out wiring and installation work of all descriptions and to sell and fix electricity consuming devices. The Corporation of Wolverhampton has possessed these powers since 1899, and after 14 years' experience of the practical operation of these powers, I can unhesitatingly affirm that both the electricity department and the local wiring contractors are in a flourishing condition. If a municipality has only the restricted powers given under the Electric Lighting Clause Amendment Act—by which wiring work can only be carried out through a contractor—the result is of very little use to either party.

I sincerely trust that this Association and the municipalities which it represents will continue to press for the general concession of those powers to all municipalities, which are at present confined to a section only.

I am entirely opposed to what I regard as the vicious practice of rate relief from the profits of electricity undertakings, and I sincerely trust that the members of this Association will do whatever lies in their power to discountenance these donations. Whilst municipally owned electricity undertakings should be self-supporting, their surplus earnings should be allocated, first, to the accumulation of an adequate reserve fund; secondly, to the provision of working capital, and any balance remaining should be devoted to the extension and improvement of the undertaking.

Much has been done in recent years in the direction of lowering the average rate of charge per unit to all classes of consumers, but much still remains to be done in this direction; if municipally-owned electricity undertakings as a body were to go boldly for a drastic reduction in prices, they would not only be more faithfully performing their duties to the community as a whole, but they would also reap a rich reward in the shape of increased output and better financial results. As a general principle I believe that practically every central station can afford to sell electricity at a profit, at a lower price than that at which none but a specially circumstanced private generating plant can produce it, and it should

be the aim of every undertaking to supply from its mains every unit of electricity consumed within its area.

The time is now rapidly approaching when a large part of the present capital liabilities of electricity undertakings will be liquidated by the operation of the sinking fund, and, when this day arrives, it seems probable that such a general reduction in the selling price of electricity will be possible, that its practically universal adoption for lighting and motive power purposes will become inevitable.

The chief engineer of every electricity undertaking should be given full control, not only of the technical, but also of the financial side of his department—subject, of course, to the strictest audit by the accountants' department and the public auditors. He should have complete control of the general staff of the department, and all matters of discipline and of the remuneration of employees should be left to his discretion. He should also be provided with a competent and well-paid technical staff. In too many cases the rates of pay of the technical assistants in some of our large undertakings are entirely inadequate to their duties and responsibilities. The best asset that any electricity undertaking can possess is a loyal and zealous staff, who have at heart the commercial and technical well-being of the concern, and, in order to secure this, it is necessary that every member of the staff of every grade shall be made to feel that he is a trusted and responsible official, and that he is adequately remunerated for his services.

#### Prime Movers for Electric Power.

By DR. S. Z. DE FERRANTI, Past President I.E.E.

(Abstract.)

NOTWITHSTANDING the amount that has been written regarding the different systems of driving electric generators, the subject still seems to be one of considerable interest.

The position to-day is that the steam turbine is in possession of the field, and that gas and oil engines are looked upon as likely alternatives. Many people believe that it is only prejudice or the fear of doing something new that prevents engineers from using these two latter methods for generating their power. I do not, however, agree with this view, and believe that engineers are using the only means that are at present economically available for the work they have to do.

As we are a coal-producing country, it is evident that coal is our natural fuel. The very fact of oil being so sought after as fuel for certain purposes puts it out of the question for general power production.

A good steam turbine and boiler plant will to-day give back 15 per cent. of the energy of the fuel as electricity. As high an efficiency as 18½ per cent. has actually been obtained in practice. It is probable, however, that this is by no means the limit of economy, and that developments in this class of machinery will result in an efficiency of 25 per cent. being obtained in the near future.

The next coal-burning machine that we have to consider is the gas engine. With it we have to consider not only the efficiency of the machine itself, but also that of the gas producing plant. When the system is considered from this point of view, its efficiency is probably between 20 per cent. and 22 per cent. With this process there should, of course, be worked by-product recovery. Although it appears evident that in the future all coal must be gasified, and its by-products recovered, it does not seem that present knowledge enables this to be done at sufficient profit for it to be generally adopted.

In the oil engine we have a machine which represents the highest efficiency yet realised. Moreover, test figures and those obtained in practice agree very closely. The efficiency, as already defined, may be taken as between 28 per cent. and 30 per cent.

The question of stand-by losses may next be considered. In the oil engine there is practically no loss under this heading. In the gas engine there is the producer loss, and in the turbine the boiler loss. These will vary very much with the nature of the load, and where the plant is well designed and run, and the load factor is good, they may be reduced to a small quantity. Both the oil engine and the gas engine are, however, badly handicapped in relation to the steam turbine by their incapacity for dealing with overloads which the station must always be in a position to meet.

With regard to the question of the labour involved in running and maintaining the plant, as matters stand to-day the turbine installation is undoubtedly the best, but it is hard to make a direct comparison, as the number of generating units with either gas or oil would be so great. It is, however, certain that the plant which is the simplest will always have the advantage, and where one is purely rotary and the other reciprocating there can be no question at all.

In the matter of capital cost the turbine system is again much the best, the simplicity, large units and small space occupied contributing to this result. The size of the units on the turbine system compared with those on the other systems is perhaps the greatest determining factor in the case. The turbine is to-day adequate in fulfilling the demand, whereas the other two systems are not. Moreover, combined with its boilers and auxiliary plant, it is a simple means of generating power.

Reliability of operation is, of course, vital, and here again the turbine system scores on account of its simplicity and because in working its parts are not subjected to either high or uncertain stresses. In practice the turbine system has proved its capacity to meet the demand that is made on power-producing plant. All this goes to show that the course now followed by engineers in the

selection of their plant is the right one, and that they really have no option in the matter.

Looking at the question in the light of possible developments in the future, I cannot help thinking that as long as engines are used the rotary principle will be followed. For the moment the steam turbine system will be perfected so as to improve its efficiency and fuel consumption; later on, when the turbine can be made of the internal-combustion type, better economies still will be obtained.

#### DISCUSSION.

ALDERMAN SINCLAIR (Swansea), who opened the discussion on the above paper, agreed with the speaker's concluding remarks, but said that these applied to large stations only; for small stations the reciprocating engine would always find a place. As an instance of what the reciprocating engine could do, he cited his own experience with two 300-kw. uniflow type engines in use some two years, with steam superheated 225°. These operated on 9 lb. steam per I.H.P.-hour and consumed 3½ lb. of coal per unit, the total operating cost being 34d. per unit. The plant was worked in conjunction with a battery

MR. A. E. SEATON in the course of a humorous speech dwelt on the necessity of engineers ensuring that their guarantees on new plant were obtained. He pointed out that no engineer could claim that he knew all about "diddling," consequently it was necessary that tests of new plant should be carried out by an independent party, as, for instance, one of the well-known insurance companies. Under no circumstances whatever would he (the speaker) allow the contracting firms to have anything to do with the testing.

MR. H. S. RUSSELL (Mirlees, Bickerton & Day) took up the cudgels on behalf of the Diesel oil engine, attacking the author's assumption that it was necessary to have a big power station, transmission line and sub-stations. It would be more economical to install Diesel engines in sub-stations (requiring no more attendance than previously) and to dispense with the power station and transmission, as there was not much use in trying to save 10 per cent. in generating costs if 15 per cent. was going to be lost in transmission. The question whether coal was the most suitable fuel for power station purposes depended entirely on economic conditions; it might pay better to export it. In any case, in view of the important by-products of coal distillation, particularly the tar oil obtainable which was suitable for Diesel engines, it seemed that the latter was the best prime mover even with coal as a fuel. He pointed out that there was a considerable difference between coal stored and coal burnt due to fuel depreciation, and the coal stored figure should be used for comparisons. Steam plants on the average always exceeded their rated consumption (German statistics showed that they took over 100 per cent. more than their rated consumption), while Diesel plant worked within a narrow margin of guarantees. The high price of oil fuel now was entirely due to lack of transport facilities; huge stocks of oil were being held up, and there was no appearance of shortage of production. Moreover, the use of the Diesel engine in the Navy would lead to a substantial reduction of the oil consumed for naval requirements as compared with its use for boiler firing.

MR. R. A. CHATTOCK (Birmingham) did not consider the criticism of Dr. Ferranti's remarks as justified in view of the ascertained facts. In connection with the large Birmingham extension, he (the speaker) had carefully considered the relative costs of steam and gas plant for their new station, and taking capital and all the items usually entering into works costs, he found that for a gas-engine station, running on a 27 per cent. load-factor, the cost would be 12 per cent. higher than if a steam turbine plant were used. Further, if town's gas were used at only 6d. per 1,000 cu. ft. in large gas engines, the working cost would be 41 per cent. higher than with steam turbines. The load factor was low for a gas-engine plant, but taking an all-round 25 per cent. load factor of supply, he did not see how it would be possible to get more than from 27 to 30 per cent. on the gas plant. The turbine units were of 5,000 kw., and the gas-engine sets of 4,000 kw., which was the largest size commercially made. If smaller gas engines were considered the labour charges increased unduly. With regard to the previous speaker's suggestion for Diesel engine sub-stations, with a 100,000-kw. scheme as at Birmingham, it appeared that some 200 Diesel engines would be required, and the labour costs would be appalling. Lack of overload capacity in internal-combustion engine plants was a serious drawback, as if the plant would not stand up to the load it might mean a total shut-down.

MR. R. W. WEEKES referred at some length to the economy to be derived in industrial plants where the steam required for electrical generating purposes was subsequently used for heating and boiling, as was the case in the sugar and soap-making industries.

MR. H. GRAY (Accrington) remarked that all were well acquainted with the steam turbine and what it could do, but only the Accrington Council had so far installed large producer gas engines with by-product recovery plant, and their experience only covered eight months as yet. This plant was intended to run fully loaded, but due to the poor Sunday load the load factor had only reached 82 per cent. The running conditions suggested by Mr. Chattock were unsuitable; such a plant must run night and day. Their output from the gas engines had been 86,000 units per week; the fuel consumed was 156 lb., costing 125d. per unit, taken over a period of three months. From by-products there was a credit of 77d. per unit, or more than half the total fuel cost, and this was obtained with local coal. It was a question whether it would pay to increase the by-products return by using better

coal. Keeping a 1,250-h.p. producer ready for working for one week required ½ ton of coal, which compared well with any steam plant. For overload purposes steam plant should be installed.

MR. E. E. HOADLEY (Maidstone) said that consideration of a smaller extension scheme at Maidstone, where the question of steam or oil plant arose, had led him to decide on a 750-kw. steam set, as, taking carefully ascertained costs for an output of 2½ million units by this set, he found that steam plant was the cheaper, although he had himself favoured oil-engine plant in the first instance.

MR. C. H. WORDINGHAM suggested that the author dealt entirely with the future, which was some way off. Present requirements pointed to the small station as a necessity, and he adhered to his opinion, expressed recently, that the practical solution of the problem was to use small gas engines running in conjunction with the existing gas works. He knew they were in general disagreement with him, and that they favoured Dr. Ferranti's views.

MR. H. RICHARDSON (Dundee) said that, in connection with H.T. supply in Dundee, he had considered the question of steam and oil generating plant, having had the idea of assisting the sub-station plant by means of Diesel engines. He found that a 5,000-kw. turbine, with boilers, bunkers, &c., would cost £30,000, while four Diesel units, to give the same output, would cost £68,000, neglecting the greater space taken. With the Diesel plant the fuel cost would be 15d. per unit generated, while they were then generating at their own steam station for 11d. per unit coal cost. The oil engine was suitable for small lighting areas, but could not compete in power areas. The Sunday interval which Mr. Gray deplored was often highly valued by those using gas engines. He agreed with the author on the necessity of looking ahead; it had been a great fault in the past that this had not been done. The capital cost of hydro-electric works rendered it hopeless for water power to compete with steam generally.

MR. W. A. CHAMEN (S. Wales E.P.D. Co.) said he had been much disappointed on looking into the question of oil and gas plant in his area. He pointed out that sub-station attendance was not nearly so serious an item as was made out by the Diesel engine people, as many sub-stations were of the static type. Transmission losses were also less than had been suggested.

MR. J. E. EDGECOME (Kingston-on-Thames) said his interest in the paper was aroused by the remarks on fuel. At Kingston he was hoping to run his Diesel plant on water gas tar, but found it was nearly all exported to Germany.

DR. FERRANTI, in replying, said that what could take place in the future was likely to help greatly in the decisions of the present. He thought it possible that he might be charged with dealing too much with the present, in view of his remarks on the turbine.

The plant one would have to use was really settled by what one could use. In America he found huge gas engine-plants in use, under ideal conditions, at the Gary plant of the U.S. Steel Corporation and elsewhere, yet the Commonwealth Edison Co., at Chicago, were installing 25,000-kw. steam turbines, and were considering one of 30,000 kw. capacity, despite their full knowledge of the use of gas engines. The question of prime movers was closely allied with extension of distribution; if large communities could supply smaller adjoining ones, it would be very beneficial to the country at large.

(To be continued.)

## BUSINESS NOTES.

**Earl's Court Exhibits.**—The visitor to this Exhibition will observe among the other objects of military interest a display of telegraphic equipment for field service loaned by the Secretary of State for War. The Harper Electric Piano Company relieves the quietness of the hall wherein this exhibit is to be found, and elsewhere we observed Mr. Heathman's show of portable and other ladders, and an exhibit of the Acme patent ladders. From the electrical point of view the finest show, in our opinion, is that of the International Electric Co., Ltd., of Kilburn, who have an excellent collection of military and naval telephones, selective railway signalling sets and other manufactures well worthy of a visit.

**"Paragon" Internal-Combustion Locomotive.**—A manufacturing licence for the construction of this interesting locomotive has been purchased by MESSRS. HAWTHORNE, LESLIE & Co., locomotive engineers, of Newcastle-on-Tyne. The power transmission in these locomotives is on the "Paragon" variable-frequency polyphase alternating-current system (Durtall's patents). The electrical plant will be manufactured by licensed manufacturers of the "Paragon" plant. Mr Durtall informs us that a large amount of business is opening up in various parts of the world, judging from the number of inquiries both himself and his partner, Mr. Herbert H. B. Deane, of Sydney, Australia, have received for these locomotives, which are being designed for use with both residue oil and coal gas as fuel. Designs are now being got out for locomotives up to 800 h.p. for a large Colonial railway, on which this system will be used. The principle on which these engines work was explained in our issue of January 10th, 1913.

**Osram Motor Vans.**—THE GENERAL ELECTRIC CO., LTD., have just put on the road two new motor delivery vans (40-h.p. Daimler), devoted exclusively to the distribution of Osram drawn-wire lamps

**Lamp-making Films.**—MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD., of Dalston, made arrangements for the exhibition of their "Wotan" and Tantalum lamp-making films at the Kingsland Empire Cinematograph Theatre, Dalston, on Monday afternoon last.

**Book Notices.**—*Electric Wiring.* By W. C. Clinton, B.Sc. London: John Murray. Price 2s.—This book has been revised and the type has been entirely reset, with new illustrations, and a new chapter on dynamos and motors; it has been reprinted five times, and is now in its third edition. The voice of good report has, therefore, spoken in its favour, and we need only say that it is a neat and handy little volume, clearly printed, clearly worded, and covering the ground very well. The subjects dealt with are elementary principles, calculations, insulation and wiring, switches and lamps, installations, bells, batteries, testing, and dynamos and motors.

"*Journal of the American Society of Mechanical Engineers.*" Vol. XXXV, No. 6. June, 1913. New York: The Society. Price 35 cents.

"*Journal of the American Institute of Architects.*" Vol. I, No. 6. June, 1913. Washington: The Institute.

"*Boletín de Ingenieros.*" Vol. III, No. 9. May, 1913. Mexico: Secretaría de Guerra.

"*Bulletin Scientifique de l'Association des Elèves des Ecoles Spéciales.*" April, 1913. Liège: Lahaye & Co. Price 75 cents.

"*Memoirs of the College of Science and Engineering, Kyoto Imperial University.*" Vol. IV, Nos. 1 and 2. November and December, 1912. Vol. V, Nos. 1 to 5. September, 1912, to April, 1913. Kyoto, Japan: The University.

**Catalogues and Lists.**—THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—The company have issued their 1913 fan catalogue. Early in 1912 they erected at Witton a separate factory which is devoted to the construction of fans, and this catalogue covers the whole field of the application of electricity to ventilating work. Beginning with a small desk fan taking 20 watts, the catalogue concludes with centrifugal fans and exhaust fans with diameters of 60 in.; ceiling fans, oscillating fans and punkahs in great variety are included. Amongst the various designs of "Freezor" desk fans, the "Lite-weight" fan may be mentioned. It consumes 25 watts and weighs 10 lb.—a point which will appeal to shippers, especially where Customs duties are charged on a weight basis. For use aboard ship, a back plate pattern of fan has been introduced, which can be fixed to a ceiling and withdrawn from the plate and disconnected at will. The air can be thrown in any direction by an adjustment of the fan, which is effected by merely turning a screw. Illustrations and particulars are given of the desk and bracket fans made to British Admiralty specification; the Swan fan; Pitter blades for fitting in place of the ordinary blade; exhaust fans of both C.C. and A.C. types having either induction or repulsion motors; a large range of centrifugal fans, for which a big order was recently placed by the Admiralty. The speed regulators listed include a neat device not much larger than an ordinary tumbler switch by which the speed of a fan can be varied as desired. All Freezor desk fans have a special regulator fitted in their base, so that no additional speed regulator is necessary. Moreover, since the speed regulator also includes an "off" position, the installation of a switch is obviated. In the sweltering weather that we have just passed through, the very name of the GENERAL ELECTRIC CO.'s fan is refreshing, and we are informed that the company have inaugurated a special express delivery service to enable their trade customers to cope with the demand without carrying large stocks.

THE CAMBRIDGE SCIENTIFIC INSTRUMENT CO., LTD., Cambridge.—New catalogue (No. 107) of about 40 pages, dealing very fully with electro-cardiographic apparatus, including full descriptions and cost of outfits suitable for taking electro-cardiograms and phono-cardiograms. Several special pieces of apparatus, such as the cardiograph switchboard and time markers, &c., have been designed, and complete outfits are arranged in every way to meet the requirements of either the ordinary medical practitioner or the research physiologist. The pamphlet is well and fully illustrated.

ALLGEMEINE ELEKTRICITÄTS-GESELLSCHAFT, Berlin.—Pamphlets relating to "Electricity in Farmers' Houses," and "Tube-wire," an insulated wire with a metal sheath which is used in installation wiring.

THE SCHNEIWINDT ELECTRIC CO., 40 and 41, Staniforth Street, Birmingham.—New illustrated price list No. H.P. 100, giving particulars of "asbestos cement" electrically-heated hot-plates, cast-iron cooking plates, and large enamelled iron cooking plates with nickel-plated feet.

MESSRS. J. BURNS, LTD., 187 and 189, Central Street, London, E.C.—Price list, No. 513, giving tabulated sizes and prices of vulcanised fibre, and ebonite sheets, tubes, rods, &c.

MESSRS. SCHOLEY & CO., LTD., 151, Queen Victoria Street, London, E.C.—The *Scholey Magazine*, of which No. 1 is before us, is a booklet specially intended for shippers and exporters, containing a description of a number of the firm's manufactures—Graham electric lifts, electric soldering and branding irons, indestructible cables, tool-steel gears and pinions, and switchgear. There are some notes entitled "Why Australia Buys So Cheaply."

THE DOWNSING RADIANT HEAT CO., LTD., 105, Great Portland Street, London, W.—Eighteen-page list containing a number of illustrations, with brief particulars and prices, of their Solarium or

electric light cabinet baths. The folding and reclining patterns shown have, we understand, been installed in many country houses, including those of the Duke of Westminster, Duke of Portland, and Lord St. Oswald. Portable electric baths, supplied for giving local light and heat treatment to particular limbs or parts of the body, are among the lines included in the list.

MESSRS. OSKAR WEBER, 25, Pariserstrasse, Berlin, W. 15, announce the issue of their new catalogue, No. 200, of numerous types and fittings for wire lamps of all sizes, and installation materials, in five languages.

MESSRS. MAGIC APPLIANCES, LTD., 6, Farringdon Avenue, London, E.C.—Illustrated folder (for consumers' education) entitled "A Scandal in High Society," dealing with the "Magic" suction cleaner, and a leaflet "Aids to Health and Comfort," showing and pricing the "Oscillus" vibrator and the "Hotwind" hair dryer, &c.

MESSRS. SIEMENS BROS. & CO., LTD., Woolwich.—Catalogue No. 513 (28 pages) fully illustrating and describing, also stating prices of, their electric apparatus for mines, including luminous and combined visual and recording mine shaft signalling apparatus, bell indicators, hooters, bells, loud-speaking 'phones, dial signalling apparatus, &c.

MESSRS. R. H. PATTERSON & CO., LTD., Forth Street Works, Newcastle-on-Tyne.—June catalogue of new and second-hand machinery for sale or hire.

THE NATIONAL ELECTRIC TIME CO., LTD., 15, Great Sutton Street, Clerkenwell, London, E.C.—Several publications relating to their electric impulse clocks, headway indicators, and train time recorders. One is entitled "Electric Time Service for Railways," and another gives descriptive notes, with illustrations and prices, of the Dallett controlled system of electric impulse clocks. These clocks are now being installed at the northern stations of the Bakerloo section of the London Electric Railway, and the company have devised a system to meet the special requirements, including the transmission of time impulses imparted over the long distances entailed.

**Strike Settled.**—The *Daily Express* says that the first settlement of importance in connection with the Black Country strikes took place on Monday, when the General Electric Co., of Witton, decided to concede the 23s. minimum wage.

**Montreal Exhibition.**—*Canada* says that an electrical exhibition is to be held in the city of Montreal, at the Arena, from October 18th to 25th. The Montreal Light, Heat & Power Co. are taking a special interest in the exhibition, and are arranging to have a very elaborate display.

**Hendon Cottage Hospital.**—MESSRS. FRANCIS READE AND CO., of Finchley, carried out the electrical work at the Hendon Cottage Hospital, which was opened last Saturday by Princess Henry of Battenburg.

**Electrical Industry.**—The annual report just issued by the Wolverhampton Chamber of Commerce contains the following reference to the electrical engineering trade:—"This industry has been very busily engaged during the past 12 months. The use of electricity for a large variety of purposes continues to increase and expand. Wireless telegraphy has caused a large demand for special types of electric generators, and large power plants have been put down nearly all over the country, while at the same time there has been a steady flow of good shipping business. The local factories are full of work, and there is no doubt that a heavy demand will be made upon them for a long time ahead. Prices are better, and the industry on the whole is in a much more satisfactory condition."

**Malleable Iron.**—MESSRS. JAMES SIMMONDS & CO., LTD., of Whitmore Reans, Wolverhampton, inform us that by an entirely new process Blackheart malleable iron is being produced giving, as certified by Prof. Dixon, of Birmingham University, a tensile breaking strain of 20'8 tons per sq. in., and with a bending strain, on a bar 1 sq. in. in section, between points 12 in. apart, weight in centre 2'7 tons, a deflection of 1/4 in. The material withstands repeated shocks better than mild steel, and can be worked under the hammer hot or cold, in very much the same way as mild steel. It can also be machined with ease. They are the sole selling agents for this material.

**English Steel Works in Canada.**—The *Times* correspondent at Montreal, reports that MESSRS. ARMSTRONG, WHITEWORTH are about to erect steel works on the south shore of the St. Lawrence River, opposite Montreal. The site cost £80,000, and the first series of buildings will cost £200,000. The works will be in operation on May 1st next year. They will employ 500 men to start with, and in two years' time 2,000 men. The undertaking is not designed for warship building. It is proposed to establish later subsidiary plant throughout the Dominion.

**Dissolutions and Liquidations.**—GEM DYNAMO BRUSH CO., LTD.—A meeting will be held at 233, Park Lane, Aston, Birmingham, on July 14th, to hear an account of the winding up from the liquidator, Mr. J. W. Massey.

THORP & ARKELL, motor and electrical engineers, Marlborough Street, Faringdon.—Messrs. J. Thorp & T. Arkell have dissolved partnership. Mr. Thorp attends to debts and will continue the business as James Thorp & Co.

H. BARDER & Co., Johannesburg.—Messrs. H. Barder & Alexander Solomon have dissolved partnership. Mr. Solomon will continue the business (under the old style until August) at the same address, 169, Simmonds Street, Box 2,587. Mr. Barder has commenced business with Mr. T. H. W. Williams, M.E., as H. Barder and Co., Ltd., doing business in electrical and mechanical appliances. Catalogues and terms are invited by the new company at Box 2,587 as above.

**Meter Approved.**—The Board of Trade has approved of the polyphase meter type D.a. submitted by the ELECTRICAL CO., LTD., in April last.

**Fire.**—It is reported that a serious fire occurred on Sunday morning at the works of MESSRS. YATES & THOM at Blackburn, doing damage to the tune of £150,000.

**Bankruptcy Proceedings.**—FRANK HUCKS, electrical engineer, lately carrying on business at 2, Adelaide Road, Hampstead, under the style of Frank Hucks & Co.—The first meeting of creditors was held on Tuesday at the London Bankruptcy Court, under a receiving order made in this case. It transpired that the debtor commenced business in May, 1909, having a seat in his father's office in James Street, Camden town. He removed a year later to 18, Charing Cross Road, and from thence, in February, 1911, to Hampstead, where he carried on the business until last February, when he relinquished it and became managing secretary to a company. The business was never a success, and the debtor kept it afloat from the beginning with the aid of borrowed money; he eventually gave a bill of sale over the furniture, and sold his reversion under his father's will; but owing to pressure by creditors, he closed down. Since then, a creditor continued to exercise pressure, with the result that the debtor filed his petition on June 14th. He attributes his failure and inactivity to loss on contracts through under-estimating, and to further losses caused by a 12 weeks' illness in the spring of 1911. The liabilities are estimated at £775, and the assets consist of "book debts, £110." In the absence of any proposal, the estate was left to be wound up by the Official Receiver in bankruptcy.

FRED. SHAW, electrical contractor, Hessele Road, Kingston-upon-Hull.—A supplemental dividend of 3d. and 4 per cent. interest is payable June 20th, at York City Bank Chambers, Lowgate, Hull.

ROBT. E. JOY (Bristol Electrical Co.), electrical engineer, 143, Cheltenham Road, Bristol.—Discharge suspended for two years, to take effect from May 23rd, 1915.

TOM ARTHUR FLATHER, electrical engineer, of 406, Mendwood Road, Leeds.—At the Leeds Bankruptcy Court, last Tuesday, before his Honour Judge Graham, K.C., application for discharge from bankruptcy was made. The liabilities in the case were £357, and the assets totalled to only £23. The discharge was suspended subject to the debtor consenting to judgment for £100.

J. G. S. CUNNINGTON & H. P. ALISON (Laing Wharton & Cunningham), electrical engineers and contractors, 7, Great Newport Street, London.—Third and final dividend of 1½d. in the £, payable at 28, King Street, Cheapside, E.C.

CECIL WRAY, electrical and mechanical engineer, Bradford.—A first dividend of 10d. in the £ is payable at 12, Duke Street, Bradford, by the Official Receiver.

J. A. BAUER (Electrical and General Engineering Co.), 17, Gracechurch Street, E.C. Trustee released, May 28th.

**Trade Announcements.**—MESSRS. NALDER BROS. AND THOMPSON, LTD., announce that they will shortly be moving their factory and head office from Queen Street, E.C., to very much larger premises now building at 97A Dalston Lane, N.E. They will retain an office and showroom at Queen Street which will be in communication with the head office by means of a private telephone extension line. The existing part machine shops at Kingsland Green will be continued as heretofore. The new premises will afford the firm largely increased facilities both for output and for prompt delivery.

THE SOUTH LONDON CONDUIT FITTINGS CO., of Kennington, are removing to larger and more convenient premises at 10-16, Marlborough Road, Old Kent Road, S.E., where they are putting down more extensive machine shops and a malleable and common iron foundry.

MR. G. E. HIPKINS, formerly with Mr. O. C. Knight, has commenced business as an electrician and electrical goods dealer at 48, Wolverhampton Street, Dudley.

THE ELECTRICAL ENGINEERING AND EQUIPMENT CO., LTD., 109-111, New Oxford Street, London, W.C., are taking up the sale of the "Pelapone" oil and gas engines.

MESSRS. EDMISTON, BROWN & Co., mechanical and electrical engineers, have removed to 219, St. Vincent Street, Glasgow. Telephone numbers:—Central 1189 and 1190 (two lines).

In our paragraph regarding MESSRS. BAXTER & CAUNTER last week we mentioned their "switchboard" department in error. We should have said "export" department. For Mr. Best read Mr. Betts. Some words sound very similar on the telephone.

THE BASTIAN ELECTRIC HEATING SYNDICATE, LTD., are, tomorrow (Saturday), removing their sales office from Palmerston House, E.C., to 185, Wardour Street, W. (near Oxford Street end).

MESSRS. BRITISH INSULATED AND HEAVY CABLES, LTD., last week removed their Manchester branch to Orme Buildings, Parsonage, Manchester, where more commodious premises have been secured. The telephone and telegraphic numbers remain unchanged.

## LIGHTING and POWER NOTES.

**Argentina.**—The Mayor of Santa Fé has stated that as soon as the additions to the electric light station have been completed it will be the fourth in importance in the Republic. The inhabitants of that city are of the opinion that it would be advantageous to the authorities if they were to reduce the present rate charged for energy which is considered to be excessive.—*Review of River Plate.*

The Gesellschaft Columbus für Elektrische Unternehmungen, which, as stated in a recent issue, has been formed at Glarus, Switzerland, will devote itself to the development of electrical undertakings in the Argentine Republic; to this end it has acquired three-fourths of the shares of the Compagnie Italo-Argentine d'Electricité.

**Barnstaple.**—The increased stability of the municipal electric light undertaking is shown in the result of the past year's working. The gross profits amount to £2,337, compared with a five years' average of £1,400, and show an increase of £871 over last year. There have been increased receipts for private lighting amounting to £198, and for power and heating amounting to £102. Public lighting has cost £49 less. By the installation of new accumulators, a reduction of no less than £345 was effected in the cost of production, although the output was largely increased. Capital charges amounting to £2,124, left a net profit of £213 on the year's working. But the new accumulators were paid for out of revenue, and this left a debit balance of about £20. Extensions of the service and other indications point to a further increased output next year.

**Barrow-in-Furness.**—The L.G.B. has sanctioned an expenditure of £764 by the B. of G. for lighting the workhouse by electricity. Of this sum £650 is to be obtained on loan, and repaid in 10 years.

**Bedford.**—For the convenience of consumers, the T.C. has decided to allow connections for one or two lamps to the power supply for the purpose of lighting isolated motors or machines. For this a fixed charge is to be made of 2s. per quarter for each 30-watt point *et pro rata* in addition to 1d. per unit for energy used. The minimum charge per point is to be 2s. per quarter. A cable is to be placed under the railway in order to supply current to the new works of Messrs. Peek, Frean & Co.

**Bedworth.**—The P.C. has decided to have experiments in public lighting made by the Leicestershire and Warwickshire Electric Supply Co. and the Gas Co. The former offers to supply 100 50-c.p. lamps at £3 10s. per lamp per annum.

**Bexhill.**—The financial report of the borough electric light undertaking for the year ended March 31st shows a gross profit of £6,173, as compared with £5,247 in the previous year. A sum of £611 is brought forward from last year's account, and after providing for the repayment of, and interest on, loans, there remains a balance of £1,875, which has been allocated as follows:—Meters, £320; public lighting, £100; income-tax on profits, £125; depreciation account, £51; balance carried forward to next account, £1,275. There has been no borrowing during the year. The total capital sanctioned and borrowed amounts to £74,148, of which £23,359 has been repaid, leaving an outstanding debt of £50,782 at March 31st.

**Bingley.**—The U.D.C. has applied to the L.G.B. for a further loan of £1,500 for electricity purposes. The Council has sealed an agreement with the Keighley T.C. for a supply of current in bulk.

**Bradford.**—The Electricity Department of the Corporation reports that the past year's trading shows a net profit of £8,477, an increase of £425 upon that of the previous year. The income has increased by £9,802, of which £8,969 is in respect of the sale of electricity; expenditure on coal has increased by £4,955 to £17,969; the total cost of generation was £35,120; the cost of distribution was £4,921; and repairs, £7,736, an increase of £486. The gross profit on the year's working was £66,743, as compared with £64,808 a year ago; £21,614 has been paid for interest on loans and income-tax, and £36,652 has been set aside to the sinking fund for paying off the debt. The total capital expenditure on the undertaking has been £877,000, in respect of which the present debt is now only £502,382. The total number of units sold during the year was 24½ millions, an increase of 2½ millions as compared with a year ago; the tramways absorbed 10½ million units of the total sold.

**Colchester.**—A L.G.B. inquiry was held on June 10th by Mr. T. C. Ekin, relative to the Corporation's application for a loan of £7,660 for electricity purposes, viz., services, mains, feeder pillars, feed pump, condenser, 375-kw. set, a booster and switch panel. There was no opposition.

**Gargrave.**—At the last meeting of the Parish Council, the matter of electric lighting was considered and a suggested contract with Messrs. Crompton & Co., Ltd., of Chelmsford and Manchester, was read. In this the company proposed to make arrangements with the Rural District Council in regard to road breaking; the sum of £2,000 would be required for the electric undertaking, and the company would be glad if the money could be raised locally for the formation of a company to be called the Gargrave Electric Supply Co., Ltd. After some discussion on the subject the following resolution was unanimously adopted:—

"That this Council approves of the scheme, and would be willing to accept the offered terms of the promoters for street lighting purposes."

**Gravesend.**—In order to further encourage the greater use of electricity the T.C. has adopted an alternative tariff to the present flat rate, viz.:—A fixed charge of 9s. per annum per 25-c.p. 32-watt lamp, with supply for lighting, heating, or cooking at ½d. per unit, or a contract rate of 12s. per 25-c.p. 32-watt lamp per annum.

**Great Lumley (Co. Durham).**—It was reported at the last meeting of the P.C., that the local Colliery Co. had signified its willingness to take over the Council's electric lighting plant, to light up the district on certain conditions, and also to supply current to private consumers.

**Hebburn-on-Tyne.**—At the meeting of the Urban Council on the 9th inst., the General Purposes Committee reported that the clerk had written to the B. of T. requesting it to hold an inquiry into the circumstances of the explosion on March 30th, and the board had replied that it was making certain investigations with regard to the laying of mains in the district, and that on the completion of the investigation, the board would communicate further with the Council. The Committee recommended that the clerk be instructed to write again to the Board urging upon it the necessity of holding an inquiry. It was further reported that a letter had been received from the Northern Counties' Electricity Supply Co. stating that the cables to be laid to the C pit would be lead-covered with steel armour and laid direct in the ground without any troughing, in accordance with the company's usual and most recent practice. The report was adopted.

**Hull.**—The Sculcoates District Council has sanctioned the application of the Corporation for the supply of electricity to the village of Sutton. The price is to be ½d. per unit, being a ½d. higher than the price charged in Hull.

**Luvergordon (near Cromarty).**—The T.C. has appointed a Committee to inquire into the advisability of introducing electric light into the burgh.

**Kettlewell (Yorkshire).**—In the upper reaches of the river Wharfe, high among the Craven Hills of West Yorkshire, last Saturday was a day of festivity, when the new electric lighting installation of the village of Kettlewell was inaugurated. The affair is under the control of a little local company, the Kettlewell Electric Supply Co., Ltd., which has £625 capital in 21 shares, fully paid up, and of which the village postmaster is secretary and the village schoolmaster one of the directors, with the support of other local gentlemen. The plant consists of a "Turgo" turbine of 10 H.P., and a dynamo of 6 kw. at 230 volts, 515 R.P.M. The plant is in a stone power house, erected on a concrete foundation on the bank of a stream, the waters of which drive the turbine. The village is connected by four miles of aerial cable. The installation is probably the smallest and cheapest public one in the country. It was provided at a cost of £560. The lighting in this village is a change direct from oil and candle to electricity. The local council is considering the question of lighting by electricity streets which have never been lit by anything before.

**Knottingley.**—The U.D.C. on June 12th passed a resolution for application to be made to the B. of T. for a pro-vider for electric lighting. It was also decided that Messrs. Crompton and Co. be informed that the Council cannot at present enter into any arrangement with them, and that the Electricity Committee should prepare a scheme for the consideration of the Council.

**Leek.**—The U.D.C. on June 10th decided that it had no power to grant the facilities for laying cables across part of the town, applied for by Messrs. Brough, Nicholson & Hall, Ltd., silk manufacturers, in order to convey current for use at their works, in lieu of steam as at present used. Particulars of the firm's scheme appeared in a recent issue of the ELECTRICAL REVIEW.

**London.**—**FULHAM.**—Application is to be made for sanction to borrow £5,000 to cover the estimated expenditure for mains extensions during the ensuing two years. The accounts of the electricity undertaking for the year ended March 31st last, show an excess income over expenditure of £4,665, which is arrived at after debiting the revenue account with £631 in respect of new meters, and £722 for house connections. If these items had been charged to capital account in the usual way, the total surplus would have been £6,020. The total available surplus, including the amount brought forward from the previous year, now amounts to £7,898, and of this amount, £5,000 is to be transferred to reserve account.

**HAMMERSMITH.**—The Council, in May, 1912, decided to set aside a sum of £100 for the purchase of electric fans for hiring purposes at the following rates for 12-in. fans:—Minimum terms, 7s. 6d. each; first month of hire, 7s. 6d. each; second month, 5s. each; third, and each subsequent month, or part of a month, 3s. each.

**SOUTHWARK.**—At a meeting of the Board of Guardians on Friday, the medical superintendent of the infirmary (Dr. Bruce) submitted in his annual report that the electric light should be substituted for gas throughout the building. The new nurses' home had been fitted with electric light, and its extensions, Dr. Bruce stated, would result in advantageous terms all round. "The advantages of electric light," Dr. Bruce wrote, "in an institution for the sick are enormous. It reduces dirt and greatly facilitates the nursing of the sick during the night. Its installation would be an improvement of the first magnitude." Acting on this advice

the Guardians have decided to ask the London Electric Supply Co. to furnish them with a quotation for installing the electric light, and to give the price per unit.

**BATTERSEA.**—The B.C. has decided not to take any further action to restrain the London Electric Supply Co. Ltd., from laying mains through the Borough. The Court of Appeal ordered that the action of the Council should be dismissed, with costs, and it was then agreed that the hearing of the appeal should be treated as the trial of the action. The Council proposed that the B. of T. be urged to approve an alternative route for the mains. The company desires to lay its mains through Nine Elms Lane, Battersea Park Road, and York Road.

**WOOLWICH.**—An inquiry has been received from the chief engineer of the L.C.C. as to the probability of the B.C. being able to give a supply of electricity for lighting and power purposes at the North Woolwich pumping station, which would necessitate the laying of mains through a portion of the East Ham area. Subject to a definite application being made by the County Council an agreement is to be entered into with the East Ham authority to allow of the necessary mains being laid.

**HOLBORN.**—At the last meeting of the B.C., the Works Committee reported having considered the question of the desirability of extinguishing a proportion of the public lamps at or about midnight. Having regard, however, to the difficulty and expense which would be incurred in rearranging the conditions of the present lighting contracts by which the contractors are paid a gross sum per annum, the Committee thinks that any saving in the cost of light would be outweighed, and it has therefore decided not to take any further action on the suggestion.

**MARYLEBONE.**—Special protest has been made against the clause of the Post Office London Railway Bill, which, if carried, will empower the Postmaster-General to supply with electricity any Post Office premises in the borough from the generating station of the proposed undertaking.

**Londonderry.**—At a L.G.B. inquiry held on the 14th inst. into the proposal of the Corporation to borrow £13,000 for electric lighting extension, the town clerk stated that the electric lighting undertaking was proving most successful. This year the Corporation would have a profit of £1,247. Mr. Macroy, electrical engineer, said the necessity for the contemplated expenditure arose through the re-opening of the shipyard, which was taking all its power from the Corporation. The Inspector asked whether the losses to the ratepayers in the early years of the undertaking had yet been made up. Mr. Algoe, city accountant, said there was still a deficit of £2,426 to be made up. The town clerk said the wiping of this out would only be a matter of time. There was no opposition.

**Luton.**—The total working expenses of the electricity undertaking during the year ended March 31st last amounted to £13,485, as against £9,384 the previous year, an increase of £4,100. The income amounted to £23,039, as compared with £17,767, an increase of £5,272. The revenue account shows a gross profit of £9,553, an increase of £1,171 over last year, and this profit equals 10.68 per cent. of the capital expenditure, as against 10.43 per cent. for 1911-12. The net profit amounts to £3,135, being £590 less than last year, and equal to 3.5 per cent. of the capital expenditure, comparing with 4.64 per cent. in 1911-12. Amounts have been charged against profits totalling £1,957, leaving a balance of £1,177 to be appropriated. The reserve and renewals fund amounted to £6,925 at March 31st, being equal to 7.74 per cent. of the capital expenditure at that date. The expenditure on capital account during the year was £8,929, making the total capital expenditure at the end of the year £89,260. The amount repaid or in sinking fund is £23,316, leaving a net debt of £63,297.

**Morley.**—Under the auspices of the Corporation Electricity Committee, and by arrangement with Messrs. Gillespie and Beales, a series of demonstrations and lectures on electrical cooking with the "Tricity" cookers has been given in the King's Hall, Town Hall, by Mr. F. S. Grogan.

**Newport (Mon.).**—On Friday a fire occurred at the Corporation electricity works, at Newport (Mon.), and practically destroyed one of the old turbo-generators, doing damage to the extent of about £500.

**New Zealand.**—A private company has agreed with the Devonport B.C. to erect an electric lighting and power station for that town, and to spend about £20,000 upon the system. The new Plymouth municipality is raising £55,000 for an electric tramway service.

**Shrewsbury.**—In presenting to the T.C. the report of the Lighting Committee, Ald. T. P. Deakin stated that the total income of the electricity undertaking for the year was £8,388, an increase of nearly £500 on last year. The capital raised for the undertaking was £59,289, and they had already paid off nearly £30,000 on it. With their reserve fund they had made on the undertaking about £32,000. The report was adopted.

**Southend-on-Sea.**—On June 11th a L.G.B. inquiry was held by Mr. T. C. Ekin, relative to the application of the T.C. for a loan of £11,000 for boilers and other plant at the electricity works. There was no opposition.

**Swindon.**—The T.C. has instructed the electrical engineer to prepare plans and specifications for the provision of an additional cooling tower at the electricity works. A loan of £9,200 for extensions to the plant has been applied for.

**Taunton.**—The T.C. on June 10th decided to apply to the L.C.B. for a loan of £2,600 for extensions to the electricity works, for which a site has been obtained.

**Tynemouth.**—In order to improve the lighting of the borough, the Electricity Committee has rescinded its resolution to extinguish 400 lamps during the four summer months. The extra cost will amount to about £120 a year.

**Truro.**—The T.C. has been informed that there is now no opposition to the Bill in which a prov. order for electric light is applied for.

**Whitworth (near Rochdale).**—The B. of T. has deferred the question of the revocation of the Whitworth Electric Lighting Order, 1905, until the end of the year.

The U.D.C. decided at its last meeting to apply for sanction to borrow £10,005, the estimated cost of the work in connection with the electricity scheme.

**West Bromwich.**—At the last meeting of the T.C. a report was presented which showed that on the electricity undertaking there was a balance of £337.

**West Ham.**—At the last meeting of the T.C. the electrical engineer (Mr. J. W. Beauchamp) submitted a detailed report upon the use of electricity for domestic cooking and heating, with recommendations for a domestic tariff suitable to the needs of the borough, and based upon the ascertained costs of supply. There has been, the report states, considerable development during the past year in the production of electric heating and cooking apparatus for domestic use, but before a cooking and heating load of considerable magnitude could be developed at all, it would be necessary to offer a suitable tariff. In framing a domestic tariff it becomes necessary to keep in mind several points of importance, which, in the case of West Ham, are:—(1) The present flat-rate charge for lighting (3d. per unit) is already quite low in comparison with gas at 2s. 6d. per 1,000 cb. ft. (2) A suitable tariff would put within the reach of the private house consumer a supply of electricity at a cost which would compete with gas or coal for heating and cooking; and (3) It is desirable that the tariff should be so designed that the consumers are encouraged or discouraged in proportion to the hours of use during which they employ their apparatus; that is to say, in proportion to their desirability or otherwise from the point of view of the supply department. The following is the tariff which the engineer proposes to make, and which will be applicable only to private houses, and the family residence portions of business premises where electric light is in general use. In the latter it is proposed that all electricity supplied for the business portion of the premises shall be treated separately and kept electrically distinct from any residence portion in which this tariff is adopted:—(1) An annual charge payable in advance, on account of lamps or apparatus used directly or indirectly for the production of light, at the rate of £10 per annum per 1,000 watts installed (a) with a minimum annual payment of £2 for any lamps or lighting apparatus installed up to 200-watts capacity; (b) beyond the limit of 200 watts, the annual charge of £10 per annum per 1,000 watts will be subject to division into one-hundredths (being 2s. per 10 watts per annum). (c) Where the aggregate capacity of lamps or lighting apparatus is less than or equal to 200 watts it will be taken as 200 watts, and where more than 200 watts it will be taken at the next higher value in tens of watts. (d) In assessing the fixed charge an allowance up to 25 per cent. may be made off the aggregate capacity of lamps and lighting apparatus connected in order to allow the installation of lamps for occasional use free of fixed charge. (2) An annual charge payable quarterly in advance on account of all other apparatus used for heating, cooking, power, and other uses of electricity permitted by the Supply Department, and in accordance with the following schedule.—10s. per annum for the first 1,000 watts capacity of permanently connected or portable apparatus, with a minimum annual payment of 10s. for apparatus up to 1,000 watts capacity; 10s. per annum for the second 1,000 watts capacity of permanently connected or portable apparatus; 6s. 8d. per annum per 1,000 watts beyond 2,000, and within such limits as may be allowed by the supply department for apparatus under this tariff. (3) In addition to the above charges, electricity consumed for all approved purposes will be registered by one meter (supplied free), and charged at ½d. per unit. Concluding, the engineer states that he considers the tariff proposed will be sufficiently attractive to bring about a very great increase in the present heat business, and that a subsidiary advantage of the system from the point of view of the consumer, is that the bulk (about 5ths) of the electric lighting bill is known accurately in advance, whilst the actual rate per unit which is to be paid for the heating and cooking is very much in the consumers' hands, if he is properly advised with regard to the type of apparatus and method of use.

**Birmingham.**—It is stated that the Tramways Committee contemplates introducing an ambitious scheme for linking up the various tramway routes in the centre of the city.

**Chesterfield.**—The Tramways Sub-Committee is to report upon the type and number of motor-buses to be obtained for route trials consequent on the passing of the Corporation Railless Traction Bill.

**Dumbarton.**—Subject to the interests of the county being safeguarded, the Eastern District Committee of Dumbarton County Council has expressed approval of the scheme to extend the tramways from Clydebank to Duntocher.

**Dunfermline.**—The T.C. has offered to relieve the Tramways Co. of the annual payment of £100 per mile for upkeep, provided that the company extends the line to Milesmark.

**Edinburgh.**—At a meeting of the T.C. last week the town clerk stated that they had got a definite offer from the Colinton Tramway Co. to sell their undertaking to the Corporation at a given sum. That offer was under the consideration of the Tramway Committee. The Council agreed to meet on July 1st to deal with the question.

**Farnborough (Hants.).**—The U.D.C. has decided to offer no opposition to the application of the Aldershot and Farnborough Light Railway Co. for a further extension of time until June 4th, 1914, for the completion of the proposed electric tramways.

**Little Hulton.**—It was announced on Monday that cars will probably be running by the end of September or the beginning of October on the South Lancashire Tramways Co's new lines through Little Hulton, near Bolton, connecting up at Walkden and Farnworth.

**Ilford.**—The U.D.C. has under consideration the question of purchasing a motor-tower wagon.

**London.**—L.C.C.—The figures for the past year's working of the Council's tramway system are eloquent of the effect of the strenuous competition of the motor-bus. Although the cars travelled 3½ million more miles in 1912-13 than in the previous year, they carried 20,787,000 fewer passengers, with the result that the gross earnings fell by £195,159. After deducting debt and other charges, the surplus remaining is only £497, compared with £222,702 in 1911-12. Appended are the figures for the two years:—

	1911-12.	1912-13.
Car-miles run ... ..	50,457,812	53,943,104
Passengers carried ... ..	533,440,235	512,652,653
Gross earnings ... ..	£934,212	£739,053
Net surplus ... ..	£222,702	£497

The surplus of £497 is all that is available for the renewals fund, for which a resolution of the Council provides that two-thirds of a penny for each car-mile run on the electric system must be set aside each year. On this basis the provision for 1912-13 should amount to £150,309. Nothing is, of course, available for the general reserve fund, to which any surplus remaining after providing for renewals is carried. On March 31st the renewals fund amounted to £633,010, and the reserve fund to £273,786. How the position as regards these funds compares with the previous year may be thus stated:—

	1911-12.	1912-13.
Available for renewals ... ..	£138,151	£497
Available for reserve ... ..	£84,551	Nil

The year's income amounted to £2,251,729; working expenses were £1,512,676, leaving a surplus of £739,053. Of this amount, debt and other charges absorbed £738,556, and a balance of only £497 remained.

The following table shows the position of affairs during the past few years:—

	Miles open.	Receipts per track-mile.	Receipts per car-mile.	Gross receipts.
1906-7 ... ..	40'66	£19,929	11'95d.	£810,320
1907-8 ... ..	61'91	20,223	11'74d.	1,252,001
1908-9 ... ..	77'94	19,762	11'56d.	1,539,434
1909-10 ... ..	99'61	18,546	11'21d.	1,817,327
1910-11 ... ..	116'98	17,925	11d.	2,096,914
1911-12 ... ..	127'55	17,498	10'98d.	2,231,902
1912-13 ... ..	132'49	16,179	9'73d.	2,143,569

The Highways Committee, discussing the question of successfully meeting this competition, considers that the linking up of the London termini and a rearrangement of services and fares would meet the position. Reference is also made to the burden of road widening at the expense of the tramways, which facilitates bus competition; also to the all-night services and workmen's fares, the burden of which falls only on the tramways.

**Oldbury.**—The Light Railway Commissioners have granted an order for the extension of the electric tramways from Birmingham to Warley, in the area of the Oldbury U.D.C.

**Scarborough.**—The South Cliff Tramways improvements are now nearly completed. The old steam power plant has been superseded by an electric pump, and a new type of car is to be used which will enable the officials to deal more effectively with heavy traffic.

## TRAMWAY and RAILWAY NOTES.

**Argentina.**—Work has commenced on the electrification of the Santa Fe tramways, and it is hoped to have the first section ready for service by the middle of next year. The work is being carried out by Messrs. J. G. White & Co.—*Review of the River Plate.*

**Tynemouth.**—The Tynemouth and District Electric Traction Co. recently proposed extending the tramway system to Preston, but has now been informed by the Parliamentary Committee of the local Corporation that it cannot entertain the proposal.

## TELEGRAPH and TELEPHONE NOTES.

**Argentina.**—Shares are being placed in Rosario for the construction of a network of telephone lines which will join up Galvez, Rafaela, Esperanza, Serodino, Irigoyen, Maciel, Caboto and San Carlos with Rosario.—*Review of the River Plate.*

**Canada.**—The Navy Department intends to erect a wireless station in Toronto, a link in a chain of wireless stations, designed to communicate with shipping on the Great Lakes.

**Dutch East Indies.**—Rapid progress is being made in the Dutch East Indies with the erection of wireless stations. The most powerful station is at Sabang, an island and coaling station north of Sumatra, with a minimum range of 1,000 miles, which brings it within reach of Colombo on one side, and Batavia on the other. Other wireless stations have been installed, and are now working at Batavia, Sitoebondo (East Java), Koepang (the capital of Dutch Timor), and Amboina (Moluccas), and a sixth is to be erected at Menado (Celebes). Koepang lies within 500 miles of Darwin, and could, therefore, communicate with the proposed station at this port, which would then give Australia direct wireless communication with the Dutch East Indies.

**France.**—A new telephone cable is to be laid between Marseilles and Algiers.—*African Engineering.*

**South Africa.**—A submarine bell worked by electricity has been fixed near the Green Point Lighthouse, Cape Colony.

**Telephone Service.**—The Council of the London Chamber of Commerce, at a meeting last week, decided to make representations to the Postmaster-General on the questions of the terms of telephone contracts; the system of registering calls; the provision of additional junction lines; the desirability of modernising the London telephone exchanges; improvements in the trunk line service; the need for greater efficiency and supervision of telephone operators; and the inconvenience of the "pillar" instrument.—*Daily Telegraph.*

**Wireless Telephony.**—Last week experiments were carried on between Northampton and Letchworth, a distance of 42 miles, with the Grindell-Matthews system of wireless telephony, by representatives of the *Daily Express*, who reported that they were very successful.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Australia.**—VICTORIA.—July 1st. Telephone instruments and submarine cable, for the P.M.G. See "Official Notices" May 23rd.

July 8th.—Common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" June 6th.

July 8th.—Rubber-covered wire, batteries, telephone switchboards, measuring instruments and telephone instruments, for the P.M.G. See "Official Notices" May 30th.

July 29th.—Detectors, for the P.M.G.'s Department. See "Official Notices" to-day.

August 4th. (a) Twin surface condensers, hotwells, piping and sundries; (b) air and water extraction pumps and motors; (c) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" June 13th.

September 16th.—Switchboard, C.E. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 30th and August 6th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

July 23rd.—Telegraph and telephone instruments, for the P.M.G. See "Official Notices" to-day.

July 23rd.—Telephone switchboards and parts, for the P.M.G. See "Official Notices" to-day.

July 30th.—Cable, switchboard, for the P.M.G. See "Official Notices" to-day.

SOUTH AUSTRALIA.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

NEW SOUTH WALES.—July 9th. Switchboards, for the P.M.G. See "Official Notices" May 30th.

**Austria-Hungary.**—CRACOW.—July 5th. The Magistrate of Krakau calls for tenders for the supply of two steam turbines, two boilers, piping, feed pumps, a turbo-generator, a switchboard, ironwork, &c. Particulars and plans (10 kronen) from the Bureau des Städtischen Elektrizitätswerkes, Krakau.

**Belgium.**—September 9th. The municipal authorities of Antwerp are inviting tenders for the supply and erection of 20 electrically-operated cranes for the extension of the Bassin Canal.

July 2nd.—The Belgian Telegraph authorities invite tenders for 1,255 metres of armoured, lead-covered, paper-insulated cable with accessories, as per Cahier des charges spécial No. 152. It is advisable to send in tenders by June 28th. Deposit 1,300 fr. Apply Administration des Télégraphes, Salle de la Madeleine, Brussels.

July 2nd.—Telephone cable and accessories for the city of Antwerp. Deposit 10,000 fr. Price of plans 21-30 fr. Cahier des charges spécial No. 146. It is recommended to forward tenders on June 28th. Salle de la Madeleine, Brussels.

**Carlisle.**—June 23rd. (a) Extensions to coal storage and conveying plant; (b) extensions to steam and water piping, for the City Electricity Department. Mr. F. W. Purse, City Electrical Engineer, Victoria Viaduct.

**Eccles.**—June 28th. Electric lighting of Green Lane Council School, Patricroft. Mr. S. H. Neave, Secretary to the Education Committee.

**Elland.**—July 2nd. Street lighting lanterns, for the U.D.C. See "Official Notices" June 13th.

**France.**—June 30th. The French State Railway authorities in Paris (Bureaux du Service Electrique, 43, Rue de Rome) are inviting tenders for the supply of 18 electrically-operated capstans for the St. Lazare Station.

July 5th.—Telegraph office instruments. Particulars, and leave to compete, from the Ministère du Commerce, de l'Industrie, des Postes et des Télégraphes, 103, Rue de Grenoble, Paris, before June 26th.

**Leeds.**—June 23rd. Electric light installation in Church and School, for the Trustees of Clowea Primitive Methodist Church, Meanwood Road. Mr. F. S. Morland, Secretary, 18, Cambridge Road, Leeds.

**Leyton.**—June 24th. Electric lighting and hot-water heating for the new Church Road Schools, for the U.D.C. See "Official Notices" June 13th.

**Limerick.**—July 3rd. Switchboard and gallery, battery, motor-driven booster, balancer, &c., for the County Borough Council. See "Official Notices" June 13th.

**London.**—L.C.C.—June 24th. One 50-ton overhead travelling crane for Greenwich generating station. See "Official Notices" June 6th.

June 25th.—Electrical installation at Randall Place Elementary School, Greenwich, S.E. See "Official Notices" June 6th.

July 2nd.—Electrical installation at the Caldecot Road Elementary School, Denmark Hill, Camberwell (192 lighting points). See "Official Notices" June 13th.

STEPNEY.—July 3rd. The Electricity Committee invites tenders for two E.H.T. converting plants suitable for 6,000-volt three-phase A.C. to L.T., D.C., for Limehouse and Whitechapel stations. See "Official Notices" June 13th.

June 30th. Arc lamp carbons, for a year, for the Borough Council. See "Official Notices" June 13th.

ROYAL MINT.—June 26th. 100 tons of copper in ingots. See "Official Notices" to-day.

HACKNEY.—July 24th. Extra-H.T. ring main conduits, sub-station plant, switchgear and cranes, for the B.C. electricity department. See "Official Notices" to-day.

H.M. OFFICE OF WORKS.—Incandescent electric lamps for one year. See "Official Notices" to-day.

**Newcastle-under-Lyme.**—June 21st. Supply and laying of cables, for the Corporation. See "Official Notices" June 6th.

**Newport (Mon.).**—July 1st. Refuse destructor for the T.C. Borough Engineer, Town Hall.

**Norway.**—June 26th. The electrical department of the Municipal Council of Christiania is inviting tenders for the supply of a 25-ton travelling crane.

June 28th.—Norwegian State Telegraph Department. 400,000 metres of double wire.—*Board of Trade Journal.*

**Oldham.**—One 2,000-kw. steam turbine, coupled to extra-H.P. A.C. generator, also barometric condenser, pumps, &c., for the Corporation. See "Official Notices" to-day.

**Ramsey (Hunts.).**—June 30th. Street lighting, for the U.D.C. Mr. R. F. Serjeant, Clerk.

**Rotherham.**—July 8th. Tramway stores, coal, cable and meters, for the Corporation. See "Official Notices" to-day.

**Salford.**—June 23rd. 4,000 steel tie-bars, for the Tramways Committee. General Manager, 32, Blackfriars Street.

**South Africa.**—CAPE TOWN.—July 4th. High-tension switchgear, feeder pillars and three-phase transformers, for the Corporation. Particulars from the City Electrical Engineer on payment of deposit of £1 ls. per section (three sections).

**Spain.**—August 1st. The Harbour Works authorities at Barcelona are inviting tenders for the conversion to electric operation of 10 hydraulic cranes.

The municipal authorities of Sax (Province of Alicante) have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

**Swindon.**—June 23rd. Cooling tower, water softening plant and flamed cast-iron piping, for the Electricity Department. See "Official Notices" June 6th.

**Wakefield.**—June 21st. Calder Vale electricity works. Tenders for 1,000 tons of good round slack, or alternatively "through" coal. Town Clerk, Town Hall, Wakefield.

**West Stanley (Co. Durham).**—Electrical work for new Royal Hippodrome Theatre of Varieties. Mr. Frank Sinclair, lessee and manager, The Rink, West Stanley.

### CLOSED.

**Bradford.**—The tender of Messrs. J. Dyson & Co. has been accepted by the Guardians for the supply of an E.P.S. battery, for £140, less £15 for old material.

**Colchester.**—The T.C. has accepted the following tenders for coal for the electricity works:—

Wm. Cory & Co., Ltd.—About 8,500 tons of Shirebrook, 15s. 11d. per ton.  
A. J. Hayward.—About 1,500 tons of Digby Gilding, 15s. 4d. per ton.

**Chile.**—It was recently mentioned that the Siemens-Schuckert Works had secured a large contract for the equipment of a central station and sub-station in Chile, of the value of £600,000. The contract, which has been obtained in competition with the large electrical firms in the United States, has now been signed, the order having been placed by the Chile Exploration Co., which has been formed by the Guggenheim syndicate for the working of copper ore in the north of Chile, and in anticipation of the great development of trade which is expected to occur on the west coast of South America after the opening of the Panama Canal. It is understood that the order comprises boilers, machinery, transformers and switchboards, and four turbo-generators of 10,000 kW. will first be installed at the coastal generating station. The transmission to the sub-station at the mines, which are situated about 124 miles distant, is to be effected at 110,000 volts, and the sub-station will be equipped with seven rotary converters of 2,500 kW. at the beginning of working.

**France.**—The French Post and Telegraph authorities in Paris last week gave out orders as follows:—

La Société des Tréfileries du Havre.—50 tons of bronze wire 11/10 mm. dia.; 10 tons ditto 15/10 mm. dia. and 700 tons of high conductivity copper wire, 23 mm. dia.  
M. Grammont, of Pont-de-Cheruy.—50 tons of bronze wire, 11/10 mm. dia. and 600 tons of high conductivity copper wire, 23 mm. dia.  
La Compagnie Générale d'Electricité, Paris.—50 tons of bronze wire, 15/10 mm. dia. and 50 tons of high conductivity copper, 23 mm. dia.  
La Compagnie Française du Minéral, Paris.—30 tons of high conductivity copper wire, 2 mm. dia. and 160 tons ditto, 4 mm. dia.  
La Société d'Electrometallurgie de Nives.—200 tons ditto, 3 mm. dia.  
La Compagnie Française des Metaux, Paris.—300 tons ditto.  
La Société de Pontgibaud.—100 tons ditto, 4 mm. dia.

**Government Contracts.**—The following tenders have been accepted during the past month by the Government departments named:—

#### ADMIRALTY—CONTRACT DEPARTMENT.

Steel masts for wireless telegraphy.—Siemens Bros & Co., Ltd.

#### INDIA OFFICE.

Cells.—J. Stone & Co.  
Telephone exchange.—Automatic Telephone Manufacturing Co.  
Copper wire.—Callender's Cable, & Co.

#### CROWN AGENTS FOR THE COLONIES.

Underground telegraph cable.—W. T. Henley & Telegraph Works Co.  
Armoured telegraph cable.—Siemens Bros. & Co., Ltd.  
Porcelain insulators.—Bullers, Ltd.  
Steel telegraph poles.—Bullers, Ltd.

#### POST OFFICE.

Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; D. H. Bonnell & Son, Ltd.; B.I. and Helsby Cables, Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; Karabon Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Peel-Comer Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Sterling Telephone and Electric Co., Ltd.; Western Electric Co., Ltd.  
Telegraphic apparatus.—Gell Toleg; Appliances Syndicate, Ltd.  
Wood arms.—R. Lander & Co.  
Silence cabinets.—Siemens Br. s. & Co., Ltd.  
Telephone cable.—B.I. and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Western Electric Co., Ltd.  
Telegraph cable.—Callender's Cable and Construction Co., Ltd.  
No. 2 detector.—London Electric Co., Ltd.  
Solder.—B.I. and Helsby Cables, Ltd.  
Bronze wire.—Barton & Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith and Co., Ltd.  
G.I. strand wire.—Rylands Bros., Ltd.  
Annealed copper wire.—T. Bolton & Sons, Ltd.  
Platinum wire.—Macintosh & Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.

Leclanché rod zincs.—Siemens Bros. & Co., Ltd.  
Steel mast, Malin Head, co. Donegal.—Marconi Wireless Telegraph Co., Ltd.  
Telephone exchange equipment, Tunbridge Wells.—Western Electric Co., Ltd.

**Great Yarmouth.**—The T.C. has accepted the tender of Messrs. E. Foster & Co., Ltd., for slack coal for the electricity works, at 14s. 5d. per ton.

**London.**—L.C.C.—The Highways Committee received the following tenders from selected firms for two hydraulic accumulators and a pump for the third section of the central car repair depot:—

Leeds Engineering and Hydraulic Co., Ltd., (accepted), £206.  
W. H. Bailey & Co., Ltd.  
Glenfield & Kennedy, Ltd.

**L. AND S.-W. RAILWAY.**—With further reference to this matter, the *Railway Gazette* states that the London and South-Western Railway has let the contract for motors and train equipment for the first portion of its electrification scheme to the British Westinghouse Electric and Manufacturing Co., Ltd. The conductor rails it is purchasing from Messrs. Bolckow, Vaughan & Co., Middlesbrough, and these will be laid down under the supervision of Mr. J. W. Jacob Hood, M.Inst.C.E., and his department. The high-tension cables are being obtained from Messrs. Siemens Bros. & Co., Ltd., Woolwich. The contract for the power house has not yet been let, but it is understood that 10,000 kW. and 5,000 kW. units will be installed, generating at a pressure of 11,000 volts. The sub-station equipments have been placed with the British Thomson-Houston Co., Ltd. The first section to be completed will be the two lines to Hampton Court. The electrical work is being carried out by the company's electrical engineer, Mr. Herbert Jones, the whole of the work being under the supervision of Messrs. Kennedy & Jenkin.

**MARYLEBONE.**—The B.C. has accepted the tender of Messrs. J. Simpson & Son, at £234, for carrying out certain alterations at the Aybrook Street sub-station in order to house the new rotary converters. The tenders of Messrs. Pirelli and Messrs. Siemens have also been accepted for a supply of rubber tubing and rubber gloves respectively.

The Metropolitan Asylums Board has received the following tenders for installing internal telephones at the Western Hospital:—

S. W. Vaughan & Co., Ltd. . . . .	(accepted) £284
Toy & Winslow . . . . .	318
Electrical Installations, Ltd. . . . .	336
Electrical Contacts and Maintenance Co., Ltd. . . . .	320
Private Telephone Co., Ltd. . . . .	380
C. H. Cathcart & Co. . . . .	357
J. W. Gray & Son . . . . .	450
British Home and Office Telephone Co. . . . .	453
Thomas Williams & Co. . . . .	489

**SHOREDITCH.**—The B.C. Lighting Committee has accepted the tender of Messrs. Harrison, Tidswell & Co. for a nine months' supply of Manners Kilburn D/3 nuts, at 17s. 6d. per ton, and Whitwick D/3 nuts, at 17s. 6d. per ton.

**BERMONDSEY.**—The B.C. Electricity Committee has accepted the tender of Messrs. G. Hinchliffe & Co. for an annual supply of Stockingford nutty slack, at 13s. 11d. per ton; also the tender of A. Usher & Co., Ltd., for a supply of Exhall D/3 nuts, at 17s. per ton.

**FULHAM.**—The following tenders have been accepted by the B.C. for supplies of coal to the electricity department:—

Gilman & Co.—3,000 tons of Mapper ey, 15s. 4d. per ton.  
Cory Bros.—2,000 tons of Geddings, 13s. 1d. per ton.  
Harrison & Tidswell.—1,000 tons of Bedworth, 15s. 11d. per ton.

**HAMMERSMITH.**—Mr. E. C. Berridge is to supply, at £105, a 16-in. twin strainer for fitting to the condenser of set No. 12 at the generating station, that already fitted to another set having proved of very great advantage in enabling the rubbish contained in the river water to be cleared away without shutting down.

**Southampton.**—The Post Office has submitted an estimate of the cost of installing the "Gamewell" fire alarm system between Cobden Bridge, Bitterne Park; the junction of St. Denys Road with Kent Road and the Brigade headquarters in St. Mary's Road. For wiring only, £22 10s. per annum is quoted, with £36 10s. per annum for apparatus only; and £2 2s. 6d. per annum for providing two pedestals for carrying the apparatus at the first two points. The terms are stated to be inclusive and cover all charges for provision and maintenance under agreement for 10 years. Twelve fire helmets are to be fitted with electric lamps, at 11s. per helmet, and a quotation is to be obtained from the patentee for the equipment of the whole of the helmets of the Brigade.

**Southport.**—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for steel pipes and valves for the boilers at the electricity works, at £1,032.

**Swindon.**—The T.C. has accepted the tender of the Bruh Electrical Engineering Co., Ltd., for a 500-kw. turbo-generator with surface condensing plant, at £5,567.

**Woolwich.**—The tender of Messrs. Switchgear and Cowans, Ltd., has been accepted by the B.C., at £106, for two complete panels, with all the necessary controller gear mounted thereon, required in centralising the switchboard in connection with the Woolwich works extensions.

**Workshop.**—The U.D.C. has accepted the tender of the Wigan Coal and Iron Co., Ltd., for nutty slack coal for the electricity works; and that of the tender of the British Insulated and Helsby Cables, Ltd., for materials for overhead wiring, &c

**FORTHCOMING EVENTS.**

- Municipal Electrical Association.**—Eighteenth Annual Convention, Friday, June 20th.—At 10 a.m. At the I.E.E. Annual general meeting, Saturday, June 21st.—At 9.30 a.m. Leave for visit to Chingford reservoir.
- Association of Electrical Station Engineers (Newcastle-on-Tyne Section)**—Monday, June 24th.—At 7.30 p.m. At the Drawing Room Cafe, Northumberland Street. General meeting, to form a branch.
- (London Section).**—Tuesday, June 24th. At 8 p.m. At Chandos Hall, Malden Lane, Strand, W.C. General meeting. Paper on "The Status of Electrical Station Engineers, and the Need of an Association," by Mr. J. W. Thomas.
- Institution of Municipal Engineers.**—Wednesday, June 25th. At 10.30 a.m. to 1 p.m. At the Institution Offices, 39, Victoria Street, S.W. An informal meeting to facilitate intercourse between members coming to London for the International Road Congress. At 7.45 p.m. In the Council Chamber, 4, Southampton Row, W.C. Paper on "The Relations of the Engineer and the Municipal Engineer," by Mr. H. C. H. Shenton (member).
- National Physical Laboratory.**—Thursday, June 26th. At 3 p.m. Opening of the new buildings by Mr. A. J. Balfour.
- Institution of Electrical Engineers.**—Thursday, June 26th. At 9 p.m. At the Natural History Museum, S.W. Annual Conversazione.

**THE ELECTRICAL ENGINEERS (LONDON DIVISION).**

Commanding Officer—Lieut.-Col. H. M. LEAF.

- The following orders have been issued for the current week:—
- Monday, June 23rd.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 5th rate, and for all candidates for higher rating, 7 to 9 p.m.; musketry instruction, 9 to 10 p.m.
  - Tuesday, June 24th.—"B" Company. Ditto.
  - Thursday, June 25th.—"C" Company. Ditto.
  - Friday, June 27th.—"D" Company. Ditto.
  - Saturday, June 28th.—All Companies. The whole corps will parade at Headquarters at 5 p.m. Ceremonial parade on Wimbledon Common. Dress, Drill order, service dress, black boots and puttees will be worn. The Officers' Drill Cup Competition will be decided on the turn-out for this and the Royal Review Parade. Members are requested to turn up at Headquarters as early as possible, on account of the great number of arms to be issued. Regimental business will be transacted from 10 a.m. to 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant.  
For Officer commanding L.E.E.

**NOTES.**

**Wanted—Two Hundred and Fifty Pounds.**—Three-fourths of the £1,000 which it is hoped to bring to the Electrical Trades Benevolent Fund, consequent upon the movement set on foot at the annual dinner, is now promised, and the list of donors given below includes an amount generously offered by Messrs. A. P. Lundberg & Sons, on condition that other offers aggregating £250 are forthcoming before the closing date.

It seems to us that, with both Mr. Byng's and Messrs. Lundberg's offers as an inducement, there should be little difficulty in obtaining this further £250. We are sure that good resolutions have been formed, or half-formed, by a number of our well-to-do readers during the past few weeks as they have read our appeals: but they have been too busy, or it has been too hot, or they have been to Ghent or to Paris, or to Blackpool or the I.M.E.A., and their good intentions have been unwittingly smothered up by a hundred pressing matters. We trust that, as to-day they open out their ELECTRICAL REVIEW, and, suddenly remembering the Fund, turn over to this note to see what progress is being made, they will take out that cheque-book and draw a crossed cheque for £100 or £50, payable to "The Electrical Trades Benevolent Institution," and dispatch it—before interviewing even that man who is waiting to see them—to Mr. F. B. O. Hawes, the secretary (18, Park Mansions, Vauxhall Park, South Lambeth Road, S.W.), or to us.

The terms of Messrs. Lundberg's offer are as under:—  
"We are surprised to notice the very poor response to the appeal to subscribe the £1,000 for the Electrical Trades Benevolent Institution, of which £700 has already been promised, for we quite thought the few hundreds necessary would have been immediately forthcoming.

"Possibly were it made more widely known that donations of £50 would be thankfully accepted to make up the required amount, the difficulty might be overcome.

"In order to start the ball rolling, we will follow on Mr. Byng's offer to the effect that we will give £50, providing the remaining £250 is made up in amounts of not less than £50 before the time stated at the Dinner.

"As only a few weeks now remain, may we ask you to make a special appeal on these lines.

"A. P. LUNDBERG & SONS.

"Liverpool Road, N."

The following is the list down to date:—

1	Mr. E. G. Byng	£100
2	Mr. G. Sutton	£100
3	Mr. H. Hirst	£100
4	Mr. E. Garcke	£100
5	Sir W. H. Preece, K.C.B., F.R.S.	£100
6	Mr. Justus Eck	£100
7	Mr. Dane Sinclair	£100
8	Messrs. A. P. Lundberg & Sons	£50
9	*	
10	*	

**Imperial Motor Transport Conference.**—The following are the subjects to be discussed at the forthcoming conference

Monday, July 21st.—The fuel question and the possibilities of creating an adequate fuel supply for internal-combustion engines within the Empire. Particular stress will be laid on questions relating to the production and use of alcohol as a fuel. Papers will be submitted by Sir Boverton Redwood, Prof. Vivian Lewes, Mr. A. J. Butterfield, and Dr. W. R. Ormady.

On Wednesday, July 23rd.—Motor vehicles for military use, and the production of vehicles suitable for military purposes, and also for ordinary industrial use throughout the Empire. Official statements will be made on behalf of the Army Council by Col. H. C. L. Holden and Capt. A. E. Davidson, secretary of the Mechanical Transport Technical Committee. Further papers will be submitted by Col. R. E. Crompton and others.

On Friday, July 25th.—The discussion will be upon the subject of the carriage of goods and passengers by motor vehicle. Papers will be submitted by Mr. W. Worby Beaumont, Col. R. E. Crompton, C.B., and others.

The President of the Conference is H.R.H. Prince Arthur of Connaught, K.G., and the chairman of the Executive Committee is the Hon. Arthur Stanley, M.P., chairman of the Royal Automobile Club. The Conference opens on July 18th, when the delegates will be entertained at luncheon at Olympia, Kensington, by the President and Council of the Society of Motor Manufacturers and Traders, on the occasion of the opening of the Exhibition of Industrial Motor Vehicles organised by that Society.

In the list of overseas representatives we observe the following names:—Mr. Matthew G. Coates, A.M.I.E.E., consulting engineer, Melbourne; Mr. Stephens, electrical engineer to the Public Works Department, South Africa, and Mr. H. Twycross, under-secretary for Posts and Telegraphs, South Africa; Mr. J. Mordey Lamb, town electrical engineer and tramway manager, East London; and Mr. H. Willsmer, representing the Department of Railways, Telegraphs and Telephones, Saskatchewan.

**German Wire Lamp Prices.**—It was stated at the recent general meeting, held in Berlin, of the Julius Pintsch Co., that the prices of incandescent lamps had recently further receded, and that the reduction would probably become of a more pronounced character in the future. The fact could not be concealed that the industry was now under the influence of a price war, and those who were equipped so as to fight it out would finally become victorious. Quite a number of undertakings would probably be unable to hold out, but the company would be able to retain its position. It was added that the contest appeared to be driving in the direction of the formation of a syndicate for this type of lamp.

**Kelvin Memorials.**—The statue of Lord Kelvin, executed by Mr. Albert Bruce-Joy, was unveiled at Belfast yesterday. The *Times* states that the Kelvin memorial window in Westminster Abbey is to be unveiled on July 15th, and that Mr. Birrell will unveil a statue at Glasgow University on October 8th, when Mr. Balfour will deliver an appreciation of the great scientist.

**Annual Outings.**—The annual outing of the employes of the Siemens "Wotan" and "Tantalum" Lamp Works, Dalston, was held on Saturday last, 14th inst., when a party of over 500 made a journey to Ramsgate. The firm made a new departure on this occasion, bearing the expense of travel, and thus leaving the members of the party free to make their own arrangements for refreshments and entertainment. As there was no organised programme, visitors were not invited, but everybody had a right royal time. The company went down by a specially chartered train, which left London Bridge at 7.15 a.m.

**Austrian Electrical Mail Vans.**—Thirty new electric motor mail vans have just been put in service in Vienna by the Austrian postal authorities. The vehicles are mainly employed in transporting the mails to and from the railway stations. A new Post Office garage, for the storage of 50 electric vans, is being erected in the Austrian capital.

**Japan Cable Making.**—It is reported from Japan that the Yokohama Cable Manufacturing Co. has decided to establish a branch factory, with a view to starting the manufacture of wire rope as an addition to its operations.

**The Strike at Leeds.**—The reports in the local newspapers of the strike of Leeds municipal employes have been somewhat exaggerated. We understand that the following accurately represents what has occurred:—

The strike originated amongst labourers in the Highways Department, who sought an increase of wages and other concessions, and ultimately the Gas Workers' and General Labourers' Union called upon all its members employed by the Corporation to cease work. The call was pretty generally responded to, but the only effect upon the operations of the Electric Lighting Department was to cause a suspension of cable laying for a few days. A number of members of the Union engaged inside the generating station also ceased work, but their places were readily filled by loyal officials and workmen usually engaged in the outdoor operations of the department, with the result that no occasion was given for a moment's anxiety as to the maintenance of the supply. Threats were flying broadcast as to the cessation of work by the remaining workmen of the Corporation, but the department was fully prepared to maintain a complete supply of energy for all purposes for an in-

definite period. Many offers of help were received, and although it was not necessary to take advantage of these, the gratitude of the department and of Mr. C. Nelson Ifford, the manager, is none the less sincere. The strike was settled at the end of three or four days by substantial concessions to the workmen in other departments.

**Cable-Stealing on the Rand.**—Reports received by this week's mail show that there have been further large thefts by a gang of "copper thieves." As a result of their operations, the Kleinfontein Group have been robbed in the most audacious fashion of something like 5 miles of copper wire, valued at over £300, and weighing approximately 4 tons. The private wire connection of the New Boksburg Gold Mines with the Kleinfontein Group central administrations was entirely removed from the standards and carried away. Some 2½ miles of copper wire, of the value, roughly, of £175, had been stolen. The New Kleinfontein Gold Mining Co. later discovered that four drums of copper, weighing in the neighbourhood of ½-ton each, had been stolen from the stores-yard. The thieves broke off the locks of the stores, and rolled the drums out of the yard, over the railway line to a point where they were loaded on a trolley and carted off. Two native police boys patrol round the stores every night!

**Report of the Marconi Committee.**—On Friday last the report of the Select Committee of the House of Commons on the Marconi Contract, dealing only with the rumours regarding the actions of Ministers, was published, together with the minutes of proceedings. The official report is that of the majority of the Committee; it states that the allegations reflecting on the conduct of Ministers ranged themselves under two heads: that they had exercised undue influence to procure for the company a Government contract, and that they had made use of knowledge acquired in their official capacity, and had purchased shares in the English company with a view to selling them later at a profit. On October 11th, 1912, Sir Rufus Isaacs, on behalf of himself and his colleagues, the Postmaster-General and the Chancellor of the Exchequer, described the allegations as baseless fabrications, and the report states that "it has been proved to the Committee that there is no foundation for any of the charges made against these Ministers." The Committee publicly invited evidence relevant to the subject matter of the inquiry, and summoned various journalists and others responsible for the publication of the charges. The papers in which the charges appeared are named. The report states that there is no foundation for the suggestion that the contract was obtained through the influence of the Attorney-General, and the latter had no negotiations with any official or member of the Government. No evidence has been submitted to the Committee to justify any of the charges regarding altered transactions by Ministers in shares of the English company during the course of the negotiations prior to the acceptance and publication of the company's tender on March 8th, 1912, and these charges have been denied on oath by the Ministers concerned. The Committee cannot adopt the view that the Postmaster-General unduly pressed for the approval of the agreement before the rising of the House of Commons on August 7th, 1912; the construction of the Imperial Chain of Wireless Telegraphy was declared by the Imperial Defence Committee to be a matter of extreme urgency, and the Committee considers that the P.M.G. was bound to do everything in his power to secure the approval of the agreement at the earliest possible date. No evidence has been forthcoming in support of any suggestion that any member of the Government exercised any influence to procure for the English company a Government contract, or that he took advantage of any knowledge acquired in his official capacity in relation to the purchase or sale of shares in the English company or otherwise.

The Committee reports that the charges made against Sir Rufus Isaacs, Mr. Lloyd George and Mr. Herbert Samuel are absolutely untrue, and strongly condemns the publication in such a way of unfounded charges against the honour and integrity of public men.

Regarding the purchase of shares in the American company by the Attorney-General, Mr. Lloyd George and Lord Murray, the Committee finds that in these transactions there is no ground for any charge of corruption or unfaithfulness to principle; the American company were not parties to the agreement, and could have no interest in the construction of the stations to be erected under it, or in any profit derived by the English company from the contract. Neither the English company nor its managing director, Mr. Godfrey Isaacs, was a party to any of the transactions in question, and the Ministers named received no favour of any kind from the English company or Mr. Godfrey Isaacs.

The report concludes that, on the whole, all the Ministers concerned acted in the sincere belief that there was nothing in their action which would in any way conflict with their duty as Ministers.

In the draft report by the chairman, Sir A. Spicer, the circumstances are reviewed at length, and the conclusions with regard to the contract and the shares of the English company are substantially the same as those of the Committee's majority report; but the draft report states that in view of all the circumstances, Sir Rufus Isaacs would have been well advised if he had had nothing to do with the issue of shares in the American company, and if it had occurred to Ministers on October 11th, 1912, to disclose the facts regarding these shares, their statement would have tended to avert much misunderstanding.

A draft report submitted by Lord Robert Cecil points out that a contract between the Government and the English Marconi Co. would indirectly benefit all the subsidiary companies of the Marconi system, and that an erroneous version of the terms of the contract, circulated by the company on March 7th, 1912, was not

corrected by the P.M.G. Mr. Godfrey Isaacs's account of his position with regard to the American share dealings is not regarded in the draft report as satisfactory; the 500,000 shares in the American company belonged to the English company, and were at the disposal of Mr. Godfrey Isaacs as the agent of that company.

The transaction between the Attorney-General and Mr. Harry Isaacs "appears to us," say the draft report, "to have been gravely improper, because a Minister of the Crown made an advantageous purchase of shares upon advice and information not then fully available to the public, given to him by the managing director of a company which was in course of obtaining from the Government a contract of the greatest importance." The draft report further expresses the view that the new capital was raised for the American company largely on the strength of the indirect advantages conferred by the contract upon the whole Marconi system, and that there was a speculative element in the whole of the transactions of Ministers. The charges alleging corruption are stated to be without foundation, but they were due to a distorted account of the transactions in American shares. Ministerial reticence was mainly to blame, and is described as "a grave error of judgment, and as wanting in frankness and in respect for the House of Commons."

The Committee's report was under discussion in the House of Commons on Wednesday and Thursday this week.

**The British Engineers' Association.**—This Association held its fifth provincial meeting at Glasgow on June 12th. Mr. T. Cuthbert Stewart (Stewarts & Lloyds) was in the chair, and he was supported by Mr. James Downs, member of the council, and several other members; Captain Fitz-Hugh, the Chief Commissioner of the Association in China; Prof. C. A. M. Smith, Dean of the Faculty of Engineering at the Hong-Kong University; Mr. Stafford Ransome, Organiser of the Association, and others. The meeting was well attended by directors and other representatives of the Scottish engineering firms. The chairman said that they had now 170 members representing firms with a capital of about 70 millions sterling, and if they reckoned the many verbal promises they had received from other firms, the membership might be said to have very nearly reached 200. There were 22 Scottish members, which was not a large percentage on the whole, and he hoped that the result of that meeting would be to induce a great many more to join.

Captain Fitz-Hugh first dealt with the progress of events in China, and pointed out how it was bound to become a huge market for engineering plant.

Prof. Smith dealt more particularly with the technical educational problem. When he was sent out to China to take charge of and open the engineering department of that University he was firmly convinced that British engineering interests were paramount in China. He was astounded to find that there was a general impression that British influence was on the wane, and more astonished still to find that British residents in China were not slow to admit that allegation. When they heard that the British Engineers' Association had been started they were enthusiastic at the idea of our manufacturing engineers becoming alive to the trade possibilities of the country. It was essential to our future success that the prestige of British engineering and machinery should be upheld in the eyes of the Chinese, and the Hong-Kong University, purely a British institution, though certain Chinese subscribed largely to the funds, was there to educate the Chinese engineer of the future on British lines, and now they had the British Engineers' Association to strengthen the business interests. These were the two great factors working side by side which should do more than anything else to maintain British engineering prestige. They could rest assured that the Hong-Kong University would do its share, and the British Engineers' Association had already begun to bear a portion of the burden. It remained for British manufacturing engineers throughout the country to support the Association in a manner which would render it all-powerful for the good of their industry.

Mr. James Downs said that the time was ripe for a combination like the British Engineers' Association, as, without it, we could not hope to capture our proper share of the Chinese market. His firm (Messrs. Rose, Downs & Thompson) had spent a good deal of money, and had taken a great deal of trouble to obtain Chinese trade, and he had himself visited the country for the purpose of studying the question on the spot. The result of his investigations had been the conviction that British engineers should combine to retain and increase their trade, and he agreed with the previous speakers that British prestige should be upheld. The Association, which had already done something, would, when supported by all the principal firms in the country, possess a power which would give its voice weight with the Government and in financial circles. A banking system which would advance to an engineering firm £500 on the security of a £1,000 Bank of England note was not one which was likely to promote the interests of its clients, and he considered that it was worth while having an Association even if its effect were only to render British bankers more reasonable in their treatment of engineering propositions. He then dealt with the various reasons why engineering firms should give their support to the Association, and urged all those Glasgow firms who had the interest of British engineering at heart to become members.

**Aluminium Conductors.**—The use of bare overhead conductors of aluminium was discussed at the recent meeting of the Association of Electricity Works held at Triar. Mr. Henney, who stated that the town of Triar had obtained favourable results from aluminium mains, mentioned that the total length amounted to 322 miles, and the saving as compared with the use of copper reached the sum of £6,750.

**Electrical Contractors' Association (Incorporated).**

—ANNUAL DINNER.—On Tuesday last the annual dinner of the Association was held at Frascatti's Restaurant; the President, Mr. W. A. Shaw, occupied the chair, and was supported by Mr. S. H. Webb, President-Elect, Mr. J. E. Edgcome, Mr. A. Bruce Anderson, and other guests and members to the number of about 80.

After the loyal toasts, Mr. M. N. Druquer proposed "The Electrical Contractors' Association (Incorporated)," recalling bygone battles in which he had acted on behalf of members of the Association, with the invaluable assistance of the secretary, Mr. L. G. Tate, whose lucid explanations in the witness box were irresistible to any judge. The Association never failed to achieve any purpose that it set out to accomplish, and it had now attained a membership of 500, which rendered it a powerful body. He referred to the victories over the Leicester and Sheffield Corporations, and said that if the Association wished to continue its existence, it must present a united opposition to municipal trading. In reply, Mr. Webb said that the Association only took to law in the last resort, and it had always been successful in the Courts. He regretted that the municipal engineers, with whom they wished to cultivate a better feeling, had introduced a Bill that they must oppose. He had never seen a true balance-sheet for the wiring department of a municipality, including all the items of expenditure that were in fact incurred; they felt keenly the competition of these departments, and must fight the Bill, though really their interests were identical with those of the station engineers. It was most desirable that all contractors should join the Association, not only for the strength of union but also to get to know each other.

At the request of the President, Mr. W. R. Rawlings presented to Mr. A. Davidson an illuminated address, remarking that they owed him a great debt for his services to the contractors of Great Britain in leading the successful attack on the Sheffield wiring department. Mr. Davidson expressed his thanks for the honour, which he shared with his colleagues, and stated that he was about to start another fight which would have still more far-reaching consequences. He was going to urge the Chambers of Commerce of the United Kingdom to press for the impartial audit of all municipal accounts, in view of the "disgraceful state" of the accounts of the Corporation of Sheffield. He referred to the great personal merits of the secretary, Mr. Tate, whose policy, at first cold-shouldered, had eventually borne fruit owing to his untiring energy.

The President then presented an illuminated address and a cheque to Mr. Tate, expressing the hearty good wishes of all contractors and station engineers that he and Mrs. Tate should enjoy every happiness. He was a born secretary, and had rendered magnificent services to the Association in Parliament and elsewhere. Mr. Tate briefly expressed his appreciation of the gifts and good wishes, remarking that at times he had been down-hearted, but those times had passed.

Mr. E. C. Wallis, in a humorous speech, proposed "The I.M.E.A., the B.E.A.M.A. and Kindred Associations," hoping the latter would back the Association up in resisting the aggression of municipal authorities. The President pointed out that the contractors had always had a good friend in Mr. J. E. Edgcome (President I.M.E.A.), who, in his reply, said that the questions at issue between their respective Associations were questions that ought to yield to treatment—there must be some way of reconciling their differences. His Council had had full powers since 1900, and had practically acted as bankers, preparing specifications and placing contracts with the lowest tenderer; they advanced the money to pay the contractors, who thus made no bad debts, and they collected the cost from the consumers, to the advantage of all parties. He hoped some means would be found to bury the hatchet.

Mr. A. Bruce Anderson (Chairman B.E.A.M.A.) also replied, reiterating his gospel—that all their interests converged in the common interest of the British electrical industry; they were all interdependent and must work for one another as well as for themselves. The same argument applied to the whole of British industry. When that great fact was realised, they would be doing all in their power to give employment to the working classes of this country.

"The President" was proposed by Mr. R. Tweedy Smith, who remarked that the Association went to the north country for fighting men. In his reply, Mr. Shaw acknowledged his indebtedness to all his colleagues for the great kindnesses accorded to him during his year of office.

An excellent musical entertainment was provided, and the proceedings throughout were "merry and bright."

**Appointments Vacant.**—The appointment of Professor and Head of the Department of Civil Engineering at the Imperial College of Science and Technology (£1,000) is vacant, and applications are invited by the Delegacy (City and Guilds Engineering College); the appointment of Professor of Mechanical Engineering at Manchester Municipal School of Technology (£700), rendered vacant by the death of Prof. J. T. Nicolson, is also advertised in the *Times*; lecturer in wireless telegraphy for Royal Technical College, Glasgow (£150); telegraph inspector for the Posts and Telegraphs Department of Northern Nigeria (£250 + quarters); mechanic for the Middlesex Education Committee (42s.). See "Official Notices" to-day.

**Colliery Fatality at Redhill.**—Referring to the note in our issue of the 6th inst., which stated that the faulty cable was "protected by rubber," we regret to learn from the St. Helens Cable and Rubber Co., Ltd., that this expression has been taken to mean that the cables were of the "cab-tire sheathed" type. In point of fact, the cable was insulated with rubber, and protected with tapes and braids in the ordinary way. The cab-tire rubber

compound with which the company's patent G.T.S. cable is protected has acquired a unique reputation for safety, though it is used under the most severe conditions, and we are pleased to be able to clear it of any imputation in connection with this unfortunate accident.

**Inquiries.**—A correspondent wants small armature-core plates, or the addresses of makers of notching presses for these. Makers of the "T'recht" ceiling fan are asked for.

**Institution and Lecture Notes.**—**INSTITUTE OF MARINE ENGINEERS.**—A party of members of the Institute on June 6th made a visit of inspection to the G.S.N. steamer *Faurelle*, at present engaged in the London-Bordeaux service, which is the latest addition to the company's fleet and has been constructed and fitted throughout on a generous scale. A complete installation of electrically-operated windlass, cranes, winches, capstans, &c., has been supplied by Messrs. Clarke, Chapman & Co., Ltd. The windlass has two cast-iron cable holders, each suitable for working two 1½-in. diameter cables. The six cranes, each with a lift of 1½ tons at 120 ft. per minute, or 3 tons at 60 ft., are of the two-motor type, the hoisting and slewing motions each being operated by a separate motor. There are two capstans, and each barrel has two diameters, the larger diameter at the bottom being necessary to give room for the gear case; this also gives a quick speed necessary for hauling in slack rope. They give a pull of 3 tons at 40 ft. per minute. There are two winches, one with a lift of 5 tons at 60 ft. per minute, or 2½ tons at 120 ft., and the other of 3 tons at 60 ft. per minute, or 1½ tons at 120 ft. The pressure of supply from the two 100-kw. power generating sets is 220 volts, and from the lighting plant 110 volts. The power installation is quite separate from the lighting installation as regards both wiring and machines. The absence of deck steampipes is a noticeable feature, and the silent running and absence of vibration are distinct advantages in a passenger vessel of this description. The masthead, stern, anchor and side lights are all electrically operated, and are connected to an electric ship log in the captain's room. The vessel is equipped with a wireless telegraph outfit.

**ROYAL SOCIETY OF ARTS.**—On Tuesday the annual conversation of the Society was held in the galleries of the Natural History Museum, the guests being received by Lord Sanderson, chairman, and the Council. Music was provided by the bands of the Royal Artillery and the University of London O.T.C., and a concert was given; a large number of members and guests were present and passed an enjoyable evening.

**JUNIOR INSTITUTION OF ENGINEERS.**—The second Gustave Canet lecture will be delivered on Monday, June 30th, by Dr. Dugald Clerk, F.R.S. Sir Trevor Dawson, who delivered the first Canet lecture in 1909, is this year the president, and has consented to preside. Visitors wishing to attend should make early application for tickets, which can be obtained from Mr. A. Clifford Swales, secretary, 39, Victoria Street, S.W.

**SOCIETY OF ENGINEERS (INCORPORATED).**—A large party of members of the Society visited the Chingford Reservoir of the Metropolitan Water Board on the 17th inst. to see the Humphrey pumps.

**Association of Electrical Station Engineers.**—At a number of meetings held during the past week at Manchester, Dublin, Glasgow, Bradford, Birmingham, Liverpool and Grimsby, delegates were appointed to attend a Conference with the London Organising Committee to be held in London, June 23rd, the object of which is to ratify a set of rules and finally fix the policy of the Association. The delegates will also attend a general meeting to be held at Chandos Hall, Maiden Lane, London, W.C., June 24th, at 8 p.m., when a report on the result of the Conference will be given.

An informal meeting was held on Friday last at the Y.M.C.A., Newcastle-on-Tyne, with the object of forming a branch. A temporary committee was appointed, which has arranged to hold a general meeting, at which all station engineers will be welcomed, at the Drawing Room Café, Northumberland Street, Newcastle-on-Tyne, on June 23rd. A branch had not been formed previously, owing to the fact that a gentleman could not be found to undertake the onerous duties of hon. secretary, but this difficulty has now been overcome.

**OUR PERSONAL COLUMN.**

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—Our Australian exchange, *Tenders*, says that Mr. GEORGE CROWTHER, of the Melbourne City Council electrical engineer's staff, has been appointed electrical engineer to the Inverell municipality, N.S.W.

Mr. L. H. KING, on relinquishing the position of electrical engineer to the Whitby Urban Council, has been presented by the staff with a leather travelling bag.

Mr. G. P. FARRER has been appointed assistant manager of the Brighouse electricity works, of which Mr. A. Aspinall is the manager.

Mr. OLIVER H. BARKER, of Charlton, Kent, has been appointed to fill the post of switchboard attendant at the Portsmouth Corporation electricity works, which was recently advertised.

MR. HARRY E. BETTS has resigned his position as district representative with the South London Electric Supply Corporation, Ltd., in order to take up a position as engineering representative with the City of Sheffield electric supply department.

The *Mining and Engineering Review* states that Mr. F. J. CARMODY, late of the Melbourne Municipal electrical supply department, has been appointed electrical superintendent to the Footscray (Vic.) Council.

The Whitehaven T.C. has decided to increase the salary of the borough electrical engineer, Mr. B. SANKEY, by £25 a year to £275.

MR. CHAS. F. WELLS, of the staff of the Isle of Wight Electric Light and Power Co., has been appointed commercial representative at the electricity works of the Dundee Corporation.

**Tramway Officials.**—The Southport Electricity and Tramways Committee at the end of May received a letter from Messrs Brighouse, Jones & Co., claiming damages on behalf of Mr. B. ANDREWS, of Bradford, who had been recommended by the Electricity and Tramways Committee for the position of tramways manager. The Committee approved of the reply thereto of the town clerk, and decided that Messrs. Brighouse, Jones & Co. be informed that the Committee cannot admit any liability, nor agree to make the payment to Mr. Andrews which they suggested.

**General.**—The marriage took place at All Saints' Church, Writtle (Essex), on June 12th, of MR. FREDK. RICE MARKHAM, eldest son of Col. Markham, of Morland House, Westmorland, and a member of the firm of Bray, Markham & Reiss, electrical engineers and manufacturers of Blackhorse Lane, Walthamstow, London, and Miss Elizabeth W. Woodhouse, daughter of Mr. Robert Woodhouse, of Longmead, W. Writtle.

Congratulations and best wishes to MR. W. MURRAY MORRISON, M.Inst.C.E., M.I.E.E., general manager of the British Aluminium Co., Ltd., who was married on Friday last, 13th inst., to Marie Vera, only daughter of K. E. Markel, Ph.D., and Mrs. Markel, of 20, Queen's Gate Terrace, S.W.

MRS. J. DEVONSHIRE, wife of the managing director of the London United Electric Tramways, Ltd., will distribute the prizes at the annual sports of the employés to be held at the Brentford Football Ground on July 9th. One of the leading events will be the tag-of-war for the Lady Robinson Challenge Cup, to be competed for by tramway teams of the United Kingdom.

MR. F. GILL, late engineer-in-chief, and MR. W. W. COOK, late assistant engineer-in-chief for many years to the National Telephone Co., Ltd., have entered into partnership as consulting engineers, specialising particularly in the work of telephone undertakings. Associated with them are MESSRS. D. B. FULTON, J. II. H. BOYD, S. H. POOK, E. WILLIAMS, and H. GREEN, all of the National Telephone Co.'s staff. Messrs. Gill & Cook will remove their offices on the 24th inst. from Hamilton House, Temple Avenue, to Winchester House, Old Broad Street.

MR. R. W. WEEKES, Whit. Sch., M.I.E.E., informs us that he is taking into partnership Mr. Alfred O. Kolkhorst, M.I.E.E., and that in future the name of the firm will be Messrs. Weekes & Kolkhorst. The latter gentleman has resided for many years in Chile, where he has carried out some of the largest electrical undertakings, including the Valparaiso tramways and electricity supply, of which he was general manager from 1903 to 1912, besides being manager of the Chilean Electric Tramways and Light Co., of Santiago. The capital expended on these undertakings and the Chile hydro-electric plant (also under Mr. Kolkhorst's management) was about 3½ millions sterling. As for Mr. Weekes, much of whose work has been done in our midst, no introduction is necessary; but we may remind our readers that amongst the important undertakings with which he has been connected as electrical adviser are the South London, Chiawick, Aberystwyth, and Kandy Electric Supply companies, in addition to numerous large factory installations such as the Tate Sugar Refineries at Liverpool and London, the Xylonite Co.'s two works, Broadwood's and Marshall's piano factories, and various foreign and colonial gas works, mining plant, &c. We join with Mr. Weekes's many friends in wishing him and his partner (one of his oldest electrical friends) all success and prosperity in their joint career.

**Obituary.**—MR. R. S. ERSKINE.—We deeply regret to learn of the death of Mr. Robert Stenart Erskine, secretary of the Kensington and Knightsbridge Electric Lighting Co., Ltd., which occurred on Saturday last, 11th inst., at 10, Ovington Gardens, S.W. The deceased gentleman was only 62 years of age. The funeral service took place at St. Stephen's, Gloucester Road, on Wednesday afternoon, and was followed by interment in Brompton Cemetery. Mr. Erskine was an old Crompton man, and he went straight from the service of that firm many years ago to the Kensington and Knightsbridge Electric Lighting Co., being associated with it from its beginning. He will be remembered by many of our readers by reason of his connection with the Electrical Engineers Volunteers, of which, with Dr. Hopkinson, Col. Crompton and others, he was one of the originators, and in which he was a major. He was a member of the Institution of Electrical Engineers.

MR. OSWALD DEWEY.—We regret to record the death of Mr. Oswald Dewey, which occurred suddenly in Blackpool, the cause being acute pneumonia. The deceased gentleman had been on the representative staff of Messrs. Ferranti, Ltd., and the Reason Manufacturing Co., and at the time of his death was representing Messrs. Tearla, Ltd. Mr. Dewey's sudden death has come as a shock to his many acquaintances and friends in the electrical profession.

## NEW COMPANIES REGISTERED.

**Electric Utility Co., Ltd.** (129,420).—This company was registered on June 6th, with a capital of £20,000 in 50 shares, to acquire any invention relating to electric and other lamps and accessories, and generally any invention or business relating to lighting or illuminants, to acquire the business and assets of Electric Lamp Regenerators, Ltd. (in liquidation), and to carry on the business of manufacturers and repairers of and dealers in electric lamps, reflectors, lenses and other articles, &c. The subscribers (with one share each) are:—E. Edwards, 112, Turner's Road, Burdett Road, Bow, clerk; H. E. West, 19, Kay Road, Stockwell, S.W., clerk; A. W. Skan, 4, Cophall Chambers, E.C., solicitor; P. H. Brashier, 23, Klea Avenue, Clapham Common, S.W., gentleman; H. E. Skan, 5, Kilburn Priory, Maida Vale, N.W., clerk; F. W. Beard, 23, Summerfield Avenue, Kilburn, N.W., secretary; L. M. Howe, 24, Ellingham Road, Shepherd's Bush, W., clerk. Minimum cash subscription, £3,000 shares; the number of directors is not to be less than three or more than seven; the first are H. A. Herbert, E. B. Sargent, R. Bell, J. M. Longe and H. B. Hohne; qualification (except first directors), 500 shares; remuneration, £150 per annum and 5 per cent. of the net profits, divisible. Registered office, Caxton House, Westminster, S.W.

**Garrett, Hartley & Co., Ltd.** (129,357).—This company was registered on June 4th, with a capital of £1,500 in £1 shares, to take over the business of an electrical engineer and contractor, carried on by C. W. Garrett, at Morena Street, Catford, S.E., as "Garrett's Engineering Co." The subscribers are: C. W. Garrett, 31, Culverley Road, Catford, S.E., electrical engineer, 710 shares; S. Hartley, B.Ec., A.M.I.C.E., Cranford, Grand Drive, Raynes Park, S.W., engineer, 400 shares. Private company. The number of directors is not to be less than two or more than five; the first are C. W. Garrett and S. Hartley, secretary. Registered office, Morena Street Works, Catford, S.E.

**W. N. Berry & Co., Ltd.** (129,459).—This company was registered on June 7th, with a capital of £1,000 in £1 shares (10 deferred), to take over the business of electrical and mechanical engineers carried on by W. N. Berry and H. Bamber, at 32, Queen Street, Manchester, as "W. N. Berry and Co.," and to adopt an agreement with W. H. Edge. The subscribers (with one share each) are: W. N. Berry, 40, Lillesmere Road, Didsbury, electrical engineer, 300 shares; H. Bamber, 33, Ansdell Street, W. Manchester, electrical engineer. Private company. The first directors are W. N. Berry and H. Bamber; qualification, £100. Registered office, 32, Queen Street, Albert Square, Manchester.

**L. Apple, Ltd.** (129,396).—This company was registered on June 5th, with a capital of £500 in £1 shares, to take over the business carried on by Lazarus Apple as the West End Ironmongery Stores and Electrical Engineers, at 13, Brewer Street, Soho, W. The subscribers (with one share each) are: L. Apple, 13, Brewer Street, W., ironmonger and electrical engineer; B. Apple, 31, Berwick Street, W., ironmonger's assistant. Private company. Table "A" mainly applies. Registered office, 13, Brewer Street, Soho, W.

**Wireless Telephones, Ltd.** (129,533).—This company was registered on June 11th, with a capital of £500 in £1 shares, to acquire inventions relating to or in connection with telephones, wireless telephones, and the transmission of graphic and acoustic signals, to carry on the business of electricians, manufacturers, generators, accumulators, and suppliers of electricity and electrical energy for lighting, heating, telegraphic and telephonic communications, telegraphists, proprietors and managers of telephone and telegraph works, lines, systems, stations and exchanges, &c. The subscribers (with one share each) are:—E. Ronaldson, 4, Branville Road, West Drayton, director; F. Ayriss, 345, East Dulwich Grove, S.E., clerk; F. A. Cohn, Holywell, director; H. Bamber, 33, Ansdell Street, W., Manchester, 191, Fane Avenue, Farnhams Avenue, Barking, clerk; Lillian Ford, 77, Ruskin Avenue, Manor Park, E., clerk; J. Banks, 91, Alberta Street, Kennington, S.E., clerk; A. F. Nash, 31, Matham Grove, East Dulwich, S.E., secretary. Minimum cash subscription, seven shares. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first: H. Bacon, 62, London Wall, E.C., is the first secretary; qualification, £1; remuneration, £150 each per annum (chairman, £200), and a percentage of the profits. Directors' borrowing powers restricted to the nominal amount of the company's capital for the time being. Registered by F. Ayriss, 62, London Wall, E.C.

**Globe Associated Cable and Telegraphic Co., Ltd.** (129,166).—This company was registered on June 9th, with a capital of £15,000 in 12,500 preference shares of £1 each, and 50,000 ordinary shares of 1s. each, to carry on and extend the business of cable and telegraphic services as formerly carried on by the Universal Cable Code (Parent) Co., Ltd., at 20 2/3, Holborn, E.C. The subscribers (with one share each) are:—W. Newman, 20, Holborn, 20 preference shares; H. Palmer, Greenwood, Bushey, Herts, assistant manager to Cable Services, 200 preference shares; J. P. Baird, 24, Egmont Avenue, Surbiton, private secretary, 150 preference shares; W. G. Godber, 33, Braemar Avenue, Wood Green, N., supervisor, 150 preference shares; D. S. Crale, 114, Palace Gates Road, Alexandra Park, N., supervisor, 150 preference shares; B. A. Birtles, 10, St. Andrew's Road, Finchley, N., independent representatives, 150 preference shares; F. E. Griffiths, 69, Ramuz Drive, Westcliff-on-Sea, supervisor, 150 preference shares. Private company. The number of directors is not to be less than two or more than seven; the subscribers are to appoint the first. W. Newman is the first secretary; qualification (except first directors), 500 shares. Registered office, Halton House, 20 2/3, Holborn, E.C.

**Continuous Reaction Co., Ltd.** (129,540).—This company was registered on June 12th, with a capital of £15,500 in 30,000 shares of 10s. each, and 30,000 shares of 1s. each, to carry on the business of constructors, smelters, refiners and treaters of ores, manufacturers of electrical or other furnaces for smelting or other purposes, &c., and to adopt an agreement with W. B. Ballantine and D. C. Lea. The subscribers (with one preference share each) are:—W. B. Ballantine, 5, Brunswick Court, Hove, metallurgist; D. C. Lea, 4, Paper Buildings, Temple, E.C., barrister. Private company. The number of directors is not to be less than three or more than five; the subscribers are to appoint the first; qualification, £50; remuneration, £150 each per annum. Registered by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

**Mudie's Electrical Co., Ltd.** (129,546).—This company was registered on June 12th, with a capital of £1,500 in £1 shares, to take over the business of a manufacturing electrician and electrical engineer, carried on by A. B. Mudie at 117, Sherborne Road, Balsall Heath, Birmingham, as "Mudie's Electrical Co." The subscribers (with one share each) are:—A. B. Mudie, 117, Sherborne Road, Balsall Heath, Birmingham, mechanical engineer; H. A. Pepper, 14, Temple Street, Birmingham, electrical accountant. Private company. The number of directors is not to be less than two or more than five; the first are A. B. Mudie and H. A. Pepper (both permanent); qualification, £100; solicitors, Rowlands & Co., 41, Temple Row, Birmingham. Registered by Waterloo Bros. & Layton, Ltd., Birchin Lane, E.C.

**Magneta Guarantee Syndicate, Ltd.** (129,585).—This company was registered on June 13th, with a capital of £12,250 in 11,000 ordinary shares of £1 each, and 25,000 deferred shares of 1s. each, to carry on the business of financiers, company promoters, stock and share brokers, concessionaires, contractors, constructors and controllers of roads, tramways, telegraphs, telephones, electrical works, &c., and to adopt an agreement with W. Holt. The subscribers (with one share each) are:—W. Holt, 12, Juniper Road, Dartmouth Park Road, Highbury, N.W., solicitor; H. W. Poirard, 21, Aberden Road, Highbury, N., clerk. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification (except first directors, who require none), 100 shares; remuneration, £50 each per annum (chairman, £75), and 5 per cent. of the net profits divisible. Registered by Spyer & Sons, Austin Friars House, E.C.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Income for the year ... ..	£210,880
Expenses ... ..	21,168
	£189,712
Debt interest ... ..	91,806
	£97,906
Amounts written off and reserved ... ..	47,732
	£50,173
Amount brought into the account ... ..	10,751
	£60,924
Dividends, alluded to above ... ..	48,431
	£12,493

**Asbestos and Asbestite Co., Ltd.**—Deed of hypothec mortgage and trust, executed abroad, and dated April 25th, 1913, to secure \$600,000, charged on mines, mining property and rights, buildings and machinery, &c., in Shipton, Canada. Holders: Royal Trust Co., Montreal.

**Reading Electric Supply Co., Ltd.** (35,651).—Return dated April 18th, 1913. Capital £150,000 in 4s shares. 29,495 shares taken up. £147,475 paid. Mortgages and charges: £50,000.

**Para Electric Railways and Lighting Co., Ltd.** (85,368).—Return dated March 11th, 1913. Capital £75,000 in 4s shares (72,000 pref. and 78,000 ord.). 61,000 pref. and 78,000 ord. shares taken up. £5 per share called up on 5,000 pref and eight ordinary. £25,040 paid. £681,360 considered as paid on 63,000 pref. and 77,994 ord. Mortgages and charges: £681,290 5 per cent. first debenture stock.

**Johnson-Billington Electric Meters, Ltd.**—Particulars of £500 debentures, created March 3rd, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £300. Property charged: The company's undertaking and property, present and future, including un-called capital. No trustees.

**Yorkshire (West Riding) Electric Tramways Co., Ltd.** (81,167).—Return dated February 14th, 1913; capital, £600,000 in 4s shares; 87,238 shares taken up; £136,190 paid. Mortgages and charges, £475,000.

**Premier Accumulator Co., Ltd.** (96,121).—Return dated April 3rd, 1913; capital, £25,000 in 2s, 600 participating pref. shares of £1 each, and 10,000 ord. shares of 1s, each; 9,832 pref. and 10,000 ord. shares taken up; £1 per share called up on 1,321, 10s on 600, and 6s, on 1,511; £4,024 6s. paid; £7,000 considered as paid on 10,000 ord. and 6,500 pref. Mortgages and charges: Nil.

**Universal Cable Code (Parent) Co., Ltd.**—Mortgage debenture dated April 30th, 1913, to secure £2,500, charged on the company's undertaking and property, present and future, including un-called capital. Holder: W. Newman, Halton House, Holborn, E.C.

**Chelsea Electricity Supply Co., Ltd.** (20,458).—Return dated March 26th, 1913. Capital, £100,000 in 4s shares (6,000 pref.), 49,436 ord. and 6,000 pref. shares taken up; £5 per share called up on 37,770 ord. and 6,000 pref.; £218,850 paid; £28,380 considered as paid on 11,666 ord. Mortgages and charges: £175,000 debenture stock.

**Brompton and Kensington Electricity Supply Co., Ltd.** (25,913).—Return dated March 27th, 1913. Capital, £300,000 in 4s shares (20,000 pref.); 8,468 pref. and 31,534 ord. shares taken up; £5 per share called up on 8,468 pref. and 39,532 ord. shares; £195,000 paid; £5,000 considered as paid on 1,000 ord. Mortgages and charges: Nil.

**Northampton Electric Light and Power Co., Ltd.**—Issue on May 8th, 1913, of £100 debentures, part of a series of which particulars have already been filed.

**Rhondda Tramways Co., Ltd.**—A memorandum of satisfaction to the extent of £700 on May 8th, 1913, of charges dated March 24th, 1911, and November 13th, 1912, securing £240,000, has been filed.

**Metalite, Ltd.**—Mortgage dated April 30th, but executed on May 23rd, 1913 (as verified by statutory declaration), to secure £1,300, charged on land at Osmaston, Derby, with factory, workshop and buildings thereon, with fixtures, &c., therein, and the company's undertaking and property, present and future, including un-called capital. Holders: H. S. Golding, Cambridge, and J. McDougal, Wednesbury.

**Electromobile Co., Ltd.**—Particulars of £6,000 debentures, created May 19th, and secured by trust deed and land registry charge both dated May 20th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £4,000. Property charged: Land in parish of St. George, Hanover square, W., with buildings erected thereon, 93 electromobile carriages and company's other assets, present and future, including un-called capital. Trustee: L. Fletcher.

**Lamplough & Sons, Ltd.** (in liquidation).—A memorandum of satisfaction in full on February 1st, 1913, of mortgage dated October 29th, 1912, securing £200, has been filed.

**Mills, English & Co., Ltd.**—A memorandum of satisfaction to the extent of £3,000, on May 31st, 1913, of first mortgage debenture, dated November 3rd, 1914, securing £8,000, has been filed.

**Lancashire Power Construction Co., Ltd.**—Particulars of £100,000 5 per cent. prior lien debentures, created April 17th, 1913, and secured by trust deeds dated April 27th, 1911, and May 29th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: Certain debenture stock and shares in Lancashire Electric Power Co., and the company's undertaking and property, present and future, including un-called capital, ranking *pari passu* with £50,000 existing bonds. Trustees: S. C. Boulter, 41, Threadneedle Street, E.C.; and N. Spens, 12-13, Nicholas Lane, E.C.

**James Kelth & Blackman Co., Ltd.**—A memorandum of satisfaction in full on May 15th, 1913, of debentures, dated March 10th and December 8th, 1908, and May 19th, 1910, securing £750, has been filed.

Issue on May 30th, 1913, of £100 debentures, part of a series of which particulars have been filed.

### CITY NOTES.

We are glad to note an improvement in the B.E.T. Report, condition of this company since our criticisms during the past few years. The report for the financial year ended March 31st, 1913, which was adopted at last Monday's meeting, exhibits a satisfactory increase on the credit side of the revenue account, at £210,880 (described as "gross profit"), compared with the previous year, the result of the year's operations enabling the directors to satisfy the 6 per cent. dividend on the cumulative preference stock and 3 per cent. for the year on the 7 per cent. non-cumulative preference stock; the preferred ordinary, the deferred ordinary, and the holders of £256,371 non-interest bearing income certificates redeemable out of profits, only looking into space. The position is:—

Some £23,000 of the 5 per cent. and 1½ per cent. debenture stocks has been purchased and cancelled during the year under review, which is a favourable feature, but probably unsatisfactory to the late holders, since the purchases have yielded to the company a profit (difference between nominal amount and purchase price) of £4,367, which has been added to the reserve. Included in the £47,732 indicated in our statement, is £40,000 reserved in respect of investments and undertakings, and £1,000 written off goodwill, which latter item now disappears from the balance-sheet. Perhaps the outstanding item on the liabilities side of the balance sheet is a mortgage on Federation Offices, Kingsway, of £20,000.

Investments appear in the balance-sheet at £5,109,631. Those standing in the books at £1,358,117 did not yield any return in respect of the year, the amount of the non-yielding return investments for the previous year being £1,518,579. Investments standing in the books at £3,751,513, yielded an average of 4.92 per cent., a slight improvement upon 1911-12. At the date of the accounts there are un-called liabilities on the investments amounting to £100,786. The auditors report that securities standing in the books at £964,455, which had published values, or were dealt in on the London Stock Exchange at March 31st, 1913 showed a depreciation, at middle prices, of £214,511, and that they are unable to form an opinion of the value of the remaining investments. Schedule II—Dividend and interest (receivable in cash) from investments for the year ended March, 1913, is not of value, since it does not disclose the amount of shares and/or debentures and rates in each case whilst the expense of printing Schedule IV, which represents amounts set aside by associated companies for reserves, including balances of profit carried forward, might be avoided, as the statement, as at present prepared, is also valueless.

Amounts due to the company by associated companies and others, less a reserve of £35,207, total £164,392, a figure which is still too large.

During the year there was a profit on the sale of investments of £9,115, but there were losses on sale or realisation of investments and sundry investments written off totalling £124,758, all of which have been dealt with in the reserve, which now stands at £552,457, and which appears in the balance-sheet in reduction of the items of investments and undertakings. From the report, the B.E.T. are still looking out for openings abroad, though not neglecting any suitable home outlets which may be discovered, or which may present themselves.

**Mareconi Russian Co. of Wireless Telegraphs and Telephones.**—This company met in St. Petersburg on May 31st. Mr. M. G. Salberg read the directors' report, which showed great improvement for the year, with a gross profit of 250,189 roubles, as compared with 62,850 roubles in the previous year. After making provision for reserve, depreciation, &c., a dividend of 6 per cent. is paid on 1,800,000 roubles. The full report appears in the *Times* for Wednesday last.

**Montreal Light, Heat and Power Co.**—Dividend, 2½ per cent. for the quarter ended July 31st (10 per cent. per annum), as compared with 2¼ per cent. last year.

**Reduction of Capital.**—A petition to the Court to confirm the reduction of the capital of Messrs. Bayliss, Jones and Bayliss, Ltd., from £400,000 to £250,000, is to be heard in London on July 4th.

**Aron Electricity Meter, Ltd.**—The directors are stated to have declared a dividend of 7 per cent. for the past year.

**Siemens Brothers & Co., Ltd.**—The directors (says the *Financier*), have declared a dividend of 4 per cent. (4s. per share) for the year to December 31st, £1,480 being carried forward.

**Japanese Electrical Dividends.**—The Tokyo Electric Light Co. is declaring a dividend of 10 per cent. for the last half-year, the Yokohama Electric Light Co. one of 12 per cent., and the Tokyo-Narita Electric Tramway Co. one of 5 per cent.

### Aluminium Corporation, Ltd.

MR. KENNETH M. CLARK presided at the meeting of this company held at Salisbury House, E.C., on Monday. In moving the adoption of the report (see *ELECT. REV.*, page 994), he referred to the addition of £10,000 second mortgage debentures, £6,000 of which had been paid up at the date of the accounts, the whole amount being as explained last year, provided by himself to enable the company to remove its carbon works from Wallsend to Dolgarrog. There had been an addition of £13,857 to the capital account. This consisted of £4,997 spent on the erection and equipment of a laboratory at Dolgarrog, additions to the hydraulic works, power house and reduction works, wharf and tramway, together with certain preparatory work in connection with a canal from the river to the works, and a tunnel to connect the Dulya water to the present lake. Also additions to the rolling stock and the purchase of certain necessary freehold land, buildings and water rights. £7,884 had been expended to the date of the accounts on the erection and equipment of the new carbon works and Mendheim furnace at Dolgarrog. £924 had been spent in buying a site and building a new bauxite store at St. Raphael, and making some new roads, together with extensions and improvements found necessary at St. Barnabe Mine. The new laboratory at Dolgarrog had proved a very great advantage to the company. A number of new furnaces had been erected in the reduction works, and it had been decided to proceed with the construction of the tunnel necessary to connect the Dulya water to the company's present lake, as the directors felt confident that they could dispose of the increased metal output which would be obtained thereby upon a profitable basis. The erection and equipment of the new carbon works was taken vigorously in hand in the latter part of last year, and very considerable progress made, but, unfortunately, during the spring of this year, when completion was expected, it was found impossible to obtain deliveries of material from the manufacturers, an experience which was shared by every other trader, and there still remained some two or three weeks' work to be done before the new furnaces could actually be started up, but the benefits that they would obtain from this up-to-date plant would more than compensate for all the anxiety and worry that the work had caused. The bauxite concessions in France would prove of great value to the company. Under the heading of "Investment account" there was a decrease of £14,900. This had been caused by the sale to the British Aluminium Co. of 15,000 shares in the Bauxite Refining Co., and was looked upon by the directors as a most satisfactory arrangement. The works of the Bauxite Refining Co. were designed very much in excess of the capacity of Dolgarrog, and, in consequence, it was found extremely difficult to run these alumina works at a reasonable cost, when only half the output could be consumed. In conjunction with the British Aluminium Co. they were at present engaged in considerably extending the bauxite works, and as soon as these extensions were completed, they would have secured to this corporation a supply of alumina of a quality, and at a price, it was quite impossible for them to obtain under the old conditions. Preliminary expenses they hoped to deal with in the near future. They brought forward a debit balance of £9,989 last year, to which had been added £3,745, the adverse balance on the Bauxite Refining Co., for which under agreement this corporation was liable. The 7 per cent. dividend on the preference stock became cumulative in the year under review, and the directors regretted that it had not been possible for them to earn a sufficient profit to meet this charge. They, however, felt that, in allowing only two years for the bringing of this very complicated and difficult manufacturing concern into full bearing, the time was short enough, but they hoped on the next occasion of meeting to show a more satisfactory result. It was satisfactory that a net profit was shown this year, but this could only be regarded as a start, and the figures must be very considerably increased before they could be considered in any way satisfactory. With regard to the future, he had very great faith in the market price of aluminium being maintained at a reasonable figure, but their first and essential necessity was the increase in the output. They had had many difficulties, but the outlook was very encouraging, and they now considered that the company was about to become a successful trading concern.

The report was adopted.

### Edison & Swan United Electric Light Co., Ltd.—

The meeting of the first debenture-holders was held on Wednesday to consider the resolutions, already referred to in these columns. Mr. Ellice Clarke presided. Mr. Lea Smith said he opposed the entire scheme, and after discussion the resolutions were carried by 9 votes to 8. Mr. Lea Smith then demanded a poll, and it was announced that the result would be declared to-day (Friday). A meeting of the second debentures was subsequently held, when the resolutions were carried with one dissentient. Our report of the proceedings will appear next week.

**James Keith & Blackman Co., Ltd.**—Dividend on ordinary shares 10 per cent. per annum for past year, with £9,000 put to reserve and £3,550 carried forward. Business done exceeds that of any previous year.

**Sheerness and District Electric Power and Traction Co., Ltd.**—The directors' report for the year ended December 31st showed a total revenue of £11,065. After meeting debenture interest and other charges the net profit is £783, and the debit balance brought forward is converted into a credit of £329.

### German South American Telegraph Co.

THE report for 1912 of the Deutsch-Sudamerikanische Telegraphen Gesellschaft, of Cologne, states that the company's activity was mainly devoted to the securing of agencies in South America in order to obtain as large a share as possible of the telegraph traffic to Europe. The results were very gratifying, as the traffic considerably increased in both directions and already exceeded the original anticipations, although the greater activity naturally involved larger expenses. A further satisfactory development of business had taken place in the new financial year. The cable station in Liberia was not affected by the political unrest, and the erection of a cable station for the company's account at Pernambuco had been commenced. As is known, the banking group closely associated with the company held 80 per cent. of the share capital of the Compañia Telegrafico-Telefonica del Plata, of Buenos Ayres, which was only able to pay 5 per cent. in consequence of additional expenses due in part to transitory causes. Nevertheless, the gross receipts of the latter in 1912 seemed better than those for 1911, having regard to the reduction of telegraphic rates in May, 1912. The negotiations for the extension of the South American Co.'s cable from Monrovia, *via* Lome (Togoland) to Duala in the Cameroons were concluded, and the new cable was brought into use on January 19th, 1913, thus raising the total length of the cables to 7,762 miles. New shares of £125,000 and debentures for £192,500 were issued to defray the cost of this extension. The total receipts from traffic and interest amounted to £168,000 in 1912, as compared with £150,000 in 1911. After making provision for working expenses and interest charges on loans, and placing £8,600 to the cable redemption fund, as against £6,000 in 1911, the accounts show net profits of £54,000, as contrasted with £49,000. It is intended to pay a dividend of 6½ per cent. on share capital of £500,000, this comparing with 6 per cent. in 1911.

### Marconi International Marine Communication Co., Ltd.

THE directors report that the business has continued to show very satisfactory progress during the year ended December, 1912. The net profit amounted to £24,436, after deducting £10,781 for depreciation and allowing for debenture interest, as compared with £15,028 in the preceding year. The revenue from ships' telegrams, traffic, subsidies, &c., amounts to £100,325, again show a substantial increase over the amount of £64,160 for the year 1911, and £40,536 for the year 1910. Some further indication of the substantial development of the company's business is shown by the number of telegraph stations owned and worked by the company on board ships on the high seas, the number of which increased from 250 at the end of 1910 to 350 on December 31st, 1911, and on December 31st, 1912, the actual number of stations in work had increased to 580. To the present date progress continues on much the same scale, the number of ships actually equipped by this company being 686, and considerable additional orders are in hand. There are now some 1,700 ships of different nations, exclusive of ships of war, fitted with Marconi wireless stations. With every prospect of the company's business continuing to show further substantial development, for which additional capital will be required, it is the intention of the directors in the early future to place a further portion of the unissued capital, and this in the first instance will be offered to the shareholders. The directors now recommend the payment of a dividend for the year 1912 at the rate of 10 per cent., which will absorb £20,105, and allocate £3,500 to the repayment of debenture account, leaving £3,142 to be carried forward.

**Marconi Wireless Telegraph Co., of America.**—The report for the year ended January 31st, 1913, shows a profit of \$211,245. A dividend of 2 per cent. is announced. The annual meeting was held in Jersey City on Monday, and a report of the proceedings appeared in the *Times* on Wednesday.

**Credenda Conduits Co., Ltd.**—The directors' report for the four months ended April 30th states (says the *Financial Times*) that the profit, after providing for repairs, depreciation, directors' fees and reserve for income-tax, amounts to £2,461. After writing off stamp duties on registration and transfer, £457, there remains a balance of £2,003. The directors recommend a dividend at the rate of 8 per cent. per annum on the ordinary shares for the four months, carrying forward £670.

The directors of Tubes, Ltd., mention in their report that last December they decided to dispose of their electrical conduit business, and in January a company was formed with a capital of £50,000, of which £30,000 was offered to the public, the remaining £20,000 being retained in shares by Tubes, Ltd.

**Prospectus.**—*Ruston, Procter & Co., Ltd.*—The list of applications is to close next Monday in an issue of 100,000 ordinary shares of £1 each. The turnover of the business continues to increase, and the volume of trade is bigger than ever before, rendering additional capital necessary. For the last seven years the ordinary dividend has been 8 per cent. per annum.

**Winnipeg Electric Railway Co.**—The directors announce a dividend at the rate of 3 per cent. for the quarter ending June 30th.

## British Electric Traction Co., Ltd.

MR. E. GARCKE (chairman) presided at the Holborn Restaurant on Monday over the seventeenth ordinary general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 995), said that at the last annual meeting he held out the hope that the company would in future continue to make steady progress, and he was glad to be able on this occasion to offer them a further instalment towards fulfilment of this promise. The net profit made in the year was £189,712. The result of the year's working was better than that of the year before, but the increase in profits was not as great as they had hoped it would be, considering that they had done more work, that was to say, carried more passengers per route mile, and had earned more gross receipts per route mile, and had sold a larger number of units of electricity; in other words, the net profits had not increased in the same ratio as the gross receipts. The explanation of this fact was given in the report. Labour troubles were likely to continue. The return on the investments had steadily improved during the last five years. For 1908 it was 2.8 per cent., for 1909 it was 3 per cent., for 1910 it was 3.1 per cent., for 1911 it was 3.7 per cent., and for the past year it was 4.1 per cent. The proportion of the total investments which were yielding revenue was increasing. The proportion of remunerative investments to the total was now 73.4 per cent., compared with 70.6 per cent. in 1911, 66.8 per cent. in 1910, 65.6 per cent. in 1909, and 58.8 per cent. in 1908. Before recommending the payment of a dividend on the 7 per cent. preference stock, the directors had again carefully weighed the question of the depreciation which had taken place in the assets of the company. The directors had previously stated on several occasions that whilst some depreciation of the investments had undoubtedly taken place, such depreciation was not so great as might be inferred from the decline in the market prices of the company's capital, but the directors had never before expressed even an approximate figure which, in their opinion, represented the actual depreciation of the investments and undertakings. He was now in a position to carry the matter a step further and give the shareholders an idea of what provision would be necessary to meet this depreciation. The directors still maintained that to make an accurate valuation of each undertaking was practically impossible, and, moreover, inadvisable, but every year they were acquiring additional experience as to the basis on which these undertakings would be valued if and when they were taken over by the local authorities, and several of the directors and the managers had made separate estimates of the probable value of their undertakings from the point of view of their present condition and future prospects. These estimates necessarily differed widely in detail, but taken collectively they gave an approximation of the aggregate value of the undertakings. In his opinion and in that of those directors who had made such estimates, the depreciation of the investments, having regard to the reserves which had been made by the Associated Companies themselves, could be met by the existing reserves of this company supplemented by a sum which approximated to between two-thirds and three-quarters of a million pounds, but the board as such had not come to any definite decision on the figure. Large and regrettable though these figures were, they were less than one-third of the present market depreciation of the company's capital. The problem of what was the best way to deal with this depreciation in the book value of the assets required careful consideration. It was a matter which was receiving the earnest consideration of the directors, and they would not hesitate to deal with the situation at such time and in such manner as the best interests of the company dictated. The reserves of the company at March 31st last amounted to £616,756. They had realised the Hartlepool and Leamington undertakings during the past year, and the deficiency in book value on their realisation had been debited to reserve. There were other undertakings in the course of realisation, and the deficiency, when ascertained, would be dealt with in the same way. Investments which had cost them £472,994, were realised during the year, and new investments were acquired during the year at a cost of £404,185. It was by changes of this kind that they hoped to still further improve the position of the company, for it was obviously better that investments yielding no return, or which did not possess the potentiality of improvement, should be sold, even at a loss, and that the proceeds should be re-invested in better yielding and improving investments. The chairman referred to their Associated Company—the Electrical and Industrial Investment Co. They had written off the item of "goodwill" entirely, and had written down to a nominal figure of £1,000 the past expenditure on surveys and negotiations. Apart from the question of depreciation, the balance-sheet now presented would, he felt sure, be recognised as showing a thoroughly sound position, and considering that they owed at the date of the balance-sheet less than £5,000 to sundry outside creditors while they possessed between four and five millions of assets, they were entitled to say that the financial position of the company was a strong one. They had appointed Mr. Dade, the former secretary of the company, and Mr. Howley, who formerly acted as chief inspecting officer, as joint managers of the company. These two gentlemen had been for many years in the service of the company and had an intimate knowledge of the business. They were also well served by Mr. Walmsley, who has been the accountant of the company since its formation, and by the numerous other expert officers and committees of the Federation. If they looked through the particulars and statistics of the Federation, they could not fail to recognise that most of the companies were improving. Of course there were some undertakings which did not admit of great improvement, and they recognised that the right policy in regard to these was to sell them when opportunity offered, rather than allow them to absorb

efforts and energies which were capable of being more profitably employed in other directions. For the first time for many years the aggregate receipts and the passengers carried by the Federated Companies showed a decrease as compared with the preceding year, but this was due to some of the lines—City of Birmingham, Cavelli, Leamington and Warwick, and Hartlepool, having been disposed of. It was, however, very encouraging to observe that the average receipts and passengers carried per route mile showed a steady increase. This might be regarded as a very satisfactory feature, for although the rate of increase was accelerated by the prosperous condition of trade in the country, they believed that part of the increase in wages which the working man now received, as compared with a few years ago, was being spent in the more frequent use of the cars, and that a large part of the increased traffic would be maintained, even when a set-back took place in trade. The electricity supply side of the business continued to increase satisfactorily. With one or two exceptions, all their electricity supply undertakings showed a substantial increase in the number of units sold. The development of this branch of the business was even surer than that of the traction side. They looked forward with confidence to a steady increase in the returns from their investments in these small lighting undertakings. The report contained particulars of some of the undertakings abroad in which they had recently taken interest, and negotiations were pending in regard to others which they expected would mature in the course of the current year. Their investment in the Northern Ontario Light and Power Co. was showing a return of 8 per cent. on the cost, and was expected to improve. The Maritime Coal Railway and Power Co. had in it, they believed, the elements of a profitable undertaking. Their representative was now in Brazil in connection with their interests there, and during the past few months he had, together with some of their officers, made several visits to the Continent in connection with new enterprises. Another matter to which he wished to refer was the important bearing which the advent of the modern and improved motor-omnibus had upon the tramway undertakings in London and the provinces, and upon their business generally. On the last occasion when speaking of the metropolitan electric tramways he informed them that they had decided to run motor-omnibuses through London in connection with their tramways, and that they had adopted this policy in order to meet the competition by motor-omnibuses on their tramway routes. The speaker next referred to the London and Suburban Traction Co., Ltd., in which the B.E.T. holding was £850,000. It was too early for him to make any definite statement in regard to the profits which they hoped to derive from their investment in this company, but they had every reason to expect that the return on their investment in the London and Suburban Traction Co. would be larger than it was on the separate undertakings before the amalgamation, and they had no doubt whatever as to the wisdom of the policy which dictated this union of interests, for the only alternative would have been the continuance and accentuation of a destructive competition. He had already explained on other occasions that the motor-omnibus was a severe competitor of the tramways in the Metropolis, because their tramways did not serve the central parts of London and the omnibuses were able to overlap the tramway terminal points. It was interesting to note in this connection that the London County Council had agreed with the Metropolitan Electric Tramways Co. for through running of cars over some lines of the Council and company, and so well were these services appreciated by the public that it was now proposed to extend the policy of through running to other lines. Tramways in the provinces were not so exposed to this danger of over-lapping by motor-omnibuses because there the tramways radiated outwards from the centre of the towns. Nevertheless, there was also scope for the employment of omnibuses in the provinces in conjunction with existing tramways and light railways, and also in districts which were at present not served by tramways. They had constituted the British Automobile Traction Co. for the purpose of organising motor-omnibus services wherever suitable openings presented themselves. It had been said that the situation presented by this company—formed to promote electric traction—adopting motor-omnibuses, was not without its ironical features, and that it was a significant sign of the ever-changing possibilities of mechanical invention, but that was not a complete statement. He still considered that given sensible legislation, electric traction on rails was capable of holding its own, but the feature which he hoped shareholders would recognise and appreciate in their new policy with regard to motor-omnibuses was that the management of the company was moving with the times, and was alert to take advantage of any opportunity which might present itself to compensate for past misfortunes and improve their future prospects. In conclusion, he referred to changes which had been made in the constitution of the British Electrical Friendly Society and the British Electrical Endowment Fund.

MR. C. G. TEGEMEIER seconded the motion.

Several shareholders asked questions and made suggestions. Among them was MR. PARKER, who said that a reduction of capital was hinted at by the chairman, and he suggested it might be considered by the Committee who conferred with the board on the question of the rearrangement of capital some time ago. He trusted also that the board would not be led away by the attractive side of the motor-bus business, because there could be no doubt that the time was coming when the question of rating motor-buses would become a very live one.

The CHAIRMAN, in replying to all questions, said they took the Bideford Railway by way of a bad debt, and the best thing was to hold on to it and wait for better times. They had a perpetual tenure of it. He thought the board would have been subjected to a great

deal of adverse criticism had they proposed to carry money available for dividend to a reserve fund. The item of the Brighton and Shoreham Tramway would appear in the accounts for the last time next year. They had been awarded £1,000 by way of compensation for one portion of the line, and had arranged with the other local authorities for the dismantlement of the line. They had had a sad experience with regard to the line. They bought a steam tramway and submitted a good scheme for an electric tramway, but the opposition of Hove was too great for them. As to Mr. Parker's observations, the board recognised that depreciation had taken place, and that it would have to be dealt with in some way or another, but they would rather not be pressed to take unduly early action in the matter. So long as they recognised the position, it was better to leave the matter to be dealt with at the right time.

The motion was then carried unanimously, and the retiring directors and auditors were re-elected.

### Madras Electric Supply Co., Ltd.

MR. A. M. H. WALROND (chairman) presided at 1, Queen Victoria Street, E.C., on Friday, over the ordinary meeting of the above company.

The CHAIRMAN, in moving the adoption of the report, said that since the last meeting they had issued a further £117,875 six per cent. debentures and 20,000 preference shares of £5 each. The principal capital expenditure had been £6,629 for new mains, £1,984 for quarters for the staff, and £542 for new plant foundations. The revenue account receipts were an encouragement for the future. They showed an actual increase of revenue for units sold of £7,000, the return being £30,316 this year, an increase of over 38 per cent. He intimated last year that their present plant was proving itself expensive in coal consumption, maintenance and wages. This was plainly shown on the other side of the revenue account, as there was an increase in nearly every item of the working costs. The principal item was coal, the expenditure on which had gone up from £7,140 to £11,699, part of which they must attribute to the increased output. They were compelled to purchase a highly volatile coal, the supply of which was limited, and the price high. The price had largely increased, and was still increasing, the average cost during the year being £1 0s. 6d. per ton, against 18s. 2d. per ton the year before, or an increase of 2s. 4d. per ton, this extra charge accounting for £1,350 of the increased expenditure. The new boilers would, however, be capable of burning ordinary Indian coal, at a cheaper price, and with the new plant in full working order, there would be a saving of about 30 per cent. They were also now inserting in all their agreements with large power consumers a coal clause which would protect them to some extent against dearer coal. The repairs of mains and maintenance had increased by a large figure, but £2,000 of this increase was exceptional, being due to the replacement of defective armoured services. The net result was a loss, after paying debenture interest of £2,236. In the general balance-sheet they must add to this a loss of £1,803 for sales of fans, and £563 on sale of investments. They were obliged to realise last year their holding of tramway preference shares in order to pay off moneys they had borrowed. The loss on fans would not occur after this current year, as they now had only 821 left in stock. This left £18,399 against them at suspense account, which would subsequently have to be dealt with. To this they would have to add the loss they would make during the current year, and the shareholders must bear in mind that no allowance had been made for depreciation. As soon as the earning capacity of the undertaking had been gauged, it might be desirable to reorganise the capital of the company. Matters were not going to be improved until the new plant came into operation. The board realised this position, and as they knew, advised the shareholders at their last meeting to take immediate steps to remedy matters by raising money by an issue of debentures to install a new turb-generator plant, with a modern boiler plant which they were advised would be capable of burning ordinary Indian coal. The money was raised, and by the end of the year this plant should be in commission. Certain of the new boilers would, they hope, be connected up in about four months; the present boiler house equipment was giving them a very great deal of trouble, and the difficulties the staff had had to contend with to keep the supply going were very great. They had, in fact, been obliged to put into commission the old tramway plant to help them out. From what he was telling them they would understand what their position would have been if they had not the prospect of the new plant being ready before long. Their consulting engineers informed them that had the new plant been responsible for the balance-sheet now before them, the generating costs, instead of being £19,000, would have been approximately £13,000. The significance of these figures in regard to their future, he need not emphasise. They would see by the report that the increase in consumers and units taken was satisfactory, and they must bear in mind in this connection that they had been afraid to push this side of the business until their new plant was in order. There was no doubt whatever that if they could only generate their current at a reasonable cost, they could secure a large and profitable business. They would have noticed what was said about future management in the report. This matter had had their most serious consideration, but before deciding anything, they thought it advisable to await the result of Mr. Merz's visit to Madras, and for the arrival in England of Mr. Simpson, a member of Messrs. Binny & Co., their managing agents' firm, who particularly attended to their business. They had now had the advantage of fully discussing matters with them, with the result that they had arranged

that the management of the tramways and themselves would be closely identified. Messrs. Binny would generally supervise as managing agents both concerns, and their representative, Mr. Simpson, would be appointed local director. There would be one chief engineer and a commercial engineer for both properties, and the accounts and correspondence would be removed to their own offices. Referring to their holding in the tramways, they would have read in the report that their last year's working was good, there being an available balance of £43,000 more than in the previous year, and that after paying a 4 per cent. dividend they carried forward £3,732, which was equivalent to a further dividend of over 6 per cent. on the ordinary capital.

MR. J. G. B. STONE seconded the motion, and it was carried.

### Trafford Power and Light Supply (1902), Ltd.

THE report for the year ended March, 1913, states (according to the *Financial Times*) that after charging interest on the debenture stock, interest on loans, current expenses, debenture trustees' remuneration, debenture stock redemption fund, transferring to depreciation account £3,000, and writing off plant, &c., £2,322, the accounts show a balance of £1,509, as compared with £512 for the preceding year. The debit balance is thereby reduced to £803. Additional generating plant has been installed in the station in anticipation of increased demand. On June 15th, 1910, to provide for the general growth of the business, £25,000 6 per cent. second mortgage debentures of £100 each were offered to the shareholders and the debenture stockholders. No application being forthcoming, W. T. Glover and Co., Ltd., the largest shareholders of the company, undertook to provide, on loan, at 6 per cent. interest per annum, such an amount as might be required from time to time not exceeding £25,000; and until January 1st last (by which date the loan amounted to £25,000 and was then satisfied by the issue to them of the above-mentioned 6 per cent. debentures to such an amount, redeemable in 1915) the company availed itself of this facility, which, during a period of some 2½ years afforded an advantage to the company of 1 per cent. per annum. The aggregate amount of the ½ per cent. first mortgage debenture stock of the company purchased and cancelled amounted on March 31st last to £13,500. The trustees of this stock have invested £1,519 during the past financial year, and at the end of that period had in hand for a similar purpose or further purchase of the company's first debenture stock a balance of £589. It being considered more expedient that the two joint managing directors of the company should both be resident in the Manchester district, Mr. Atkinson, who resides near London, has already resigned his position as joint managing director (but retains his seat upon the board), and Mr. A. E. Tanner, who resides in Manchester, has been elected a director by the board and appointed a joint managing director with Mr. E. A. Claremont, who has for many years served in that capacity.

### United Electric Tramways of Monte Video, Ltd.

THE ninth ordinary general meeting of the shareholders of the above company was held on Monday at Winchester House, Old Broad Street, Mr. G. A. Touche, M.P., presiding.

The CHAIRMAN, in proposing the adoption of the report (see *ELEC. REV.*, page 996), said that the capital expenditure during the year had amounted to £78,288, increasing the property account to £1,910,269. A portion of this expenditure was forecasted at the last general meeting, viz., the provision of further additional rolling stock; the completion of the extension to Colon, and the erection of new administrative offices, the building of which was now proceeding. These items came to about £30,000. The additional 25 cars had been in use since December last. The extension of the Colon line was inaugurated on June 20th, 1912, and the results of the working so far had been satisfactory. That was the last extension the company was bound to make under concessions. The line showed signs of being successful. Sites had been secured for the erection of two substations, and the renewal car-shed was being erected. The cost of the sites and some of the preliminary expenditure in connection with the cost of sundry additional permanent way, and feeder works accounted for a further £21,000. The balance of the capital expenditure during the year was represented chiefly by the cost of paving and reconstruction of the track. Practically, all that work was still in progress. Considerable sums would have to be expended in the next few years, as under their concession they were obliged to pay for, and keep in repair, the paving between and a certain distance on each side of their track. Expenditure on improvements of one kind or another was practically inevitable and much of it must be borne by revenue. Within the next few years it would be necessary to make still further additions to the plant and the rolling stock, which was only to be expected in a developing city like Monte Video. The increased traffic was due solely to the internal growth of the city and the development of its activities. There had been no further trouble with their employees, and the weather had been decidedly better than in 1911. The traffic receipts for the year had amounted to £316,306, compared with £298,553 during the previous year, an increase of £47,753, or nearly 16 per cent. The passengers carried showed an increase of 6,074,064—about 17½ per cent. The operating expenses showed an increase of '81 per cent. which was partly accounted for by the increase of wages to the staff granted in 1911 which had been in operation during the whole of the year as compared with a period of about five months in the previous year. The wages bill was about £9,150 heavier than in the previous year and fuel costs

increased by £8,872. Repairs and maintenance costs showed an increase of £6,623. Permanent work, plant and rolling stock must be kept in first class order and it was only natural to expect annual increases in maintenance during the first decade of operation. There had been important economies in other directions. The net traffic receipts for the year amounted to £147,401, an increase of £17,931 or 13.85 per cent. For the first half of the current year to April 30th, the traffic receipts amounted to £199,762, an increase of £14,400 or about 7½ per cent. That percentage of increase was not so great as in the previous year when they were favoured with an exceptionally fine summer. The working expenses were 55.5 per cent. as compared with 52.97 per cent. The increase was partly attributable again to an increase in repairs and maintenance charges and fuel expenses. There was an amount available for distribution of £101,187, as compared with £92,933 a year ago. For the redemption of debenture stock an amount of £2,810 had been set aside; and an initial appropriation of £2,500 had been made for the purpose of redeeming the preference and ordinary share capital on the expiry of the company's concessions, which was some 60 or 70 years ahead. A further sum of £30,000 had been placed to renewals and contingency account, making a total of £100,000. There he wished to say that the board did not consider that they had yet reached the limit as regarded that provision. Having referred to the fact that Senor Catt, the general manager in Uruguay, was present, having come to Europe to confer with the board on important matters of policy, the chairman quoted at length from a report which Senor Catt had prepared regarding the prospects of the company, in which that gentleman referred to the possibility of the Uruguayan Government nationalising the means of transport in the country. That proposal, said Mr. Touche, led him to refer to what had happened in London in regard to the tramway service under the L.C.C., the figures respecting the last year's working having just been published. The tramways were acquired on behalf of the ratepayers on a promise that there was going to be a reduction of rates by the application of profits. Some 1½ millions of the ratepayers' money was invested, and now the property was very seriously threatened by competition. Last year 20 million fewer passengers were carried than in the previous year, and there was a decline of £88,000 in the passenger receipts. On all sides they heard a great cry raised in favour of doing something to handicap competing forms of traction. It was not in the public interest that that should be done, but it placed the L.C.C. in a very false position. Their duty and their interest conflicted. Their duty was to exercise judicial control over all forms of traction, and their interest was to handicap competitive forms of traction. That pointed at once to the great danger of these Socialistic methods—the public became tied to some particular method of traction, even after it might have become obsolete. Their electric tramways were very far from that, but it was a very great discouragement to progress, even if it did not mean the death of all progress.

Mr. H. A. TROTTER seconded the motion, and the report was adopted without discussion.

**Globe Telegraph and Trust Co., Ltd.**—The net revenue of the company for the year ended May, 1913, after deduction of expenses, amounts to £209,828, and makes, with the balance of £27,997 brought forward, a total of £237,825. From this amount there has been distributed £131,085 in interim dividends, leaving an available balance of £106,739. The directors now recommend the payment of the following final dividends, viz., 3s. per share, less income-tax, on the preference shares, making, with previous distributions, a total dividend for the year on those shares at the rate of 6 per cent. per annum, less income-tax; and 6s. per share net on the ordinary shares, making, with previous distributions, a total dividend on these shares at the rate of 6 per cent. net for the year. These dividends will absorb £79,922, and leave £26,817 to be carried forward. During the year £4,500 Anglo-American Telegraph Co.'s preferred stock has been sold, and 15 of the certificates of the Submarine Cables Trust, belonging to this company, have been drawn for payment at £120 per certificate; part of the proceeds have been, and the remainder will be, reinvested in suitable securities.

**Electric and General Investment Co., Ltd.**—The directors report that the gross profit for the year to May 31st was £14,797. After deducting all general charges, interest on debenture stock, the interim dividends already paid on the preference and ordinary shares, and providing for the proportion of the final dividend accrued on the preference shares to May 31st, there remained a balance of £5,268, plus £2,726 brought forward, making £7,994. Of this amount £3,072 has been carried to the contingencies fund, making the amount to the credit thereof £81,000, leaving a balance of £4,922, which is to be appropriated as follows:—Balance dividend of 1s. per share, which, with the interim dividend of 1s. per share paid in January will make the full rate of 10 per cent. on the capital paid up on the ordinary shares, £1,000; dividend of 6d. a share on the deferred shares, £1,000; leaving to carry forward, £2,922.

**Automatic Telephone Manufacturing Co., Ltd.**—The share and transfer books will be closed from 19th to 26th inst., inclusive, for the purpose of preparing the warrants for the 6 per cent. preference shares for the half-year ending 30th inst., on which date the warrants will be posted.

**National Electric Supply Co., Ltd.**—The directors have declared an interim dividend of 3s. per share, on the ordinary shares for the half-year ending June 30th.

## Traction and Power Securities Co., Ltd.

Mr. H. A. VERNET presided a few days ago at the annual meeting held at 2, Norfolk Street, Strand, W.C. He said that the net income had increased to £33,242, or more than 3½ per cent. on the share capital, but while under ordinary circumstances they would probably have recommenced paying dividends, it was thought that under present circumstances it would be well to transfer £30,000 to reserve, and carry forward the balance. The Clyde Valley Co., in which they were the largest shareholders, had advanced considerably in recent years, and the net profit for 1912 was £54,440, as compared with £45,781 in 1911. In a few years he expected to see regular dividends on the ordinary shares in that company. During March last the Clyde Co. made a public issue of £300,000 in 6 per cent. preference shares at par, and was able to repay this company's loan in full. The Mersey Railway was also showing progress. When the company was formed in 1901 a large portion of its capital was subscribed by a strong group of Americans who were familiar with the operations of the Westinghouse Electric and Manufacturing Co., at Pittsburg. The idea was that it would work with, and be of assistance to, the British Westinghouse Co., which at that time had recently started taking contracts which involved accepting payments, in whole or in part, in securities rather than in cash. This idea was duly carried out. The securities proved not to be worth the money paid for them, and the shareholders had had to go without dividends for a great number of years, the depreciation in their investments having necessitated carrying to reserve the meagre revenue received, instead of paying it out in dividends. The surplus revenues which had been kept in the company had enabled it to finance the Clyde Valley Co. until it could take care of itself. In recent years the British Westinghouse Co. had not been taking contracts involving payment to any large extent in securities, but there was a wide field of investment which was open to their company just as it was to other investment trust companies which had done well for their shareholders. Had the shareholders so would they could have reinvested the money received from the Clyde Valley loan to advantage and have paid moderate (probably increasing) dividends with the prospect that the shares would become saleable at par in shorter time than by adopting any other course. An alternative had, however, been put forward by some of the American shareholders, namely, that the greater part of the available cash should be distributed in the form of a return of capital. These shareholders argued that the original purpose of the company was at an end. Had the board been able to induce their American friends to see eye to eye with them they would have preferred carrying on the company as an investment trust company, because he believed that in that way the shareholders would get their money back most quickly, but as these important shareholders took the opposite view, and as majorities controlled, they were proposing to proceed with the other alternative, and ask the shareholders' assent to the resolution for the reduction of capital.

A resolution was passed to reduce the capital from £2,000,000 to £1,829,180 by returning to the holders of the 85,410 shares that had been issued paid-up capital to the extent of £2 per share.

**Venezuela Telephone and Electrical Appliances Co., Ltd.**—Meetings of the holders of the first and second debentures were called for yesterday to consider resolutions authorising the creation and issue of additional first debentures for a total of £80,000, carrying interest at the rate of 5 per cent. per annum, the first £30,000 to be applied in discharging prior lien bonds.

## STOCKS AND SHARES.

Tuesday Evening.

THE stormy settlement of the mid-June account passed off with fewer failures than had been expected. Prices recovered substantially from the lowest; members began to talk hopefully of a return of confidence; the bargain-hunter was seen in the land. A good sign is the maintenance of the investment securities, although prices of the speculative stocks and shares swing erratically. An evening newspaper amused the city with a placard on Monday announcing a "burst of activity" in the Stock Exchange. Prices are higher, but of public activity there has been all too little. In fact, so slender has been the outside support accorded to markets, that general opinion throughout the House was somewhat inclined to regard the swiftness of the rise as in some measure overdone. It is noticeable that Consols remain depressed. The approach of the end of June is a reminder that the window-dressing process may bring about some degree of stringency in the money market at the time of the next Stock Exchange settlement. All things considered, see-saw markets are only what can be expected for some time to come, and Tuesday's setback surprised nobody.

One of the principal features in the sections with which we deal has been the improvement in Underground Electric Railways. Metropolitans, after touching 45, spurted to 49, and Districts, which had fallen to 32½, jumped up to 35½. The full extent of

these recoveries was not maintained, but both prices show rises on the week. The Central London group failed to recover from its last week's depression: East Londons made a rapid rally to 8½ before reacting to 8. Underground Electric Railway "A" shares came into favour. From 8s. the price jumped to 10s. 6d., while the 6 per cent. stocks of both kinds improved, the income bonds being 2½ points higher at 90. Tuesday's depression brought relapses from the best. The £10 shares fell ¼ to 3¼. Considerable speculation as to the probable dividend on the shilling shares is rife, and all kinds of estimates are being made as to what the profits of the Bus Company must be at the present time.

The London County Council has just issued the report on its tramways system for the past year, and it must be admitted that the showing is a sorry one. There is scarcely a redeeming feature to be found in the statement, and this is an indirect factor which holders of the omnibus issues will do well to bear in mind. For it would be against human nature were the L.C.C. to submit to the losses now being made on their tramways system without drawing comparisons between these and the profits of the Bus Company. To redress the balance, it is at least possible that the municipal authorities may take repressive action against the prosperous motor-buses, and some of the ways in which they could do this were set out here not very long ago.

Metropolitan Electric Tramways shares have been withdrawn from the Stock Exchange Official List, since they are now practically incorporated in the London and Suburban Traction shares. The Suburban Ordinary are quoted at 6s. 3d., the Preference about 11s. 6d., while the 4½ per cent. First Debenture stock stands at 80, at which price the return works out to £5 12s. 6d. on the money.

The Telegraph market has thrown off some of its recent depression, and the cessation of sales of real shares has caused recoveries of ½ in Eastern Extension shares, ¼ in Western Telegraphs, and so on. The Anglo-American group continues dull, consequent upon the uncertainty which is felt with regard to the American position, and some of the other higher-priced shares have given way. Great Northern at 31 are 10s. down. Indo-Europeans at 56 are 1 lower. West India and Panamas have further receded. Amongst the telephone stocks, American Telephones regained a point, the feature in this section, however, being a smart recovery in National Telephone Deferred, where the price jumped to 21. Reuters went back to 10¼, a fall of 10s. New York Telephone Bonds are ¼ down at 96½, although this is one of the securities which the investor has been picking up as being well secured and showing a fair rate of interest on the money.

The Marconi market has been alternately good and dull. On the week the parent shares show a rise at 3½, this being due to the circulation of estimates as to the forthcoming dividend. Two or three weeks ago, when the shares stood about 3, rumour scoffed at the idea of the Company paying anything at all; now the report goes that it will declare anything up to 35 per cent. Between these two boundaries there is ample scope for the directors to surprise the market. We should say that the one estimate is just about as unlikely to be consummated as the other. The Marconi subsidiaries moved in sympathy with the parent shares. Canadians touched 11s. and Americans £1, the price in both cases going back a little from the top. South American Telephone shares are steady.

Rises in the electric lighting market have been secured by Bournemouth and Poole Ordinary and Preference, in consequence of a little demand that there has been from local inquirers, who possibly think that there is a chance of the company being taken over by the municipal authorities. The rest of the market, however, is very dull, and there are falls of 1s. 8d. to ¼ in City Preference, London Preference and the Ordinary shares of the Westminster, Metropolitan, St. James', and Brompton Companies. London Electric Preference can be picked up at about 4½, at which the return is the handsome one of £6 6s. per cent. on the money. The decline in their case was brought about by pressure to realise, which, although not undue, came upon an unwilling market; and the shares are thought by some people to look attractive, in view of the high yield which they pay. Obviously, however, with so many other good investments to be obtained on which the return ranges from 5 to 6 per cent., it requires especially strong attraction to induce purchases of industrial shares at present. It will be noticed from our lists that the ordinary shares of the best electric lighting companies can be bought to yield nearly 5½ per cent. on the money. Moreover, the market in illumination shares is always a dull one during the summer.

The Latin-Canadian group remains fairly steady, and no net changes of importance have occurred in the Mexican division. Sao Paulo Debentures are a little better. The report of the Montreal Light & Power Company shows steadily increasing progress, and the dividend has been put on a 9 per cent. basis for the year recently ended, while the new year starts with 2½ per cent. for the quarter. The Shawinigan Company, whose shares have been lately particularly depressed, and which show another fall of 3 this week, issues a report, showing an increase in the profit of 300,000 dollars; and the dividend in its case is raised to 5½ per cent. for the year, an advance of the fraction. Montreals have not recovered the 10 points which they were ducked down last week. The Anglo-Argentine Tramways group is dull, and blocks of the 5 per cent. Debenture Stock keep on coming to market. This security can be obtained at 96½, and (in view of the ample margin for its interest and principal) is being recommended as one of the bargains to be obtained at the present time. The Company's 4 per cent. Debenture is ¼ higher on the week.

A rise of 2 wiped out half last week's loss in Brazilian Traction shares, and the Company's new 6 per cent. Preference, from being 97, moved up to 99. In their case also the security, according to the prospectus issued last month, is ample. Calcutta

Trams fell ½, and Madras Ordinary went down the same amount upon a mere handful of shares being offered. City of Buenos Ayres Trams are a good market. British Columbia Electric Deferred fell a further two points, but the Preferred and the Preference stocks are both 1 up. There has been some inquiry for the West Australian Tramways shares. Kalgoolie Preference, for instance, were ½ up, and Perth Ordinary hardened to 1½.

The Miscellaneous group is steady. Arons have advanced, both as regards the Ordinary and Preference. Castner-Kellners are ¾ higher at 3¼. There is no change in the Edison & Swan issues, the battle which is raging over the reconstruction proposals not affecting the market prices, although, of course, it is difficult to deal. British Westinghouse Debenture at 68 is 1 lower, and the public announcement of the company's having secured the London and South-Western electrification contract has aroused no further demand for its issues.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, June 18th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
▲ Acid, Hydrochloric .. .. per cwt.	5/-	..
▲ " Nitric .. .. ..	22/-	..
▲ " Oxalic .. .. .. per lb.	23d.	..
▲ " Sulphuric .. .. .. per cwt.	6/6	..
▲ Ammoniac Sal .. .. ..	42/-	..
▲ Ammonia, Muriate (large crystal) per ton	£29 10	..
▲ Bleaching powder .. .. ..	£6 5	..
▲ Bisulphide of Carbon .. .. ..	£18	..
▲ Borax .. .. ..	£17 10	..
▲ Copper Sulphate .. .. ..	£22 10	15/- dec.
▲ Lead, Nitrate .. .. ..	£27 10	10/- inc.
▲ " White Sugar .. .. ..	£26	16/- inc.
▲ " Peroxide .. .. ..	£32	..
▲ Methylated Spirit .. .. .. per gal.	2/6	..
▲ Potassium, Bichromate, in casks .. ..	84d.	..
▲ Potash, Caustic (88/90) % .. .. per ton	£22 10	..
▲ " Chlorate .. .. .. per lb.	84d.	..
▲ " Perchlorate .. .. ..	44d.	..
▲ Potassium, Cyanide (98/100) % .. ..	71d.	..
(for mining purposes only)		
▲ Shellac .. .. .. per cwt.	85/-	2/6 inc.
▲ Sulphate of Magnesia .. .. ..	£4 10	..
▲ Sulphur, Sublimed Flowers .. .. ..	£6 10	..
▲ " Recovered .. .. ..	£5 10	..
▲ " Lump .. .. ..	£5	..
▲ Soda, Caustic (white 70/72) % .. ..	£10 5	..
▲ " Chlorate .. .. .. per lb.	82d.	..
▲ " Crystals .. .. .. per ton	£3 5	..
▲ Sodium Bichromate, casks .. .. per lb.	8d.	..
METALS, &c.		
▲ Aluminium Ingots, in ton lots .. .. per ton	£95	..
▲ " Wire, in ton lots .. ..	£121 6	£9 13 4 inc.
▲ " Sheet, in ton lots .. ..	£126	..
▲ Babbitt's metal Ingots .. .. ..	£50 to £221	..
▲ Brass (rolled metal 2" to 12" basis) per lb.	8½d.	¾ dec.
▲ " Tube (brazen) .. .. ..	10½d.	¼ inc.
▲ " (solid drawn) .. .. ..	9d.	¼ inc.
▲ " Wire, basis .. .. ..	8½d.	¼ inc.
▲ Copper Tubes (brazen) .. .. ..	11½d.	..
▲ " (solid drawn) .. .. ..	10½d.	..
▲ " Bars (best selected) .. .. per ton	£82	2½ dec.
▲ " Sheet .. .. ..	£82	2½ dec.
▲ " Rod .. .. ..	£82	2½ dec.
▲ " (Electrolytic) Bars .. .. ..	£70	£2 10 dec.
▲ " Sheets .. .. ..	£87	£2 10 dec.
▲ " Rods .. .. ..	£75 5	£2 5 dec.
▲ " H.C. Wire per lb.	9½d.	..
▲ Ebonite Rod .. .. ..	4/6	..
▲ " Sheet .. .. ..	4/1	..
▲ German Silver Wire .. .. ..	1/10	..
▲ Gutta-percha, fine .. .. ..	7/- to 8/-	..
▲ India-rubber, Para fine .. .. ..	3/9	¼ inc.
▲ Iron Pig (Cleveland warrants) .. .. per ton	55½	2/11 dec.
▲ " Wire, galv. No. 8, P.O. qual.	£21	..
▲ Lead, English Pig .. .. ..	£21 to £21 5	£1 inc.
▲ Manganese Wire No. 28 .. .. .. per lb.	6/6	..
▲ Mercury .. .. .. per bot.	£7 10	..
▲ Mica (in original cases) small .. .. per lb.	6d. to 8s.	..
▲ " " " medium .. .. ..	8/6 to 8/-	..
▲ " " " large .. .. ..	7/6 to 11/-	..
▲ Nickel, sheet, wire, &c. .. .. ..	3/6 to 4/6 nom.	..
▲ Phosphor Bronze, plain castings .. ..	1/1 to 1/3½	..
▲ " rolled bars & rods .. .. ..	1/0½ to 1/2	..
▲ " rolled strip & sheet .. .. ..	1/2½ to 1/5½	..
▲ Platinum .. .. .. per oz.	185/-	..
▲ Silicon Bronze Wire .. .. .. per lb.	10½d.	¼ dec.
▲ Steel, Magnet, in bars .. .. ..	£56	..
▲ Tin, Block (English) .. .. ..	£208 to £203	£11 dec.
▲ " Wire, Nos. 1 to 18 .. .. .. per lb.	2/7	1d. dec.
▲ White Anti-friction Metals .. .. per ton	£50 to £228	..
▲ Zinc, Sh't (Vielite Montagne bnd.)	£27 5s.	..

Quotations supplied by—

- ▲ G. Boor & Co.
- ▲ The British Aluminium Co., Ltd.
- ▲ Morris Ashby, Ltd.
- ▲ Thos. Bolton & Sons, Ltd.
- ▲ Frederick Smith & Co.
- ▲ Richard Johnson & Nephew, Ltd.
- ▲ F. Wiggins & Sons.
- ▲ India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
- ▲ James & Richards.
- ▲ W. T. Glover & Co., Ltd.
- ▲ Edward Till & Co.
- ▲ P. P. Ormiston & Sons
- ▲ Johnsons, Matthey & Co., Ltd.
- ▲ R. W. F. Dennis & Co.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations June 17th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Share.	Dividends for		Closing Quotations June 17th.	Rise + or Fall	Present Yield p.c.
		1911.	1912.						1911.	1912.			
Bournemouth & Poole, Ord. ..	10	5 1/2	6	82 1/2-104	+	5 17 1/2	Kensington & Knightsbridge, Ord	5	9	81	71-72	..	5 16 2
Do. 4 1/2 % Pref. ....	10	4 1/2	4 1/2	82-97	+ 1/2	4 12 1/2	Do. 4 % Deb. ....	Stock	4	4	90-98	..	4 6 0
Do. Second 6 % Pref. ....	10	8	6	10-104	..	5 14 8	Kent Elec. Power, 4 1/2 % Deb. ....	Stock	4 1/2	4 1/2	78-80	..	5 12 8
Do. 4 1/2 % Deb. Stock ..	Stock	4 1/2	4 1/2	96-98	..	4 11 10	London Electric, Ord. ....	5	2 1/2	2 1/2	12-12	..	4 7 9
Brompton & Kensington, Ord. ....	5	10	10	82-94	- 1/2	4 0 0	Do. 8 % Pref. ....	5	5	8	4 1/2-5	..	4 8 0
Do. 7 % Cum. Pref. ....	5	7	7	82-82	..	4 0 0	Do. 4 % First Mort. Deb. ....	Stock	4	4	86-91 rd	..	4 8 0
Central Electric Supply, 4 % Guar. Deb. ....	100	4	4	94-97	..	4 2 6	Metropolitan ....	5	4	41	84-88	- 1/2	5 10 4
Charing Cross, West End & City	5	5	5	4-44	..	5 11 1	Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	4 1/2	92-92	..	4 17 4
Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	4 1/2	4 1/2-4 1/2	..	4 17 4	Do. 4 1/2 % First Mort. Deb. ....	Stock	4 1/2	4 1/2	99-102	..	4 8 8
Do. City Undertaking	5	4 1/2	4 1/2	3 1/2-4	..	5 12 6	Do. 8 1/2 % Mort. Deb. ....	Stock	8 1/2	8 1/2	80-83	..	4 4 4
Do. 4 1/2 % Cum. Pref. ....	100	4	4	90-92 rd	..	4 7 0	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	5	5	98-101	..	4 19 0
Do. Do. 4 % Deb. ....	5	5	5	42-52	..	4 15 8	Notting Hill, 8 % Non-Cum. Pref.)	10	6	6	102-102	..	5 11 7
Chelsea, Ord. ....	Stock	4 1/2	4 1/2	96-99	..	4 10 11	Oxford .. .. .	5	7 1/2	6 1/2	64-64	..	5 18 9
Do. 4 1/2 % Deb. ....	10	8	9	15-104	..	5 9 1	St. James' and Pall Mall, Ord.	5	10	10 1/2	4 1/2-4 1/2	- 1/2	5 14 8
City of London, Ord. ....	10	5	5	113-124	- 1/2	4 8 4	Do. 7 % Pref. ....	5	7	7	5 1/2-7 1/2	..	4 18 3
Do. 8 % Cum. Pref. ....	10	5	5	116-120	..	4 8 8	Do. 8 1/2 % Deb. ....	100	8 1/2	8 1/2	84-87	..	4 0 6
Do. 6 % Deb. ....	Stock	5	5	100-102	..	4 8 8	South London, Ord. ....	4	5	8	2 1/2-2 1/2	..	7 7 8
Do. 4 1/2 % Second Deb. ....	100	4 1/2	4 1/2	102-104	..	5 10 4	Do. 5 % First Mort. Deb. ....	100	5	5	94 1/2-101 1/2	..	4 18 6
County of London, Ord. ....	10	5	5	11 1/2-12	..	5 0 0	Do. 4 1/2 % Cum. Pref. ....	1	7	7	1 1/2-1 1/2	..	5 17 11
Do. 8 % Pref. ....	Stock	4 1/2	4 1/2	104-106	..	4 5 0	Do. 4 1/2 % First Deb. Stock ..	100	4 1/2	4 1/2	96-99	..	4 10 8
Do. 4 1/2 % Deb. ....	Stock	4 1/2	4 1/2	98-101	..	4 9 1	Urban, Ord. ....	2 1/2	2 1/2	2 1/2	1-2 1/2 rd	..	..
Do. 4 1/2 % Second Deb. ....	5	5	5	1 1/2-2 1/2	..	3 6 8	Do. 6 % Cum. Pref. ....	100	6	6	84-87	..	5 8 8
Edmundson's, Ord. ....	2 1/2	2 1/2	2 1/2	4 1/2-4 1/2	..	5 4 8	Do. 4 1/2 % First Mort. Deb. ....	5	10	10	8	- 1/2	5 17 8
Do. 6 % Cum. Pref. ....	5	5	5	4 1/2-5	..	8 0 0	Westminster, Ord. ....	6	4 1/2	4 1/2	42-52	..	4 5 9
Do. 5 % Non-Cum. Pref. ....	100	4 1/2	4 1/2	83-86	..	8 0 0	Do. 4 1/2 % Cum. Pref. ....	5	4 1/2	4 1/2	..	..	
Do. 4 1/2 % First Mort. Deb. ....	5	5	5	4 1/2-5	..	4 17 10							
Folkestone .. .. .	100	4 1/2	4 1/2	90-92	..	5 18 2							
Do. 6 % Cum. Pref. ....	5	5	5	7 1/2-7 1/2	..	..							
Do. 4 1/2 % First Deb. ....	100	4 1/2	4 1/2	..	..	..							
Here .. .. .	6	9	9 1/2	..	..	..							

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref. ....	5	8	6	5-5 1/2	..	5 14 8	Monterey Rly. Light & Power, 5 % 1st Mort. Deb.)	100	6	5	79-82	..	6 2 0
Calcutta, Ord. ....	5	5 1/2	5 1/2	5 1/2-7 1/2	..	5 17 8	Montreal, Lt., H. and Power ..	\$100	8	9 1/2	210-220	..	4 1 1/2
Do. 5 % Pref. ....	5	5	5	4 1/2-5 1/2	..	4 16 5	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$500	5	5 1/2	15-25	..	..
Calgary Power, 1st Mort. Bds.	100	5	5	93 1/2-95 1/2	..	5 6 8	River Plate, Ord. ....	Stock	10	10	207-217	..	4 8 0
Canadian Gen. El. Com. ....	\$100	7	7	112-115	..	6 1 9	Do. 6 % Non-Cum. Pref. ....	Do.	6	5	102-107	..	5 9 1
Do. 7 % Pref. ....	\$100	7	7	116-123	..	5 14 8	Do. 5 % Deb. Stock ..	Do.	5	5	100-102	..	4 18 0
Cordoba Lt., Power and T., Ord.	1	8	8	1 1/2-4	..	5 4 2	Roy. Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.)	100	4 1/2	4 1/2	100-102	..	4 8 8
Do. 6 % Deb. ....	100	6	6	94-96	..	6 10 5	Shawinigan Water, Capital ..	\$100	5	5 1/2	126-130	- 3	4 0 8
Elec. Lt. and P. of Cochabamba, 3 % Bonds	100	6	6	90-92 rd	- 2	5 7 6	Do. 5 % Con. 1st Mort. Bonds	\$500	5	5	107-109	..	4 11 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.)	100	6	6	90-93	..	5 7 6	Do. 4 1/2 % Per. Deb. ....	Stock	4 1/2	4 1/2	97-100	..	4 10 0
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5	5	92 1/2-94 1/2	- 1	5 5 9	Toronto Power, 4 1/2 % Deb. ....	Do.	4 1/2	4 1/2	97-100 rd	..	4 10 0
Kalgoorlie Elec. P. and Lt., Ord.	10/-	Nil	Nil	..	..	Nil	Vera Cruz Lt., P. and T., 6 % 1st Mort. Deb.)	100	6	6	93-85	..	5 6 3
Do. 8 % Pref. ....	5	5	5	..	..	9 12 0	Victoria Falls Power, Pref. ....	1	11 1/2	17 1/2	1 1/2-1 1/2	..	..
Kaminiataqua Power, 6 % G. Ba. Madras, Ord. ....	\$500	5	5	100-102	..	4 18 0	West Coast Power and Lt., 1st Mort. 5 % Gold	100	6	6	106-108	..	5 11 1
Melbourne, 5 % 1st Mort. Deb.	\$100	5	5	112-113	..	4 17 0							
Mexican El. Lt. 5 % 1st M. Bds.	5	5	5	80-83	..	5 19 1							
Mexican Lt. & Power, Common	\$100	4	4	67-70	..	5 14 4							
Do. 7 % Cum. Pref. ....	\$100	7	7	98-102	..	6 17 3							
Do. 5 % 1st Mort. Gold Bds.	5	5	5	87-90	..	5 11 1							

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph .. .. .	10	4	4 1/2	6 1/2-7 1/2	..	6 2 0	Monte Video Telephone, Ord. ....	1	6	6 1/2	1-1 1/2	..	6 6 8
Do. 6 % Deb. Red. ....	Stock	6	5	97-99	..	5 1 0	Do. 6 % Pref. ....	1	5	5	3-4	..	5 14 3
American Telep. & Teleg., Cap.	\$1000	8	8 1/2	130-138	+ 1	6 0 4	New York Telep., 4 1/2 % Gen. Bnds.	100	4 1/2	4 1/2	96 1/2-97 1/2	- 1 1/2	4 12 7
Do. Collat. Trust .. .. .	4	4	4	91-93	- 1	4 5 1	Oriental Telep. and Elec. ....	1	8	10	1 1/2-1 1/2	..	10 2 0
Anglo-American Telegraph ..	Stock	8	8	61-64	..	4 13 9	Do. 8 % Cum. Pref. ....	1	5	8	1 1/2-1 1/2	..	4 16 3
Do. 8 % Pref. ....	Do.	8	8	107 1/2-109	..	5 10 0	Do. 4 % Deb. ....	Stock	4	4	88-90	..	4 8 11
Do. Dist. ....	Do.	80/-	30/-	23-28 1/2	- 1/2	6 7 8	Pacific and European Tel., 4 % Guar. Debs.)	Do.	4	4	98-100	..	4 0 0
Anglo-Portuguese Tel., 5 % Mort. Deb.)	100	5	5	104-106	..	4 15 3	Reuter's .. .. .	10	10	10	92-102	- 1/2	9 6 0
Chill Telephone .. .. .	5	7	8	7 1/2-7 1/2	..	5 1 1	Sobmarine Cables Trust ..	Cert.	5	8	124-127	..	4 14 6
Commercial Cable, Sigs., 4 % Deb.	Stock	4	4	84-94	- 1/2	4 13 7	Telephone Co. of Egypt, 4 1/2 % Deb. Red.)	Stock	4 1/2	4 1/2	96 1/2-97 1/2	..	4 11 5
Cuba Telegraph .. .. .	10	10	10	84-94	+ 1/2	5 6 4	United River Plate Telephone	5	5	8 1/2	6 1/2-7	..	5 14 4
Do. 10 % Pref. ....	10	10	10	162-162	..	5 8 8	Do. 5 % Cum. Pref. ....	5	5	5	5 1/2-5 1/2	..	4 9 0
Direct Spanish Telegraph, Ord.	5	4	4 1/2	84-84	..	6 18 0	West Coast of America ..	2 1/2	2 1/2	..	1 1/2-1 1/2	..	4 7 0
Do. 10 % Cum. Pref. ....	5	10	10	62-71	..	6 5 6	Do. 4 % Debs., 1 to 500 guar. by Braz. Sub. Tel.)	100	4	4	96-99	..	4 0 10
Direct United States Cable ..	10	5	4	5 1/2-6 1/2	..	4 9 0	West India and Panama Teleg.	10	1 1/2	1 1/2	23-24	- 1/2	4 7 0
Direct W. India Cable, 4 1/2 % Reg. Deb.)	100	4 1/2	4 1/2	99-101	..	5 6 10	Do. 8 % Cum. 1st Pref. ....	10	6	8	94-94	..	6 0 0
Eastern Telegraph, Ord. Stock	10	7	7 1/2	123-131	..	4 12 1	Do. 6 % Cum. 2nd Pref. ....	10	6	8	94-92	..	6 0 0
Do. 8 1/2 % Pref. ....	Do.	8 1/2	8 1/2	74-76	- 1/2	4 7 0	Do. 5 % Debs. ....	100	5	5	101-103	..	4 17 1
Do. 4 % Mort. Deb. ....	Do.	4	4	90-92	..	5 7 8	Western Telegraph, Ltd. ....	10	7	7 1/2	18-13 1/2	+ 1/2	5 8 8
Eastern Extension .. .. .	10	7	7	12 1/2-13	+ 1/2	4 5 1	Do. 4 % Deb. ....	Stock	4	4	93-95	+ 1	4 4 3
Do. 4 % Deb. ....	Stock	4	4	82-94	..	8 11 7	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	4 1/2	90-93	..	4 16 9
East and S. Africa Tel., 4 % Mt. Dh. Mauritis Sub.)	25	4	4	93 1/2-100 1/2	..	5 3 3							
Globe Telegraph and Trust ..	10	8	6 1/2	11 1/2-11 1/2	..	4 13 2							
Do. 8 % Pref. ....	10	6	6	123-124	..	6 5 0							
Great Northern Telegraph ..	10	18	20	30-32	- 1/2	8 14 0							
Indo-European Telegraph ..	36	18	13	55-57	- 1	6 0 6							
Mackay Companies Common ..	\$100	5	5	80-83 rd	- 1	6 14 4							
Do. 4 % Cum. Pref. ....	\$100	4	4	67-70 rd	- 1	6 14 3							
Marconi's Wireless Telegraph	1	20	..	33-34	+ 1/2	5 14 3							
Do. 7 % Cum. Partic. Pref.	1	17	..	22-3	+ 1/2	5 13 4							

\*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. 8s. in Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations June 17th., Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations June 17th., Rise or Fall, Present Yield p.c. Lists various electrical railway and tramway companies like Bath Trams, Brit. Elec. Trao., Central London Railway, etc.

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations June 17th., Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations June 17th., Rise or Fall, Present Yield p.c. Lists international electrical railway and tramway companies like Anglo-Arg. Trams, Brisbane Trams, B. Columbia Elec. Rly., etc.

MANUFACTURING COMPANIES.

Table with columns: NAME, Stock or Share, Dividends for, Closing Quotations June 17th., Rise or Fall, Present Yield p.c., NAME, Stock or Share, Dividends for, Closing Quotations June 17th., Rise or Fall, Present Yield p.c. Lists manufacturing companies like Aron, Babcock & Wilcox, British Aluminium, etc.

\* Unless otherwise stated, all share are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

## REVIEWS.

*Handbuch der Elektrizität und des Magnetismus.* Edited by Dr. L. GRAETZ. Vol. I, Section I. Price 6 M. Vol. II, Section I. Price 13 M. Leipzig: J. A. Barth.

This work, which is to be completed in five volumes, is intended as a complete survey of the theoretical and experimental field of electricity and magnetism, giving the latest information on the subject and all necessary references to enable the reader to follow up any particular point thoroughly. The engineering and technical side of the subject is not dealt with.

The various sections are to be handled by experts, the list of names including those of some of the foremost German physicists.

As far as can be judged from the present portions of the first two volumes, the treatment is thorough and complete. At the same time, a fair knowledge of the ordinary theory of the subject is assumed, so that the matter can be dealt with concisely as is, of course, necessary in a book of moderate price covering so large a ground.

The first section of Vol. I contains articles on "Frictional Electricity," by Dr. L. Graetz; on "Electrical Machines and Apparatus," by Dr. W. H. Schmidt; and on "Electrostatic Apparatus and Measurements," by Dr. P. Cermak.

In the first section of Vol. II are articles on "Stationary Electric Currents," by Dr. Felix Auerbach; on "Measuring Instruments and Methods," and on "Absolute Measurements and Units," by Dr. W. Jaeger.

It is intended to publish the whole of the remaining sections and volumes within a period of two years.

*The Practice of Electrical Wiring.* By DONALD SMEATON MUNRO. London: H. Alabaster, Gatehouse & Co. Price 3s. net.

A good many books have been written on wiring, some intended for the householder or consumer, others for the wireman or plumber, others for the contractor, and others for no one in particular.

In the introductory chapter, the author tells us that his book is not intended for the non-electrical reader, but rather for those who have had, or are now receiving, a certain amount of practical training in applied wiring. It is intended also to prove useful to architects, engineers and others who are interested in this branch of electrical work.

The author has succeeded uncommonly well in writing a book which in every way fulfils his intentions, and the reader will find something of practical interest on almost every page.

Glancing through the pages which deal with early installations, one cannot help remarking on the differences between modern practice, and the crude methods of 30 years ago when bare wires were run on varnished wood battens. This method was followed by the zinc tubing system, two tubes at first being employed, each containing one conductor insulated with pure rubber. The tubes were kept separate from each other, just as though they were the actual conductors.

Some of these pioneer installations, erected in the early eighties, are still in satisfactory use, although the pressures have been raised to a much higher figure than was ever contemplated. Such an installation put up nowadays would be considered quite unsafe, and would not be passed by any fire office. No doubt the safety of those early installations is due largely to the fact that they were put up by electricians, men who to-day would be regarded as amateurs.

Turning, however, to present-day practice, one is pleased to note the author's criticism of the "looping" system, which is often carried to absurd lengths: to save a soldered joint, we may have to put up with the disadvantage of a plurality of insecure connections.

Discussing conduit wiring on page 17, the author recommends us to "Keep away from hot pipes, keep far away from gas pipes, and avoid possibility of contact with all other metal work." This sounds very much like an extract from the rules of an insurance company, and it is advice which cannot always be followed. Take the case of a modern factory. The electrical conduits must be fixed to

the steel girders, stanchions, &c., which form the constructional framework, and whilst they may be kept quite clear of gas or other pipes, these pipes are also fixed to the same metal work, and are, therefore, in metallic contact with each other. The rule on which this advice is founded has always struck us as illogical, and it would be better to insist on efficient earthing and mechanical bonding together of all pipes and metal work than to recommend that they should be kept apart—a separation which is generally only apparent and not real.

The author rightly points out that "with A.C. the sum of all currents flowing at any moment in the conductors within a metal tube, or near other metal, must be zero," but is not this put rather too academically in a book of this character? It will be double Dutch to some readers.

The remarks on the treatment of cables are very sound, and some of these might with advantage be reprinted by wiring contractors and handed out to their men, as it is almost heart-breaking to see the careless manner in which cables are generally treated prior to erection.

There is an excellent section on jointing, and the remarks on jointing flexibles to solid wires are particularly interesting. The author appears to apply to the term "married" joint, a specialised meaning. South of the Border "married" and "spliced" are practically synonymous terms, whether applied to cables or to human beings, and the terms "brush" and "spigot" joint would also appear to be localised terms. Married, or spliced, and telescopic are the more usual terms employed.

The author has a good word to say for wood casing, and there is no doubt that for some classes of work it is quite good, and is preferable under practically any circumstances to slip-joint conduit.

There is some extremely practical advice to be found in the conduit section—but why particularise further? The book is good from cover to cover, and is obviously the outcome of an intimate acquaintance with practical wiring as applied to electric lighting, for there is no mention of motors.—F.B.

*Design of Polyphase Generators and Motors.* By H. M. HOBART. London: Hill Publishing Co. Price 12s. 6d. net.

Mr. Hobart is a most energetic producer of books on electrical subjects, and his works cover a remarkably wide range—from electrical propulsion of ships, electric railways, and books on design similar to the one under review, to elementary text-books on the principles of electricity. Occasionally, the author—or compiler—of this mass of literature does not pay the slightest regard to conventional methods or terms; he strongly "says his say" on highly controversial matters, and, in consequence, some of his books are rather painful reading in places, and altogether unreasonably expensive at the price asked for them. Others are fairly welcome, and, on the whole, this latest treatise is of this character.

Mr. Hobart commences by giving his views, based on the experience gained at three of the technical schools in London, at which he recently lectured on the design of electrical machinery, on methods of teaching and the "sandwich" system of engineering education. Briefly, it may be stated that he favours the "sandwich" system, and thinks that it is the function of the professional teacher to supply the student with essential preparatory information, and for an outside practitioner to lecture on subjects with which he has occasion to be especially familiar. In the same preface he gives a list of subjects relating to the subject matter of this book, but which he does not discuss. These include the stresses called into play when generators are short-circuited or put to work partly unsynchronised, parallel operation, and wave form, which is rather a pity since, although there have been a number of papers recently read dealing with these subjects, the information is not accessible to students in a text-book, while the bulk of the information contained in this book already exists in text-book form.

Chapter I is introductory, and might have been omitted without disadvantage.

Chapter II deals with the design of three-phase alternators. It contains a large number of formulæ and tables,

and the design of a low-speed alternator is worked through as an example. The method of determining the fundamental dimensions is by means of a table giving the pole pitch, and by an output coefficient. A table of specific loadings is given, but this is only used for finding the number of conductors required. The reviewer has checked a number of these constants, and they appear to be well on the safe side. A quantity of quite elementary matter is to be found in this chapter, e.g., how to find the number of poles required for an alternator, dynamic induction, &c.

Polyphase generators with distributed field windings are discussed in Chapter III. The treatment is very meagre—the whole chapter only consisting of five pages. Since the modern tendency is almost entirely towards using this type of rotor for high-speed alternators, more attention should have been given to the subject even in a text-book for technical schools.

The design of squirrel-cage induction motors is treated in the succeeding chapter. A table of pole pitches and output coefficients is again used for determining the leading dimensions. For predetermining the dispersion coefficient, or "circle ratio" as the author calls it, a lengthy table is given, and also a formula. Stress is rightly laid on the approximate character of this predetermination. A small amount of information is given in this chapter on works cost, together with some useful data regarding the total weight in relation to weight of effective material. The design of totally enclosed motors receives no attention whatever.

Following this we have eight pages devoted to the design of slip-ring motors. We are afraid that the information given relating to rotor windings will be insufficient for the average student. The method of calculating the necessary external resistance for obtaining maximum starting torque should also have been given.

Chapter VI is a reprint of certain portions of articles contributed by the author to the *General Electric Review* dealing with synchronous motors *v.* induction motors, and is very good. An outline of the design of an induction generator is given in Chapter VII, and as far as it goes, is remarkably good. Some useful methods of ventilating this type of machine are given.

In connection with the lecture courses given by the author, he has had occasion to set a number of examination papers, and some of these papers are reproduced in Chapter VIII. These examples comprise various problems connected with the design of alternators and motors, and should prove useful to teachers and students.

There are four appendices to the book giving bibliographies connected with the subject-matter, trigonometrical and wire tables. As is becoming common in books of this character, several coloured winding diagrams are included.

The reviewer would have liked to see some information regarding the mechanical design of machines incorporated in the book, since this class of work is at least as important as the purely electrical design, and is often quite ignored, or receives inadequate treatment in books on the design of electrical machinery.—H. G. S.

**University of Hong-Kong.**—We have received from Prof. C. A. M. Smith, Dean of the Faculty of Engineering, a brochure containing particulars regarding the Faculty of Engineering at the University—explaining the scheme of study, regulations for the degree of B.S.Eng., the syllabus of subjects, and the cost of instruction, residence, &c. An historical sketch of the University is included. An important section of the volume gives details of the engineering equipment already presented to the University, with the names of the donors, which we are glad to see makes a very good show; particulars are also given of other apparatus which are urgently needed for the engineering laboratories and workshops. In an introduction by the Dean two important facts are emphasised: the almost complete absence of science in China, and the insatiable desire of the Chinese for scientific knowledge. The University is in its infancy; it may become an immense power in the development of British trade in the East, and if we at home support it as we ought, undoubtedly it will. Hong-Kong is already a noted centre for general education, and if we see to it that it becomes the focus of engineering training, drawing towards it the young men who have been awakened by the revolution to the need for acquiring "Western learning," the supremacy of British engineering in the East will be assured.

## NOTES FROM CANADA.

[FROM OUR OWN CORRESPONDENT.]

THE Mayor of Vancouver has just issued a public warning, according to the daily papers, that "too many people are coming to Vancouver seeking work, giving up good positions in the Old Country." The Mayor is afraid that there will be many of the new arrivals out of work next winter.

The Campbell River Power Co. proposes to erect a hydro-electric power plant to supply electricity all over Vancouver Island. Three hundred thousand horse-power is to be developed at a cost of from £2,400,000 to £3,000,000.

Petrol-electric cars are to be used by the Pacific Great Eastern Railway on a new section of line now being constructed.

The plant of the Dawson Electric Light and Power Co., of Dawson City, in the Yukon, was totally destroyed by fire last month. The loss must have been very serious, as all light and power, and even the water supply, were dependent on the supply of electricity. The money loss is placed at about £40,000.

The town of Edmonton, Alberta, has decided to lay about 21 miles of track for tramways this summer; extra cars also have just been ordered.

The question of technical education has been reported on recently by the Royal Commission on Industrial Training and Technical Education. The chief recommendation is that the Dominion Government should annually, for ten years, furnish £600,000, to be divided among the Provinces on a basis of population. The establishment, or extension, and maintenance of classes for industrial training and technical education; the provision of suitable appliances, &c.; and the publication of scholarships, are among the recommendations of the Commission. The importance of having the manufacturing and commercial interests of any locality ready and able to co-operate in carrying out the work is also emphasised.

The Commission states that:—

1. Secondary vocational education should be provided for those who follow manual industry vocations.
2. Such persons should have opportunities for acquiring secondary education which would be as fully advantageous to them in their vocations as the secondary education provides. General school system has been advantageous to those who enter into learned occupations.

Secondary education for those who have gone to work should be provided in day and evening classes in close co-relation with their occupations, while they are still learners, also when they have become skilled workmen or journeymen, or have come to fill positions as foremen, superintendents, or managers.

It is to be hoped that these recommendations will be acted upon, as in this country the facilities for technical education, outside of the large cities, are few and far between, and, apart from the correspondence schools, there is no way by which the younger generation of residents in the rural districts can gain much knowledge beyond the mere rudiments. Of course, those whose parents can afford to do so, send their children to the technical schools and colleges in the big towns, but there are many young people for whom such a course is impossible, and who have to start work at an early age, having little or no chance of fitting themselves for the higher positions. Distances between towns, absence of good roads, the severe winters and the poor train services (due to scanty population) are some of the difficulties which militate against young men and women living outside the towns getting any secondary education at present, but these proposals are a decided step in advance and in the right direction.

**Terrestrial Magnetism.**—In the report of Greenwich Observatory for the past year, it is stated that the magnetic elements for 1912 were:—Declination, 15° 24' 3" west; horizontal force, 0'18528 (C.G.S. units); dip, 66° 51' 46". It has been decided to build a new magnetic observatory in the park.

Wireless time signals are received daily from the Eiffel Tower and Norddeich, and can be read with an error not exceeding 0'05 second. Both the French and the German times appear to be 0'3 second late on the average, as compared with the Greenwich determinations.

**SOME METHODS OF DETECTING LEAKAGES ON ALTERNATING AND CONTINUOUS-CURRENT SYSTEMS.**

BY R. D. GIFFORD, M.Sc., A.M.I.E.E.

IN view of the interesting discussion on the subject of "Earthed *v.* Unearthed Neutrals," arising from a paper recently read before the Institution, the writer feels that this would be an appropriate time to bring before those interested some methods of detecting leakages in electrical power circuits.

That this matter is one of importance is attested by the fact that several members in the discussion made direct reference to the necessity for some means of ascertaining, at

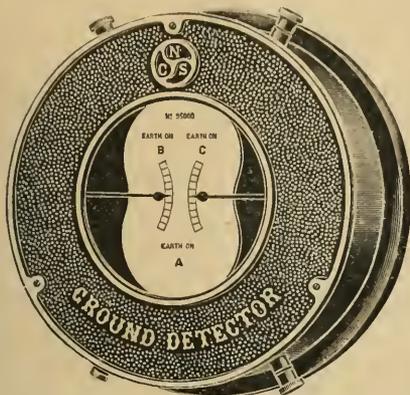


FIG. 1.—ELECTROSTATIC THREE-PHASE GROUND DETECTOR.

all times, the condition of the insulation of the system, and of cutting off the supply in cases of dangerous faults.

Many attempts have been made to find a simple and satisfactory solution to this problem, and have been met with varying degrees of success.

**ELECTROSTATIC GROUND DETECTOR.**

On high-tension alternating-current systems, one of the most usual forms of apparatus is the electrostatic ground detector. An instrument of the type suitable for use on three-phase circuits is illustrated in fig. 1. The internal arrangement consists of two electrostatic movements, each having two fixed quadrants and a moving needle. One quadrant of each movement is connected to Phase A, and

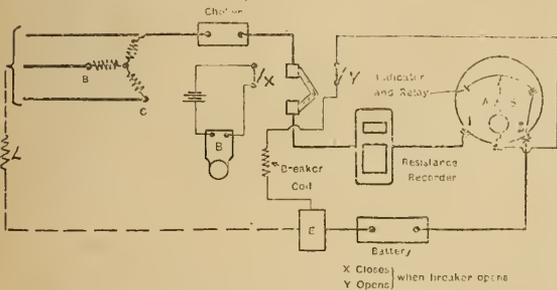


FIG. 2.—A.C. LEAKAGE INDICATOR ARRANGED FOR SYSTEM WITH INSULATED NEUTRAL.

the other quadrants to Phases B and C respectively. Both needles are earthed. Under these conditions it will be seen that if a fault occurs on Phase A, the needles will move towards quadrants B and C, the pointers, therefore, taking up the position marked "Fault on Phase A."

If a fault occurs on Phase B or C, a corresponding movement takes place on one or the other of the pointers.

Although this form of instrument is to some extent discriminating it is not altogether so, for if the insulation of all three phases becomes impaired but remains equal in each

(a very improbable condition) the needles will not be deflected. It will, therefore, be seen that these instruments cannot be calibrated to read in definite units of insulation resistance or leakage current, nor do they lend themselves readily to function as relays for opening the circuit in cases of dangerous faults.

**LEAKAGE CURRENT INDICATOR AND RECORDER FOR A.C. SYSTEMS.**

An alternative method, applicable to both insulated and earthed systems, and one that gives highly accurate results will now be described.

The principle involved is that of superimposing on the A.C. mains a small direct current supplied from a battery of dry cells or other source.

Fig. 2 shows the connections for an insulated system. Between one bus-bar and earth are connected in series a choking coil, circuit breaker, insulation recorder, an indicating relay, and the battery.

In case of a fault arising on the system as shown at 1, a direct-current flows *via* the fault through the apparatus. The choking coil is designed to have a comparatively low resistance and very high impedance, so that the apparatus, although connected between the mains and earth, cannot be

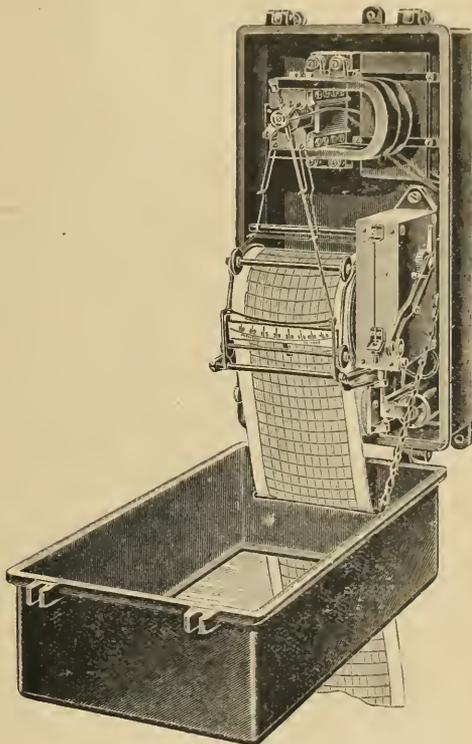


FIG. 3.—INSULATION RECORDER.

considered as earthing the system. An actual choking coil of this type was found to pass only a few milliamps. with the full line voltage of 3,300 volts across it, which condition can only arise if one of the other mains goes dead to earth.

The recorder and relay are of the moving-coil pattern, and therefore are unaffected by the alternating current passing through them, but respond only to the D.C. detecting current.

The recorder is calibrated to read the insulation resistance of the system to earth, and the indicating relay indicates the maximum leakage current flowing between mains, consistent with the resistance recorded at the moment. This statement may be explained as follows:—

It will be seen that the insulation to earth may be due to the imperfect insulation of one main only, any two mains, or all three mains. Each of these possibilities can give rise to somewhat different currents flowing between mains for a given insulation resistance to earth. The condition chosen for calibrating the indicator is that one which gives the maximum leakage current, so that at all times the engineer

can be certain that there is never more leaking current than is being indicated. Combined with the indicator is a relay of special design, so arranged that when the insulation resistance falls below a predetermined value the relay operates, connecting terminals 2 and 3, thus throwing the battery directly across the circuit-breaker. This opens the instrument and relay circuits  $\gamma$ , closes the alarm bell circuit  $\lambda$ , and, if necessary, it can also be arranged to trip the circuit-breakers or oil switches.

Fig. 3 shows the recorder, which is of special design, as it is essential that it should be extremely sensitive and free from the usual pen friction errors, &c. These have been eliminated by allowing the pen to swing clear of the chart. The pen is kept moist by capillary feed from the trough, and

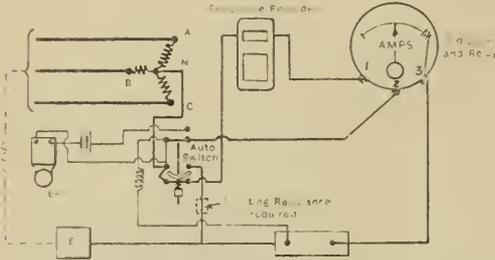


FIG. 4.—A.C. LEAKAGE INDICATOR ARRANGED FOR SYSTEM WITH NEUTRAL POINT EARTHED.

is electromagnetically tapped on to the chart at frequent intervals. The result is a series of semi-superimposed dots having the appearance of a continuous line.

In the case of earthed neutrals a modification is made in the connections, as shown in fig. 4. No choking coil is necessary, the recorder and indicating relay being connected directly between neutral and earth until the resistance falls below the allowable value, when the auto switch cuts the instruments out of circuit and puts the neutral point to earth, either directly or through a limiting resistance. This automatic may be made to trip the circuit-breakers if desired, the limiting resistance in that case being unnecessary.

GROUND DETECTOR FOR CONTINUOUS-CURRENT SYSTEMS.

We may turn now to means employed for the detection of leakage current on continuous-current mains. A method which has been adopted largely is shown in fig. 5.

A suitably calibrated voltmeter with central zero has one terminal permanently earthed, and the other connected to a

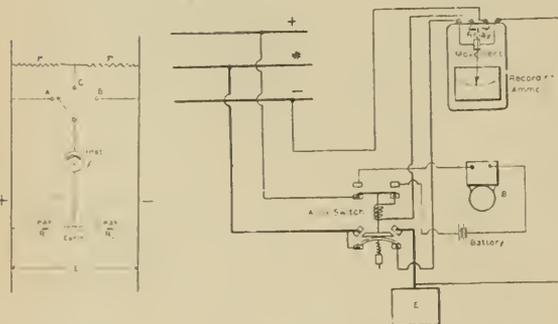


FIG. 5.—GROUND DETECTOR FOR D.C. SYSTEMS.

FIG. 6.—D.C. THREE-WIRE SYSTEM: DIAGRAM OF CONNECTIONS FOR LEAKAGE CURRENT RECORDER.

three-way switch, as indicated. The resistance  $rr$  has an extremely high value, and is placed directly across the mains,  $c$  being a mid-point tapping.

Normally the switch is on contact  $c$ , and, therefore, when the resistance of one main to earth falls below that of the other, a deflection is produced to right or left, according to which main is faulty. When it is desired to take the actual insulation resistance of each main to earth, readings are taken on the meter with the switch successively on  $A$  and  $B$ . Let these readings be respectively  $v_a$  and  $v_b$ .

If  $\rho$  be the resistance of the meter, it can be shown that—

$$\text{Insulation resistance } R_1 = \rho \frac{(E - v_a - v_b)}{v_b}$$

$$\text{and similarly, } R_2 = \rho \frac{(E - v_a - v_b)}{v_a}$$

The total insulation resistance of the system to earth will be—

$$\Omega = \rho \left( \frac{E}{v_a + v_b} - 1 \right),$$

and the leakage current from + to - main is—

$$i = \frac{E v_a v_b}{\rho (v_a + v_b) (E - v_a - v_b)} = \frac{E}{R_1 + R_2}$$

It will be seen that it is not possible to calibrate the instrument directly in any of these required quantities, but by assuming various successive values of  $v_a$  and  $v_b$  the resulting values of  $R_1$ ,  $R_2$ ,  $\Omega$ , and  $i$  can be found and tabulated on a chart accompanying the instrument.

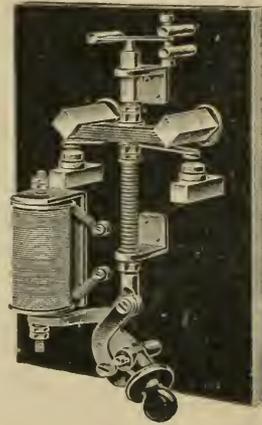


FIG. 7.

As an example, take the case of a 220-volt system. The instrument would be adjusted to have a full deflection from central zero to right and left with 220 volts. Suppose the resistance to be 10,000 ohms. Then, if readings  $v_a = 100$  and  $v_b = 20$  are obtained, we have—

$$R_1 = \frac{10,000 (220 - 120)}{20} = 50,000,$$

$$R_2 = \frac{10,000 (220 - 120)}{100} = 10,000.$$

Total insulation to earth = 8,350 ohms, and leakage current = 3.7 milliamperes.

A recording instrument is now made operating on this principle, the switching being performed by the recorder clock at regular intervals.

THREE-WIRE SYSTEM.

For the detection of leakage current to earth occurring on three-wire systems in which the mid-wire is always earthed, the usual method is to place a central zero indicating or recording ammeter in the earth connection.

The recording instrument should preferably be of the type shown in fig. 3, this being sufficiently sensitive accurately to record small earth currents without introducing any appreciable resistance into the earth connection.

In order to protect the instrument from damage in the event of a heavy fault on either outer, it is provided with a relay circuit as described above, which places the tripping coil across the mains, opens the instrument circuit, puts the mid-wire direct to earth, and rings the alarm bell, as shown in fig. 6. Fig. 7 shows the automatic switch used in the last diagram and in fig. 4.

It will be understood that these notes do not claim to be a complete survey of the means at the disposal of the central station or colliery engineer for safeguarding both the public

and the continuity of supply from the danger of faulty insulation, but it is hoped that the methods described may be of interest to those who recognise the necessity of keeping a watchful eye on the condition of the insulation of the circuit.

In conclusion, the writer wishes to acknowledge the kindness of Messrs. Nalder Bros. & Thompson in lending the electrotypes illustrating this article.

**NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.**

**Generator Protection for Chicago.**

The accompanying illustrations will be of interest at the moment, as showing the details of the protective gear apparatus which MESSRS. A. REYROLLE & CO., LTD., Hebburn, are supplying for the 25,000-kw. turbo alternator, which is now being made in England for the Chicago Edison Co. The system of protection

adopted is the well-known invention of Messrs. Chas. Merz and Bernard Price. A diagram of connections is shown in fig. 1. The actual current transformers are enclosed in iron cases and are filled in solid with compound. It will be seen from fig. 2 that provision is made for a single-turn primary conductor which will pass straight through the centre of the core. Fuses are used for the purpose of providing a time-limit overload protection. As shown in the diagram, the fuses are connected in the main secondary circuit. Under ordinary circumstances the fuses would be set to blow at a heavy current, so that they would only melt in the event of a persistent bus-bar fault. The relay is connected to the main secondary circuit across phases at points which are normally at equal potential, and it is set to release the switch for a fault to earth or between phases on the armature or on the connections between the machine and the current transformer, which is fixed on the switchboard. The operation of the relay is instantaneous, therefore, in the event of a fault between phases or to earth occurring, the generator will be cleared from the bus-bars, and the whole operation will take no more time than that required by the switch in moving the mass of its mechanical moving parts from the positions which correspond to the "closed" and "open" positions of the sparking contacts. This time lag is exceedingly small, and, in accordance with the experience obtained elsewhere on the Merz-Price protection, it is expected that a faulty machine will be cleared from the system without causing a disturbance to the sound running plant, other than throwing additional load on the sound generators.

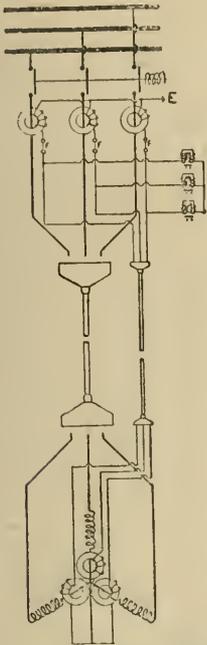


FIG. 1.—MERZ-PRICE CURRENT BALANCE CONNECTIONS.

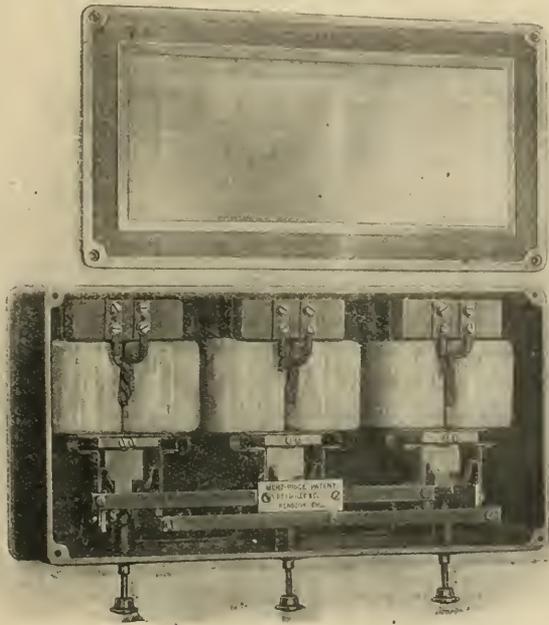


FIG. 2.—REYROLLE CURRENT TRANSFORMERS.

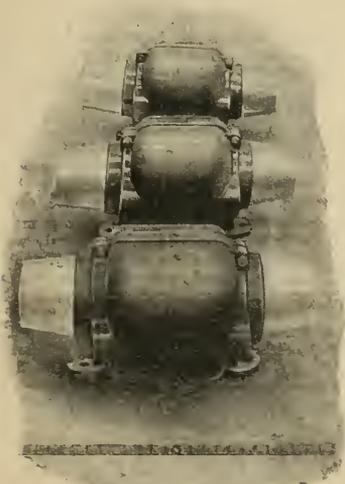


FIG. 3.—RELAYS FOR MERZ-PRICE SYSTEM.

**Arc Welding Plant.**

THE PARSONS MOTOR CO., LTD., of Town Quay, Southampton, have sent us particulars of an arc welding plant which they have just supplied to an important firm of engineers and shipbuilders on the Continent. From the illustration it will be seen that the whole plant is self-contained, and can be placed where required. The engine is a 28-h.p. four-cylinder standard pattern Parson's

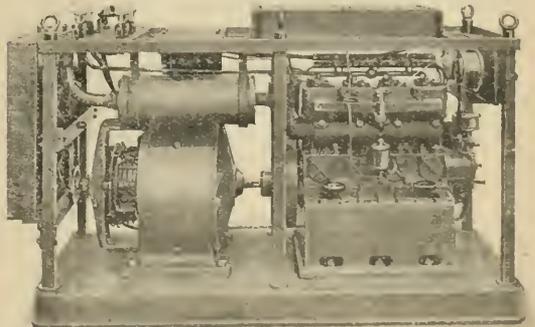


FIG. 4.—PARSONS 28-H.P. PARAFFIN ENGINE AND SELF-CONTAINED ARC WELDING SET.

paraffin engine, fitted with magneto ignition and patent timing drive, having an enclosed sensitive vertical type governor driven by enclosed gears at the forward end, which regulates the speed within 1.05 per cent. The lubricating oil tank, with sight feeds, is at the back of the engine, and the brackets for the blow lamps for starting up on paraffin are seen on the bedplate. The cooling water is circulated by a Parsons pump at the forward end of the engine, and the fuel is carried in the tank situated above the engine.

The dynamo has an output of 250 amps. at 65 volts, and in this case is of the Holmes type. The voltmeter and ammeter are placed on a teak board at the forward end of the engine; the resistance is on the opposite side to that seen in the view, also carried on a board at the top, and next to it will be seen the main switch and cut-outs.

At the commutator end of the dynamo there is a pulley-driven fan fixed at the back of the radiator, running in a casing. Having a very wide experience of the difficulties connected with the efficient cooling of these arc welding sets on stationary work, the makers have made provision for ample cooling surface and a large displacement of cold air, so that even on long runs at full power the water never boils, although there is no reservoir beyond that formed in the radiator.

The silencer itself, seen in front, is of the ordinary type, with the usual diaphragms, &c., and is carried from the upper frame. The six columns are securely attached to the cast-iron base plate, and the upper frame is of welded construction. The makers have turned out many of these plants, and are in a position to appreciate the difficulties that have to be overcome in order that the results may be absolutely satisfactory. There are many instances where such a plant would effect an enormous saving in connection with dock work, ship work, boiler work, &c.

#### The Polish-Grinding Machine.

MESSRS. A. T. MURRAY & SONS, of 30, Great Charlotte Street, Liverpool, have introduced a little machine for putting a straight polish on to metallic and other articles. It is impossible to obtain this straight polish from disk grinders or emery wheels, their grinding lines being curved. In this case an endless emery band

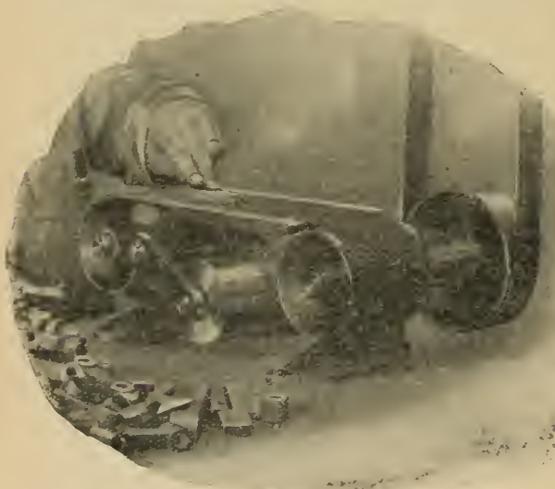


FIG. 5.—THE POLISH-GRINDING MACHINE.

4 in. wide and running at 350-500 R.P.M., is employed; this is supported on overhung pulleys and kept taut by means of a tension pulley, and it can be removed without loosening a single screw. The part of the band on which the grinding is done is supported by a table to ensure accurate results, the arrangement being shown in fig. 5.

#### The "Oriona" Lamp.

A lamp in which the metal filament is held stretched in the horizontal plane is described in a recent issue of *l'Electricien*. It is made by M. M. DU MOULIN, 86, Boulevard Léopold, Tournai (Belgium). In a plane at right angles to the filaments the candle-power curve approximates to a complete circle. The spherical candle-power cannot, of course, be increased by this device, but for certain purposes, such as street or passage lighting, with a suitable reflector, the lamp presents advantages.

#### Electric Lighting for Motor Cars.

We have received from MESSRS. RICHARD PAPE, LTD., of Belvedere, Kent, their catalogues of car and launch lighting equipments. Messrs. Pape have introduced a simple system, which includes a constant voltage dynamo and a Fors car lighting battery, which together with the head and side lights, tail lights and dash light in series with the latter, are wired up to a small switchboard consisting of a volt and ammeter and four push-button switches, one of which connects the dynamo to the battery, and one each for controlling the headlights, side lights and tail light. The wiring system uses a special armoured braided concentric cable, the outer braiding being used as the negative wire, in conjunction with

specially designed fuse and junction boxes; in fact, the complete installation is standardized, and can be fitted to any type of car and make use of any type of lamp.

Our illustration gives a good idea of a Pape car lighting equipment; the arrangement has been successfully applied for yacht

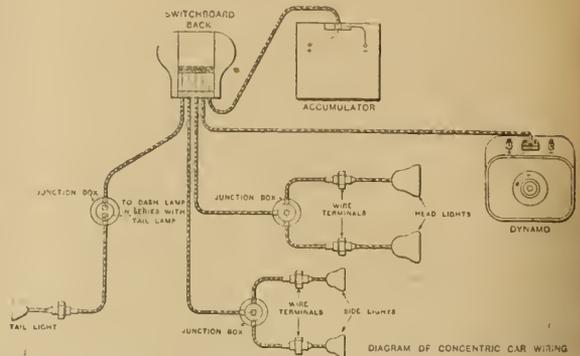


FIG. 6.—ARRANGEMENT OF "PAPE" EQUIPMENT FOR CAR LIGHTING.

lighting, and in this case includes dynamo, accumulator, switchboard, together with cabin lamps, port, starboard, masthead and searchlights.

#### "Magic" Electric Blower.

MESSRS. MAGIC APPLIANCES, LTD., of 6, Farringdon Avenue, E.C., have introduced the "Magic" electric blower, for blowing dust out of any kind of machinery, and for a variety of other uses in factories and workshops. The blower is fitted with two handles for convenience in operation. One of the handles serves as a foot,

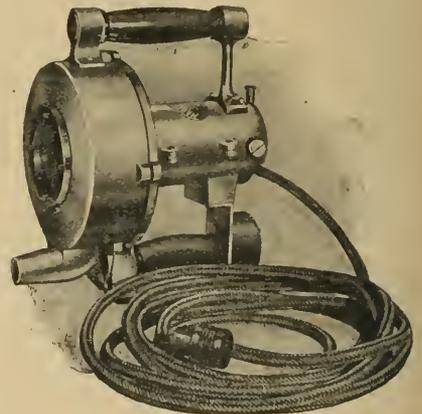


FIG. 7.—"MAGIC" BLOWER.

upon which the machine may rest when not in use. Connection to the lighting circuit is obtained by means of a flexible specially designed for rough usage, and a switch plug or R.C. adaptor. The power consumption is 110 watts, and the total weight is 10 lb. It is a handy little thing, as will be gathered from the illustration.

**Fire Brigade Competition.**—The fire department of the British Thomson-Houston Co., recruited from members of their staff and works, have been drilling assiduously with a view to reaching the highest possible state of efficiency, and have attained a remarkable degree of proficiency which is evidenced by their success in the recent firemen's competition at the National Fire Brigade Union camp, held at the Crystal Palace on June 2nd and 5th, where they secured three first prizes and one second. In the Poncelet Ambulance, Silvester's method of artificial respiration, their representative, 3rd Officer Moseley, secured first prize with the maximum number of marks obtainable. In the Junior Escape they were first, doing the drill in 57½ sec., as against 60½ sec., by last year's winners. In the Sacks Hose Cart Drill they were first, doing the drill in 25½ sec., as against last year's winner in 27½ sec. In the Hosed Escape they were second, doing the drill in 64½ sec., as against last year's first in 68½ sec. In the Dixon Memorial Shield combined Steamer Escape and Hose Cart, owing to their horses bolting, they were placed fifth, the winners' time being 2 min. 18½ sec., as against their time of 3 min. 32 sec.

## THE INSTITUTION OF ELECTRICAL ENGINEERS IN PARIS.

(Abstracts of Papers discussed in Paris at the Joint Meeting of the INSTITUTION OF ELECTRICAL ENGINEERS and the SOCIÉTÉ INTERNATIONALE DES ÉLECTRICIENS, 21st-24th May, 1913.)

(Concluded from page 971.)

### Railway Electrification Problems in the United States.

By MONSIEUR H. PARODI.

In this paper the author considers the various aspects of the problems met with in electrifying railways in the United States, where the conditions are very different from those obtaining on the Continent of Europe. Numerous statistical tables are given, and the author shows that the tendency on the long lines is constantly to increase the power of the steam locomotives and the length and weight of the trains, to reduce working expenses as much as possible, while on the urban railways and tramways, on the contrary, electric traction is almost exclusively employed with frequent trains or cars. Traffic on urban transport systems grows in proportion to the square of the population of the area served, a fact of immense importance in America, where in certain towns the population has doubled in less than 10 years. In 1910 the United States, with a population of 90 millions, had railways aggregating 400,000 km., while France, with a population of 39 millions, had 40,438 km. of railway, and Germany 55,731 km. In France the average capacity of a goods truck is 10 tons; in America it is 33 tons.

The cost of electrification of a railway ranges between 100,000 and 200,000 fr. per kilometre of single track, according to conditions. The total net cost of working with continuous current on the Camden-Atlantic City Railway in 1910 was 0.58 fr. per car-kilometre, compared with 0.80 fr. for steam operation. Companies which use single-phase alternating current are reticent as to their costs. In the case of tramways using D.C. and A.C. under comparable conditions, the costs are available. Excluding the cost of energy, on account of the great differences in the generating conditions, the average cost per car-kilometre for repairs and maintenance of the cars and the working conductors, with the cost of running the sub-stations, is for D.C. 0.0795 fr. and for A.C. 0.176 fr. The total cost for the former averages 0.5 fr., so that the total for the latter should come to 0.59 or 0.6 fr., working conditions being supposed to be the same in both cases.

The problem of the electrification of suburban railways presents no technical difficulty, and has become almost exclusively financial and economic in its nature. Even when the substitution of electric for steam traction might appear financially unsound, the increase in traffic resulting from the improved service would often justify the change.

The suburban lines of the New York Central Railway are worked with D.C. motor-car trains of variable composition, while those of the New York, New Haven and Hartford Railway are worked with single-phase A.C. locomotives; on the latter line four single-phase motor-cars are used, but it is believed that their number has not been increased on account of the weight and high price of these cars. With D.C. motor-cars, 6.8 H.P. per ton of train is available; with A.C. only 3.5 H.P. The dead weight per seat in the former case is 670 kg., and in the latter 750 kg. The single-phase service is the more expensive, owing to this greater weight, and is inferior owing to the lack of power of the motor-cars. The motor-cars used in the Löscheberg tunnel were to weigh 55 tons and to carry four motors of 250 H.P. each, but it was found impossible to equip them with more than half that power. Similarly the New Haven and Hartford S.P. locomotives have only half the power of the D.C. locomotives, and their maintenance cost 18,000 fr. each in 1911, as compared with 4,750 fr. for the latter. The maintenance cost per locomotive-kilometre for the former was 0.225 fr. in 1911, and for the latter 0.106 fr. in 1912, though the former are of 1,000 H.P. and the latter of 2,000 H.P. Steam locomotives in 1911, on the Pennsylvania Railway, cost 0.47 fr. per locomotive kilometre.

There exist scarcely any examples of the application of electric traction to the main lines of the United States railways.

The only systems of traction actually considered in America to be capable of giving satisfactory results in drawing heavy trains over considerable distances are the high-tension continuous-current system at 1,200, 1,500, or 2,400 volts, and the simple alternating-current system at 11,000 or 22,000 volts and a frequency of 25 periods. Three-phase traction seems systematically excluded in the United States.

As regards ordinary alternating-current, there is reason to believe that a method of supplying current will be adopted similar to the three-wire continuous-current distribution by connecting the running rails to the centre of a transformer winding at 22,000 volts, of which the terminals would be connected to the two overhead conductors serving adjacent lines. This arrangement will allow a reduction of the very considerable fall of pressure which occurs even in the case of single-phase distribution at 11,000 volts.

Serious electrostatic and electromagnetic inductive effects on neighbouring telegraph and telephone wires are experienced, due to the presence in their neighbourhood of conductors carrying large high-tension single-phase currents; and both in America and Germany it has been necessary to replace the overhead network of telegraph and telephone wires by underground cables near railway lines. The cost of installing single-phase traction has thereby been increased to a considerable extent.

Whatever system of traction is adopted, the older method of working railways ought to be retained, and the trains should be drawn by as powerful, light and fast a locomotive as possible.

In respect of power, weight and first cost, the advantage without a doubt lies with steam locomotives. The very powerful "Pacific" and "Atlantic" types of locomotive actually in use in America, which, at a speed of 120 km. per hour, can give continuously about 2,600 I.H.P. and 1,800 draw-bar H.P., weigh only 113 tons, with 90 tons for adhesion. Their power can probably be still further increased by the use of grates of 7.8 sq. m., provided with automatic stokers.

The electric locomotives of the Pennsylvania Railway, weighing 150 tons, with 90 tons for adhesion, can only develop at speeds of 100-110 km. per hour, 1,300 H.P. at the axles, and about 800 draw-bar H.P. The most recent express single-phase locomotives of the New York, New Haven and Hartford Railway, weighing 92 tons, scarcely give at 90 km. per hour 700 H.P. at the axles, and 400 draw-bar H.P.

In the United States there are no continuous-current or single-phase locomotives which are really very powerful at their maximum running speed. The three-phase locomotives now in use in the Simplon Tunnel develop at 70 km. per hour a draw-bar pull of 6,000 kg.; the new locomotives which are under construction, however, will weigh 86 tons, and will develop 3,000 H.P. at this speed. The Italian State Railways, also using three-phase equipment, have ordered 10 locomotives able to develop 2,000-2,400 H.P. at 100 km.

Whilst the three-phase locomotives can develop their maximum power at full speed, continuous or single-phase locomotives, *i.e.*, machines with a series characteristic, only develop their maximum power at a speed of 50 or 60 per cent. of their maximum speed. Whilst tractors having a series characteristic appear quite suitable for suburban service, *i.e.*, for drawing comparatively light trains at a high acceleration and at a low mean speed, those tractors with a shunt characteristic are likewise perfectly adapted for main line working, *i.e.*, to drawing heavy trains at high speeds on long stretches of track where the gradients are small, and where acceleration is only of secondary importance.

The obtaining of high-speed locomotives with total adhesion and as light as possible appears to be the vital problem of main line traction. The New York Central Railway and the General Electric Co. are actually experimenting with 2,400-H.P. 600-1,200-volt total-adhesion locomotives.

The Pennsylvania Railway has been making interesting tests to measure the lateral force to which the rails are subjected when heavy locomotives of various types are passing at various speeds. In steam locomotives having a very high centre of gravity and with the axles distributed in an unsymmetrical arrangement, the shocks are feeble and distributed in an irregular manner throughout the length of the track, the highest value corresponding with a steady force of about 2,400 kg. With electric locomotives having a low centre of gravity the conditions are no longer the same, and it is proved that not only are the blows much more violent but they are produced at a regular frequency, showing that resonance is present. With an experimental electric locomotive of the "gearless" type, the maximum blows corresponding with a steady force of 12,000 kg. in the case of locomotives with gear, were still dangerous, and of the order of about 6,000 or 7,000 kg. In view of these results the Pennsylvania Railway have decided to construct locomotives with a very high centre of gravity. These locomotives are formed in two parts, each part carrying four driving wheels and a supporting bogie. The axles of the wheels are driven through connecting rods, cranks and intermediate shafts by a 1,000-H.P. motor. On test, the machines have given satisfactory results. We thus see that in America, as in Europe, those railway companies who themselves make a study of electric locomotives seem to prefer the connecting-rod drive which proves so satisfactory for steam locomotives.

To sum up, it seems that the problem of the electrification of main lines can still not be considered either in America or Europe from an entirely financial or economic point of view. A large number of technical problems are still waiting a definite solution.

The advantages offered by electric traction on mountain lines are of the same nature as those pointed out for suburban lines. The problems are very similar, since in both cases a large draw-bar pull must be obtained at a comparatively low speed, but whilst the working of suburban lines seems to tend more and more towards motor-cars, the operation of mountain lines calls for two or three locomotives in the case of long trains.

The construction of locomotives of low speed and large power no longer seems to offer any particular technical difficulty. A large number of three-phase locomotives exist of a power equal to or greater than 2,000 H.P. Such locomotives can make use of the whole of their weight for adhesion. The electrification of a line having steep gradients thus seems to be purely an economic and financial problem.

Whilst with electric traction the maximum draw-bar pull allowable with the given adhesion can be made use of up to a speed of about 35 km. per hour, with steam locomotives the maximum pull can only be maintained up to speeds of 6 km. or 12 km. per hour.

The Cascade Tunnel trains weighing 2,100 tons are hauled by three electric locomotives, each of 102 tons weight, one being placed at the front and two at the back of the train. With electric traction it will be possible in some cases to deal with a traffic two or three times greater than that possible with steam traction.

As the weight increases, the cost of steam traction rises much more rapidly than in the case of electric traction. There is thus a certain weight above which electrical working is much more economical than steam working.

After the electrification of the Giovi Tunnel, near Genoa, in Italy, a notable decrease in the cost of track maintenance was found, due to a reduction in the wear of the running rails and the brake gear. Three-phase working allows, owing to the powerful braking provided by automatic regeneration, of the descent of the long gradients of 35 mm. per metre almost without the application of mechanical brakes. The saving in upkeep and repairs to the track—particularly the down track—appears to be sufficient to pay for a considerable part of the initial cost of the electrification.

### Application of Mechanical Devices to the Assistance of Manual Operating in Telephone Exchanges.

By W. SLINGO, M.I.E.E.

IN ordinary circumstances an operator at a manual telephone exchange has the load of her position so arranged that she is left with a fairly large percentage of unoccupied time in the busy hour; this is necessary to enable her to cope with the traffic during short rush periods. Also during the slack periods, when several positions are coupled, the conditions of operating are such that the load efficiency per position is considerably reduced. Some consideration, therefore, has been given to the feasibility of utilising automatic equipment in such a manner that when a subscriber lifts his receiver his call will be transferred immediately to an idle operator. By this means it is expected that the percentage of idle operating time in the busy hour will be considerably reduced, and also, as it will be arranged that a position can be rendered inoperative, when not required, the whole of the traffic during slack periods can be thrown on to one or two positions which will be operated with the same efficiency as obtained during the busy hour.

The experimental arrangement which will shortly be installed in one of the London exchanges will provide for the replacement of the existing lamps and jacks, individual to the subscribers on each position, by others, say 10 to 20 in number, common to the traffic-distributing apparatus. Each position will only be able to receive one call at a time, i.e., whilst an operator is answering one call one further glow can be received. All further traffic will pass forward to other positions.

The proposal outlined above provides only for the introduction of traffic-distributing equipment such as can be readily introduced at an existing exchange, and such as will permit of the continued utilisation of the existing cord circuits. If such a scheme proves satisfactory in practice, future installations involving traffic-distribution apparatus will be designed on the basis of single cord connecting circuits without answering jacks. The traffic distributor will pass the call direct to the answering side of the cord circuit, and a single operation only will be involved in completing the connection with the subscribers' multiple.

Much difficulty has been experienced during recent years in large cities owing to the poor transmission conditions involved when several underground call-wires are connected to the same "B" position. It is proposed to install experimentally a simple automatic call-seeking device which will enable one call-wire at a time to have access to the "B" operator. It will be arranged so that the "B" operator can trip the apparatus in order that only one call can be passed by a particular exchange before the other exchanges working to the same position have each had an opportunity of passing a call. The "B" operator will be made aware of the necessity for using this tripping apparatus by the glowing of a lamp on her position, which will indicate the fact that an outlying exchange wishes to pass a call. By giving improved transmission it is expected that quicker operating will result, with comparative immunity from "wrong numbers."

On groups of outgoing call-wires between very busy exchanges much trouble has been experienced as a result of—

- (a) Confusion during busy periods owing to one operator interrupting another in their desire to dispose of the traffic; and
- (b) Delay experienced by the "A" operators in finding a slack call-wire at such periods.

Both these troubles result in reducing the load efficiency of the "A" operator and increasing the liability to "wrong numbers." An automatic call-wire selecting equipment has been installed at the Central Exchange, London, which has for its object the selection and isolation of a call-wire when one is required by an "A" operator. There are 10 call-wires in the group affected, and they were, before the introduction of the new conditions, operated from 10 call-wire keys, the circuits of which were multiplied over 160 "A" positions. When the selecting equipment was introduced the 10 keys per position were replaced by 1 key per position.

Each operator is given a selector which rotates when she depresses her call-wire key. The rotation continues until the wipers find an idle "B" operator, when the "A" operator is able to pass her call. The following are some of the facilities thus obtained:—

When an "A" operator depresses her call-wire key, she is automatically connected to a disengaged "B" operator.

More than one "A" operator cannot obtain connection with the same "B" operator at the same time.

A click is heard in the "A" operator's receiver when a disengaged call-wire is obtained.

During periods when one of the "B" positions are open a calling lamp on the "B" position switchboard glows when any of the call-wire keys on the "A" positions are depressed. The night bell also rings under these conditions.

Any "B" position is capable of being rendered inaccessible to the "A" operators by throwing a call-wire circuit key situated on the "B" operator's keyboard; as, for instance, in cases where the

position is closed or when all the junctions terminating on the positions are engaged.

The motor interrupter which supplies driving current to the selectors can be closed down during the period of night-working, but will be restarted automatically when a call-wire key on an "A" position is depressed, and will continue running until the selector has found and stopped on the contacts corresponding to an accessible and disengaged "B" position, or until the call-wire key is released.

An alarm is given when any of the spring sets belonging to the interrupter in use fail to make proper contact. Also in this case a lamp lights, indicating which spring set requires attention.

The experimental equipment has been installed for the British Post Office by Messrs. Siemens Brothers & Co., Ltd.

### The Transmission of Electrical Energy by Continuous Current on the Series System.

By J. S. HIGHFIELD, M.I.E.E.

IT is due to the skill and persistence of M. Thury that a practical method of using the constant-current series system for long transmissions has been evolved, and he has carried out many schemes of considerable magnitude. There has been a tendency in discussing the use of the continuous-current series system to treat it as a rival of the alternating-current parallel system. It is a very natural point of view, but it is not a correct one. When existing methods and standard apparatus offer a satisfactory commercial and technical solution to an engineering problem, there is no reason to depart from existing practice. In the transmission of electrical energy over very long distances, the cost of the transmission line is often the most important element in determining the commercial success of the scheme, and it is notably in such cases that the continuous-current series system offers advantages. The schemes carried out by M. Thury, and also that carried out by the author, were decided on only after the fullest consideration of all the factors in each case, and they have all resulted in most satisfactory operation. Many schemes for the electric transmission of power necessitate the use of an underground line, and in others, although an underground line is not absolutely necessary, it is desirable. It would be commercially and technically most difficult to carry out some of these schemes with underground cables, except by the use of continuous current. In short, there are limiting conditions where it is less costly to carry fuel than to carry electricity by means of an expensive transmission line, and these limiting conditions are reached at a much less distance with alternating current than with continuous current.

The chief characteristic of the machinery used in all parallel systems is that it generally tends to run at nearly constant speed from the inherent qualities of its design. Where from the nature of the work, variable-speed motors are required—as, for instance, in mining work—considerable difficulties and complications are introduced with the parallel system. The constant-current series machine is naturally capable of running at variable speeds without complicated regulators and with high efficiency. In a mine the ventilating fans, pumps, winders, hoisting, and air-compressing machinery are all preferably driven with variable-speed motors. Air compressors can be driven with constant-current series motors without any regulating gear; as the pressure rises the motor will slow down, and will stop when the pressure exceeds any predetermined limit, which can be adjusted by giving the brushes of the motor the proper lead. Such an arrangement is more efficient and less complicated than any of the parallel systems for driving compressors. There is no doubt that in many cases where variable-speed motors are required, a local constant-current series plant would give excellent service. The system is inherently suited to such work, and the author is of opinion that it requires only careful development to be used to an increasing extent for such purposes.

The plant and apparatus described in the paper are mainly those used by the author in the Western area of the Metropolitan Electric Supply Co., and were fully described by him in a paper read at Glasgow last year at the summer meeting of the Institution of Electrical Engineers.\*

With the continuous-current series system it is usually convenient to use one line from a small station, and perhaps two lines from a large station, and the system does not lend itself to a large number of automatic contrivances such as are generally used in the parallel system. It is necessary, therefore, to install the cable system in the strongest possible way, so that the chances of failure are removed. Similar care should be taken in the design of the station plant and of the little switchgear and accessory apparatus required.

The generators are provided with a short-circuiting switch, which is closed mechanically and automatically should the generators reverse their direction of rotation due to a breakdown of the prime mover. A slipping coupling protects the prime mover from the generator in the event of a very sudden short-circuit.

The line current is kept constant by a form of regulator which may vary either the speed of the prime mover or the position of the brushes where constant speed is required.

The Montier-Lyons cable has been in use since 1906, first at a pressure of 57,600 volts and recently at 75,000 volts.

The whole of the Western area cables have been subjected to a

steady pressure of 150,000 volts for a period of about 30 minutes. The joints have been tested at alternating pressures up to 150,000 volts. The cables are intended for a regular working pressure of 100,000 volts, and it is anticipated that there would be no difficulty in working them at a still higher pressure. For making these tests two special machines have been built. The first consists of an influence machine giving a direct pressure of rather over 130,000 volts. The second machine consists of a contact maker working in conjunction with condensers and a step-up transformer, and is expected to give pressures up to 300,000 volts.

The Western Area underground system consists of the two single cables referred to above, laid in cast-iron pipes. This cable system, at a pressure of 100,000 volts, will carry a load of 12,000 kw. In addition to the cables, provision is made for working with an earth return, and for considerable periods the whole of the power has been supplied through a single cable and the earth. The two cables with the earth return provide a system having a capacity of 12,000 kw. in complete duplicate.

The difficulties of running in parallel are entirely avoided, so that several power stations may be connected to the same ring as the total load increases, thus allowing the effective working pressure to be raised far above any figure possible with any other system. In this respect the uniform section of the cable renders the series system far more flexible than any parallel system.

Difficulties due to the capacity and inductance of the line are eliminated, and where an underground system is necessary, owing to the high pressure that can be used with continuous current, energy can be transmitted to a far greater distance than is possible with alternating current.

Broadly, it may be said that where, owing to the great length of the line, the cost thereof is the dominating factor from a commercial point of view, then the continuous-current series system will show an advantage over the alternating-current parallel system. Where, however, the cost of the line is not the important point, the latter system will usually show to the greatest advantage.

At the present time the maximum pressure for underground cables for alternating current over a long transmission is probably 25,000 volts, and even when working with a frequency of 25 cycles the capacity current presents considerable difficulties.

The cost of an overhead three-phase line, even at equal pressure, is greater than that of a series continuous-current line.

In many cases the cost per kilowatt-mile of overhead lines is greater than the cost of the underground continuous-current cable system.

Quite apart from the question of cost, the underground system offers definite advantages over the overhead system. It is possible to run underground cables in urban districts where overhead lines would not be permitted. Then the overhead system is more subject to wilful damage, and suffers far more harm from storms and lightning; also the cost of maintenance is much heavier with overhead lines, the cost of maintaining underground lines being an almost negligible quantity. Therefore, other things being equal, where continuity of supply is of the first importance, the underground system will usually be chosen.

Where continuous current is used, the earth can be employed as part of the circuit. The earth may be used either as a permanent conductor for the return current, or it may be used as a stand-by in the event of the failure of one of the insulated lines. In either case, but particularly in the former, this use of the earth on a long transmission is of immense commercial importance. When the earth is used as the return circuit two single lines in parallel would take the place of four, thus reducing the weight of copper and the number of insulators by one-half.

Before making use of the earth connections near London careful experiments had to be made in order to prove that no damage was caused to other users of the soil. These experiments were described by the author in June, 1912. It is of interest that the Board of Trade and the Post Office Authorities will allow the earth connections to be used in the case of a breakdown.

It is a simple matter to make earth connections having a joint resistance of not more than 1 ohm. The total resistance of a line 100 miles long with two conductors of 0.125 sq. in. section, including the resistance of the earth connections, would be 18 ohms, and the number of kilowatts required to keep the line charged would be 180, or 15 per cent. of the capacity of one of the conductors of which the line consists, so that complete duplicate transmission is provided for. With the two lines in series, without the earth connections, the total resistance would be 68.3 ohms, and the number of kilowatts required to keep the line charged would be 683, or nearly 6 per cent. of the maximum capacity of the line.

The chief difficulties in the series system arise in connection with the power station. The generator is subject to rigid restrictions as to size. It is possible to build machines giving 100 to 200 amperes at a pressure of 5,000 volts; it may be possible to go up to a pressure of 6,000 volts if suitable speeds can be chosen. For generators of 300 amperes probably a lower pressure would be necessary, say, 4,000 volts. Consequently, the maximum size of a generator at the present time may be taken to be 1,200-1,500 kw., the larger machines running at 250-300 R.P.M., and the smaller ones at about 400-500 R.P.M. Consequently, to make up a large power unit, it is necessary to couple two or more generators to a single prime mover.

In the case of an hydraulic power station where the turbine speed is suited to the generators, the overall cost of the power station will be similar to that of an alternating-current station. When it is necessary to drive the generators by means of steam turbines or high-speed hydraulic turbines, double-helical gear provides a satisfactory means of reducing the high speed of the prime mover to the most suitable speed for the generators. The power station would, in this case, generally cost more than a power

station of similar size for alternating current. Where the size of the units is very large, the cost of the power house on the series system will be considerably higher than that of a similar station containing alternating-current plant.

The energy lost in the line with constant current will usually be higher than with the constant-pressure systems. The high-load factor with which most long-distance transmission systems must work in order to show commercial advantage makes the large amount of energy represented by the constant losses a comparatively small percentage of the energy transmitted. Where the frequency of the transmission system is different from the frequency required in the distributing circuits, the continuous and alternating-current sub-stations will be equal in cost. In other cases the alternating-current station will usually have the advantage.

There are certain clearly defined cases where the series system offers an advantage; for instance, where a load of about 7,000 kw. had to be supplied at various points in a scattered district, involving a length of approximately 100 miles, by underground mains and where the cost of energy was comparatively small, the series system was the only system commercially possible.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

### AMENDMENTS.

**COLUMBIA.**—The Board of Trade have received a copy of a resolution of the Columbian Ministry of Finance, in which it is provided that all materials which are necessary for the establishment or extension of electric plants, so far as they can be considered as forming part of one and the same installation, and provided that the weight of each importation exceeds 3,000 kg. (about 59 cwt.), are entitled to duty free admission into Columbia. The following list of articles entitled to duty free admission in virtue of the above provision is given in the resolution:—Generators (dynamos) and electromotors, with their rheostats, accessories, and measuring, safety, regulating and governing apparatus; mechanical cranes, with their support blocks and running tracks; wires, cables and bars of copper, uncovered or insulated; insulators weighing over 50 grammes each, and iron supports therefor; cloth and bands of rubber and insulating materials and substances, in forms for use in electrical industry; transformers, and oil for the same; fusible wires of metallic alloys; switches, cut-outs and valves, which are not expressly excepted; accumulators and condensers; lightning conductors; sheets of marble or slate, smooth, not carved nor ornamented, suitable for the mounting of switchboards. The resolution also contains a list of certain materials and elements for electric installations inside buildings in respect of which duty free admission cannot be claimed.

**AUSTRALIA.**—The Australian Commonwealth Customs authorities have issued the following decisions as to the duties to be levied on certain electrical goods on importation. The duties in each case are those leviable under the preferential tariff for British goods:—

Earth detectors:		
Which merely indicate without measuring	...	10 %
Which indicate earth and measure the insulating resistance	...	free
Indicators, ringing:		
Telephone types	...	free
House bell indicators	...	10 % ad val.
Rods, ebonite	...	20 "
Tubes, ebonite	...	20 "
Magnetos for use on home cinematograph or similar machines	...	20 "

**SWEDEN.**—A Swedish Royal Decree provides that private merchants and firms and companies carrying on commercial operations in Sweden may be accorded the right of receiving a refund of Customs duty on the re-exportation from Sweden of goods on which duty was paid when they were imported. The Customs authorities are to grant permission to reputable merchants and firms that avail themselves of this right for certain classes of goods. In the case of some goods, refund of duty is to be allowed only when the person re-exporting them makes a sworn declaration that to his knowledge the goods are not intended to be returned to the country of production or purchase, or to the agent of the producer or of the original seller in another country. In order to receive a refund of duty under this decree, merchants must, when entering the goods for payment of duty, declare their intention of claiming such refund. In this case a special tax, amounting to  $\frac{1}{2}$  per cent. of the import duty, will be levied at the same time as the latter.

**BRITISH GUIANA.**—The Government of British Guiana have been authorised to make regulations for the carrying into effect of the Canada-West Indies treaty, which provided for the establishment of a preferential tariff for British and Canadian goods on importation into the West Indies.

**SOUTH AFRICA.**—The South African Customs authorities have decided that lamp-locks and keys are to be dutiable at the rate of 3 per cent. *ad valorem* if of other than British origin, whereas British goods of the same class are to be admitted free of duty.

## NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

- 12,753. "Supports for the filaments of glow-lamps." WOLFRAM LAMPEN AKT. GMS. (Convention date, June 3rd, 1912, Germany.) June 2nd. (Complete.)
- 12,829. "Generators for high-frequency currents." E. GIRARDEAU. (Convention date, June 3rd, 1912, France.) June 2nd. (Complete.)
- 12,818. "Electrical mine-igniting machines." ELEKTROTECHNISCHE FABRIK SCHAEFFER & Co. (Convention date, February 6th, 1913, Germany.) June 2nd. (Complete.)
- 12,827. "Means for overcoming electrical disturbances." J. S. WITHERS. (E. S. HEURLEY, Germany.) June 2nd.
- 12,827. "Method of construction of electrical heating resistances particularly applicable to electrical furnaces." SOC. GENERALE DES NITRURES. (Convention date, July 26th, 1912, France.) June 2nd. (Complete.)
- 12,833. "Electrical measuring-instruments." BRITISH THOMSON-HOUSTON Co., LTD., and F. HOLDEN. June 2nd.
- 12,811. "Power-transmission and control apparatus on motor-vehicles." J. G. P. THOMAS and THOMAS TRANSMISSION, LTD. (Divided Application on 17,130.12. July 23rd.) June 2nd.
- 12,852. "Adjustable telephone arms." M. J. D. CARTER. June 4th.
- 12,871. "Timing gear in electric-ignition devices." W. RUTHARDT. June 4th. (Complete.)
- 12,852. "Controllers for electric motors and like apparatus." G. ELLISON and M. R. H. MUELLER. (Divided application on 22,959, October 8th, 1912.) June 4th.
- 12,919. "Electric arc lamps." A. H. RAILING and A. E. ANGLD. June 4th.
- 12,935. "Switch arrangement for electric heating apparatus." R. WEATING and FERRANTI, LTD. (Divided application on 17,837, August 1st, 1912.) June 4th.
- 12,936. "Electric motor starters." J. ROTHMAN and FERRANTI, LTD. June 4th.
- 12,942. "Wireless transmitter and automatic recording apparatus." W. A. FREEMAN. June 4th.
- 12,956. "Multipole ignition magnet with rotary field magnets." NEUFELD and KUNKE. (Convention date, January 13th, 1913, Germany.) June 4th. (Complete.)
- 12,966. "Calling-device for telegraph or telephone circuits." C. W. LUND and NEW PHONOPE TELEPHONE Co., LTD. June 4th. (Complete.)
- 13,006. "Magneto-electric ignition apparatus." UENTERBERG and HELMLE. (Convention date, March 15th, 1913, Germany.) June 4th. (Complete.)
- 13,019. "Mechanical and electrical device for starting and stopping a stop watch, primarily intended for timing motor-cycle and motor-car racing, but applicable to all other forms of racing without alteration." H. R. HAIGER. June 5th.
- 13,023. "Form of electric dimming switch." L. HULBERT. June 5th.
- 13,034. "Electrically-operating governors for marine engines." T. PARKEE. June 5th.
- 13,046. "Means for use in controlling electric motors." ELECTRIC CONSTRUCTION Co., LTD., and N. PENSABENE. June 5th. (Complete.)
- 13,053. "Apparatus for detecting and magnifying minute electric impulses." T. HARVEY. June 5th.
- 13,054. "Receivers for wireless telegraphy." T. HARVEY. June 5th.
- 13,063. "Electrically-heated flat-iron." F. S. RIPPINGILLE. June 5th.
- 13,064. "Electric railway signal relay to be operated by alternating or pulsating currents." A. H. JOHNSON and W. J. THORROWOOD. June 5th.
- 13,065. "Calling or alarm apparatus for use in wireless signalling." W. T. DITCHAM and GRINDLE-MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD. June 5th.
- 13,075. "Automatically reversing overhead collector for electric trains and the like." P. ALEXANDER and R. F. STEWART. June 5th.
- 13,084. "Systems employing electric motors controlled synchronously from a distance." J. L. ROUTIN. (Divided application on 735/13, January 9th.) June 5th. (Complete.)
- 13,089. "Telegraphic transmission." C. ECHOT. June 5th. (Complete.)
- 13,093. "Safety device and signals for electric cars, motors, motor-buses, and other mechanical or horse-propelled vehicles." E. G. H. PYLE and H. PYLE. June 5th.
- 13,106. "Cooking apparatus." A. F. BERRY. June 5th.
- 13,107. "Cooking ovens." A. F. BERRY. June 5th.
- 13,109. "Apparatus for covering the silvering of glass by the galvanic deposition of a protecting metal." J. J. DECLERE, A. L. E. GREY and G. PASCALIS. (Convention date, June 6th, 1912, France.) June 5th. (Complete.)
- 13,115. "Control apparatus of electrically-driven hoists or other machinery fully or partly automatically operated on the potentiometer principle." J. WAGNER. June 6th.
- 13,142. "Electric incandescent lamps." C. W. READ. June 6th.
- 13,143. "Loud-speaking telephonic apparatus." E. A. ORAHAM. June 6th.
- 13,144. "Movable radium ray carrier for medical purposes." O. WALKER. June 6th. (Complete.)
- 13,145. "Devices for medical administration of electricity." J. SCHNEIDRIZIK. June 6th. (Complete.)
- 13,148. "Controlling electric motors for ship propulsion and other purposes and means therefor." SIEMENS-SCHUCKERTWERKE G.m.b.H. (Addition to 2,186 of 1913.) June 6th. (Complete.)
- 13,159. "Electric fuse switches." A. L. WEEKES. June 6th.
- 13,175. "Portable electric lamps." G. F. HITZELBERGER and NEW BRITISH EVER READY Co., LTD. June 6th. (Complete.)
- 13,177. "Process for coating metal plates and the like." S. O. COVERCOLENS. June 6th.
- 13,242. "Electrical train-control system." W. B. MURRAY. June 7th. (Complete.)
- 13,243. "Electrical train-control system." W. B. MURRAY. June 7th. (Complete.)
- 13,249. "Electric light fittings." G. VALE and R. H. BERT. June 7th.
- 13,250. "Electric furnace with rotary flame for the treatment of gases and steam." I. MOSCICEI. June 7th. (Complete.)
- 13,262. "Ammeters." W. DUNDELL. June 7th.

## 1912.

- MEANS FOR OBTAINING A PROTECTIVE LAYER ON IRON AND STEEL ELECTRODES AND OTHER ARTICLES. A. E. GIBBS. 15,852. July 6th.
- SYSTEMS OF CABLE WORKING FOR ELECTRIC TELEGRAPHS. J. GOTT. 22,964. October 1st. (May 2nd, 1912.)
- ELECTROMAGNETIC APPARATUS FOR DRIVING THE PENDULUMS OF ELECTRIC CLOCKS. A. JOBS. 21,313. October 24th. (October 26th, 1911.)
- ELECTROMAGNETIC SUSPENSION DEVICES. B. GRAMMIGER. 24,459. October 26th. (October 27th, 1911.)
- METHOD OF UNITING SHEETS OF BRASS, ALUMINIUM AND OTHER METALS OF HIGH CONDUCTIVITY FOR HEAT. N. PROSTLER and Ges. für Elektrotechnische Industrie. 25,987. November 12th.
- SELECTIVE SIGNALLING APPARATUS FOR TELEPHONE AND TELEGRAPH INSTRUMENTS. H. E. R. ROOSE and W. T. FINLAY. 23,483. December 10th.
- ELECTRIC RELAYS. F. H. NICHOLSON. 30,053. December 31st. (March 8th, 1912.)
- AUTOMATIC TELEPHONIC APPARATUS. B. DEGENHARDT, née RENTZ. 3,978. February 16th.
- TELEPHONY. S. G. BROWN. 4,067. February 17th.
- MEANS FOR PRODUCING ELECTROMAGNETIC WAVES OF HIGH GROUP FREQUENCY, AND IN THE APPLICATION THEREOF TO WIRELESS TELEPHONY. W. T. DITCHAM, H. G. MATTHEWS and GRINDLE-MATTHEWS WIRELESS TELEPHONE SYNDICATE, LTD. 6,486. March 15th.
- DISTRIBUTION OF ELECTRIC ENERGY. E. G. WATERS. 11,559. May 15th.
- ELECTRIC CURRENT DISTRIBUTION SYSTEM. E. HLOUSTEID. 11,684. May 15th.
- METHODS OF EQUALISING THE LOAD ON SYSTEMS OF SUPPLY FOR DIRECT-CURRENT ELECTRIC MOTORS. S. ECKMANN. 11,597. May 15th.
- WIRELESS TELEGRAPH OR TELEPHONE. H. MERTON. 11,714. May 16th.
- DEVICES FOR DAMPING THE OSCILLATIONS SET UP IN ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES. SIEMENS-SCHUCKERTWERKE Ges. 11,957. May 20th. (May 20th, 1911.)
- ELECTRIC LAMP APPARATUS FOR SIGNALLING BY SEMAPHORE AND LIKE CODES. C. W. G. HILL. 11,997. May 21st.
- ELECTRIC HEATING DEVICE. H. S. MARTIN. 12,075. May 21st.
- APPARATUS FOR OPERATING ELECTRIC SEARCH-LIGHTS FROM A DISTANCE. SOC. ANON. OFFICINE GALILEO. 12,449. May 25th. (May 31st, 1911.)
- STORING AND CHARGING OF ELECTRIC HAND-LAMP AND LIKE SECONDARY BATTERIES, AND APPARATUS THEREFOR. W. M. MAUTICE. 12,505. May 28th.
- ELECTRICAL RESISTANCES MADE IN THE FORM OF WOVEN NETS OR MATS. A. B. ROSE. 13,133. June 5th.
- MEANS FOR SUPPORTING ENGINES MORE PARTICULARLY APPLICABLE TO SELF-PROPELLED VEHICLES. BRITISH THOMSON HOUSTON Co. (General Electric Co.) 13,757. June 12th.
- MANUFACTURE OF ARTICLES OF CERAMIC REFRACTORY MATERIAL. G. B. SCHWERIN. 14,235. June 18th. (Addition to 2,626 of 1911.)
- APPARATUS DESIGNED PRIMARILY FOR STARTING AN INTERNAL-COMBUSTION ENGINE BY MEANS OF ELECTRIC ENERGY. E. V. HARTFORD and L. MASTRANGEL. 14,929. June 26th. (July 27th, 1911.)
- ELECTROMAGNETICALLY-OPERATED SWITCHES, CUT-OUTS AND THE LIKE. SIEMENS BROS. DYNAMO WORKS, LTD. and R. BROOKS. 15,659. July 4th.
- ELECTRICALLY-HEATED WEARING APPAREL, SUCH AS GLOVES, MITTENS AND THE LIKE. A. L. CAYTON. 18,980. August 6th. (September 9th, 1911.)
- IRONCLAD ELECTRIC SWITCH AND DISTRIBUTION BOARDS. H. H. BERRY and W. J. MARKHAM. 18,349. August 9th.
- GENERATOR REGULATORS. W. T. LAKE. (J.B.M. Electric Co.) 18,425. August 10th.
- ELECTRIC FLAME ARC LAMPS OF THE MAGAZINE TYPE. H. F. ANGLD. 18,908. August 19th.
- ELECTRIC SWITCHES. A. PAGE. 18,980. August 19th.
- FURNACES OF THE TUNNEL OR CHANNEL TYPE. E. C. R. MARKS. (Electric Smelting and Aluminium Co.) 19,007. August 27th.
- CONTACT FINGERS OR BRUSHES FOR ELECTRIC CONTROLLERS AND LIKE PURPOSES. W. G. H. COX. 19,740. August 29th.
- ELECTRIC INDICATING APPARATUS. TYLER APPARATUS Co. and E. H. BISHOP. 21,179. September 17th.
- ELECTRICAL REGULATING APPARATUS. SOC. ED. GABREAU et P. DELANX. 21,813. September 25th. (February 9th, 1912.)
- INDICATORS FOR ELECTRIC SWITCHES. H. H. BERRY. 22,593. October 3rd.
- PRODUCTION OF LIGHT AND OTHER RADIATIONS. S. O. HOFFMAN. 22,972. October 8th.
- PORTABLE SELF-CONTAINED ELECTRIC TRAIL-TALE AND DASHBOARD LIGHTS FOR MOTOR VEHICLES AND THE LIKE. W. H. COLE. 23,732. October 17th.
- FITTING ELECTRIC LAMPS TO FIREMEN'S HELMETS. W. C. ANGEL and E. A. CREASE. 23,814. October 18th.
- ELECTROMAGNETIC ORE-SEPARATORS. O. RIETKÖTER and P. CLAES. 24,435. October 25th.

## 1913.

- CONNECTING TERMINAL FOR HIGH-VOLTAGE CIRCUITS. E. BEEFELY. 119 January 2nd.
- COMBINED MECHANICAL LOCKS AND ELECTRIC CIRCUIT BREAKERS FOR LIFT DOORS AND GATES. ELECTROMOTOR EQUIPMENT Co. and W. B. BIENDER. 1,438 January 17th.
- DEVICES FOR ELECTROCUTTING ANIMALS. H. SMITH. 2,152. January 27th. (February 3rd, 1912.)
- APPARATUS FOR ELECTROCUTTING ANIMALS. H. SMITH. 2,159. January 27th. (February 17th, 1912.)
- PROCESS OF MAKING AN ALKALINE GELATINOUS ELECTROLYTE FOR GALVANIC BATTERIES. G. S. ENGLE. 2,595. January 29th. (October 8th, 1912.)
- COPPER OXIDE PLATE FOR USE IN ELECTRIC BATTERIES AND PROCESS OF PRODUCING SAME. G. S. ENGLE. 2,396. January 29th. (October 8th, 1912.)
- DEVICES FOR AUTOMATICALLY ADJUSTING THE TIME OF IGNITION IN INTERNAL-COMBUSTION ENGINES. ROBERT BOSCH (Firm of). 4,693. February 24th. (March 14th, 1912.)
- PENDULUM INDICATORS FOR USE WITH ELECTRIC BELL SYSTEMS OR FOR LIKE PURPOSES. I. H. PARSONS and H. R. WADDINGTON. 4,890. February 26th.
- ELECTRIC ALARM SIGNALLING APPARATUS FOR ORDNANCE. FRIED. KRUPP AKT. Ges. 5,572. March 10th. (April 22nd, 1912.)
- WINDINGS OF ALTERNATING-CURRENT DYNAMO-ELECTRIC MACHINES. ALLMANDA Svenska Elektriska Aktiebolaget. 7,776. April 2nd. (April 6th, 1912.)

## PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

## 1911.

DYNAMO-ELECTRIC MACHINES. J. LECOCHÉ. 22,766. December 21st. (May 23rd, 1912.)

**Driving Chains.**—MESSRS. HANS RENOLD, LTD., have sent us particulars of recent tests on two identical gear-cutting machines in their shops, one belt-driven and the other fitted with their silent chain drive. It is found that the chain-driven machine gives 60 per cent. more output for 10 per cent. more power, or at equal output requires 14½ per cent. less power. It is claimed also that the tools last longer. The drives fitted with their chains are increasing at the rate of about 25,000 H.P. a year.

# THE ELECTRICAL REVIEW.

Vol. LXXII.

JUNE 27, 1913.

No. 1,857.

## ELECTRICAL REVIEW.

## THE L.C.C. TRAMWAYS REPORT.

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By the time that this article appears in print our readers will be well aware of the result of the year's working of London's tramway system. This result is welcomed in different ways by different papers. The fact that under company management there would have been a surplus for dividends, renewals, and depreciation (but probably dividends) of £739,053, is hailed with delight by advocates of municipal ownership. The fact that £738,556 of this is swallowed up by debt charges, leaving only £497 net surplus, is hailed with a great air of "I told you so" by the opposite party. We have, then, at once, the first and greatest argument against public ownership—that is, that any result at all is used as a peg to hang party politics upon. Moreover, in the case of public ownership of property of any kind, the caprice of the individual is as powerful as it is in private ownership; and continuity of policy is difficult to preserve, because the process of educating a kaleidoscopic succession of inexperienced people aspiring to local honours has to be repeated over and over again.

Apart altogether from the political aspect of the matter, the financial result cannot be regarded as satisfactory. By the Council's own resolution the renewals fund should receive a contribution of £150,309—and it gets £497. The primary cause of the whole trouble is to be found in the enormous and unnecessary capitalisation of the system. The installation of the conduit system involved a vast expense which might have been avoided by the use of the overhead system; and in the Minutes now under consideration we learn that the Bermondsey Metropolitan Borough Council refuses its consent to the use of the latter in its area. If Berlin can put up with the overhead system, surely Bermondsey should be able to do so. Aberdeen and Liverpool, both stately cities, use the trolley. It ought not to be possible for obstacles to be placed in the way of the development of a huge and necessary system of rapid transit in this unreasonable manner. The use of the conduit system renders the roadways at points such as the Elephant and Castle positively dangerous to pedestrians and horsed vehicles. The road is covered with interlacing steel plates, all highly polished and slightly rounded, half of which are due to the conduit.

The cost of street widenings has added much to the capital expenditure, and the only offset against this burden is the fact that it is yearly diminishing and must, in course of time, disappear. The fact that the tramways have to pay for the maintenance of the middle part of the roadway, which they do not use, is a long-standing grievance, which is, in general, admitted to be just.

We say "in general." Our contemporary *Engineering*, in its issue of June 20th last, does not admit the justice of the complaint at all. It refers to the tramways as "a system of transport which is being rapidly rendered

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## THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

# 1913 EDITION.

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obsolescent by the march of progress." It refers, none too graciously, to what it describes as the "whining" and "peevish whimpering" of those who are responsible for the construction and working of the tramways. Everyone knew, it is said, that these charges would have to be met, and in this knowledge promises were made of lavish financial assistance to the rates. Our readers will remember that we have never failed to point out the unfairness of saddling the tramways with such liabilities, nor have we ever countenanced the paying over of either tramway or electricity profits in aid of rates. The case of the railways is entirely different. They have a monopoly of the use of their track, and they can, and generally do, charge higher fares. Farther, they do not have to repay their capital, but always issue more for extensions—sometimes for objects properly chargeable to obsolescence. They pay for the property they demolish in constructing their lines, and rightly so, because they leave in its place a tract of private land. The tramways, on the other hand, leave a better road, and a wider, than existed before; and it is not private, but is there for the use of everyone—including their severest competitor, the motor-bus. *Engineering* objects to the use of stone sets between the rails, and we candidly admit that we do not know why they are necessary. We seem to have seen, however, stone sets recently laid in Oxford Street and Holborn, with which the tramways have not been concerned. The contention as to injury of road surfaces is summarily dismissed with the remark that the motor-buses are no more destructive than the fast motor delivery vans. It should be remembered that there are many more of them.

For good or for ill, we have got the tramways, and we must make them pay. The money has been spent, and must be repaid. Competition must, therefore, be made fairer, and there must be no factitious difficulties placed in the way of the undertaking, either as regards development and extension, or working. We note that between January 1st of this year and June 10th the police issued 29 summonses, the alleged offence being failure to stop in time to avoid an accident. Of these 29, no fewer than 19 were dismissed: in one case the magistrate awarded a guinea costs against the police.

It should be borne in mind that the tramways are heavily burdened with the obligation to carry workmen at fares which entail an enormous annual loss; if the tramways were shut down, would the motor-buses fill their place in this respect? We think not. The cost of providing a night service—a great boon to many workers—and the loss on half-penny fares, are other items contributing to the deficit. The advocates of motor-buses fail to take account of the heavy handicap imposed upon the tramways as a public undertaking, from which their rivals are free, to say nothing of the fact that at least twice as many buses would be required to deal with the same traffic as the tramcars in fine weather, and four times as many in wet.

London has no local patriotism. Let anyone try to start and work a system of motor-buses in Glasgow: nobody is likely to do so, for it could never be made to pay. When the horse-drawn tramcars became public property, an attempt was made to compete with them by means of horse-buses. The attempt met with no success at all.

The present financial position is unsatisfactory, but it cannot be said to be unnatural, or even unexpected. There is no need to be despondent about the future, provided that the concern continues to run on business lines. There is room for all systems of traction in London—train, tramcar and motor-bus—and in the course of a few years they will all settle down nicely into their stride. Censure is equally out of place with "peevish whimpering."

Let all extensions be made as cheaply as possible. Let none be made that will not, either now or in the near future, pay their way. Let no money be spent outside the undertaking, even if there be a surplus. Finally, let the people of London support what is their own. If these things be done, the position cannot fail to improve.

### Ministers and Marconis.

THE publication of the interim report and minority reports of the Marconi Committee enabled the House of Commons last week to debate the issue, so far as Ministers were concerned. Efforts by old Parliamentary hands to carry the discussion on a high plane and remove it from the party groove were unsuccessful. The party character of the Committee proceedings was reflected in the reports, and the House eventually decided the issue by a party vote.

The essential difference lay in the expression of regrets. The Ministers concerned expressed theirs in no measured terms, and it was desired by the Opposition that the House should record their regret also. As this would have been a vote of censure which the majority were not prepared to endorse, it was decided to be content with the expressions of the Ministers. The sincerity of those expressions is beyond question, and the generously minded would hardly desire to press matters further. The Ministers have had a lesson, and the whole incident should have a healthy effect on public life. Accused of corruption by irresponsible, and of indiscretion by responsible, persons, the Ministers, unhappily, attached undue importance to the former, and only tardily realised the gravity of the latter. The incident ends with the recognition of the fault and the expression of regret, and it only remains to draw useful lessons from it. One of these lessons is to emphasise the utility of the expert. Politicians whose activities and interests extend over a wide sphere should recognise their limitations, and acquire the habit of leaning to some extent at least on others. In their confessional speeches both the Attorney-General and the Chancellor of the Exchequer revealed the extent to which they had absorbed a view of wireless telegraphy, which may be described, without offence, as the "Marconi atmosphere." Sir Rufus Isaacs thought wireless telegraphy and Marconi were synonymous terms. In the midst of his own troubles, Mr. Lloyd George interpolated a quite unnecessary reference to the illustrious inventor and the verdict of history. These are features upon which from the nature of the case they could not be fully informed. Wireless telegraphy as a science is one thing; as a business it is another. There are experts capable of properly appraising the merits, historically, scientifically and financially. Their judgment would be free from bias by reason of any mysteries or marvels upon which the lay mind loves to dwell. Amongst the mass of evidence given before the Committee, that of Mr. Lloyd George's own broker stands out in its clearness and frankness. It shows the value of the expert with a sense of responsibility and illustrates the general lesson which we wish to draw, though necessarily our remarks apply more particularly to the scientific and engineering side. The layman and the politician must cultivate a mistrust of his own judgment on points beyond his experience and place himself more fully in the hands of the best experts that are available on any technical or scientific question that may present itself for solution. The earlier application of this principle would probably have avoided much unpleasant controversy, and the failure to apply it in the future will be inexcusable.

COPPER prices have had a very nasty fall within the past week or so, and the market has at times verged upon a condition of semi-demoralisation. For some little time consumers have not been at all too well satisfied with the position, even though it was not easy to put a finger on a really weak spot, the favourite argument being that the statistics issued for the information of the trade were not reliable. There certainly is not, however, the slightest ground for impugning their good faith, and all attempts to discredit their accuracy have failed in the matter of proof. As to surmise, it is always easy to cast doubts, and a much more difficult matter to carry conviction. Really there is not the slightest reason to be sceptical as to the essential correctness of the European returns, and the American statistics are also quite reliable so far as they go; but in times such as those just passed through there is no

room for even moderate optimism, the market having been infected with rank distrust of everything, and selling pressure on a large scale finding an entire lack of support on the part of strong houses whose attitude has for a long period been one of friendliness towards the metal. What really brought about the *débacle* was a succession of unfavourable outside influences, notably the weakness of the New York and Paris Bourses, on each of which drives were made against copper shares, especially Tintos and Amalgamateds; this, together with the restriction of credit facilities and the heavy realising of speculative commitments, combined to bring about a flood of selling, and prices broke sharply.

So far as the statistical situation is concerned, matters have improved very considerably this year, for the world's visible supply has decreased from 98,101 tons at the end of January to 71,809 tons at the end of May, but it may well be considered whether the best of the returns has not now been seen. For one thing, the production in the United States is apparently increasing, notwithstanding certain local difficulties, caused in part by the Mexican Revolution, and output seems to be headed for a fresh new record, the highest figure yet reached being 65,012 tons in August of last year, while the total last month was 63,089 tons. This is one thing which gives pause to those who entertain a moderately good opinion of the market. Another is the huge deliveries of the last three months—68,877 tons in March, 73,239 tons in April, and 71,809 tons in May. It is felt, and with reason, that the world cannot go on taking copper at this rate. The total American home trade deliveries and exports for the five completed months of this year were 323,737 tons, against 291,567 tons last year, an increase of some 32,000 tons, or 6,400 tons a month. The average of March, April and May, is, however, over 66,000 tons a month, and this surely implies a falling off in the takings during the next few months, even though consumption remains as good as ever. With a reduction in the deliveries by the American producers, we shall be brought face to face with increasing stocks either in America or Europe, and either contingency in the present temper of the markets might be sufficient to give prices a further twist downwards. It is a question, however, whether the events of the past week or so have not pretty well discounted bad figures at the end of this month, in which event, especially if the outside conditions which have been such a drag on the market improve, there might easily be a rather sharp recovery.

The reduction in prices recently declared by the Amalgamated Copper Co., and later followed by other leading interests, further unsettled the market, not so much because of the cut, but because the reduction was not sufficient to stimulate buying. At all events, the producers have not, so far, made any sales worth considering; and what business is about, has gone to the dealers. That there is buying to be done, however, nobody doubts, and a restoration of confidence in trade and financial circles would work wonders as regards the appearance of the market, which, moreover, is greatly oversold speculatively.

**The L.C.C. and its Employés.** THE Central Conciliation Board, consisting of representatives of both the Council and its employés, has just prepared an amended scheme for the tramway department. The scheme has been presented to the Council by the Highways Committee, which is responsible for the working of this section of the Council's activities.

The questions which may be dealt with under the new scheme relate to differences in rates of wages, hours of labour and general conditions exclusive of discipline and management. It is proposed to classify the various workers into four sections: one dealing with traffic, one with rolling stock, one with the electrical operatives, and the fourth with permanent way and buildings. Each section is to have 12

members, six appointed by the Council, of whom not more than two are to be officers of the Council and the remaining six are to be chosen by the men. For the purpose of choosing their representatives the employés in each section are divided into groups, each of which elects one or two representatives. Each side selects its own secretary, and the arrangements for electing the representatives are left in their hands. On the men's side those nominated must belong to the group they wish to represent, and must have the support of six or, in some cases, 20 of their colleagues. At each meeting of the sections each side appoints its own chairman, and after discussions the sides vote apart, all binding decisions being arrived at by agreement between the two sides. If after full discussion the two sides of a board fail to arrive at any agreement, the matter is left for decision by a court of arbitration, to be appointed by the Board of Trade; each side of a sectional board is to have the right to present its case, but, except in the case of a joint request by the two parties and the consent of the Board of Trade, no legal assistance is to be obtained.

The sectional boards are not to be called on to meet oftener than every two months, and the question of payment for loss of time and expenses of the workers' representatives is left to their discretion.

In the event of any decision arrived at by any of the sectional boards involving increased expense, the matter is to be brought before the Council for its decision by the Highways Committee within 28 days.

The scheme is to remain in force until six months after March 31st, 1916, unless terminated earlier by mutual consent. No decision arrived at by a board is to be reopened for a period of 12 months.

We think that the scheme outlined above has in it the groundwork of an acceptable working plan. Much will depend upon the spirit in which the parties enter upon it, but given the determination on both sides to be fair and reasonable, it should provide a means for settling the disputes which are sure to arise in any large undertaking. This principle of conciliation boards is now on its trial; if it succeeds it may be found applicable to smaller undertakings where disputes of the same class have to be settled.

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## THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION'S ANNUAL CONGRESS.

(Concluded from page 1013.)

MR. FRED BLAND, M.I.Mech.E., gave a *résumé* from a manufacturer's standpoint of "Tramway Track, 1883 to 1913"—a subject with which he was familiar, having been closely identified with tramway construction for 30 years. He mentioned that steel-tired wheels had been generally adopted in preference to chilled iron, an American importation to which he had been opposed from the commencement. Since 1907, 125,895 tons of British Standard section rails had been rolled in this country, as against 38,537 tons of other sections; but the matter was again under revision by the Engineering Standards Committee. The general tendency was towards more massive construction. Now manganese steel was the rule for points. The paper contains a mass of information regarding old-time practice, showing also the tendencies of modern designs.

In submitting his paper, Mr. Bland said he would like the members, as tramway men, to consider the following points:—

1. Why should they have so many rail sections? Why not have two or at the outside, three, say 6 in., 6½ in., and 7 in., and adopt these generally? This would simplify matters for manufacturers, and there would be cheaper production and improved deliveries, as they could stock with some degree of safety. Personally, he selected No. 4, 7 in. rails as the best standard at present.

2. Adopt standard radius points in renewals; take 150 ft. radius as the standard as experience showed that this radius would replace their old loops the most economically. Then have, say 100 ft. and 200 ft. for special work, and either 200 ft. or 240 ft. equilateral for diamond loops.

3. Adopt standard types of points—automatic and open mates on country roads; double-tongue points in towns (where the points were constantly cleaned) and upon all facing points.

4. Should the tongue be fitted with a heel pin, or be pinless? He advised a pin with a heel adjuster, as the tongue could not then work forward.

5. Raise all grooves of open points and crossings on turn-outs, &c., to ½ in. deep, but in double junctions where cast connected crossings were used, as at present, he suggested carrying the raised groove throughout, and, if they would pay more, then carry the grooves out square across the track. This would ensure easier running.

6. He advocated the use of a rail with a raised groove rolled in for curves, &c.

7. What type of renewable guard was most suitable for sharp curves?

8. On emergency crossovers, otherwise than at terminals, abolish the old crossings, and put in an unbroken tread, or use a long rail and bolt on wing crossings for the crossover track. They would thereby reduce their repairs and give easier running.

MR. H. M. SAYERS (Brazil), in opening the discussion, said the main thing on which improvements were required, in his view, was the special work, points and crossings. During the last three years he had been using crossings for grooved rails made by two English manufacturers, and for Vignoles rails by an American manufacturer. He had had to send all the crossings into the machine shop before they could be put into the track, because the raising of the grooves was insufficient or misplaced, so that the wheel flanges caught the points of the diamond. Manufacturers succeeded very well in constructing special work for curves, crossings and junctions, where they were given the full elements. During the period mentioned he had had to put in about 96 crossings and junctions of various sorts, all of which were constructed in England—the drawings being sent from Brazil—and in very few cases had any adjustment had to be made when they came to fit them together. He was very well satisfied as to the groove rails with the British standards, but all the heads should be similar in width and inclination, so that they would butt up and meet.

MR. W. B. PICKERING (Sheffield) said that the difficulty of renewing point tongues was a matter which tramway engineers themselves were responsible for in great measure. The manufacturers to-day turned out tongues from the same pattern which were absolutely interchangeable. In regard to the standardisation of the rail section, he hoped that the Standards Committee would not increase the present number of sections. The question of raised grooves on curves was a very debatable one. He had talked with engineers abroad, particularly where the raised groove had been carried right through the grade of the curve, and he believed they were gradually dropping the idea altogether.

MR. E. H. EDWARDS (Atherton) said that whereas in 1882 the length of points was 7 ft. 6 in., they had got the length to 15 ft. in 1912. There must be some advantage to the manufacturer of points, but there was not a great amount of advantage to the user, and they were getting very expensive. His experience of silencers had not been satisfactory.

MR. F. HEWER (Lorain Co.) said it had been proved in several places that insert work stood up and was more economical than solid manganese. He thought that 9 in. manganese tongues in practice gave bad results. Manganese steel, although having high resistance to abrasion, had a tendency to flow, or cold-roll, and did not possess the resilience necessary for a tongue, unless it was reinforced to give lateral stiffness. The ordinary single tongue in manganese steel was liable to be bent by the car wheel and would cause derailment.

MR. CHARLES FURNES (Blackpool) said that more than 70 per cent. of the trouble experienced by tramway managers in track maintenance was due to bad foundations; he had endeavoured to persuade the Blackpool surveyor to lay his track on a cushion foundation, *i.e.*, placing a timber medium between the rail and the concrete. They had a length in Station Road, and he was watching it very closely; there had been no movement of the rails during the last 2½ years, since the track was laid down. It was laid on timber about 9 × 5, and was a very good job.

MR. R. HUMPHRIES (Black Country) said they had a great deal of track that ran over pit subsidences, and in some cases they lost their concrete years ago. The track was originally laid on a concrete bed, but now they ran on sleeper construction for miles, and they found that the permanent way laid on that type of construction gave them less trouble, the cars ran far sweeter, and they could maintain it far cheaper than the tracks where concrete was used. Since they had scrapped their chilled wheels and equipped everything with tired wheels, the trouble on their special work had wonderfully decreased.

MR. C. G. TEGEMEIER (British Electric Traction Co.) said that, as chairman of the Auckland Tramways Co., he could corroborate the remarks of previous speakers upon the foundation of track. Sleepers laid upon broken-up masses of concrete formed an ideal track. The running of the cars was much more easy and the cost of repairs very much less. The main street in Auckland was originally the bed of a creek. There was about 20 ft. of made ground on which the track was laid. The track, originally laid upon longitudinal concrete sleepers, subsided, and the remedy was to reconstruct the track entirely, driving into the ground wooden piles 20 ft. to 40 ft. in length. These were driven until they reached a solid bottom, and upon them a longitudinal 18-in. sleeper was put. Between the sleeper and the base of the rail, which was laid over the sleeper, there was about 2½ to 3½ in. of concrete. That was about seven years ago. Now the concrete between the rails and the longitudinal wooden sleeper, resting upon the 20 to 30-ft. wooden piles, had all disintegrated, and the track had to be reconstructed again. The method now was to put an additional long wooden sleeper upon the top of the previous one, and to lay the rail direct upon the wood, resting upon the wooden piles. The cost of course had been very considerable, but when the work was completed, they thought they would have a track that would last a good many years. There was no concrete used in the process.

MR. A. W. A. CHIVERS (E.T.Co.) said the method of construction advised by the permanent-way engineer of the British Electrical Federation was a combination of the concrete foundation with sleepers, and had been so devised that they got a very sound foundation, which was very satisfactory for heavy vehicular traffic, and at the same time there was sufficient resilience to give a

very even running. That track was advised with a view to meeting all conditions where they were not subject to subsidences.

MR. BLAND, in reply to the discussion, said that they did not want to make any longer points, but they had to meet the demands of engineers. As to inserts and manganese, the Sheffield manufacturers made both, and it was immaterial which was used. He thought that if maintenance engineers would consult constructional engineers on the actual road itself, they would possibly meet difficulties better.

On Thursday evening the members of the Association were the guests of the Mayor and Corporation at dinner at the Imperial Hydro. The Mayor (Councillor M. G. Wilde) presided, and was supported by members of the Corporation and officials of the Association.

The MAYOR proposed "The Tramways and Light Railways Association," and said it was appropriate that the Congress should be held in Blackpool, as the borough was almost the pioneer of electric street tramways, as it was also a pioneer of the lighting of streets by electricity. MR. HARRY ENGLAND responded to the toast.

THE HON. ARTHUR STANLEY, M.P. (chairman of the Association), proposed "The Blackpool Corporation." ALDERMAN BRODIE (chairman of the Tramways Committee), in responding, said the electric cars had been running in Blackpool for about 28 years. He had thought that no other town would adopt the conduit system, but London had seen fit to do so. The conduit was a costly system, and the overhead system was the only one that would pay at the present time. COUNCILLOR COLLINS (ex-Mayor), who also responded, said the members would readily understand the difficulty of making a concern such as the Blackpool tramways successful when they were told that they had to deal with 300,000 people at one time of the year, although at another time they had to meet the requirements of a population of only 60,000. They had a capital expenditure of half a million, and last year their cars travelled a million miles and carried 1½ million passengers. Tramways had led to the extension and improvement of rural areas, and it was likely that in the future they would perform an even more important function than they had done in the past.

MR. CHARLES FURNES (manager of the Blackpool Corporation Tramways) also responded, and pointed to the fact that the Corporation could afford to lay up during nine months of the year practically 75 per cent. of the rolling stock.

SIR EDWARD WHITE (chairman of the Highways Committee of the L.C.C.), who proposed "The Mayor," said that unfortunately in London they had very serious competition with the motor-buses, and the result was that there had been a considerable falling off in their revenue, but he hoped that it was only temporary, and that in the near future they would recover the prosperous position they formerly held. He strongly advised Blackpool not to have ½d. fares. In London they carried 26 per cent. of the passengers at ½d. fares; they also carried a large body of workmen by early cars, and they ran all-night cars; on those services alone they were losing £100,000 a year.

The MAYOR briefly acknowledged the toast, and the proceedings ended.

The Congress resumed on Friday, June 13th, under the chairmanship of the Hon. Arthur Stanley, M.P.

MR. HARRY ENGLAND presented his paper on "Railless Traction Legislation," and explained that he held no brief for railless traction; he did not entertain the idea that railless trolley cars were superior to motor-buses under all conditions, and certainly he would not admit the converse. Touching upon road maintenance, he said that whether their leanings were to motor-buses or trolley cars they would agree that a tax which was applicable to one particular form of mechanical traction only was inequitable. Further promotions and extensions of the railless trolley system would be governed largely by the amount of the tax which Parliament put upon the industry for road maintenance purposes. By some means or other all forms of traction should pay for the road they used, according to the weight and speed of the vehicle, and the mileage run. He referred to the mutilation of the Government Light Railway Act last year, whereby the attempt to facilitate the construction of railless trolley systems was defeated, and the position remained unchanged. There was a crying need, he said, for legislation to cheapen and accelerate applications for powers to run trolley cars, which, at present, cost practically 12 months' time and hundreds or thousands of pounds, so that companies were driven to use motor-buses in preference to applying for powers. Eighteen private Acts had received the sanction of Parliament, 15 promoted by local authorities and three by companies. The time allowed for completion ranged from two to five years. The type of vehicle was generally left open, subject to the approval of the Board of Trade. Powers to carry goods were usually restricted, only Brighton and Stockport having full powers; as the railless systems penetrated into districts where other transport facilities were lacking, adequate powers in this respect were very desirable, more especially as the railless system enabled connection to be provided to manufacturers' premises at small cost. It would be to the advantage of the railways to cease their opposition to these facilities, as road motor vehicles were rapidly multiplying and would capture much of the railway traffic if the railways did not co-operate with the railless trolley promoters. Several local authorities had taken powers to use trolley vehicles for the conveyance of sanitary refuse, road metal, &c. The powers of the Board of Trade in some cases to sanction the extension of authorised trolley vehicle systems were valuable, and should be incorporated in all future Acts. Powers to convert the system into a tramway when the traffic

proved sufficient would be useful. Facilities for through running and interchange of traffic between adjoining systems should be obtained. Usually no provision was made for running trailers. Practice varied as regarded the cost of road widenings and paving. Railless systems ought not to be singled out from all other forms of road traffic for a special road tax, which was strongly objected to; in several cases a liability to this end had been laid upon the promoters. When this liability was strictly defined (as at Rhondda,  $\frac{1}{2}$ d. per car-mile) the cost of operating trolley cars could be definitely estimated, but where the liability was indefinite investors would not provide the necessary capital. Railway authorities should not be given special protection against the owners of trolley vehicles using their bridges, and the same applied to county bridges, the mains of gas companies, and sewers, for heavy motor traffic was increasing, and was likely to do far more damage than trolley vehicles. The removal of snow from the road was the duty of the local authorities, and should not be imposed upon railless traction systems. The competition of motor-omnibuses ought to be prohibited on all routes where trolley vehicles were installed, as in the Brighton Corporation's Act. The author proceeded to quote in abstract the Acts relating to the 18 undertakings referred to, and gave a summarised account of their route mileage, number of vehicles, &c. Those in operation are at Dundee, Leeds, Bradford, Rotherham and Stockport, and several have been described in the ELECTRICAL REVIEW. The others are at Chiswick, Halifax, Northampton, Aberdeen, Brighton (company), Hove, Brighton (Corporation), Sheffield, Keighley, Ormsley, Ramsbottom, Chesterfield and Rhondda. In all cases the maximum fare is 1d. per mile or less; in four cases a minimum fare of 2d. is authorised, the minimum otherwise being 1d. Workmen's fares are at the rate of  $\frac{1}{2}$ d. per mile. The periods for repayment of loans under the various Acts are as follows:—

Trolley vehicles ...	10 years.	Land for street im-	
Electrical equipment		provements ...	50 years.
of line ...	20 "	Land for depôts ...	55 "
Cost of Act ...	5 "	Depôt accom'tn. ...	20 "
Electricity works ...	20 "	Bridges ...	50 "
Land ...	60 "		

The cost of operating railless trolley vehicles at Bradford, Leeds and Rotherham was given:—

## BRADFORD CORPORATION, APRIL 1ST, 1911—MARCH 31ST, 1912.

Traffic expenses ...	3'860d.
General ...	0'448d.
Repairs and maintenance ...	1'087d.
Power expenses (1d. per unit) ...	1'228d.
<b>Total working expenses per car-mile ...</b>	<b>6'623d.</b>
Car-miles run ...	28,485
Average revenue per car-mile ...	7'148d.
Route mileage ...	1½ miles
Passengers carried ...	332,800
Units per car-mile ...	1.26
Average fare charged per mile ...	0'8d.
Cost of overhead equipment ...	£1,381 per mile
Total cost per mile ...	£1,654

## LEEDS CORPORATION, APRIL 1ST, 1912—MARCH 31ST, 1913.

Traffic expenses ...	1'98d.
General ...	0'15d.
Repairs ...	2'12d.
Power expenses (1½d. per unit) ...	0'40d.
<b>Total working expenses per car-mile ...</b>	<b>4'65d.</b>
Miles run ...	80,605
Route mileage ...	4½
Passengers carried ...	379,271
Interest and sinking fund per car-mile ...	2'11d.
Units per car-mile ...	0'87
Average fare charged per mile ...	0'5d.
Cost of electrical equipment ...	£4,723
Cost of four railless vehicles ...	£3,048

## ROTHERHAM CORPORATION, OCTOBER 3RD, 1912—JANUARY 31ST, 1913.

Working expenses per car-mile ...	6'61d.
Miles run ...	38,918
Receipts per car-mile ...	10'07d.
Passengers carried ...	126,028
Interest and sinking fund per car-mile ...	1'20d.
Net profit per car-mile ...	2'26d.

The rest of Mr. England's paper was devoted to brief descriptions of the Cedes-Stoll, R.E.T., Bremen, and Filovia railless systems.

In opening the discussion, ALDERMAN IVEY (London) said that if they could only get the Government to treat motor-buses and railless trolley cars in exactly the same way as they treated tramways, the greater part of their troubles would disappear. What they felt in London was the excessive and unfair competition which was brought about by the privileged user, such as the proprietor of motor-buses and—when they came—railless trolley cars. As to working costs, he thought it was distinctly unfair to saddle a tramway undertaking with a large addition in the way of running and administrative work, as had been done in connection with the railless cars at Leeds. It was not a fair return of costs at all, and when they added the management costs he did not think the

railless system presented a position which was much better than that of the tramways. Personally, he thought that if they wanted any addition to their existing tramways, as a feeder to their existing systems, they could do better than go in for motor-buses. They were still looking to Parliament to promote a general Bill in the interests of all road traffic, which would really bring some uniformity, and remove many of the disabilities from which they suffered.

MR. R. M. DICK-PEDDIE (Edinburgh) said he represented the Cable Tramway Co., of Edinburgh, and would like information as to the probable results, economically and otherwise, of working self-propelled vehicles.

MR. W. CLOUGH (Bury) remarked that Mr. England had stated that there was a stipulation placed in all Corporation Acts to the effect that the accounts of the railless car undertakings should be kept separate. He would like to know how Leeds managed to get outside that stipulation. Mr. Hamilton made it quite plain that he never intended to put certain costs in, such as the superintendent's office and depôt expenses, and even the ticket check he had only charged at the rate of 2s. per week. They should have the matter quite clear, because if those figures went forth some little urban district might base its expenditure on the Leeds figures with serious results. He noticed that the wages of motormen and conductors in Bradford were extraordinarily high—2'836d. The vehicles got a good speed per hour, in Bradford 7'56, and in Leeds 8 miles per hour. The wages of motormen and conductors ought to come out more like 1'8d. than 2'8d. There was also a big difference in the number of units per car-mile. In the case of Bradford they got 1'26, and in the case of Leeds '87 unit per car-mile. Again, in Leeds the cost of electricity was 1'1d. per unit, an extremely low figure. That also was a misleading figure without some explanation. Taking the total working expenses, they found that the Bradford figure was 6'623d. per car-mile. They were not given the interest and sinking fund, but they had the Leeds interest and sinking fund, and there would not be much difference between them. If they added 2'110d. to 6'623d. they got 8'733d., and on that they had to put road maintenance, which he did not think they could get out of with less than '375d. That gave them 9'108d. for working the railless trolley system. He thought Mr. England was quite right when he said that it was hopeless to expect investors to put money into an undertaking of that description. Whilst they got a railless trolley system worked as part of an existing system, there must and would be expenses that were not put in the railless trolley accounts. At Ramsbottom, three miles from his own system, a railless trolley system was being put up, and he intended to get the railless trolley system figures quite separate from any other figures. He was sorry the through running system arrangement they had in regard to cars had not been included in the railless trolley system.

MR. SHEPHERD (Edinburgh) observed that the railless trolley system at Leeds came almost to the centre of the city. From the Monday to the Friday he believed the earnings came out at something like 2½d. per car-mile, and on the Saturday and Sunday they went as high as 2s. 6d. and 2s. 7d. per car-mile. He contended that wherever railless trolley vehicles could be used, the motor-bus would always be more favourable.

COUNCILLOR ISHERWOOD (Oldham) said that in his town they had motor-buses working to a residential district, where there were no tramlines, and also to another district where there had been no house property at all. In the first case they were getting a revenue of 13d. per bus-mile; in the other district, where the property was not built but where rapid developments were taking place, they were getting 12d. to 13d. per bus-mile, made up chiefly of traffic at the week-ends. The rateable value of the town was being increased very greatly in the part of the borough in which the buses were running. Although they had had several complaints from residents about the shaking caused by the buses, and the splashing of mud from the want of some effective mud-guard, he thought that instead of removing the buses they would be compelled to put more on the roads.

COUNCILLOR J. H. RODGERS said that in Newcastle they were running Tilling-Stevens motor-buses simply as feeders to their tramcars. They ran 3½ miles into the country, to a place with a population of about 2,000, they were handicapped last year because they commenced with only one bus, but they had carried no fewer than 277,000 people in the 12 months ending May 24th last. Their earnings had been 10d. per bus-mile, and their expenses worked out to between 7d. and 8d., including depreciation for a five years' write down; the service had proved an excellent feeder for their tramways. The buses ran to a tram terminus, where the greater proportion of the passengers got out and boarded the tramcar for the city. The income from that source, which they reckoned at £20 per week, went to the credit of the tramcars, but he thought it should go to the credit of the bus. So far as his experience was concerned he voted for the motor-bus.

MR. R. HUMPHRIES (Birmingham) said that steady progress was being made in the Black Country with the use of motor-buses, in some instances, as feeders to existing tramways. A great pull that the motor-bus had over the railless trolley car was its mobility. Recently a route was laid down, and it was found a little later that it was not the right thing. Consequently the route was altered, and the result was a wonderful improvement.

SIR EDWARD WHITE (L.C.C.) said that the other day, in giving evidence before a Committee of the House of Commons now inquiring into the question of London traffic, he made the suggestion that either motor-buses should be called upon to pay something towards the maintenance of the roads, which they destroyed much more than did the tramcars, or that the tramway authorities should be relieved of the cost of maintaining their thoroughfares. He was glad to hear that Mr. England had advocated that. To-day

tramways did practically no damage whatever to the roadway. He was all in favour of a cheap service of locomotion, and therefore he objected to any tax being put either on motor-buses or on trams. He had urged upon a Committee of the House of Commons that instead of having to go before the Board and two Committees, and employ counsel, one step in the direction of lessening the cost would be that a Joint Committee of the House of Commons and the House of Lords should sit and hear the evidence. Practically the same evidence was now given before both Committees, and it was a duplication of work which might well be avoided, whilst the saving would be substantial. In many respects London could not be compared with the provinces, the conditions were so different. They had to contend with no fewer than 28 local road authorities, all of whom were anxious to get something out of the tramways, and if a road authority objected to a Bill, their veto was fatal, and the scheme was stillborn. Those were difficulties which they thought were very unfair; they wanted as much freedom in dealing with those matters as possible.

MR. DE TURCKHEIM (secretary) read a letter which Mr. England had received from Mr. Edward Cross, engineer and manager of the Rotherham Tramways Department, in which he said that in their case the estimate for their proportion of the cost of road widenings was tremendous, and would, no doubt, have the effect of the Corporation reluctantly abandoning two routes out of the three. There was no doubt in his mind that county councils, urban and rural authorities were combining to obtain precedents enormously beneficial to themselves, and which would be of great benefit to them in opposing in subsequent years.

In another letter which was read from MR. STEPHEN SELDON (London), the writer pointed out that there was no obligation on the part of the Aberdare Council to construct any bridges, or maintain the same, over the Great Western Railway, as stated in the paper. The Aberdare Act of 1911 was an Omnibus Act, and by the fault of the Parliamentary agent, Sec. 43 thereof was inserted under Part III (*viz.*, Railless Traction) instead of, as it should have been, under Part V (street improvements and bridge works). The statement in the paper was not, of course, an error on the part of Mr. England.

The HON. ARTHUR STANLEY, M.P., in expressing thanks to Mr. England, said that for all forms of traction in regard to which application had to be made for sanction, Parliament was the very worst body before whom those things could go. In the present state of business, and until they had a very radical change in the system in which the House of Commons did its business, it was possible for almost any obstinate member to make the carrying of a new Tramway Act so difficult and so expensive, that it gave the promoters reason to wonder whether it was a good thing to bring forward a Bill at all. He believed that the only way of dealing with this problem was that there should be one central road authority, which would be free from all local jealousies, and would be able to decide on the general merits of the case. Once that had been decided they would have to look into the local conditions to see that all received fair play, but, as they knew, it would be a very different thing dealing with local and individual interests after they had once got permission to have a particular form of traction upon a particular road. He felt very strongly that as far as possible they ought to get some fair system of taxation from all who used the roads, and that that taxation ought to go not only to the improvement of roads, but to the maintenance of roads. There was not the slightest doubt that they, as tramway men, were unfairly taxed.

MR. ENGLAND, in reply to the discussion, said that Mr. Hamilton contended that he had charged against his railless system every penny that system had cost. As a tramway man, he did not want to employ highly skilled labour in his repair shops if he could get other labour. If he got motor-buses, he would want an entirely different class of mechanic—an expert on engines, ignition and carburetters and the like. They could not afford that. He was quite prepared to discuss the cost of capital charges of both systems, and he thought he could substantiate his contention that it was much cheaper to run railless cars than motor-buses in provincial towns. The costs at Bradford were very high, but wages were very high; and, Bradford being an exceedingly hilly city, the costs were accounted for to some extent by that.

MR. A. V. MASON, M.I.E.E. (general manager of the South Metropolitan Electric Tramways and Lighting Co.), then read his paper on "Standard Rules for Motormen and Conductors," explaining the basis on which they were compiled. No rule was included that could not be reasonably enforced, and the rules for inspectors were omitted because they were of a private nature. Forms of instructions for dealing with various eventualities were included. A written agreement was necessary to legalise the proposed deductions. The author considered that every man taken on as a conductor should be prepared to qualify as a driver within a given period. In view of the increase of speed of all vehicles, drivers should pass a medical examination on joining, and subsequently periodically, especially for eyesight.

MR. A. W. A. CHIVERS said he thought deviation from certain rules might be allowed under certain circumstances, and he thought if provision was made in the rules to allow a little flexibility, it would be a good thing.

MR. C. D. STANLEY (St. Helens) asked what they could do with persons who, having committed an offence, gave a false name and address.

MR. MASON replied, that if a man who had committed an offence against a by-law gave a name and address, they had to be content

with it. If they had reason to think it might be false they might instruct an inspector to follow the person. They could only detain a man for assault or wilful damage.

The business proceedings closed with an expression of thanks to the Corporation and the local tramway companies for their hospitality, and a vote of thanks to the chairman.

Subsequently the members went by special cars to the Norbreck Hydro, where they were entertained at luncheon by the Blackpool and Fleetwood Tramroad Co.

The HON. ARTHUR STANLEY, M.P., proposed "Our Hosts," to which MR. R. H. PRESTWICH and MR. JOHN CAMERON responded; and later on, by invitation of the Blackpool and Fleetwood Tramroad Co., the delegates and lady friends enjoyed an outing to Barrow and Furness Abbey. The social functions concluded the same evening with a members' supper and dance.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### The Mutual Protection of Engineers.

I beg to direct attention to a matter that might well claim the notice of the new Association. That is the disability we all more or less labour under owing to employers advertising for engineers and draughtsmen under an office number. This undoubtedly places the applicant at a serious disadvantage. In the usual formula he is requested to "state full particulars" (essentially of a private and confidential character), without having the faintest idea into whose hands his application may fall. For aught he knows, he may be applying for the very post he at present fills, or wasting time and paper in seeking service with some company of which he has no desire to become a member. To such an extent is this *sub rosa* business carried, that even should the firm to which he has applied have occasion to communicate with him the name is not disclosed, unless he has been successful.

I am more than a little surprised that a body of self-respecting and educated men—such as, I think, the average engineer may claim to represent—should have submitted to this indignity so long. Surely we have, collectively, the remedy in our own hands by undertaking not to recognise any advertisement which is not accompanied by the necessary *bona fides*.

To be perfectly just, I ought to add that firms of the highest status in the profession usually do advertise under their own names, but these are remarkably few.

Vertebra.

June 16th, 1913.

### The Prevention of Accidents In Electric Lifts.

I am glad to see the matter of lift safety locks taken up at last by one well-known firm of lift manufacturers. Messrs. Smith, Major & Stevens, Ltd., in their letter which appeared in the June 13th issue of this journal, make many startling assumptions, and from these assumptions, by a process of reasoning peculiar to themselves, arrive at the conclusions which they particularly desire; in other words, "the wish is father to the thought."

In the third paragraph of their letter they refer to the new lock mentioned by myself, assuming that the locking operation is effected by switching current on to the controller; further on, we are told that "in any case the duty of locking and unlocking is shifted to the controller." Before remarking further on this assumption and deduction therefrom, I would suggest that it is a little indiscreet to criticise, make assumptions and definite statements, about something of which it is acknowledged no definite particulars are available. I have no hesitation in informing my correspondents that their assumptions and arguments in this particular case are like beating the air, and as far from being in accordance with facts as it is possible to be.

Messrs. S. M. & S. then go on to discuss the merits and demerits of solenoids. Of course, there is no harm in this, but the matter is quite irrelevant. As our friends themselves are apparently obsessed by solenoids, I may say that

the lock in question may be constructed to work equally well with or without the assistance of these useful appliances.

Coming to the paragraph in which our friends mention their invention for making a fractured spring act as effectively as when intact, most people will admit, I think, that a piece of mechanism which dispenses with springs and appliances for dealing with their failures, is superior thus far to one which includes both these adjuncts. Therefore, from this standpoint alone, the new lock mentioned is superior to one which includes springs.

Referring again to the third paragraph of their letter, they say that they are bound, by the context, to suppose that gravity and springs are barred. Why? This is another pure assumption. Gravity and springs may, if desired, both be used in the example of the lock which I have seen, and, assuming for argument's sake that both these elements are present, if either of them fail, the gate will not be locked, and therefore the cage cannot move. Again, should the supposed failure take place after the cage has commenced to move, the worst that can happen is that the lift will stop at the first floor it arrives at.

Messrs. S. M. & S. state that "it is difficult to see how the lock in question advances matters in the direction of security against the only danger he (myself) describes, that of the interlocking failing to act." I think I have made it clear in my previous letters that with this new lock, if the interlocking does not take place, the lift cannot move. If my correspondents will carefully read the short specification which was given in my second letter, they will see that I laid it down as a condition to be fulfilled that "cage cannot move until the gates are both mechanically and electrically locked." The new lock is in accord with this, and therefore it should be easily seen that if for any reason the lock fails to act, the lift cannot move away, and consequently no danger exists.

On really serious consideration, I think it will be seen that the paragraph in which our friends discuss this matter has no point, and that they have completely failed to grasp the implications of the condition mentioned above. Again, referring to the 1905 patent. Is not this lock covered by the description which I gave in the second paragraph of my first letter? Of course it is, and whether small details have been altered since the first pattern was produced or whether the patent is eight or eight hundred years old matters not one iota. Therefore, it is quite fair to claim this 1905 specification as representing modern practice generally. Further, I am aware of at least one lift installed by our friends nothing approaching eight years ago, the locks of which bear the patent number 2,766. If these locks are not covered by the patent in question, what right has this number on the locks at all? But if these said locks have been made and sold under this patent, I again fail to see the force of their remarks as to whether it is fair to quote the 1905 patent. They claim to have improved their lock seventeen times in fifteen years. One can only think that for so many improvements to be possible considerable scope must have been allowed in the original design, and hope that its evolution is not yet ended.

It is claimed that one of our friends' many locks accords precisely with the specification given by myself. If this is so, I must conclude that it had some defect either in design or manufacture which precluded it from general use, for it must be acknowledged that a lock which conforms to the specification quoted must be vastly superior, if properly designed, to one which does not.

Again, we are informed that in Continental cities for about two years past locks have been working on two different systems, which achieve the same results with more or less success. Messrs. S. M. & S., as pointed out earlier in this letter, are not quite clear on the working of the new lock, and all the functions which it fulfils, therefore their statement of any similarity between this lock and any others must be taken with considerable reserve.

Going a little further, we are told that "unlocking the latch at the proper time is often more important than detecting the correct moment for locking it." Surely we are not to believe that it is seriously contended that it is better in the majority of cases to risk a broken neck rather than a shock to the nerves? Their remark on an unlocked

zone also call for comment. Nothing is easier with the new lock than to give not only any length of unlocked zone desired, but give it at the right time; that is to say, the gate is not unlocked every time the cage happens to pass it, but only when required. Should the lift for any reason stop between floors, the lock can be released in a manner similar to that used in other types of locks.

With regard to the Duc de Lorge's death, perhaps Messrs. S. M. & S. will be good enough to furnish me with correct details, but I find in an account of the inquest that two witnesses agreed that "the Duc had his hand on the handle of the door and was pulling it towards him when the lift touched the clip. The pulling open of the door would stop the cage, and no doubt the Duc, thinking the cage was at the door, stepped into the pit." Whether an unlocked zone of 2 ft. 6 in. more or less is desirable, does not affect my argument, that if it had not been possible for the Duc to stop the lift by opening the door when the cage tripped the lock instead of being obliged to wait until the cage stopped at the floor, he might have been alive to-day.

I regret that I am unable to go into other points raised without making the length of this letter prohibitive; but sufficient has been said to show that Mr. G. W. Newman's remarks on the necessity of exercising caution when accepting the advice of lift makers are amply justified.

As regards the new lock in question, I can say that the set which I have examined (not 5 miles from Finsbury Pavement) are giving every satisfaction, and I understand from the inventor that the time will not be long before the details become public property.

W. J. F. Cooper.

London, June 17th, 1913.

[We must urge our correspondents to exercise brevity in their communications.—EDS. E.R.]

Our first letter was written chiefly by way of protest against a comparison drawn between a lock patented by us eight years ago, and one discovered by your correspondent "a few weeks back."

We were able to show that during the intervening eight years we had made many improvements, including a realisation of all the results catalogued in praise of the new discovery, and therefore thought the comparison scarcely fair.

Mr. Carroll, on the 16th inst., in a letter, the general fairness of which we fully recognise, argues that a lock installed two years ago, and which was probably manufactured three years ago, must be "practically up to date." This is not so bad as Mr. Cooper's logic, but still does not take account of the rapid pace of modern progress.

In the interests of clearness, may we digress for a moment to protest against some confusing words. "Locking" is frequently used where latching is meant. "Electrical locking" is used for closing a switch.

"Electrical interlocking" is used to indicate a mechanical inert connection between a switch and a latch. "Interlocking" sometimes means the action of fixing a latch, sometimes of fixing a switch and sometimes both.

With all respect, we suggest that the terms "latching," "closing the switch," and "counterlocking" more correctly cover the ground, without leading to so much confusion.

Resuming, eight years ago we were the only lift makers pressing the desirability of first latching; secondly, closing the switch; and, lastly, counterlocking. We believe at that date every other maker omitted either the latch or the counterlock.

Later that omission was corrected by one or two makers, but there was still no certainty about the order of latching and closing the switch. It was pure chance which happened first; and still hundreds of locks were going out without any counterlock at all.

That was the state of affairs three years ago, the date of the lock now arraigned by Mr. Carroll on account of a broken spring in the counterlock.

But from the first we were perfectly alive to the shortcomings of springs, and never ceased experimenting and improving till we were able to make the statement contained in our first letter, to the effect that in our latest patterns a spring in several fragments is still effective for its purpose.

That stage was reached long before this correspondence commenced.

"Helicon" considers our "methods of discussion adventurous." But Mr. Cooper's magnificent edifice of claim was based on such a minute foundation of description, that we were compelled to be "adventurous" or dumb, and the reference to our own patent left us but little choice.

As to the result, which we avowedly put forward as inductive reasoning, we are content to let it stand as a working hypothesis till more details are forthcoming.

"Helicon" appears to understand what "danger" was in Mr. Cooper's mind when writing about the moment at which the counterlocking is effected. Frankly, we do not, nor can we find it defined in that gentleman's letters. Mr. Cooper certainly started out to describe a danger, but what followed referred merely to an irritating annoyance.

If, for instance, someone writes of the "death traps" arising out of leaving your umbrella on the landing, and proceeds to point out that all such dangers could be avoided by not buying umbrellas, no one is bound by that argument to believe in the alleged danger.

Be that as it may, an "uncounterlocked zone" is demanded by experience; Mr. Carroll joins us in "not quarrelling with a good margin for the un(counter)-locking of gates"; and Mr. Harmsworth, who is certainly not without experience either as lift manufacturer or an advertiser, says "there would be no real danger."

On another point, "Helicon" has misread our letter. We made no reference to passengers "stopping between floors."

Smith, Major & Stevens, Ltd.

Northampton, June 23rd, 1913.

As the inventor of the lock to which Mr. Cooper alludes, I am naturally very interested in the discussion which is taking place under the above heading, and have in mind Messrs. Waygood's letter. I notice that the main points claimed for my lock, as set out by Mr. Cooper, have not been fully grasped by those who would now criticise. This is not surprising considering that Mr. Cooper (at my express wish) made no attempt to describe the lock in detail, obviously to avoid advertisement (in which case our sales manager would have wanted to say something).

Much of the discussion is centred round the use of springs, which, of course, cannot be relied upon and are, in most cases, a source of danger in themselves. Realising this (and agreeing with Messrs. Smith, Major & Stevens that the spring should be arranged to do duty after breakage), I turn to Patent No. 13,183, 1911, and notice that this lock is provided with five springs and two flexible connections, which means that with an average lift of eight floors, as many as 40 springs and 16 flexes with necessary attachments would be used.

Taking this lock as a fair example of modern practice, it is difficult to see how Mr. Harmsworth can be satisfied with a lock of this description, but, perhaps, he is not in touch with the Repairs Department. So much for springs; Needless to say, I do not find them necessary in my lock.

It should be thoroughly understood that as the lift passes the floor, the gate is unlocked and locked again, but should the locking action fail, it is quite obvious that the lift moves away leaving the gate unlocked. In these circumstances anyone may open the gate in the ordinary manner, possibly with disastrous results. Unlike other essential parts of the lift, the defect is not at once apparent, and the lift may continue to work with the lock or locks out of order, thus constituting a death-trap. Assuming that Mr. Harmsworth is thoroughly familiar with all the points in connection with lift locks, it is difficult for one to understand how he comes to state that his locking gear (which does not provide against the above defects), "meets all likely contingencies." I believe very few people realise this danger, and I thoroughly endorse Mr. Carroll's remarks on this point.

I am pleased to say I have succeeded in producing a lock which excludes all the objectionable features above referred to, and hope to furnish particulars in this journal at a later date.

I might add that I have a set of locks working on a busy lift in the city, and they are giving every satisfaction.

Frank Barlow, Engineer.

London, N.

#### Ventilation of Electrical Machinery.

In your paper of September 15th, 1911, there was a review of my book "Ventilation of Electrical Machinery" (Whittaker & Co.).

The reviewer quotes the passage which occurs in the section dealing with the refrigerator as a cooling agent, viz., "that the author is very hopeful that refrigeration may form a useful adjunct to the generator," and adds that "the reviewer thinks it will be rather a long time before we find an ammonia or carbonic acid refrigerator used to cool turbo-generators."

It is interesting to note that Mr. Christie, in his paper at Kingston, considers that with wet cooling and a small refrigerator 25 per cent. increased output will be obtained. This was not pooh-poohed by any one of the engineers present.

W. H. F. Murdoch.

Mill Hill, June 21st, 1913.

#### Bedstead Antenna.

With reference to the query in your last issue, as to the effect on arc lamps of wireless signals, I might mention that I have noticed an arc lamp acted upon by what would undoubtedly be, wireless signals, in the following circumstances. A few months ago, I was burning an enclosed type lamp under open type conditions in the test room, with an abnormal arc voltage, approximately 90, coupled between positive and neutral, when the arc emitted sounds, unquestionably in Morse, at the equivalent rate of wireless sending, and pitched in like tune.

I have since endeavoured to obtain a repetition of this phenomenon, but the results obtained have not been so positive as on this particular occasion.

A. H. B.

[The idea of distributing time signals by means of public arc lamps was suggested, we believe, by Mr. Duddell himself, years ago; but their use as detectors of the wireless time signals appears to be novel.—EDS. E.R.]

#### Proposed British General Engineering Staff Association.

At last the lethargy of the "middle man"—between the capitalist on the one hand and the workman on the other, the man of brains and education—seems to be passing away and he is awakening from his slumber of disastrous isolation and individualism.

We see before us Unions amongst capitalists—the very essence of selfishness and commercial tyranny; foes to all honourable men. The idea of the strong and wealthy combining together to subdue those by whom their wealth and comfort have been obtained, those from whose ranks they have for the most part arisen, is a ghastly spectacle. That the strong should combine with the strong to protect their delicate selves at the expense of those who are really their benefactors is, I say, repugnant to the mind of every true Britisher. The Germans would not stand it, and they have their protective association; are we going to be so foolish and blind as to neglect this golden opportunity that now presents itself to us? Remember, "there is a tide in the affairs of men"; let us take it at the flood.

The time has come to act, and abandon mere words and *laissez-faire* policies—or rather, impolicies. All who can should give wide publicity to the cause, and might I suggest, as one on an engineering staff, that not only fully qualified engineers be admitted to the association, but also those employed on the staffs of engineering firms and who have a useful and thorough knowledge of the engineering business field. These, if not admitted at the same rate as qualified engineers, could be enrolled as members at a lower rate if necessary, with corresponding benefits. This could apply to those below a certain salary, or arranged according to some other agreed proposition. This would augment both the ranks and

funds of the association, and would bring in many who could not, perhaps, afford a very large sum.

If, as suggested in the last issue of the REVIEW, only a £1 ls. or 25s. subscription per annum was fixed upon, the above distinction may not be deemed a wise one, as most can afford that sum.

May I also suggest that a circular letter be prepared, and distributed *individually* in sufficient quantities to all the staff men with the various firms, in order to stimulate interest, invite membership, and obtain support. These could be sent to the supporters of the movement for distribution in their firms.

If this Association fails, and there is no excuse if it does, then we shall deserve all the plagues of Egypt, and our best men will go abroad and get on better. For the sake of our manly honour, then let us shake off this deathly lethargy, and protect our citadel.

S. Douglas.

The proposed formation of an Association for the Mutual Protection of Engineers savours rather of Trade Unionism, and would tend, if anything, to lower the prestige of the engineer. Why not at once enter into an arrangement with a large society to look after their interests, pay a higher premium, and be done with it? There is no doubt that engineers are often placed in more or less difficult positions, but, at the same time, the status of an engineer very often depends, to a very great extent, on himself, his general behaviour and his abilities.

The law of supply and demand holds good in electrical work as in other professions, and may possibly account for the low salaries offered; but there are positions which do not require to be filled by a highly trained man, and the latter takes it for lack of any other very often.

In some few works there may be wanting that cohesive spirit mentioned in one of the letters in this week's issue, which is so essential to the successful working of all industrial concerns. It may be due to the individual competition of a certain type which prevails in some places, where so many are criticised adversely by some members of the staff—sometimes, perhaps, unconsciously, but still uselessly—and casting reflection unnecessarily. Not that it is worth much, but that it exists; for to a man of average strength, certain kinds of criticism would probably be like water on a duck's back!

It is hardly feasible to have an Engineering Association analogous to the B.M.A. under present conditions, for, let an unskilled man attempt to operate on human beings, with, perhaps, fatal results, and the State will no doubt have something to say on the matter. On the other hand, let him operate on inanimate bodies, and the case has a different aspect, whatever the results.

A reasonable suggestion, which has probably been already made, would be to have an amalgamated committee of the I.C.E., Mech.E. and I.E.E., partly composed of the permanent staff of each, to deal with certain matters intended to further the interests of engineers in the various ways desired.

W. E. P.

## LEGAL.

### THE XL ELECTRIC CO. v. ARON.

IN the Chancery Division, before Mr. Justice Neville, the motion by which the plaintiffs sought to prevent the abandonment of protection for certain inventions said to have been sold by the defendant to the company, was again mentioned on June 20th.

MR. MORITZ (plaintiffs' counsel) said that the motion was for an injunction to restrain the defendant from interfering with or delaying the completion of British patent rights. His Lordship had granted an injunction not precisely in the terms of the notice of motion, but giving the plaintiffs what they asked for. Before the injunction was granted, however, the Court had exacted from the plaintiffs an undertaking in accordance with the contract to pay the expenses that the defendant would be put to in carrying out his obligations. On attending to settle the terms of the order a difficulty had arisen; the plaintiffs sought to limit their undertaking to expenses that might arise, while the defendant, on the other hand, sought to have included expenses that he had incurred prior to the contract.

HIS LORDSHIP said that the undertaking ought to follow the terms of the contract. That was what he intended should be done. It should be that the plaintiffs undertake to pay the expenses properly to be borne by them under the contract.

MR. SIMMONS, for the defendant, said that his contention was that there was a clause in the contract which covered the prior expenses.

MR. MORITZ said that was the point between them. The whole point was, could the defendant make them liable for all the costs incurred prior to their entering into the contract?

MR. SIMMONS: Not the whole of the costs.

HIS LORDSHIP said he was not going into the terms of the contract at that stage of the proceedings. The undertaking the plaintiffs had to give was, as he took it, that they would fulfil their part of the contract, that was to say, they would pay such part of the costs as they were liable to pay under the terms of the agreement. The order would be that there should be an injunction as granted, on the company's undertaking to pay such expenses, if any, as the defendant might incur, as they had contracted with him to pay.

MR. SIMMONS suggested that the words of the injunction restraining the defendant, not only from "delaying or preventing," but also from "allowing to be delayed or prevented," were too wide. It amounted, he suggested, to a mandatory injunction.

HIS LORDSHIP said it was not intended to do so.

### THE RATING OF TRAMWAYS.

IN the House of Lords before the Lord Chancellor and Lords Shaw and Moulton, arguments were begun on Friday (June 20th) in an appeal by the Urban District Council of Tottenham against an order of the Court of Appeal, dated February 8th, 1912, in favour of the respondents, the Metropolitan Electric Tramways, Ltd.

The decision of their Lordships will be one of far-reaching importance to all tramway companies throughout the kingdom as it will decide the moot point whether the land used by tramway companies for their lines is to be treated as "land used only as a railway." In that case, as hitherto, such tramway companies can claim to be rated for the general district rate under Sec. 211 (1) (B) of the Public Health Act, 1875, in respect of their lines in the proportion of one-fourth part only of the net value thereof. The appellants contend that the word "railway" in the section ought to be read so as to exclude what is ordinarily understood as a "tramway," and on various grounds they submit that the respondent company ought to be assessed at the higher value.

MR. MACMORRAN, K.C., Mr. Walter Hyde, K.C., and Mr. Cartwright Sharp appeared in support of the appeal (instructed by Mr. Francis Shelton); while Mr. Danckwerts, K.C., and Mr. C. C. Hutchinson, (instructed by Messrs. Ashurst, Morris, Crisp & Co.), were for the respondent company.

MR. MACMORRAN, in opening the case, said that the tramway was constructed under Parliamentary powers obtained for its construction as a "tramway" and not as a light railway. The man in the street might not be able to say whether he came to business by a light railway or a tramway, because to the man in the street, the appearance of the two being identical, he would have no means of deciding the point. The true test as pointed out in the Swansea case was what powers did the private Acts confer on the undertakers? Their Lordships would bear in mind that when power was obtained to construct these tramways, they were to be propelled by horse-power. The Acts he should have to refer the Court to were the North London Tramways Acts of 1882, 1897 and 1902; the North London Suburban Tramways Order, 1879 (confirmed by the Tramways Orders Confirmation Act, 1879), and the Tottenham Improvement Act, 1902. In all of those Acts the lines were dealt with as tramway lines. They purported to incorporate the Tramway Act: there was no mention in any of them of the Railway Clauses Consolidation Act. Later, horse-power was replaced by electrical traction, but it was still a tramway. Light railways were constructed under Acts of Parliament which were differently drawn to Acts of Parliament for the construction of tramways. In the present case their Lordships would have to consider the County of Middlesex Light Railway Orders of 1901 and 1903, both made and confirmed under the Light Railways Act, 1896. His submission was that this case was governed by the Wakefield case, 1908, A.C. 293. That was a decision as to light railways, and it was held that by virtue of the Light Railways Act, 1896, the light railway was a railway to which Sec. 211 (1) (B) of the Public Health Act, 1875, applied. The decision in that case went on the ground that the undertaking was not constructed originally as a tramway, and was, therefore, a light railway, and the House of Lords adopted the view expressed by the Court of Appeal. The Swansea case which was then decided—it was reported, 1892 (1 Q.B. 357)—on which the Divisional Court acted, presumably was brought to the notice of this House when the Wakefield case was argued, and if they had thought it not good law their Lordships would have overruled it.

THE LORD CHANCELLOR: You invite us to hold that the Swansea case governs this case, and that the Court of Appeal were wrong in overruling it, and following the case of Thornton Urban District Council v. Blackpool and Fleetwood Tramways Co. decided in 1909.

MR. MACMORRAN replied in the affirmative, and went on to explain the history of the Tottenham Tramways. He mentioned that the tramway and light railway had a junction with each other and had junctions with other tramways and railways outside the district, and all of them were worked by the respondents as one connected system. The carriages or cars used on each were the same, the wheels had the same flange and

could run over all parts of the system. The electrical energy used now for working the system was generated at one power station, and thence transmitted over a common system of cables and mains to sub-stations. Prior to 1904 the respondents, in respect of the tramway, were assessed by the appellants to the general rate of the district as a railway was assessed under Sec. 211 (1) (B) of the Act of 1875—namely, in the proportion of one-fourth part only of the net annual value; they then came to the conclusion that they were tramways, and therefore not entitled to the reduction. Accordingly, in the assessment appraised against they assessed them at the full net annual value—namely, £495 12s. 6d. The respondents paid £123 18s. 2d., but refused to pay the balance, £371 14s. 4d. On a complaint by the Council to the Justices, the Justices made an order for payment by the respondents of the balance of this £371 14s. 4d., and costs of the complaint were ordered to be borne by them. The Divisional Court affirmed the Justices' order, but the Court of Appeal reversed their decision. Hence this appeal. On Monday, June 23rd, the learned counsel continued his argument, and was followed by Mr. Ryde.

MR. DANCKWERTS, K.C., then opened the case for the respondents. There was nothing mysterious in the word "railway." Rails fixed to sleepers on the ground were as much a railway if used for carriages to pass over whether the undertaking was promoted under a private Bill for a tramway or a light railway. Mr. Ryde had tried to make out that in several respects there was a difference between the two. For himself, he thought the learned counsel for the appellants had drawn legislative distinctions which in no way affected the question before the House. The important point was that the railway was constructed on the land under powers of an Act of Parliament. That distinguished it from a railway put down by a company, for example, to link up their colliery with a railway company's sidings. The tramways and light railways described in the case were identical, and their user and working were identical and as one system, and each was used under statutory powers, and it was an unreasonable conclusion to hold that the light railways were land used only as a railway constructed under statute, while the tramway was not. He submitted that the decision of the Court of Appeal was right, and the appeal should be dismissed on the facts as found or admitted by the appellants. But apart from that ground for dismissing the appeal, it was quite clear that the respondents were, in law, entitled to this partial exemption. In all the early statutes, a railway was always spoken of as a "railway or tram road." Therefore, when the legislature used the words "the occupier of any land used as a railway," they must have contemplated a railway as being a railway or "tramroad." He dealt with the judgments in the Swansea case, and submitted that they were not in accordance with various other cases which he cited. The true view of the matter was that taken by this house in the Thornton case, and applying that principle here, the tramway was a railway within the meaning of Sec. 211 of the Public Health Act, 1875.

The hearing was adjourned to Thursday, June 26th, subject to a part heard case being finished.

#### BELL v. MILNE.

LORD HUNTER and a jury, in the Court of Session, this week began the trial of an action by James A. Bell, electrical engineer, of the city of Aberdeen, against Alfred Edward Milne, solicitor, Aberdeen, hon. secretary of the Aberdeen branch of the Electrical Contractors' Association of Scotland, for £1,000 damages in respect of alleged slander, said to be contained in a letter written by the defender to the town clerk of Aberdeen. The matter has already been fully referred to in our pages.

Pursner says that the statements in the letter are false and slanderous, and that the letter contains serious reflections on his ability, and imply ignorance, incompetence, and want of professional skill. The letter, he contends, further falsely states that the pursner was guilty of making grave and slanderous charges against Aberdeen contractors, reflecting upon their honesty. The defender pleads privilege, and says he was instructed to write the letter by the Association, for the purpose of its being submitted to the Town Council. He says that the letter does not represent that the pursner was ignorant, incompetent, and had no professional skill.

Counsel are:—For the pursner, Mr. Cooper, K.C., and Mr. Lippe. Agents—Scott & Glover, W.S. For the defender, Mr. Murray, K.C., and Mr. Wilton. Agents—Davidson & Syme, W.S.

(To be continued.)

#### LAUBACH v. KINZBRUNNER.

At the Barnet County Court on Tuesday, an action, remitted from the High Court, was heard, in which Phillip Laubach, 26, West End Lane, West Hampstead, electrical engineer, was plaintiff, and Charles Kinzbrunner, 12, Fortune Temple Lane, Hendon, defendant. Plaintiff claimed the sum of £35 6s., which he reduced to £34 10s. Mr. Salter was counsel for plaintiff. Defendant was not professionally represented. The claim was for translating into English, Prof. Edler's German work on "Electrical Switches and Switchgears," and for typing the manuscript.

PLAINTIFF said that in consequence of the time occupied in the translation, he paid out of his own pocket to his brother £15 for assistance in his office, and never received a penny from the defendant. He paid also £4 9s. for typing.

DEFENDANT said the agreement was that he should pay plaintiff on the publication of the book. He had a letter from the publishers that the book would be out on the following day. The action, he added, ought never to have been brought.

Plaintiff said there was no such agreement. Nothing was said about the publishers or the time of publication.

Defendant stated that originally his name was to have appeared on the title page of the book as joint translator with the plaintiff, but he consented later, at the request of the plaintiff, to only the plaintiff's name appearing. This was to be part compensation for his (plaintiff's) work as translator. It meant, added defendant, a great deal to the plaintiff to be the sole translator of the book. Plaintiff denied the statement of the defendant, who said he was to get £50 for the book, which had cost him so far £52.

HIS HONOUR said upon the evidence he must find for the plaintiff. He could not find that payment was to be delayed. As to the typing, that was an expense, not for the benefit of the translator, but for the benefit of the owner of the copyright.

Defendant (interposing): But I am not the owner.

HIS HONOUR: You are the person who made the contract with the publishers.

Judgment was entered for plaintiff for £34 10s. and costs.

#### POULSEN PATENT.

IN the Chancery Division on Tuesday, on the application of Mr. Byrne, Mr. Justice Warrington directed that the petition for the extension of the Poulsen patent relating to a dictating machine worked by electricity, should be heard on July 1st, subject to another case he had fixed for that date. Counsel stated that the Crown officers would be able to attend on that day. Some witnesses had to come from Denmark.

#### THE TELEPHONE TRANSFER SETTLEMENT.

IN the Court of Appeal on Monday, before the Master of the Rolls and Lords Justices Kennedy and Swinfen Eady, the matter of the National Telephone Co., Ltd., against His Majesty's Postmaster-General, was down for hearing upon the appeal of the Postmaster-General and the cross appeal of the company, from the judgment of the Railway and Canal Commission (Mr. Justice Lawrence, the Hon. A. Gathorne Hardy and Sir James Woodhouse), upon the application of the National Telephone Co. to have determined the differences which had arisen between the company and the Postmaster-General as to the terms on which the business of the company should be taken over by the State.

Shortly before 11 a.m. the Attorney-General and the Solicitor-General representing the Postmaster-General, and the leading counsel representing the National Telephone Co., together with the solicitors of both parties, had an interview with their Lordships in the private room of the Master of the Rolls.

Upon their Lordships coming into Court, the Attorney-General stated that he was very much indebted to their Lordships for the time granted to them, and for the assistance they had all received, and the result was that they had arrived at a compromise in all the outstanding matters. He would not trouble their Lordships with details, but he must ask their Lordships' indulgence to allow the formal application to stand out until Tuesday next. Their Lordships would appreciate that there were certain formalities to be gone through, and the result of their deliberation had to be put in writing, which would take some little time. He thought, however, their Lordships would not be troubled with the appeal or cross-appeal, and if their Lordships would allow the matter to be put on the list for Tuesday next to be mentioned, that would meet the situation.

SIR ALFRED CRIPPS, K.C., on behalf of the company, said that he desired to associate himself with everything the Attorney-General had said, and that he thought all the differences were settled. Certain formalities had to be gone through, which could be done by Tuesday next.

Their LORDSHIPS agreed to this arrangement.

#### BRAULIK v. VAUGHAN.

IN the City of London Court, on Tuesday, before his Honour Judge Rentoul, K.C., Mr. George Braulik sought to recover £6 12s. 8d. from Messrs. T. W. Vaughan & Co., Ltd., electrical engineers, Islington, balance of account for eight arc lamps supplied. The claim was admitted, but defendants raised a counterclaim for £48 6s. as damages sustained by them through the lamps being defective. Mr. Lever appeared for the plaintiff, and Mr. Given for the defendants.

MR. GIVEN stated that, in 1911, plaintiff used to sell a certain type, now extinct, of German arc lamps for using outside picture palaces. Defendants had a contract for the installation of electric lamps at the Holloway Picture Palace. The plaintiff knew the purpose for which the defendants wanted the lamps which were now in dispute. Under the Sale of Goods Act there was an implied condition that the plaintiff should supply arc lamps reasonably fit for the purpose for which they were required. In January 18th, 1911, defendants ordered from the plaintiff four arc lamps, but there had been a long series of disasters in connection with them. They were to be alternating-current flame arc lamps, 10 amperes, 10 hours, suitable and to be burnt four in series on 200 volts, 50 periods (Islington supply), and supplied with necessary resistance. In consequence of the coils not being fit to take the current, when the lamps were started two of the coils at the top burnt out. Plaintiff's engineer came down and "had a shot at them." Defendants did everything they possibly could to make the lamps go

right, but they never all worked properly together. The defendants bought a number of new coils and had spent £20 in trying to make the lamps go right. They were charging plaintiff with £12 of the £20. The theatre people became discontented with the lamps and the defendants had to take them down, putting in new ones, which were bought elsewhere for £31. Two of the lamps which were taken down were used elsewhere, but with disastrous results.

One of the defendants' electricians, named Mister, said in all they had eight lamps from the plaintiffs, but some of the coils were thoroughly charred and burnt after use. When the silk-covered wire was burnt there was simply a solid mass of copper. For no lengthened period did the lamps burn together, certainly not more than a month at a time. He and other electricians continually had to go down to the theatre from time to time. In cross-examination, witness denied that the defects in the lamps were caused by their workmanship, or by the way in which the lamps were treated by the people at the theatre.

In answer to the counterclaim, one of the plaintiff's electrical engineers, named Berners, was called, and he said that there was no truth in the suggestion that the lamp was obsolete. They were still supplying it in the ordinary course of business. The plaintiff was one of the largest arc lamp manufacturers, and the lamp in question was the Eclipse. There was absolutely nothing to complain about in regard to the lamp itself, as he found whenever he tested it after complaints. It was only the fusing of the coils about which there could be any complaints, and that was not the plaintiff's fault. They were insulated as well as any coils could possibly be. Until they came into Court there had never been any suggestion that the coils were not properly insulated. The lamps were badly used through the mechanism being stuck up so that the shunt coils could not feed the carbons. He found in one instance that the flexible connector had been put round the wrong side of the carbon, and he called the defendants' attention to that fact. Several times he advised the defendants to have safety coils, but they did not do so. The defendants had no business to take off the top part of the lamp at all. Then, again, he found that a broken carbon was the cause of the lamps not burning. They had supplied 200 lamps of the same type to other customers in various places, and they had always had satisfaction from them. There had been very few complaints about Eclipse lamps, and that was the first occasion on which he had known so many fuses to burn out since he had been in the trade.

At this stage the further hearing was adjourned until a date to be fixed, JUDGE RENTOUL, K.C., observing if the parties in the meantime could settle the case amongst themselves they would be taking a sensible course. Mr. Lever hoped they might.

#### JOHNSON-BILLINGTON ELECTRICITY METERS, LTD.

THE petition presented by W. H. Johnson for the winding-up of this company was again before Mr. Justice Neville in the Companies' Court on Tuesday, June 24th. Counsel, however, stated that further evidence had been filed, which raised contentious matter, and it was desirable that the new affidavits should be answered.

With the consent of all parties the petition stood over for a week.

#### JOHNSON-BILLINGTON ELECTRICITY METERS, LTD. v. BILLINGTON.

IN the Court of Appeal on Monday, June 23rd, before Lords Justices Vaughan Williams, Buckley and Hamilton, an application was made in this case, in which the defendant had given notice of appeal against a verdict and judgment entered at the trial before Mr. Justice Coleridge and a special jury. The company sued the defendant, Mr. Arthur Marston Billington (formerly one of its directors), for damages for alleged negligence and breach of duty. The defence was a denial of the allegations.

COUNSEL, on behalf of the defendant, applied with the consent of the company that the time allowed to the defendant for giving security for costs of his appeal should be extended by 14 days. The reason, said counsel, was that the parties had very nearly come to an arrangement which would dispose of the appeal.

Their Lordships assented.

**Accident.**—Whilst engaged on altering points and changing the trolley of a tramcar in St. George's Square, Huddersfield, last week, James Armitage, tramway inspector, and J. H. Oldham, tram conductor, were knocked down by a passing motor-wagon. Armitage was rendered unconscious, and had his shoulder dislocated, and one of Oldham's arms was crushed and bruised.

**Trade Openings at Smyrna.**—According to the report to the directors of the representative of the Deutsche Levant Line, at Smyrna, that city has escaped the effects of the late war, and the credit of local firms stands high. Among articles whose importation will pay at present, are electric motors, electric transmission and installation plants, &c.

**Sun Power.**—It is reported that several installations are at work in California employing solar heat for generating steam with the aid of reflectors; the steam is used for pumping water for the purpose of irrigation.

## PARLIAMENTARY.

### London County Council Tramways and Improvements Bill.

ON this Bill coming up for the adjustment of clauses, the question arose as to Clause 44 giving the County Council power to work the London United Tramways in Askew Road and Paddenswick Road, Hammermith, which are within the L.C.C. boundary. The Committee gave the clause, but added the condition that the County Council should give the Tramway Co. the power to run over these routes on terms to be fixed by agreement, or, failing agreement, by arbitration.

MR. E. POLLOCK, K.C., pointed out that, having regard to the circumstances of London, which was surrounded by authorities working tramways, the County Council could not accept the conditions, and asked leave to withdraw the clause.

MR. BALFOUR BROWNE, K.C., argued that unless the clause was inserted as added to by the Committee, the public would be deprived of facilities which the Committee said should be given them.

The CHAIRMAN said that Mr. Pollock must understand that if the clause was withdrawn, it would mean that the preamble of the Bill was dropped, because the clause was included in the preamble of the Bill. Either the clause must be put in to protect the public, or the Bill would not go through.

MR. POLLOCK thereupon said he would leave the matter to the Committee, and the CHAIRMAN said the Committee had decided that the clause should be inserted.

On June 17th the Committee passed the preamble of the Bill. Practically all the powers for the construction of new tramways were dropped from the Bill owing to the refusal of the local authorities to consent to the proposed tramway from the Marble Arch to Cricklewood; and, owing to the decision of the House of Commons regarding the veto of the road authorities, the trackless trolley provisions were withdrawn. The Committee passed a number of street widenings, and in connection with the miscellaneous tramway clauses, allowed a clause by which the Commissioner of Police on special occasions may permit passengers to stand inside the tramcars.

**Various Bills.**—In the House of Commons on 23rd inst. the Mexborough and Swinton Tramways (Railless Traction) Bill was ordered for third reading, and the following were read a second time:—Central London Railway, City and South London Railway.

## BUSINESS NOTES.

**Consular Notes.—Australia.**—In a recent report the American Consul at Sydney refers to the fact that in 1912 the first automatic telephone switchboard was installed in Australia, the work being carried out under the supervision of a representative of an American firm, to whom is due the credit of the introduction of the system to the Commonwealth. Geelong, in Victoria, was selected by the authorities for the initial experiment. As the result of the satisfactory working of that exchange 20 suburban exchanges near Sydney are to be similarly equipped, and there is every probability that before the end of the present year still further expansions of the automatic system will have been inaugurated. At present there are eight high-powered wireless stations in the Commonwealth transmitting public messages. These are at Sydney, Melbourne, Adelaide, Fremantle, Hobart, Brisbane, Thursday Island and Port Moresby. The near future will see stations opened at Townsville, Cooktown, Rockhampton, Mount Gambier, Geraldton and Esperance, and a little later at Rosburne, Wyndham and Broome, on the Gulf of Carpentaria. The appropriation passed by the Federal Government for the fiscal year 1912-13 was £50,000, and of that £40,000 had been spent by January, 1913. There is hardly a steamer of any size trading on the Australian coast to-day, either in the inter-State or foreign-going service, that is not equipped with wireless apparatus. The small boats, however, have not yet fallen into line, but this is probably due to the absence of a law making such equipment compulsory.

**South America.**—A Canadian Government representative at Buenos Ayres in a recent report refers to the importance of credit and packing in export trade with Argentina. As regards the former, he states that it is a source of some complaint amongst South American business men that North American shippers will not grant their customers the terms of credit given by large European houses. It is a well-known fact that a house which can easily purchase on a three months' draft from a European exporter, has not infrequently to furnish a bank credit before a United States firm will consent to do business. This predilection for ready cash on the part of United States firms should certainly suit European shippers, as, on anything like equal terms, the latter will get the business. It is convenient for the South American to have the accommodation so readily granted to reliable firms by European shippers, and it hurts his pride to some extent that so many United States firms demand to see his money before dealing with him. There is also a need for credit in South

America, owing to the fact that it is a new land, and, therefore, cash is not always abundant. It imports most of the manufactured goods which it consumes, and, being a long way from the source of supply, it is necessary to carry large stocks. Some firms may argue that it is not because they do not trust South American business men that they require cash payments, but because the extent of their capital does not permit of their standing out of their money for, say, four to six months. Granting that the former is *bona fide*, the latter can only be the result of a lack of familiarity with international banking operations or the lack of adequate bank credit. The usual methods of paying for merchandise are not more than four in number:—(1) The importer can open a bank credit in favour of the exporters; (2) he can remit with order; (3) he can, if he is buying on open account, remit at his convenience; (4) he can pay by accepting a bill drawn on him by the shipper at sight, or allowing whatever interval of time may have been previously arranged. To the North American manufacturer, it is needless to say, the first two methods would be most satisfactory, and particularly the second one, but it is so disadvantageous to the payer as to be almost negligible in practical business. The first is only a little less unpopular than the second, because the firms who have to put up the credit are restricted in their business thereby. It means that from the time the credit has been drawn upon by the shipper, until the goods are disposed of, the credit representing the value involved is dead unless, of course, the goods have been sold previously on negotiable security. The fourth is the most general, and as a rule the fairest method. The exporter draws a bill on his customers at, say, three months' sight, or what is more general locally, three months from arrival of shipment. The question of credit as it affects international trading, is a large one, and has naturally been reduced to a more exact science amongst European and Eastern traders than amongst those of the Western Hemisphere. A most important factor in deciding upon a question of granting credit abroad is the present and future economic condition of the country under consideration. Credit can be granted much more readily when a country is enjoying an extraordinary wave of prosperity than at other times. If discrimination, based upon the advice of reliable correspondents, be employed in choosing customers, if economic conditions be carefully studied from various points of view and diligence be exercised in sifting all reports from the country under review, there is no more reason to apprehend losses from overseas than from home trade.

The question of packing, too, is of very great importance. Packing in Europe has reached a very much higher state of efficiency than in either the United States or Canada, whose exporters show much indifference as to the fate of their shipments when once they have left the factory. In Europe, however, the subject is much more closely studied, with the result that each consignment is more often given just the kind of casing that best suits the goods which it contains, and the country to which they are to be sent. It is a waste of material and money to put light goods into heavy cases, and the contrary practice generally entails actual loss. For machinery, special cases should be designed. Large cases should be braced in one or more places, and round them a band painted plainly on the outside, and in English, and also in the language of the country "chain," "sling," or some such word should be plainly stencilled, also a note to the effect that the sling is to be adjusted at those bands. Failure to do this, results in the pinching in or smashing of the case when the sling takes the strain. At most of the ports in South America, the discharging is done into lighters, sometimes in rather open roadsteads where the sea may be rough. At the best, stavedoring is not gentle, and in this part of the world the sling is used freely, often to drag a box from the corner of the hold when it might properly be moved by hand. It is very essential that every case be numbered, and the contents plainly stated. If this is not done, the Customs may insist on opening the cases to the damage of the contents, and entailing a waste of time. One of the very best examples of packing was recently inspected. It was part of a shipment of calculating machines consigned from a factory in the United States. Each box was of bright new wood, and splendidly made, and was practically as intact as on the day when it left the works. Each case bore the name of the consignee plainly stencilled, also the name of the makers. Furthermore, there was securely tacked on to one of the faces a card bearing a list of the contents. The list printed legibly, contained the name of each article, even to the literature accompanying the machine. Against each of these was typed, not written, the number of that particular article which the case held. There was no need to open the case, and in another part of the town a day or two after, the same cases were seen being shipped from the agent's place of business, apparently without having been distributed in any way. There have been, and are to-day, complaints about United States' packing, but it is noticeable that when an American exporter gives his mind to the details of his work, he does it in a manner which leaves very little to be desired.

**The Glasgow Electrical Exhibition.**—This exhibition, to which full reference was made in our issue of April 11th, is now an assured success. We have before us a plan showing that by far the larger part of the space is let, though there are still some good positions open. We understand from the manager that the B.E.A.M.A. has agreed to give its support in regard to all sections of the industry concerned. From the names of the exhibitors (see below) we judge that an excellent display is certain, but we have no doubt that this list will speedily be added to by other firms who will desire to benefit from a really good exhibition under the auspices of the Corporation at the beginning of the next lighting season (opening day, October 23rd):—

Glasgow Corporation Electricity Supply Department; B.I. and Helby Cables, Ltd.; Veritys Ltd.; Edison & Swan Co.; Callender's Cable Co.; Simplex Conduits, Ltd.; Brown, Boveri & Co.; Electric Appliances Co., Ltd.; The Electric Co., Ltd.; M. K. Cooper & Co.; Electric Control, Ltd.; British Electric Plant Co., Ltd.; Scottish Vacuum Cleaner Co.; Magic Appliances, Ltd.; James Keith & Blackman; Siemens Bros.; B.T.H. Co.; Fraser & Borthwick; W. T. Henley's Telegraph Wire Co.; General Electric Co.; British Westinghouse Co.; Kelvin & James White; Anderson & Munro; Bonham, Scott & Co.; British Heaters Co., Ltd.; Carron Co.; Yates Bros.; J. Dugdill & Co.; Edward & Sons; and Waygoods.

**German Exports.**—Some figures have just been published in relation to the course of the German import and export trade in electrical and other machinery and cables in recent years. It is shown, in the first place, that the value of the imports of all classes of machinery and electrical manufactures has decreased from £7,700,000 in 1907 to £6,450,000 in 1912, whereas the exports have advanced from £36,750,000 in 1907 to £52,800,000 in 1912. The figures for the electrical trade alone are as follows:—

Imports:—	1912.	1907.
Dynamoes, motore, transformers, &c. ...	£107,000	£94,000
Electric cables ... ..	49,800	76,000

Exports:—	1912.	1907.
Dynamoes, motore, transformers, &c. ...	£2,506,000	£1,716,000
Electric cables ... ..	1,643,000	2,200,000

It is claimed by a Frankfort newspaper that Germany now occupies the first position in the supply of the markets of the world with all classes of machinery, including electrical, and that the United States holds the second place and Great Britain the third. As compared with 1909, the German exports have increased in value by 54 per cent., and those of the United States by 82 per cent., whereas those from Great Britain are credited with a decline of 1 per cent. as against 1909.

**Automatic Brake Adjuster.**—THE ANGER MANUFACTURING AND SUPPLY CO., LTD., of Fishergate, Preston, have received a number of contracts for their Anger improved automatic brake adjuster recently described in our pages, including the following:—

Sheffield Corporation Tramways.—Additional order for 64 sets, making a total of 100 sets; all of the new trucks being built, are to be fitted with the brake adjuster.

One hundred sets for new bogie trucks, for Birmingham Corporation Tramways.

One hundred and thirty sets for Cardiff Corporation Tramways, being both single and bogie trucks.

Santos Development Co.—Sixty sets for the Santos Tramways, Brazil.

The specifications also include the brake adjuster for the new trucks for York, East London, Walthamstow, Darlington, &c., and duplicate orders have been received from Huddersfield, Hastings, Walsail, Dundee, Aberdeen, Capetown, &c.

They have also received further orders from Blackpool, for six bogie trucks to be equipped, and for seven more sets for the bogie trucks for Preston Corporation Tramways.

They have made shipments to Japan, amounting to 80 sets; and have further orders for bogie trucks for several systems in Japan.

The company has recently made arrangements with another factory to manufacture the various parts of the device at Hapton, near Burnley, and the specialities are also handled at factories at Newton Heath, Brussels, and Paris. The company has just made agreements with the Ackley Brake and Supply Co., of New York City, who will manufacture and sell the device in the United States, Mexico, Cuba, Porto Rica, Central America and Philippine Islands.

**Catalogues Wanted Abroad.**—Manufacturers of electrical supplies and appliances for domestic and office use (heaters, cookers, fans, irons, &c.), and also manufacturers of tramway supplies, workshop plant and tools, are invited to send recent catalogues (with prices and discounts) to the manager of each of the following companies:—

Pará Electric Railways and Lighting Co., Ltd., Caixa No Correio No. 29, Pará, Brazil.

Mariños Tramways and Light Co., Ltd., Caixa No Correio No. 148, Mariños, Brazil.

Venezuela Electric Light Co., Ltd., Apartado 175, Caracas, Venezuela.

Compania de Luz y Fuerza Motriz de Cordoba, Calle Rivera Indarte 155, Cordoba, Argentine Republic.

Compania Luz y Fuerza de Patana, Patana, Entre Rios, Argentine Republic.

Compania de Electricidad de Merida, S.A., Merida de Yucatan, Mexico.

North Melbourne Electric Tramways and Lighting Co., Ltd., Mount Alexander Road, Ascot Vale, Victoria, Australia.

**Lead.**—Following upon our recent comments upon the position of lead, we may quote a report on the matter issued by Messrs. James Forster & Co., of 141, Fenchurch Street, London, E.C., under date June 21st:—

"The course of the market this week has amply confirmed all we have written for a long time past. We have urged that the position is due to consumption overlapping production; others affirm that it is due to restriction of output in Mexico, a country producing normally 120,000 tons a year. We think we can conclusively prove that this is not the explanation.

"Imports into this country, January to May 31st, for the last two years, are:—1912, 91,221 tons; 1913, 91,417 tons. From Mexico: 1912, 9,315 tons; 1913, 8,033 tons. Our imports, therefore, are practically the same as for the same period last year.

"We give our opinion for what it is worth, and affirm that the scarcity of prompt lead, which has been more or less in evidence for 12 months past, is due almost entirely to the increase in consumption in the electrical trades. Copper and lead run together in this respect. What do we find in the former article? The production has increased 50 per cent. in the last few years, and has

not even kept up with consumption, whereas the production of lead is stationary. The largely-increased demands of Russia for lead this year are due to the extension of electrical work. Stocks in England and America two years ago amounted to 50,000 tons; American stocks in bond to-day are 9,000 tons, and there are none in England. The serious position is intensified by the restriction in Mexico due to the revolutionary troubles, and unless a normal condition rapidly supervenes there, it is impossible to put a limit to values. Further, there is a big 'bear' account on this market for July and August. Values increased daily this week until yesterday, when £21 10s. was done for June and £21 for July. At the close we had a considerable setback, June selling at £21 and July at £20 10s.; sellers for August at £20, and September £19 7s. 6d."

**Book Notices.**—*La Télégraphie sans fil, la Télé-mécanique et la Téléphonie sans fil.* By E. Monier. Seventh edition. Paris: Dunod et Pinat. Price 2 fr. 50 c.—The new edition has been revised and enlarged, and now includes sections on musical sparks, directive aërials, coastal signal stations for the guidance of ships in fogs, &c. The Eiffel Tower installation receives special attention, in view of its growing importance as one of the most powerful stations in the world, and the official centre of the international wireless time service. The control of operations at a distance, styled télé-mécanique by Prof. Branly, and the possibility of television by wireless, are among the subjects dealt with in this brightly-written little book.

*Manual of Wireless Telegraphy and Telephony.* By A. F. Collins. Third edition. London: Chapman & Hall. Price 6s. 6d. net.—The developments constantly taking place in wireless systems have necessitated a revision of Mr. Collins's manual, and the opportunity has been taken to rearrange the contents. The book deals with the theory, the apparatus employed for sending and receiving, the aerial wire system, wiring diagrams for transmitters and receivers, and the methods of operation. Various types of equipment are described, and chapters are included on "Suggestions to operators" and wireless telephony. The book is well illustrated, and contains a great deal of useful information.

*Journal of the Institution of Electrical Engineers.* Vol. 50, No. 219, with Index to Vol. 50. London: E. & P. N. Spon, Ltd. Price 5s.—The issue for May, 1913, contains the following papers: "Parallel Operation of Alternators," by A. R. Everest; "The Ohm, the Ampere and the Volt: a Memory of 50 Years, 1862-1912," by R. T. Glazebrook; "Developments in the Street Lighting of Manchester," by S. L. Pearce and H. A. Ratcliff; "Tramway Feeding Networks," by J. G. and R. G. Cunliffe; "The 'Knight' Fire Alarm System," by E. E. Moore; "The Nature of Dielectric Fatigue," by W. Holtum.

"Annual Tables of Constants and Numerical Data—Chemical, Physical and Technological." Vol. II, 1911. London: J. & A. Churchill. Price 28s. 6d. net.

"Modern Electrical Theory." By N. R. Campbell. 1913. London: Cambridge University Press. Price 9s. net.

"Practical Alternating Currents and Alternating Current Testing." By C. F. Smith. Price 6s. net. "Engineering Tables and Data." By W. W. F. Pullen. Price 1s. 6d. net. Manchester: Scientific Publishing Co.

"Logarithms for Beginners." By C. N. Pickworth. Fourth Edition. 1912. London: Whittaker & Co. Price 1s. net.

"Proceedings of the American Institute of Electrical Engineers." Vol. XXXII, No. 6. June, 1913. New York: The Institute. Price \$1.00.

"Transactions of the Illuminating Engineering Society." Vol. VIII, No. 5. May, 1913. New York: The Society. Price 75 cents.

"Journal of the Franklin Institute." Vol. CLXXV, No. 6. June, 1913. Philadelphia, Pa.: The Institute. Price 50 cents.

"Atti della Associazione Elettrotecnica Italiana." Vol. XVII, No. 11. June 15th, 1913. Milan: Stucchi, Ceretti & Co. Price L 150.

"Memoria leida en la Junta General de Senores Accionistas de la Compania Electrica de Alumbrado y Traccion de Santiago." February, 1913. Havana: Rambla, Bouza y Ca.

**X.L. Electric Company v. Aron.**—Mr. H. S. Chamberlain, solicitor for the plaintiff in this case, writes as follows:—"Referring to the article appearing in the legal column of your issue of June 13th, I have been directed to draw your attention to the fact that Mr. Aron does not hold two-thirds of the shares, but is the registered holder of 4,604 ordinary shares, and 25 founders' shares out of a total issue of about 12,000. Will you kindly correct the statement in your next issue!"

**Australia.**—The principal of a Sydney firm, visiting London, wishes to get into touch with United Kingdom manufacturers of all classes of electrical goods and machinery.—*Board of Trade Journal.*

**Annual Outings.**—On Saturday last about 70 of the employés of MESSRS. E. BROOK, LTD., of Huddersfield went for their ninth annual excursion to Workop, and had a drive round the Dukeries. The day proved exceptionally fine, and everything was carried out in a first-class manner by Messrs. Dean and Dawson, Ltd.

The office staff of the STERLING TELEPHONE AND ELECTRIC CO., LTD., had their annual outing on Saturday last, when they were invited to spend the day at the residence of the managing director, Mr. Guy Burney, at Westcliff-on-Sea. Ample facilities were provided for sailing, motoring and sports. Mr. and Mrs. Burney were quite ideal as host and hostess, and a most enjoyable day resulted.

A large number of the members of the head office staff of W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., participated in the annual trip up the river on Saturday last. The party, consisting of about 100 ladies and gentlemen, left Paddington Station by the 9.15 a.m.

train for Bourne End, and embarked there on the steam launch *H.M. Majesty*, proceeding up the river to Shipplake. Lunch was served on board, and at intervals a musical programme was provided by members of the party. On the return journey a stop was made at Henley and also at Marlow, in order to view the Regatta which was in progress there. The launch then proceeded to Maidenhead, where the company entrained for Paddington. Altogether it was an exceedingly enjoyable outing. The weather was gloriously fine, the river was at its best, and great praise was due to the stewards, who admirably carried out the arrangements.

**Dissolutions and Liquidations.**—JOHNSON SECRET WIRELESS TELEGRAPH AND TELEPHONE TESTING SYNDICATE, LTD.—This company is winding up voluntarily, with Mr. J. A. Robertson, 38 and 39, Billiter Square Buildings, E.C., as liquidator. A meeting of creditors is called for June 26th at 40, King Street, E.C.

DIRECT GAS FUEL, LTD.—A meeting will be held at 318, Moor-gate Station Chambers, E.C., on July 21st, to hear an account of the winding up from the liquidator, Mr. A. W. Good.

PERRY & CO., gas and electric light fitting manufacturers and electricians, 21, Grafton Street, and Avery Row, Brook Street, London.—Messrs. R. Wason, J. P. Fiddling, J. St. J. Smith and B. G. St. J. Smith have dissolved partnership, Mr. Fiddling retiring. Debts, &c., will be attended to by Mr. Wason, who will continue the business with the other two partners under the old style.

**Catalogues and Lists.**—MESSRS. ERCOLE MARELLI AND Co., 26, Garlick Hill, London, E.C.—Catalogue No. 81 giving full information describing their centrifugal electric pumps with excellent illustrations and a great deal of tabulated detail, including dimensions, weights, and prices.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Leaflet, No. O 1,704 giving illustrated particulars and price of the "Victor" electric battery fan for motor-boat, motor-bus and other service.

THE BRITISH THOMSON-HOUSTON CO., LTD., Rugby.—Price list, No. 4,125, describing the B.T.H. field discharge switches; also an attractive folder particularising and pricing their electric fans—desk and bracket types.

**Trade Announcements.**—THE ARC LAMP-LOWERING GEAR Co., Darlington, have appointed, as their sole agents for London and district, for the sale of their lowering gear and accessories, Messrs. Neale & Freund, Ltd., who will keep samples at their offices at 31, Budge Row, Cannon Street, London, E.C.

THE KORBUND Co. have removed their offices and warehouses to 329, Bank Chambers, High Holborn, W.C., where all communications should be addressed. We have received a list reprinting a number of testimonials from users of their special foundation plates.

MESSRS. BALFOUR, BEATTY & Co., LTD., have removed to 66, Queen Street, London, E.C. New telephone No. "503 City."

The telephone numbers of MESSRS. OSRAM LAMP WORKS, LTD., Hammersmith, have been altered to "Hammersmith 1500 and 1501."

**Bankruptcy Proceedings.**—JAMES EDWIN STOTT (James E. Stott & Co.), electrician, Huddersfield.—Application for discharge to be heard on July 31st at Huddersfield.

At the public examination in bankruptcy of MESSRS. TANNETT-WALKER, LTD., of Hunslet, Leeds, Mr. Arthur Tannett-Walker, in answer to questions by the Official Receiver, said that he attributed the failure of the firm to the fact that there were cleverer people than they were, and people were going in more for electric than for hydraulic power. The liabilities of the firm are given at £85,295, and the assets are estimated at £2,051.

## LIGHTING and POWER NOTES.

**Abingdon.**—Progress is being made with the electric light scheme by Mr. J. H. Edwards, of Bristol, who has acquired from the T.C. its rights under a prov. order. A local Electric Light and Supply Co. has been formed, and a contract entered into for the erection of the necessary buildings.

**Algeria.**—A proposal to establish a central electric lighting station in the little town of Stoueli is at present under consideration.

**Bath.**—The E.L. Committee of the T.C. has recommended the Council to open a showroom and offices in connection with the electricity undertaking in Dorchester Street.

**Batley.**—In the annual report upon the working of the electricity department during the year ended March 31st, which has been presented to the Electricity Committee, it is stated that whereas a deficit was made a year ago, the last 12 months have yielded a small net profit. The revenue had increased from £7,934 to £8,626, there being increases of £431 in the lighting receipts and an increase of £742 in the receipts from the power supply, whilst the traction supply had increased by £75. The net cost of working was £5,354, and the gross profit was £3,271, a decrease of about £207.

**Bexhill.**—A L.G.B. inquiry respecting the application of the Council for sanction to borrow £400 for land, and two sums of £1,500 for mains and house services during the next two years, has been held. The Town Clerk stated that the new sub-station was required owing to the rapid development of Cooden Beach and the west of Bexhill generally. Commander Loane, chairman of the Electric Light Committee, in answering a question, said they were carrying forward £1,200 this year, but the question of the relief of the rates depended largely on the assessment of the undertaking which, in this case, was very high. The Council had appealed, but had only succeeded in getting the amount reduced by £100.

**Bingley.**—The District Council has decided to apply for powers to borrow a further £1,500, for the purposes of the electric supply to be obtained from Keighley, and to apply for sanction for the laying of cables and mains from the Keighley boundary to various points in Bingley. Mr. W. Emmott has been appointed consulting engineer.

**Birmingham.**—In order to provide means of cooling the circulating water for the two 5,000-kw. turbo-generators which will shortly be erected at the Summer Lane Station, the Electricity Committee recommends that it be allowed to expend £6,300 on two additional cooling towers, and that sanction to a loan for this amount be obtained.

**Blackpool.**—Arrangements have been made with the L. & Y. and L. & N.W. Railway Co.'s whereby the latter have agreed to continue with a few exceptions the summer train service to October 18th, and keep on a better service than hitherto to the end of October. This will enable the Corporation to carry out an ambitious scheme of electrical illumination, commencing in the middle of September and continuing till the end of October. The scheme, which provides for the electrical illumination of the whole of the promenade from the Gynn to South Shore, with special effects at the various squares *en route*, is expected to cost several thousand pounds.

**Bridlington.**—The report of the past year's work in connection with the Corporation's electrical undertaking states that the gross income for the twelvemonth amounted to £7,449, as compared with £6,889 for the previous year. The net profit is returned at £1,324. Of this sum £198 is to be expended on meters, £500 allocated to a machinery and batteries renewal fund and the remainder to a floating balance fund.

**Brierfield.**—The U.D.C. has decided to apply to the L.G.B. for a further loan of £200 for electrical purposes.

**Brighton.**—The net profit on the Corporation electricity department for the past year was £1,406, as compared with £8,450 in the previous year. The falling off is attributed to decreased revenue both from lighting and tramways, due in the former case to the Early Closing Act. On the other hand fuel charges and taxes were higher. Over 10 million units were sold, and the revenue was £91,231. Curiously enough, the Finance Committee had already arranged to appropriate £2,300 from electricity profits in aid of the rates, against the wishes of the Electricity Committee, with the usual object in view—to keep the rates from "going up." However, it appears that the balance will probably find its way into the right place, viz., the reserve fund.

**Bury.**—Important alterations and mill extensions at Bury promise to be of immense benefit to the electricity undertaking. The Bury Papermaking Co., Ltd., of Gigg Mills, has applied to the Corporation Electricity Committee for a supply of current for about 1,000 H.P. of motors. The proposal will mean abolishing the present steam drive, and the substitution of electricity for driving and lighting. It is estimated that electrical driving will mean a considerable saving in cost of production. It is understood that the new system will be installed at the earliest possible moment. The Peel Spinning and Manufacturing Co., Ltd., proposes to erect a third mill, which will be electrically driven by about 1,000 H.P. of motors. It will be one of the largest electrically-driven works in Lancashire. The two firms will probably consume about 7 million units a year between them.

**Chester.**—The proposal of the Corporation to borrow £7,550 for the provision of a storage battery in connection with the works in course of erection on the site of the Old Dee Mills, has formed the subject of an inquiry by Mr. Hooper, of the L.G.B. In making the application, the town clerk said the Committee, after carefully considering the reports of the electrical engineer, had come to the conclusion that the most economical course to adopt was to provide a storage battery at the Crane Street works, with a net capacity of 550 kw. for three hours, at an estimated cost of £11,550, made up as follows: Building, £1,700; battery, £8,100; battery booster, £1,200; switchgear and instruments, £300; connections, £250. Of the amount named it was intended to defray £4,000 from the reserve fund. The Corporation asked that the loan in respect of the battery should be for a period of 30 years, and in respect of the other items for a period of 7 years. Particulars of the scheme, and evidence supporting the previous speaker's observations, were given by Mr. S. E. Britton, the electrical engineer. At the close of the inquiry the Inspector visited the site of the new works.

**Clones.**—Messrs. Henry Jenkinson & Co., Belfast, are promoting a company to introduce electric light into the town of Clones. Mr. Charles Ferguson, of Clones, has consented to act as managing director.

**Continental Notes.**—**SWEDEN.**—The British Vice-Consul at Nyköping reports that a powerful syndicate under the auspices of the Traffic Co. of Grängesberg-Oxelösund Ltd., the most important limited company in Sweden, is planning the erection of large iron works, electricity works, and coke ovens in Oxelösund, which may be considered as an exterior port of Nyköping.

The electric power plant will be of large capacity, able to supply electric power at a great distance and at cheap rates.

The capital necessary for all these undertakings amounts to between £400,000 and £450,000, and has already been fully guaranteed.—*Board of Trade Journal.*

**RUSSIA.**—The Société des Tramways de Koursk which supplies current for lighting purposes, as well as running the tramways in the town of Koursk, is adding a new 225-H.P. Diesel engine and generator to its central station with the view of meeting the increased demand.

**ITALY.**—The projected construction of a great ship canal between Milan and Venice, in which much activity is now being shown by the organising committee, will have an electrical aspect, as it is expected that considerable electrical power will thereby be provided, which will set off about one-quarter of the aggregate cost of the undertaking. The salient items of the scheme are the construction of two canals, the one connecting Milan with the River Po and the other connecting that river with the Venetian Lagoon. The length of the new waterway will be 380 km. It is stated that electric locomotive trains will work traffic on the canals, rackwork steam trains on the Rivers Adida and Po and steam tugs on the Lagoon.—*Zeitschr. des Oest. Ing. und Arch.*

A new co-operative association, with the title La Associazione Italiana fra Consumatori di Energi Elettrica, has just been formed in Milan to protect the interests of consumers of electrical energy, and possibly, to establish a power supply station on its own account.

**FRANCE.**—The authors of the two schemes for developing the water-powers of the Upper Rhone, namely, the Blondel-Harlé-Mahl scheme and the Bellegarde-Malpertuis scheme, have come to an understanding to work together the one chosen by the Ministre des Travaux Publics for execution.

La Société Electricité et Gaz-du Nord, which has an electric generating station of 19,000 kw. capacity at Jeumont (Nord), proposes to establish a new power station near Maubeuge, which will be connected up to the same network of mains, in order to guarantee an uninterrupted supply of electrical energy for power purposes to the large number of industrial establishments in the district.

**DENMARK.**—According to some statistics recently published in the *Elektroteknikeren*, of Copenhagen, the official organ of the Danish Society of Electrical Engineers, 57 new central electric lighting stations were established in Denmark during 1911, representing a total of 4,645 H.P., these figure comparing with 46 new plants, of an aggregate of 2,462 H.P., in 1910. Of the 57 stations mentioned, 10 were erected for town supply and 47 in country districts. During the year extensions representing an expenditure of £198,000 were made to existing stations, the similar outlay in 1910 being only £99,000. Excluding the stations in Copenhagen and Fredericksberg, which have a total capacity of 33,240 H.P., there were altogether in Denmark at the end of 1911, 293 electric lighting stations, representing 31,100 H.P., and an outlay of about £3,500,000, these figures comparing with respectively 234, 24,650 H.P., and £1,325,000 at the end of 1910. The article concludes with the statement that now that central stations have been established at Silkeborg and Hilsbaek, every town in Denmark with over 5,000 inhabitants is provided with electric lighting.

**Dundalk.**—At the bi-monthly meeting of the Urban Council, Mr. P. A. Spalding, resident electrical engineer, in his report, stated that the total number of services in connection with the electric lighting of the town amounted to 276 to date.

**Dundee.**—The Corporation has fixed the price of electricity for each unit in the first 2,500 units per quarter at 3½d., in the second 2,500 units 3d., in the third 2,500 units 2½d., in the fourth 2,500 units 2¼d., in the fifth 2,500 2½d., and above that 2d. per unit. The ordinary rates for power supply for the first 10,000 units are 1½d. per unit, between 10,000 and 50,000 ¾d., and above that ¾d. For heating and cooking 1½d. per unit is charged for the first 100 units, and ¾d. per unit above that.

**Dewsbury.**—The Assessment Committee of the local B. of G., in considering the classes of property in the borough which shall form the subject of a new valuation, has decided to include in that category telephones (a) call offices, (b) wires; electric power; (a) stations, (b) cables; pumping station, mains, electricity works; and tramways (a) depôts, (b) lines of rails.

**East Ham.**—Negotiations are being carried out with a view of supplying power to sewage works of the Wanstead U.D.C.

**Glasgow.**—Extensive additions are being made in connection with the electricity department. The Corporation is modernising the plant and greatly increasing the output. For this year the output is estimated at 63,000,000 units. The total plant at present installed in the power stations amounts to 37,000 kw. Since June, 1912, applications have been received for supplies equivalent to 12,000 kw., but a considerable proportion of this, however, has not yet been connected to the mains.

Orders have been placed for two 6,000-kw. turbo-alternators, one with the Westinghouse Co., and the other with Messrs. Howden; and two pairs of marine water-tube boilers are on order from Messrs. Babcock, and two pairs from the Howden Boiler Co. The whole of this plant is due for delivery in time to meet next winter's load. A new generating station is also to be erected on a site near the Dalmarnock Bridge, which, when complete, will have

a plant capacity of 100,000 kw. This new station will, so far as the plans have gone, be probably erected in three sections. When the full complement of plant is installed it is anticipated that the new works will take over the bulk of the supply for the whole area, and that the present main generating stations at Port Dundas and St. Andrew's Cross will be used for peak load purposes only during the winter months. The generating stations at Partick and Govan will then have been converted into sub-stations.

The consumption of coal per unit generated has been reduced during the past seven years from 5½ lb. to 3½ lb.; this, on a total consumption of 100,000 tons, is equal to a saving of £19,000 per annum.

The supply of electrical energy in Glasgow is to ordinary consumers a low-tension supply at 250 and 500 volts, and to consumers who make a large demand there is also available extra-high-tension energy at 6,500 volts. The Corporation has done much to encourage the use of electrical energy for power purposes. About 44,000 H.P. of motors at work in private premises take current from the Corporation mains. Where the energy is metered on the high-tension side the charge may be as low as £3 10s. per kw. of maximum demand per annum plus 15d. per unit consumed, and if the energy is metered on the low-tension side the charge may be at the rate of £5 10s. per kw. of maximum demand per annum plus 18d. per unit consumed. In certain cases these charges bring the average price per unit below a halfpenny. The charge in Glasgow for public street arc lamps is £12 10s. per lamp per annum.

**Greenock.**—At a meeting of the Corporation it was agreed, in view of the agreements having been signed by the power users in Port Glasgow, to apply for the order by the B. of T., and to negotiate for suitable sites for sub-stations in Port Glasgow. The meeting also authorised the signing of the agreements by the Corporation. It was reported that the electricity generated in May, compared with the same month last year, showed an increase of 90,283 units.

**Hertford.**—The R.D.C. has decided to assent to the application of the North Metropolitan Electric Power Supply Co. for powers to supply electricity within the Council's area.

**Holmfirth (Yorkshire).**—In reference to the invitation issued by the District Council for competitive schemes for generation and supply of electricity in the Council's area, the offer of Mr. Mountain, consulting engineer, of Huddersfield, to adjudge the schemes, has been accepted by the Council. Three schemes and tenders have been submitted by the firms of T. W. Broadbent, Huddersfield, F. Parkinson & Co., Leeds, and Drake & Gorham, Ltd., Manchester.

**Hornsey.**—The L.G.B. has sanctioned the borrowing of £3,000, repayable in 15 years, for house services in connection with the electricity undertaking. The total receipts from the electricity undertaking for the year ending March 31st last, amount to £22,336, as against £21,215 for the previous year, or an increase of £1,121. The receipts from private consumers total £20,469, as against £19,401, or an increase of £1,068. Distribution and management expenses, &c., amounted during the year to £9,843, as against £8,510, or an increase of £1,333, of which £633 was for coal. The amount to be transferred to net revenue account is put at £11,790, as against £12,015 in the previous year, or a decrease of £225. The net revenue account shows that during the period under review the repayment of loans and interest accounts for £10,639, as against £10,083, and that the net profit for the year is £1,289, as against £2,038, or a decrease of £748. The amount brought forward last year was £4,156; this year it is proposed to carry forward £5,446, of which about £4,000 is required for working capital.

**Hoyle and West Kirby.**—The Electric Supply Committee of the U.D.C. has approved of an estimate submitted by the engineer, amounting to £1,010, for structural alterations to the generating station and the laying of foundations for the engine beds and the condensing plant. Application is to be made to the L.G.B. for sanction to borrow an additional sum of £440, with a further £60 for contingencies, making a total of £6,000 in respect of proposed extensions.

**Japan.**—It is reported that the Anglo-Japanese Water Power Co. is in negotiation for the purchase of the Tomoyegawa power station of the Nagoya Electric Co. If the deal is consummated the company will be able to supply electrical energy for lighting and power purposes to the extent of 4,200 H.P. to the town of Hamamatsu from November next. The dams, power station and transformer sub-stations of the Katsuragawa Water Power Co. have just been completed and passed by the Government inspectors.

**Kettering.**—A L.G.B. inquiry has been held into the application of the U.D.C. for a loan of £1,600 for the laying of a new feeder, and there was no opposition.

**Kingstown (Co. Dublin).**—The preliminary arrangements in connection with the proposed electric supply at Kingstown are being actively pushed forward by the company incorporated to proceed with the undertaking. Several sites for the erection of a power station have been visited and inspected at Sandycove by the company's engineer, Mr. Tatlow, and it is understood the erection of the building will commence in or before October.

**Lincoln.**—The chairman of the Electricity Committee, in presenting the annual report of the department, recently said they had sold 2,236,587 units, an increase of over 21 per cent.; the gross profit amounted to £6,502, a decrease of £448 on the previous

year and the net profit, after subsidising the rates to the extent of £1,500, was £1,038. This was carried to depreciation account, which now stands at £8,836. He commented on the increased cost of coal and the extensions being made to plant.

**Littleborough (near Rochdale).**—The Tramways and Electricity Committee has decided that, subject to the Rochdale Canal Co.'s being agreeable to take current for power, the scheme for the laying of a cable from the kiosk in the square to the canal wharf in Canal Street be proceeded with at once.

**London.**—**St. Pancras.**—Modern flame arcs are to be substituted for eleven old arc lamps on the circuit in Tottenham Court Road and along Euston Road to Portland Road Station at an approximate cost of £150.

The Rees Roturbo Manufacturing Co. has been asked to submit a scheme and estimate for placing a high speed, electrically-driven pump in the workhouse well at or near the water level.

**Loughborough.**—The General Purposes Committee has agreed to a scheme for making extensions at the electricity works at a cost of £11,000 and for extending the mains at a cost of £3,000. The Brush Electrical Engineering Co. is the only maker of the special generator required, and is prepared, if this is put down, to let out on hire machinery to carry over the next winter's load. It is proposed that the electrical engineer be entrusted with the carrying out of the work, and that his salary be increased from £250 to £350 for the next three years, the increase to cover his remuneration for all extensions during that period. The scheme is, of course, subject to confirmation by the T.C. and the L.G.B., to whom application will be made for a loan.

**Mark (Somerset).**—A representative Committee of ratepayers has been appointed to ascertain what number of prospective consumers of electricity there are in the village, with a view to the Wedmore Electric Lighting Co. extending the mains to the parish.

**Mexborough.**—The L.G.B. has sanctioned the application of the U.D.C. to borrow £4,082 for a turbo-generator, excluding spares; £3,914 for buildings; £1,600 for boilers, &c.; £1,060 for cooling tower; £300 for expenditure on proposed public lighting works; and £300 for the provision of services in connection with the proposed public lighting works.

**Oldham.**—The Corporation Electricity Committee has decided to grant free electricity for illuminations after 9 p.m. on the day of the King's visit, to consumers willing to provide and fix devices.

**Peterboro'.**—The sanction of the L.G.B. has been received for borrowing £4,430 for a generating set, and £2,570 for boilers and mechanical stokers.

On consideration of the price charged to the Electric Traction Co. for power, it was decided to make no change up to 170,000 units per annum; but that the price for the next 30,000 be reduced from 1'2d. to 1'12½d. per unit, and that the price for any quantity beyond 200,000 units (as regards such excess) be 1d. per unit.

**Rawtenstall.**—The Health Sub-Committee, after consideration of a report by the borough surveyor relative to the installation of gas or electricity for the lighting of the workmen's cottages at Hall Carr, has resolved that electricity be installed, and that Mr. Stewart, the Council's electrical engineer, be instructed to proceed with the carrying out of the work. The T.C. has confirmed the recommendation.

**Sheffield.**—Mr. H. R. Hooper will on July 2nd and 3rd hold an inquiry into the application of the T.C. for loans, including one of £130,860, for electricity purposes.

**Swanage.**—The U.D.C. has approved of plans submitted by Dr. Purves, of Exeter, for the erection of a generating station in the town, but has requested that gentleman to postpone the laying of cables until the autumn.

**Surbiton.**—The District Council, at its last meeting, considered a report from Mr. J. F. C. Snell, upon the electricity undertaking for the half-year ended March 31st last. Mr. Snell states that so far as he could see the plant had been maintained in excellent working order and had run satisfactorily since his last inspection. There was a substantial increase in the number of units generated and sold, lamps connected and consumers added, and in spite of the continued replacement of carbon filament lamps by the metal filament, there had been an increase of 9'6 per cent. in the sale of units during the year.

**Swinton.**—In connection with the proposals for lighting the streets by electricity, an experimental test of the Barrow system, which is reported to have had good results in many districts, is to be made on Manchester Road.

**Tilbury.**—The U.D.C. has decided to request the Hon. Rupert Guinness, M.P., to oppose in Parliament the application of the County of London Electric Supply Co., Ltd., for a prov. order for electric lighting, unless the company agrees to insert a clause to the effect that its employés will be paid the Trade Union rate of wages.

**Tempo (Co. Fermanagh).**—The inhabitants of Tempo have decided to have a plant for electric lighting purposes installed. A company has been formed, and the necessary capital subscribed. At a meeting of the directors just held, it was decided to accept the tender of Mr. J. S. Loughlin, Bundoran, for the installation of the plant, which will be proceeded with immediately.

**Troon.**—At a special meeting of the T.C. a deputation was received from a number of ratepayers, who are in favour of the introduction of a system of electric lighting into the town.

**Whitworth.**—The D.C. has decided to apply to the L.C.B. for sanction to borrow £10,065, the estimated cost of setting up an electric lighting plant. Whitworth has had an E.L. order since 1905, but nothing has been done.

**Wisbech.**—The T.C. has been informed that the plant for the electric light undertaking in the town has been purchased by the National Electric Construction Co., Ltd., and that it will be in a position to supply current by the close of the present year.

## TRAMWAY and RAILWAY NOTES.

**Aberdeen.**—The T.C. has confirmed a recommendation of the Tramways Committee that in the scheme of extension for which a provisional order is to be sought, there should be added another new route, viz., a double line from the existing line at Queen's Cross, along St. Swithin Street and Union Grove, to Holburn Street. The estimated cost of this additional line is £13,803, and the borrowing powers will, therefore, have to be increased from £50,000 to £65,000.

**Birmingham.**—In connection with the scheme mentioned in our issue of the 20th inst., for linking up the various tramway routes in the centre of the city, the Tramways Committee has decided to recommend the Council to carry out the following extensions to the system:—(1) New line from the Five Ways, down Broad Street, to Paradise Street; (2) New line along Paradise Street, Victoria Square, Colmore Row, connecting with the Handsworth route; (3) New line along Suffolk Street, Easy Road, Great Charles Street, connecting Bristol Road and Dudley Road routes; (4) New line along Navigation Street, Stephenson Street, Stephenson Place, Corporation Street, Martineau Street, connecting the Moseley and district with Aston and other routes; (5) Present track in Corporation Street to be doubled and carried the full length of the street, to join the Aston route in Aston Road; (6) Track in Dale end to be doubled; (7) New line from Hagley Road, Monument Road, Icknield Street, Waistone Lane, Vyse Street, to join the Handsworth route at Hockley; (8) New line from Selly Oak to Northfield, Longbridge and Rednal; (9) New line from Gravelly Hill, across Erdington Hall estate, to Tyburn.

**Bradford.**—A local correspondent says that the newly established system of collecting the tramway fares of upper deck passengers, in Bradford, is not working very smoothly, chiefly because of the stupidity of some of the conductors, who insist on taking the fare on the platform of every passenger, even though the car may be standing at a terminus and a great crush of people endeavouring, in slow and painful fashion, to board the car. The instructions of the authorities allow latitude on the part of the conductors at crowded termini, but many of the men do not appear to realise this, and, to their own and the passengers' inconvenience, danger to those waiting in the road, and delay in starting the cars, insist on struggling with fares and change before allowing passengers to mount the steps. Prior to the establishment of the system most upstairs passengers who boarded the cars *en route* were very willing to pay before going upstairs, but the practice is now very roundly grumbled at.

The substantial decrease in the Corporation Tramway profits for the last year has resulted in considerable controversy as to whether or not the cause has been the adoption of 3d. fares on all cars boarded before 9 o'clock in the morning. It is fully recognised that, however much this system may have reduced receipts in one direction, it has had the effect of greatly augmenting the volume of traffic, and the conclusion has been accepted pretty generally that the chief cause of the decrease in profits during the past year was the bad weather of last summer, which meant little use of the many routes which take townspeople into the surrounding country. Even in that bad year the profit was £40,000, and it is not expected that the authorities will return to the all-penny fare system.

A meeting of the residents of Woodlands has passed a resolution calling upon the Tramways Committee to proceed at once to fulfil a long-delayed promise to establish a tramway service between Odsal and Oakenshaw.

**Chile.**—The Minister for Railways will shortly apply to Congress for funds for the electrification of the railway between Santiago and Valparaiso.—*Review of River Plate.*

**Continental Notes.**—**AUSTRIA.**—The engineers of the Austrian State Railway authorities are at present engaged in considering two projects for the establishment of electricity-generating stations for the supply of the necessary energy for the railways in the Southern and Eastern parts of the Tyrol. One plan is to utilise the power of the River Eisack, on the Klausen-Waidbrunn line, where from 5,000 to 16,000 H.P. is said to be available; the other proposal is to establish a plant to utilise the power of the

River Sadebach near St. Lorenzen, in the Puster Valley, from 3,000 to 9,000 H.P. being in this case available.

**RUSSIA.**—The authorities of the Moscow-Kasan Railway are reported to be considering the question of electrifying the section of the line between Moscow and Ramenkoje. It is proposed to utilise the water power of the River Pechorka in the generation of the necessary electrical energy.

La Société Tramways et Electricité en Russie has prepared plans in respect of a projected electric railway between Riga and a number of seaside pleasure resorts on the Baltic.

Among electric transit schemes whose realisation is impending is an electric railway between Irkutsk and Bodaibo, to serve the mining fields on the Lena; an electric tramway installation in the former town; and a similar installation at Vilna, the cost of which is put at about 5,000,000 roubles.

The traffic at St. Petersburg in the suburbs, on both sides of the Neva, has hitherto been inadequately catered for by steam and electric trams and omnibuses. With a view to an increased service, the Minister of Traffic has introduced into the Duma a Bill providing 16 million roubles for the construction of a complete network of electric tramways throughout the suburbs. It is considered that the Duma, at its reassembling, will pass this Bill, as the relief of the traffic has become an urgent necessity.—*Zeit. für Elek. und Masch.*

**SWITZERLAND.**—The Swiss State Railway authorities are reported to have decided on the electrification of the railway between Erstfeld and Bellinzona. Two power stations—one at Ameteg and one on Lake Rüdum—are to be established in connection with the scheme.

**SWEDEN.**—A fairly comprehensive plan already exists for the electrification of all the trunk lines of the State railways in Sweden, based chiefly on the waterfalls which belong to the State, or have been acquired for that purpose. It is expected that the electrification will be completed during the period 1914-20, at least, on the busiest sections of the system. Work has already been started on the Kiruna-Rikegransen section of the frontier line. The necessary power will be obtained from a water-power station at Porjus, which is now being completed. The work is being executed by the Allmänna Svenska Elektriska Aktiebolaget, in conjunction with the Siemens-Schuckertwerke. The estimated expenditure, together with the cost of introducing electric traction on the Kiruna-Rikegransen railway, was computed at £1,181,000, which sum was sanctioned by Parliament. The work was then commenced, and has so far proceeded that the power station, which is claimed to be the most northerly large station in the world, is to be brought into operation in the autumn of 1914. The station will contain five generating sets each of 12,500 H.P., and two of these will be for railway working, two for industrial purposes, and one as reserve. It is considered that the new electric line will prove economical in comparison with steam traction from the beginning, having regard to the regular and increasing traffic on the line. The severe Northern climate will also be a thorough test of the system, so that the experience gained will be of advantage when the electrification of the lines further south is undertaken.

Some discussion has recently taken place in Sweden as to whether it is justifiable to reserve the waterfalls for so many years for future railway traffic, thereby rendering their utilisation impossible, especially in Southern Sweden, for industrial development. There are, however, other waterfalls in that part of the country besides those reserved by the State; and, furthermore, the water power available can be increased by the regulation of the lakes. The reserved falls are specially chosen, so that they may be encircled by large dams and basins, by which the power required can be regulated without any waste of water.

**GERMANY.**—Good progress is being made with the conversion of the railway between Magdeburg, Leipzig and Halle for single-phase electric traction, and it is expected the line will be ready for traffic under the new conditions early next year. The trials on the converted section are to be extended with the view of gaining further experience, and also of training the train staff. The voltage of the working current is being increased from 10,000 to 15,000 volts, and the distance between the gantries supporting the overhead work extended from 245 ft. to 328 ft., an arrangement which will not only enable the signals to be seen more clearly, but will reduce the cost of porcelain insulators. Work at the power station at Muldenstein is well advanced. Separate buildings are being provided for the boilers, turbines, generators and switchboard. The generating plant will comprise seven turbo-alternator sets, of which four, each of 4,000-kw. capacity, will supply current for the line. The electrical energy will be transmitted as single-phase alternating current at a voltage of 60,000 to three transformer stations located at Wahren, Marke and Gommern, the latter being the maximum distance (44 miles) away. More than half the masts and cross girders are already erected, and the 60,000-volt transmission is nearly complete. The length of the section is about 94 miles, representing a total of, approximately, 310 miles of track.

The work in connection with the introduction of electric traction on the Lauban-Königszell-Hirschberg-Grünthal and other mountain railways in Silesia is making good progress, and the generating station at Mittelsteina is approaching completion. Altogether there will be 72 electric locomotives and five motor-car trains, and 50 of the former and all the latter have already been ordered. The maximum speed of the passenger trains will be 56 miles an hour. Orders for 20 of the heavy goods locomotives have been placed with the Siemens-Schuckert Works, and with Brown, Boveri & Co., for 10 further locomotives, whilst five motor-car trains are to be delivered by the A.E.G., in conjunction with the Linke-Hofmann Works. It is expected that trials will begin on one of the lines in

the autumn, and the other sections will be brought into operation gradually as from the spring of 1914.

**GREECE.**—The Société des Tramways et Eclairage Electriques de Salonique has secured a concession for the construction and working of about eight miles of new electric tramways in the town of Salonica.

**POLAND.**—A scheme has been submitted to the authorities of the Government of Petrikau for the construction of a system of electric tramways in the town and district of Sosnowice.

**HOLLAND.**—It is proposed to convert the steam tramway between the Hague and Delft for electric traction.

**SPAIN.**—A scheme is under consideration in Barcelona for the construction of an electric tube railway in that city.

**FRANCE.**—La Société des Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont (Nord), have secured an order from the Midi Railway Co., of France, for eight 1,500-h.p. electric locomotives.

**ITALY.**—The Supervising Council in the Italian Ministry of Public Works has given an affirmative vote in regard to the application for a concession to construct an underground electric railway between Sampierdarena, Genoa and Quarto. It is, therefore, expected that the concession, which is asked for 70 years, will shortly be granted. The promoters are Emilio Rava and the Marquis Cattaneo Adorno, who are supported by a Franco-Belgian group of financiers. It is intended to establish 12 intermediate stations on the railway, which is to be 6.3 miles in length, and the cost of construction is estimated at £1,200,000. The railway is to be operated on the direct-current system, and the power is to be supplied by the Maira Hydraulic Power Co., which was formed by the Motor Co., of Baden.

**Dover.**—Some time ago Messrs. Chamberlain & Hookham offered the Corporation the use, free of cost and for a given period, of 24 meters for the purpose of checking the current consumption on tramcars. This period has now expired, and, according to the general manager, the saving effected is more than sufficient to cover the cost of purchasing the instruments, which he advises the Council to do. The Council has decided to adopt this course. The tramway track in High Street is to be relaid immediately.

**Edinburgh.**—The T.C. is considering the question of tramway facilities in the suburbs, and last week several of the members inspected a Tilling-Stevens petrol-electric 'bus. Tests were satisfactorily carried out on several steep gradients, and the Councillors appeared to be satisfied in regard to the adaptability of the vehicle for suburban traffic.

**Ealing.**—A recommendation by the Tramways Special Committee that the date of the purchase period of the London United Tramways be extended for a period of 14 years, subject to certain conditions embodying the relaying of the whole of the track, was considered at the last meeting of the T.C. Councillor Schofield moved an amendment that the Committee's recommendations be accepted with the addition that all the centre standards be removed, that the rails be contracted, and that a further clause be added in the agreement giving the Council greater power to enforce the proper repair of the track. This amendment was carried by 11 votes to 8. Councillor Farr said the amendment was somewhat indefinite, and moved that the whole matter be referred back for the purpose of considering what provisions should be inserted in the agreement. The amendment was carried as a substantive motion.

**Glasgow.**—The nineteenth annual report of the Tramways Committee has just been issued, and contains a number of points which were not included in the earlier summaries supplied to the REVIEW. These include the statement that the gross revenue for the year shows an increase of £29,327, compared with that of the preceding year, and that the average traffic revenue per car-mile has decreased from 10.561d. to 10.361d. The working expenses show an increase of £36,706, equal to 1.37d. per car-mile, mainly due to increased wages, extra expenditure incurred in permanent way maintenance, fuel, and amount paid in local taxation. The total amount of expenditure on capital account at May 31st, 1913, was £3,694,143. The balance of tramway debt owing to the Common Good now amounts to £2,479,407. The balance at the credit of the depreciation and permanent way account was £2,010,282, while the credit balance in the general reserve fund was £39,362. The total mileage of single track is now 196 miles. During the year £74,071 had been expended on the upkeep of the track in ordinary repairs, and £85,675 had been set aside out of the year's revenue to meet track renewal. The total cost of the ordinary repairs to the power plant and sundry machinery during the year was £5,627, and £35,584 was charged against revenue to meet depreciation. There were 843 cars in stock, 769 being top covered.

**London.**—It is reported that the Great Northern Railway has come to an agreement with the Metropolitan Co. regarding the future working of the Great Northern and City Line, and that the original intention of constructing a junction with the G.N. Co.'s main line at Finsbury Park, will now be carried out, presumably to allow that company's trains to run through to Moorgate Street Station.

**Paisley.**—The Paisley District Tramway Co. has completed an extension of the main tramway line to the centre of Kilbarchan.

**Walthamstow.**—With a view to overcoming the swaying and galloping of the cars, the whole of the latter are to be fitted with half-elliptic springs, at a cost of £5 10s. per car, the work to be spread over a period of two years. New ends are to be fitted to

all the tramcar axles. The tramways engineer has been instructed to obtain quotations for the supply of additional malleable steel bearing shells.

**Whickham.**—The Gateshead and District Electric Tramways Co. has informed the Council of its intention to operate an experimental service of motor-buses in the Council's district. It adds, however, that owing to the exceeding difficulty of obtaining delivery of 'buses, it does not expect to be able to inaugurate the service before next spring.

**Wigan.**—The report of the traffic manager of the tramways for the year ended March 31st shows that the past year has been the most successful yet recorded since the inception of the electric tramway undertaking. On the year's working there is a profit of £1,178, as compared with a deficit of £1,089 during the year 1911-12. The receipts amounted to £71,268, as against £66,328, an increase of £4,939. The average receipts per car-mile worked out to 11.80d., as compared with 11d. last year.

## TELEGRAPH and TELEPHONE NOTES.

**Argentina.**—A Bill is before Congress making it obligatory for all steamers carrying passengers, arriving at or leaving Argentine ports, to be fitted with wireless telegraphy.

**Australia.**—The automatic exchange installed at Geelong, Victoria, proved a success, and the Government has now intimated that it intends to install similar exchanges at Balmain, Newtown and Glebe, in this State; at Perth, in Western Australia; and at Brighton, in Victoria. Altogether these and other outstanding tenders will run into about £200,000.

**Canada.**—A Bill before the Canadian Parliament provides that from July 1st, 1913, vessels trading from any Canadian port carrying 50 or more persons, and plying between ports more than 200 miles apart; or carrying 250 or more persons and plying between ports more than 90 miles apart; or carrying 500 or more persons and plying between ports more than 20 miles apart, must be equipped with radio-telegraphic apparatus, capable of receiving and transmitting messages at least 100 miles.—*Telegraph and Telephone Age.*

**Norway.**—A Committee of the Storting has unanimously recommended that provided that certain modifications are obtainable, sanction be given to the contract made by the previous Government, subject to the Storting's sanction, with the Marconi Co. to erect a large wireless telegraph station near Stavanger at a cost of 2,000,000 kroner, to communicate with the wireless station erected by the Marconi Co. near Boston.

**Puerto Rico.**—The U.S. Government wireless telegraph station at San Juan is to be provided with two additional 300-ft. steel towers. The importance of this station will be greatly increased with the opening of the Panama Canal.

**United States.**—The *Telegraph and Telephone Age* states that there are now over 500,000 telephones in service in New York City, and 67 telephone exchanges. The New York Telephone Co. has reduced its rates between certain sections of the city from 10 to 5 cents per message, and between other sections from 15 to 10 cents.

## CONTRACTS OPEN and CLOSED.

### OPEN.

**Aldershot.**—July 1st. Electric fire-alarm call posts with telephone services to each, for the U.D.C. Mr. F. C. Uren, surveyor.

**Australia.**—VICTORIA.—July 29th. Detectors, for the P.M.G.'s Department. See "Official Notices" June 20th.

August 4th. (a) Twin surface condensers, hotwells, piping and sundries; (b) air and water extraction pumps and motors; (c) circulating water and sump pumps, with motors, for the Melbourne Suburban Railways power house. See "Official Notices" June 13th.

September 16th.—Switchboard, c.b. or automatic or semi-automatic, at Collingwood. See "Official Notices" to-day.

QUEENSLAND.—August 27th. Five sections of common-battery multiple switchboard, for the P.M.G.'s Department. See "Official Notices" to-day.

September 10th.—Nine sections of trunk line switchboard, for the P.M.G. See "Official Notices" to-day.

WESTERN AUSTRALIA.—July 30th and August 6th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" to-day.

July 23rd.—Telegraph and telephone instruments, for the M.G. See "Official Notices" June 20th.

July 23rd.—Telephone switchboards and parts, for the P.M.G. See "Official Notices" June 20th.

July 30th.—Cable, switchboard, for the P.M.G. See "Official Notices" to-day.

July 19th.—Switchgear and accessories for an electric power station at Perth. See "Official Notices" to-day.

SOUTH AUSTRALIA.—July 16th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" June 20th.

August 13th.—Common battery switchboards and telephone parts for Adelaide. See "Official Notices" to-day.

NEW SOUTH WALES.—July 9th. Switchboards, for the P.M.G. See "Official Notices" May 30th.

Austria.—VIENNA.—July 3rd. Tenders are required for the supply of an electric pumping plant with current transmission lines for the Gmünd water station. Particulars, plans, &c., from the Abteilung für Zugsförderung und Werkstättenendienst der k. Staatsbahn-direktion, Wien.

July 7th.—Tenders will be received for a variety of machine tools and accessories for the boiler smithy of the Simmering machine shops, including one three-ton electric travelling crane; one 25-ton ditto; two ironsmith's hearths with electric fans; two portable electric hand boring machines, &c. Particulars (2 kronen) from the Abteilung TV/4, Fachabteilung der Zugsförderung und Werkstättenendienst in Vienna.

Belgium.—July 25th. The Fonderie Royale de Canons, Liège (80, Quai Saint Leonard). Tenders for (1) The supply and laying of the cables in connection with the electric lighting of 12 forts in the Liège district and nine in the Namur area; (2) Forty-two dynamos and 17 D.C. motors for the forts in the Antwerp and Tense districts; also 21 switchboards.

July 7th.—Tenders are being invited by the municipal authorities of Fleron (province of Liège) for the concession for the public and private electric lighting of the town.

July 13th.—Belgian State Railway authorities at Gand-Sud, Belgium. Establishment of two transformer stations at Ostend.

Birkenhead.—July 14th. Low-tension main cable, and india-rubber lead-covered and armoured service cable for the Corporation. See "Official Notices" to-day.

Canterbury.—June 30th. Small coal and large Welsh seam navigation coal (about 1,750 and 350 tons respectively), for the Corporation electricity works. Mr. H. Fielding, Town Clerk.

Costa Rica.—September. Municipality of Limon. Hydro-electric plant, comprising two Pelton turbines of 414 H.P., 400-kw. generators, and six transformers. Plans and particulars from the Ingeniero Municipal, Limon. A copy of the *facta*, containing some particulars in Spanish, can be seen at the Board of Trade Commercial Intelligence Department in London.

Denmark.—A Danish firm wishes to secure the representation of United Kingdom manufacturers of armatures and other electrical machinery. Another Danish firm wishes to be put into touch with United Kingdom makers of electric fittings of porcelain or faience with gold decorations for fixing to ceilings. Communications regarding these inquiries should be addressed to the Danish Consulate-General in London, 8 and 9, Byward Street, Great Tower Street, E.C.—*Board of Trade Journal*.

ALTONA.—The Harbour authorities will be shortly placing orders for electric cranes, &c. Particulars of the Havencommission, Altona, Denmark.

Derby.—Steam coal for the Electricity Department. Borough Electrical Engineer, Full Street, Derby.

Eccles.—June 28th. Electric lighting of Green Lane Council School, Patricroft. Mr. S. H. Neave, Secretary to the Education Committee.

Elland.—July 2nd. Street lighting lanterns, for the U.D.C. See "Official Notices" June 13th.

Fleetwood.—June 30th. Extension of boiler house at the electricity works, Copse Road. Surveyor to U.D.C., Town Hall.

France.—July 22nd. The French State Railway authorities (Service Electrique, 2me division), 43, Rue de Rome, Paris, are inviting tenders for the supply of the necessary plant for the Paris-Vaugirard transformer sub-station.

Limerick.—July 3rd. Switchboard and gallery, battery, motor-driven booster, balancer, &c., for the County Borough Council. See "Official Notices" June 13th.

Lincoln.—June 30th. Cobbles and slack coal, for the Corporation electricity works, for a year. Electrical Engineer, Rayford Side North.

London.—L.C.C.—July 2nd. Electrical installation at the Caldecot Road Elementary School, Denmark Hill, Camberwell (192 lighting points). See "Official Notices" June 13th.

STEPNEY.—July 3rd. The Electricity Committee invites tenders for two E.H.T. converting plants suitable for 6,000-volt three-phase A.C. to L.T., D.C., for Limehouse and Whitechapel stations. See "Official Notices" June 13th.

June 30th.—Arc lamp carbons, for a year, for the Borough Council. See "Official Notices" June 13th.

HACKNEY.—July 24th. Extra-H.T. ring main conduits, sub-station plant, switchgear and cranes, for the B.C. electricity department. See "Official Notices" June 20th.

H.M. OFFICE OF WORKS.—Incandescent electric lamps for one year. See "Official Notices" June 20th.

Luton.—July 2nd. Extensions to the electricity works for the T.C. Mr. W. H. Cooke, electrical engineer, St. Mary's Road.

Manchester.—July 2nd. Stuart Street Generating Station: water-softening and filtering plant. Mr. S. L. Pearce, chief electrical engineer; Mr. F. E. Hughes, secretary, Electricity Department.

Newport (Mon.).—July 1st. Refuse destructor for the T.C. Borough Engineer, Town Hall.

Oldham.—One 2,000-kw. steam turbine, coupled to extra-H.T. A.C. generator, also barometric condenser, pumps, &c., for the Corporation. See "Official Notices" June 20th.

June 30th.—Electric light installation at Richmond Street new schools, for the Borough Education Committee. Mr. Thos. Hilton, architect, 7, Union Street, Oldham.

Ramsey (Hunts.).—June 30th. Street lighting, for the U.D.C. Mr. R. F. Serjeant, Clerk.

Roscrea.—July 11th. Roscrea Bacon Factory, Ltd., invite tenders for buildings, gas engine and suction plant, dynamos, battery, switchboard, overhead feeders, mains and street lamps, for the electric lighting of the town. See "Official Notices" to-day.

Rotherham.—July 8th. Tramway stores, coal, cable and meters, for the Corporation. See "Official Notices" June 20th.

Salford.—July 9th. Two-phase switchgear. Scott transformers and regulators, for the Electricity Department. See "Official Notices" to-day.

Scarborough.—July 12th. Electric light installation at the Workhouse and Infirmary, for the B.G. (about 360 lights). Tennant and Barrs, consulting engineers, Cathedral Buildings, Dean Street, Newcastle-on-Tyne (returnable deposit of £5).

Spain.—July 6th. Municipal authorities of Almedinelli (Province of Cordoba) for the concession for the electric lighting of the town during a period of 10 years.

Stoke-on-Trent.—Coal and slack for a year for the Corporation electricity works. Electrical Engineer, St. Peter's Chambers, Glebe Street, Stoke.

West Ham.—July 10th. Electric light installations for the Forest House branch workhouse and Forest House cottages, Leytonstone, for the Union. See "Official Notices" to-day.

## CLOSED.

Barnes.—The U.D.C. has accepted the tender of Messrs. Siemens Bros. Dynamo Works, Ltd., for an extension to the switchboard, at £150; and that of the Albion Clay Co., Ltd., for ducts for feeder extensions at East Sheen, at 3s. 5d. per yard.

Belgium.—Nine concerns—five German, one British (W. T. Henley's Telegraph Works, London), two Belgian and one French—last week submitted tenders to the Belgian telegraph authorities in Brussels for the supply of 5,234 metres of telegraph cable, the lowest being that of the Rheydt Kabelwerk Gesellschaft, of Rheydt, Germany.

Buenos Ayres.—The Auer Gesellschaft (Berlin) have secured the contract for the supply of 70,000 Osram lamps for the street lighting of the city.

China.—Messrs. Hick-Diesel Oil Engines, Ltd., have received a contract for one 200-kw. Hick-Diesel set for the Kwang Tung Electric Supply Co., Ltd., Canton.

Glasgow.—The T.C. Electricity Committee has recommended acceptance of the following contracts for the year 1913-14:—

Single cables and low-tension cables.—Callender's Cable and Construction Co., Ltd.

Extra-high-tension cables.—W. T. Glover & Co., Ltd.

Rubber-covered cables.—Craigpark Electric Cable Co., Ltd.

Flexibles.—Callender's Cable and Construction Co., Ltd.

Arc lamp carbons.—Sloan Electric Co., Ltd.

Yellow flame arc lamp carbons.—C. W. Webster.

Meters.—British Thomson-Houston Co., Ltd.; Chamberlain & Hookham, Ltd.; Ferranti, Ltd.

For providing and erecting economisers at Port Dundas and St. Andrew's Cross generating stations the offers of Messrs. E. Green and Sons, Ltd., amounting to £2,705 and £1,848 respectively, have been accepted, while the tenders of Messrs. Musgrave & Co., amounting to £675 and £679 respectively, for providing and erecting induced-draught fans for the new boilers at Port Dundas and St. Andrew's Cross stations have also been accepted. The Baloke Co.'s offer to provide air filters for the two stations mentioned, at £220 each, has been closed with.

The T.C. Tramways, Works and Stores Committee recommends the acceptance of the following:—

- Gear wheels.—E. W. Bliss Co. and W. C. Yule & Co., Ltd.
- Cast-iron gutters, &c., for Fleming Street.—W. MacFarlane & Co., Ltd.
- Cable equipments, motors, &c.—British Westinghouse Co., Ltd.
- Car equipments, controllers.—British Thomson-Houston Co., Ltd.

**Hastings.**—The T.C., on June 20th, accepted the tender of the Oliver Arc Lamp Co., Ltd., for 100,000 pairs of carbons for Oriflammé arc lamps, at £2 18s. per 1,000 pairs.

**Huddersfield.**—The Electricity Committee has accepted the following tenders:—  
Cable, service and bitumen.—I. Frankenburg & Co.; concentric, W. T. Glover & Co.

**London.**—Messrs. Siemens Bros. Dynamo Works, Ltd., of Dalston, have secured the following contracts:—

- Great Northern Railway Co.—Drawn-wire metal-filament lamps and carbon-filament lamps for 12 months.
- War Office.—Standard carbon-filament lamps.
- Further contract from the Royal Mail Steam Packet Co. for marine traction type tantalum lamps for 12 months.

**St. Pancras.**—The B.C. has accepted the tender of Messrs. E. F. Moy, Ltd., at £98, for a supply of testing panels; also the tender of the Electrical Power Storage Co., at £86, for cells. For an annual supply of coal the Electricity Committee has accepted the tender of Messrs. J. H. Beattie & Co., Ltd., as follows:—10,000 tons Haunchwood best hard, 18s. 1d. per ton; 15,000 tons Mansfield nutty slack, 15s. 7d. per ton.

**STEPNEY.**—The B.C. has accepted the tender of Messrs. Forbes, Abbott & Lennard, Ltd., for a supply of 50 tons of moulded pitch for use in the electricity department, at 54s. per ton.

**SOUTHWARK.**—The B.C. has received the following tenders for annual supplies of various cables, &c.:—

Electrical Engineering and Equipment Co., Ltd.	.. .. .	£5,189
Johnson & Phillips	.. .. .	5,296
Western Electric Co., Ltd.	.. .. .	5,116
W. T. Glover & Co., Ltd.	.. .. .	5,210
Pirelli, Ltd.	.. .. .	5,577
General Cable Manufacturing Co.	.. .. .	4,635
Henry's Telegraph Co., Ltd. (out of order, and not considered)	.. .. .	5,153
Callender's Cable and Construction Co., Ltd. (out of order, and not considered)	.. .. .	5,530
Siemens Bros. & Co., Ltd.	.. .. .	5,112
R. R. Todd	.. .. .	5,169
British Insulated and Helsby Cables, Ltd. (accepted)	.. .. .	5,031
Union Cable Co., Ltd.	.. .. .	5,358

**Orkney.**—Messrs. S. Baikie & Son, Ltd., Kirkwall, have secured the Admiralty contract for the erection of a wireless signal station at Brough, South Ronaldshay.

**Peterborough.**—At Tuesday's T.C. meeting a report was submitted by a committee, also one by Dr. J. A. Fleming, with regard to tenders for the extensions to the works. Dr. Fleming advised the acceptance of the lowest tenders in each case. These were:—Messrs. F. Danks for Lancashire boilers, £1,163 (16 tenders submitted); for turbo-generator of 500-kw. capacity, Messrs. Willans & Robinson, and Siemens—disk and drum turbine, coupled direct to Siemens direct current generator (price not stated, eight tenders). The consulting engineer wrote in highly eulogistic terms of the firms mentioned, and of the proved reliability of their manufactures. He also added that on examining the works, of which he was the original consultant, he found the plant in good order and repair, and giving excellent results from an economical point of view.

**Rochdale.**—The Corporation tramways department has ordered tantalum traction type lamps for the ensuing 12 months from Messrs. Siemens Bros. Dynamo Works, Ltd.

**Walthamstow.**—The U.D.C. has received the following tenders for a natural draught cooling tower at the electricity works:—

Midland Engineering Co.	.. .. .	£1,145
Klein Engineering Co. (1908), Ltd.	.. .. .	1,442
Worthington Pump Co., Ltd.	.. .. .	1,800
Zylba Engineering Co.	.. .. .	1,900
Hudson Economiser Co. (1907), Ltd.	.. .. .	1,706
Balcke & Co., Ltd.	.. .. .	1,254
Davenport Engineering Co.	.. .. .	1,928
Jarvis Bros., Ltd.	.. .. .	1,423
Blasberg Engineering Co., Ltd.	.. .. .	950
Kater & Ankersmit	.. .. . (accepted)	800

**THE ELECTRICAL ENGINEERS (LONDON DIVISION).**

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, June 30th.—"A" Company. Infantry drill, 7 to 9 p.m.; technical instruction for all members on the 5th rate, and for all candidates for higher rating, 7 to 9 p.m.

Tuesday, July 1st.—"B" Company. Ditto.

Thursday, July 3rd.—"C" Company. Ditto.

Friday, July 4th.—"D" Company. Ditto.

Saturday, July 5th.—All Companies. Royal Review. The corps will parade at Headquarters at a time to be notified later. Dress: Service dress—cap, jacket, trousers, putties, black boots, haversack, water-bottle (filled), belt, frog, rifle and sling, bayonet, great-coat rolled, carried on back of belt by two great-coat straps (these must be obtained from Headquarters as early as possible). A haversack ration will be issued to all N.C.O.'s and men on arrival at Headquarters.

(Signed) P. H. CAMPBELL, Capt. R.E., Adjutant,  
For Officer commanding L.E.E.

**FORTHCOMING EVENTS.**

Physical Society of London.—Friday, June 27th. At 5.30 p.m. At the National Physical Laboratory, Teddington. Inspection of work in progress.

Junior Institution of Engineers.—Friday, July 4th. Leave London for excursion to Brussels.

Saturday, July 5th. Visit to Ghent Exhibition.

Sunday, July 6th. Excursion to Dinant, the Valley of the Meuse, the Field of Waterloo and Antwerp.

Monday, July 7th. Visit to places of interest in Brussels. Return to London in the evening.

Salford Technical and Engineering Association.—Saturday, July 5th. Visit to Central Fire Station, London Road, Manchester.

**NOTES.**

**An I.M.E.A. Photograph.**—On page 1070 we reproduce a group of Municipal Electrical visitors taken at Hampton Court during the recent Convention. The original photograph, which was taken by Messrs. Geo. T. Jones & Son, of Surbiton Park Terrace, Kingston-on-Thames, is a really excellent specimen of photographic art, copies of which can be obtained from the firm mentioned.

**£250 Still Required.**—We have no definite news this week regarding further promises for the Electrical Trades Benevolent Institution. There is, therefore, still £250 wanted in order to complete the sum necessary. The time is getting short now.

**Copper.**—The visible supplies continue to diminish without, apparently, affecting the market. Messrs. Merton's mid-monthly circular shows stocks in England, France, and afloat thereto, 29,271 tons, a reduction of 323 tons for the fortnight. English stocks having transferred 578 tons, the difference is made up by increased quantities afloat. The more extended European supplies (including Rotterdam, Hamburg, Bremen and estimates for other ports) were at 41,173 tons, a drop of 514 tons on the same for May 31st. The existence of this substantial quantity may explain the apparent alteration in influence of European supplies.

Arrivals from North America to Europe were low at 12,991 tons, and Spain and Portugal have given a small quantity during the fortnight. Chile shipments are about average; Australian the same. Total deliveries are low, as would be expected after the heavy turnover of last month.

Stock in American producers' hands for May 31st, as published by the American Producers' Association, was 30,122 tons, a reduction of 3,606 tons on the preceding month. The total visible supply (May 31st) amounted to 70,309 tons, or 7,247 tons less than for the end of April.

**The American Society for Electrical Development.**—

At this Society's annual meeting, held in Chicago on June 2nd, some of the by-laws of the Society were amended, the most important being an amendment of Article IV, upon which is based the subscription payable by the members of the Society. Manufacturers and central stations have been paying one-fifth of 1 per cent. of their annual business, contractors and jobbers one-twentieth of 1 per cent. of their annual business. Some considerable objection has been raised to this plan because it discloses the amount of the annual business of the member. A new system of classification has been worked out which enables a man to go into the Society without divulging too closely what his annual business amounts to, and at the same time permits of fluctuations in his business from year to year without disclosing the same in his annual subscription.

During the Friday morning session of the National Electric Light Association Convention, June 6th, Mr. Wakeman read a paper on the plans and aims of the Society for Electrical Development. During the discussion which followed, Mr. Henry L. Doherty, the President of the Society, delivered an address upon the necessity for the full co-operation of the central stations with the movement.

During the recent slogan contest, inaugurated by the Society for the purpose of obtaining a slogan, 2,675 replies were received from all over the United States, indicating the widespread interest taken in it by the public. The slogan selected was "Do it Electrically." It is expected that all the members of the Society will use the slogan in all their advertising, also upon their stationery, &c. The membership of the Society now numbers 198, and we are informed that the success of the Society is assured.

**Electricity in Brazilian Mines.**—

The directors of the St. John Del Rey Mining Co., Ltd., in their report, say that the demand for skilled workers is increasing in Brazil, and the difficulty of obtaining the full supply of labour necessary for working the mine to the greatest advantage under present conditions may continue or recur. Mr. Chalmers is, therefore, of opinion that further labour-saving appliances should be introduced. With this object in view, he and the staff have given a large amount of study to the existing arrangement of the machinery and plant below and above ground, and he has forwarded special reports making various important suggestions. One proposal is to drive the winding and hauling engines at and below horizon VIII directly by electric power instead of by compressed air. Mr. Chalmers estimates that the saving of power to be effected by this change would be sufficient to drive machine drills for the whole of the rock drilling, thus saving a number of hand borers. As highly technical questions arise in connection with this proposal, the opinions of electrical

engineers most experienced in the class of work under consideration, have been obtained and forwarded to Morro Velho. Mr. Chalmers will now report finally with specifications of plant required, as the board have approved in principle his suggestion to convert in the first instance the "G" shaft engines and one winch engine to electric drive. If, after thorough trial, the results are satisfactory, the question of converting other underground engines will be considered. The saving of power is valuable, even apart from the shortage of labour.

**International Engineering Congress, 1915.**—In connection with the Panama-Pacific International Exposition which will be held in San Francisco in 1915, there will be an International Engineering Congress, in which engineers throughout the world will be invited to participate. The Congress is to be conducted under the auspices of the following five National engineering societies:—The American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers, American Institute of Electrical Engineers, and the Society of Naval Architects and Marine Engineers. These societies, acting in co-operation, have appointed a permanent Committee of Management, consisting of the presidents and secretaries of each of these societies, and 18 members resident in San Francisco.

The papers presented at the Congress will naturally be divided into groups or sections. During the Congress each section will hold independent sessions, which will be presided over by a chairman eminent in the branches of engineering covered by his section. The scope of the Congress has not as yet been definitely determined, but it is hoped to make it widely representative of the best engineering practice throughout the world, and it is intended that the papers, discussions and proceedings shall constitute an adequate review of the progress made during the past decade and an authoritative presentation of the latest developments and most approved practices in the various branches of engineering work. Prof. W. Durand is chairman of the Committee, and Mr. W. A. Cattell, secretary-treasurer. The executive offices are at Foxcroft Building, 68, Post Street, San Francisco.

**Fatalities.**—The inquiry into the cause of the death of Mr. Frederick D. Hasdell, engineer at the Blyadon sub-station of the Newcastle-on-Tyne Electric Supply Co., was concluded before Deputy-Coroner Lisle, at Newcastle Infirmary, on June 18th. The deceased died as the result of an accident at the station on May 1st. Mr. M. F. Sheedy, an electrical engineer, stated that before Hasdell went to Blyadon, he was assistant engineer at Jarrow and at Pandon Dene (Newcastle). He was a most reliable worker, and had been with the Electric Supply Co. since 1906. Witness produced a plan of Blyadon sub-station, and explained the working of two transformers. One of these had only just been put in, and it was while deceased was connecting the cables from the new transformer to the switchboard that the accident occurred. On the morning of May 1st, witness rang up Hasdell, and asked how the work was going on. Hasdell replied that he had got the high-tension side connected, and that all that remained was to connect up the low-tension side. Witness asked him how he intended to do it, and he said he would do it at the back of the low-tension board. Witness told Hasdell that it ought not to be there, but ought to be done in the transformer chamber; he should not go behind the panels. On receiving notice of an accident an hour later, he went to the sub-station and found two transformer switches fused. An arc had been set up, and a great flame must have been caused which had burned Hasdell. The top of the step-ladder also was burned. Robert Lynd, an electrician, who was working with Hasdell, said he knew it was dangerous to go behind the switchboard, but he had to obey Hasdell. The first time they went in, the connections were wrong, and the two of them went out again. When they went back, Hasdell asked witness to push the step-ladder along under the terminals. While the testing was going on for a third time, Hasdell said, "I think they are all right now." Then there was a great flash and a terrible noise. Witness was burned about the face and arms, but was able to go out for help. When he returned he saw Hasdell creeping out in flames. Two men arrived with a carpet with which the flames were extinguished. Philip Williams, the engineer who preceded Hasdell at the Blyadon sub-station, said he told deceased that he must not go behind the switchboard. He had received this order from the company, and it was filed at Blyadon. The infirmary house-surgeon said death was due to shock following the burns. A juror expressed the opinion that the Supply Co. should have boards exhibited at the substations warning employes against going behind the switchboard, and a representative of the company said that this was being done. The jury found a verdict of "Accidental death."

An inquest was held last week into the death of Fredk. C. Ward, of Acton Green, who fell from a scaffold whilst employed at the electric generating station, Canning Town. The medical evidence showed that death was due to apoplexy and a contracted kidney, accelerated by the accident. A verdict was returned accordingly.

**Association of Electrical (Station) Engineers.**—A general meeting was held at Chandos Hall, London, on Tuesday last. Mr. Chas. F. Wade was in the chair, supported by the London Organising Committee and the delegates from the provinces.

The meeting was opened with the secretary's report of the conference of delegates (representing the United Kingdom), with the London Organising Committee. He stated that the following representatives were present: Mr. G. D. Coe (Manchester), Mr. A. W. Lamont (Glasgow), Mr. E. A. Gordon (Birmingham), Mr. A. C. Black (Liverpool), Mr. R. D. Spurr (Bradford), Mr. W. M. Fowler (Grimsby), and Mr. J. H. Thomas (Manchester), and that

a number of alterations had been made in the rules as submitted to the last general meeting, the principal alteration being that the word station was deleted from the title of the Association, which became the *Association of Electrical Engineers*; the principal reason for this was that a large number of men in positions closely allied to station work were anxious to join the Association, but could hardly be termed "station engineers." The unanimous opinion of the Conference was that it would be advantageous to the general welfare of all engineers holding responsible positions in electrical undertakings if these men were admitted to the Association.

The Secretary also stated that the policy of the Association, as shown by the "objects," was as follows:—

1. To raise the efficiency and general status of members of this Association.
2. To obtain adequate remuneration compatible with local conditions and responsibility.
3. To obtain a 6-day week of employment for employes of all electrical stations, the maximum average week to consist of 48 hours, and that where better conditions prevail they be upheld.
4. To endeavour to obtain legislation to enforce the giving of personal testimonials.
5. To enforce that the Home Office Regulations be carried out in every case with regard to electrical stations.
6. To abolish the employment of pupils and apprentices in responsible positions in electrical stations.
7. To form an information bureau for the general assistance of members and employers.
8. To provide legal assistance for members when necessary (so far as is allowed by law) in matters appertaining to their employment, and for receiving compensation for members who suffer injury by accident in their employment.
9. To obtain for all men in electrical stations who are on duty on all public holidays, including Christmas Day and Good Friday, time off in lieu thereof, and to obtain a minimum of 14 consecutive days' annual leave.
10. To endeavour to obtain facilities for shift men to attend classes, lectures, &c.
11. To provide means for social intercourse amongst its members for their improvement, advancement and recreation.

A paper was read by Mr. J. W. Thomas, entitled "The Status of Electrical Station Engineers and the Need of an Association," which was followed by a very interesting discussion.

The following resolution was put to the meeting and carried unanimously:—"That this meeting of electrical engineers, representing stations, &c., throughout the United Kingdom, welcomes the advent of the Association of Electrical Engineers, realising that only by such an Association, and by thorough organisation, will the conditions of electrical engineers be improved. Further, we pledge ourselves to support the Association in every practicable way possible."

A vote of thanks was passed to the chief engineers who kindly granted leave of absence to the various delegates to enable them to attend the conference and general meeting.

Votes of thanks were also passed to Mr. J. H. Thomas for his paper, to the delegates, and to the indefatigable secretary, Mr. W. J. Ebben, for their services on behalf of the Association.

Receiving this report whilst going to press, we are unable to comment upon it at length; but we take the first opportunity of expressing our opinion that the adoption of a new title, differing only slightly from that of the Institution of Electrical Engineers, was a very unfortunate and ill-advised proceeding, and is likely to prove highly detrimental to the future of the Association. If any attempt is made to incorporate the latter, there can be little doubt that the Board of Trade will insist upon a change of title.—  
EDS. ELEC. REV.]

**Errors of Supply Meters.**—The Board of Trade has issued the following statement regarding the limits of error for meters:—The Board of Trade hereby allow the following limits of error for electricity meters, the construction and pattern of which have already been or may hereafter be approved by the Board of Trade, and which belong to the classes of meters capable of ascertaining the value of the supply on continuous-current or on single-phase alternating-current circuits:—

- Meters in which the maximum current for full load:—
- (a) Does not exceed 3 amperes, the error at any point from one-tenth load to full load must not exceed  $\frac{3}{4}$  per cent. plus or minus.
  - (b) Exceeds 3 amperes, but does not exceed 50 amperes, the error at any point from one-tenth load to full load must not exceed  $\frac{2}{4}$  per cent. plus or minus.
  - (c) Exceeds 50 amperes, the error at any point from one-twentieth load to one-tenth load must not exceed  $\frac{2}{4}$  per cent. plus; and at any point from one-tenth load to full load must not exceed  $\frac{2}{4}$  per cent. plus or minus.

**The Marconi Committee's Report.**—The result of the debate on the report of the Select Committee in the House of Commons last week was a party division on a Liberal amendment to a motion put forward by the Opposition. The amendment stated that the House, after hearing the statements of the Attorney-General and the Chancellor of the Exchequer in reference to their purchase of shares in the Marconi Co. of America, accepted their expressions of regret that such purchases were made and were not mentioned in the debate of October 11th; acquitted them of acting otherwise than in good faith; and reprobated the charges of corruption brought against Ministers, which had been proved to be wholly false. It was passed by a majority of 78.

(Continued on page 1073.)

## MEMORIALS TO LORD KELVIN.

It will be six years next December since William Thomson, Baron Kelvin of Largs, died. Since then nothing has occurred to lessen the world's appreciation of his unparalleled scientific greatness or to spoil in those who had the privilege to know him, the memory of his personal humility, gentleness, and charm. Always regarded with affection in his



life by his intimates, even when there were differences of opinion—Huxley transferred to him the expression "Gentler knight there never broke a lance"—it may be said that it is with personal affection, as much as reverence for his wonderful scientific mind, that his memory is still cherished to-day. To us who remember him, no memorial in marble or in glass is needed, but our children and our children's children will hear and read in their schools and colleges of his great work and character, and hear his studies referred to in lectures and papers, and they will think of Kelvin chiefly as one among a hundred other remarkable men of the past. To us he still remains *the* scientist of our day. But for their sakes, as well as for the reason that it is right and proper for us to show our recognition in some tangible and permanent form amid appropriate surroundings, we are this year witnessing the setting up of a number of memorials which will ever keep the name of Kelvin in mind and emphasise to coming generations that this age knew when to appreciate at its true worth a combination of real greatness and gentleness—indeed, we are not sure that the latter quality is not essential to the former in its best sense.

Belfast, the place of his birth; Glasgow University, for more than 50 years the scene of constant labour and research in science, where thousands of men came lastingly under his spell as Professor of Natural Philosophy, and where admirers of every clime came to take part in his triumphant jubilee celebrations in 1896; Westminster Abbey—the closing scene of all, where the world did him homage—all of these will before the end of 1913 contain unveiled memorials.

When we think of Belfast, and read Prof. Silvanus Thompson's references to the early life of the Thomson family, human nature makes us children again, and in our fancy we whip our tops with the future Lord Kelvin and his brother James on the flags in front of the house where the Thomsons lived in College Square East. Here the two boys "doubtless became familiar with the phenomenon of the procession of a spinning body."\* It was in the aforesaid house which, we believe, still stands (and if we may express an opinion, has more claim to be preserved than some), the house that William's father specially built, that all the children except the eldest daughter were born. William was born there in the year 1824—only six years later his mother Margaret passed to her rest. With an

indomitable spirit the father took up the added duty consequent upon that loss. William of six and James of eight should be his special care; he would educate them, train them, they should sleep in his own bedroom, he would personally devote himself to them. We need not apologise for touching upon what might be thought by some to be trivial matters, for they form a large part of the whole Kelvin connection with Belfast, which has made that city proud to remember one of its sons, and those very early years in close connection with so remarkable a father undoubtedly had much to do with the moulding of the Kelvin character.

The statue which was unveiled in the Botanic Gardens Park, Belfast, on Thursday last week by Sir Joseph Larmor, M.P., F.R.S., was subscribed for by the people of the city. It was executed by Mr. Albert Bruce-Joy. We understand that the relatives of the late Lord Kelvin and members of the Committee, and others who have seen the work, have been greatly pleased with it. The figure is about 10 ft. high, and stands on a granite pedestal about 13 ft. in height. It represents the subject standing erect, with the left hand extended and holding in it a design of one of his discoveries—an adaptation of the gyroscope. In the right hand is a pencil pointing to the drawing. Mr. Bruce-Joy has depicted the illustrious scientist in the prime of life and intellectual power. The personality of the man is clearly brought out. The general pose is that of one keenly interested in the subject; he is supposed to be explaining the discovery he has just made. By the side of the figure, which is draped in the doctor's gown, stands a representation of the well-known Kelvin compass. The statue itself (the bronze) was shown in the Royal Society at the Coronation Soirée, in July, 1911; ever since that time it has been ready, but it was only comparatively recently that the site was decided on. We are indebted to Mr. Bruce-Joy for the photographs here reproduced.

At the unveiling ceremony, Sir Joseph Larmor, the charm of whose manner of speech in public will be remembered by all who have heard him, delivered a tribute



well suited to the occasion, dealing with his home training, life at Cambridge and Paris, achievement and fame in the scientific world, the legacy in physical science that he has left to ages yet to be, his personal qualities, and finally his distinction "as a patriot as well as a man of science."

The Glasgow University statue is to be unveiled in October by Mr. Birrell, as Lord Rector, and the address will be delivered by Mr. Balfour, the Gifford Lecturer. The Westminster Abbey memorial, which takes the form of a stained glass window, will be unveiled next month.

\* "Life of Lord Kelvin," by Silvanus P. Thompson.



*Elect. Rev.*

### THE I.M.E.A. AT HAMPTON COURT.

On the facing page we reproduce a large group of Municipal Electrical visitors at Hampton Court last week, which contains many familiar faces.

The original photograph is an excellent one, and we trust that our reproduction will do justice both to it and to the event which it pictorially records.

Further details of the convention will be found on page 1086 and succeeding pages, to which we must refer our readers for information as to the week's doings.

### RECENT DEVELOPMENTS AT STUART STREET STATION, MANCHESTER.

THE subject of Manchester's electricity supply is, at all times, an interesting one; industrially, the area supplied by the Corporation is, for its size, probably the most important in Great Britain, and as the output of electricity sold during the past 12 months exceeded 100 million units—a figure considerably in excess of that of any other municipal undertaking in the country—and appears to be advancing at the rate of from 10 to 15 million units per annum, it can be understood that the department, of which Mr. S. L. Pearce is the well-known chief engineer, is faced with problems of a somewhat special character.

For one thing, the three existing stations are approaching the limits of their capacity with the existing plant; the most recent station, Stuart Street, huge as it is in comparison with the average generating station, will be almost fully occupied with plant when the next turbine unit and necessary boiler equipment, which the department has on order, are delivered.

This latest addition\* will have a normal capacity of 15,000 kw., and will be, we believe, the largest turbine unit in the country; one may add that it will form a worthy addition to a generating station, which has long shown the way in the matter of large plant installed.

In the meantime, the large amount of reciprocating plant comprising the original installation at Stuart Street station, offered considerable scope for the utilisation of exhaust steam

turbines, and quite recently a large turbine unit of this type, working in conjunction with existing Yates & Thom 2,500-h.p. Corliss engines was brought into use.

In the earliest portion of this station, six cross-compound engines coupled to 1,500-kw. generators, were installed,\* exhausting into barometric condensers which occupied a central bay.

A portion of this condensing plant at one end of the bay was removed and a 4,500-kw. Howden-Siemens exhaust steam turbine set, together with barometric condensing plant, installed in its place.

The turbine operates on steam from three engines, and has an output of 4,250-kw. when the former are on normal full load (1,500 kw.).

To supply steam to the new plant, the exhausts from six adjacent engines (three on either side) were connected to 36-in. dia. headers below floor level, with branches leading up to an oil separator, after leaving which the steam is passed through a horizontal tubular superheater, and enters the turbine by way of a 32-in. inlet pipe.

The superheater, which is a product of the department's own ingenuity, is fed with live steam at 200 lb. pressure, superheated 600° F., and gives 40° to 50° of superheat to the steam entering the turbine at about 16 lb. pressure absolute.

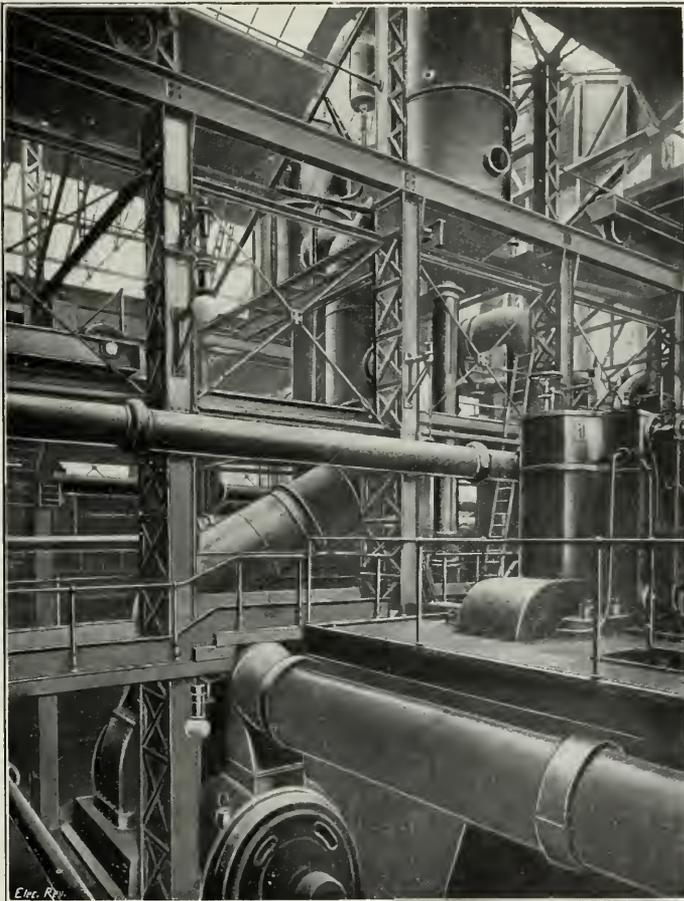
The turbine is of the well-known Zoelly impulse type, the diameter of its smallest disk wheel being 6 ft. 5 in. and of the largest, 7 ft.; it is fitted with an emergency governor only, which trips a double-beat inlet valve.

The alternator, to which it is coupled rigidly, has a solid cylindrical rotor, and is fitted with two fans, one for drawing in the cooling air through an air filter in the basement and the other for expelling it into the engine room; the machine bearings are provided with forced-oil lubrication, an oil pump being provided on the turbine shaft.

The exhaust turbine set runs at 1,500 R.P.M., delivering 50-cycle three-phase current

at 6,500 volts to the H.T. bus-bars, and it is interesting to notice that, while it was originally intended that it should operate in conjunction with four of the 1,500-kw. reciprocating sets, in practice three of the latter have been found sufficient for the purpose.

The exhaust from the turbine leads upwards to a motor-driven 66-in. sluice valve, above which the exhaust column divides into two vertical branches each ending in a jet condenser, the condensing plant, of the barometric type, having been supplied by the Mirrlees Watson Co.



4,500-KW. HOWDEN-SIEMENS EXHAUST-STEAM TURBINE SET AND BAROMETRIC CONDENSING PLANT, MANCHESTER.

\* ELECTRICAL REVIEW, November 1st, 1912, page 710.

\* See ELECTRICAL REVIEW, June 26th, 1903, page 1085.

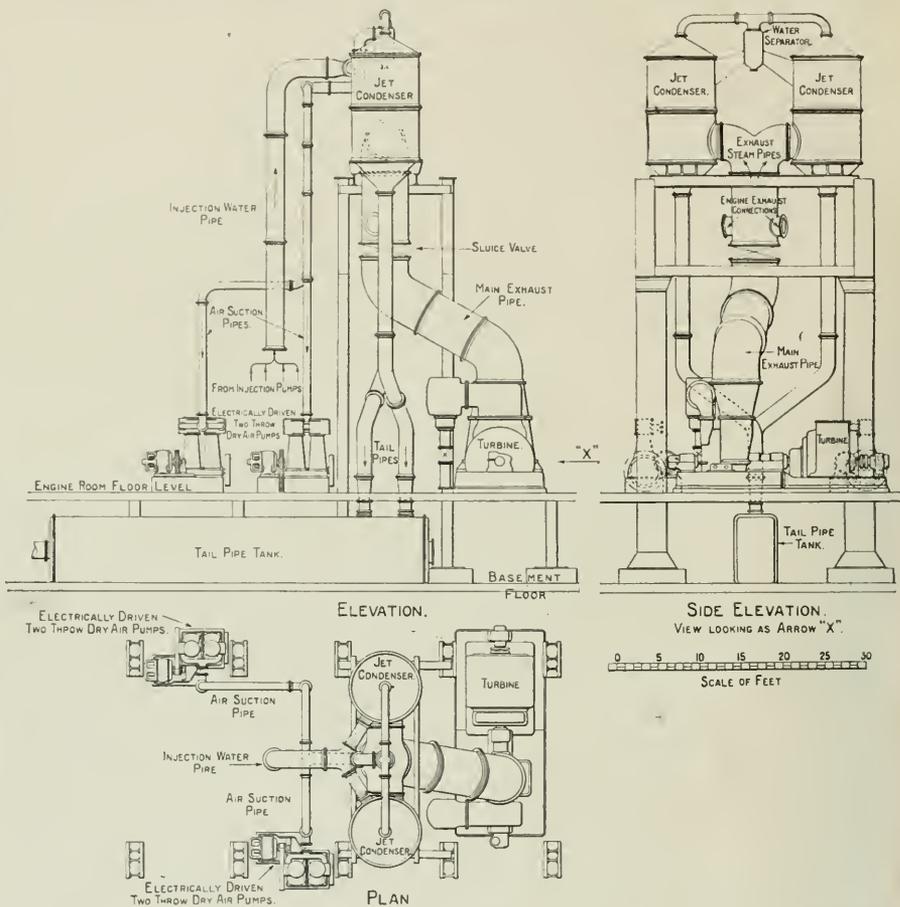
The two engines adjacent to the turbine are provided with alternative exhaust connections direct to the new condensers, so that they can be run as previously in the event of the exhaust turbine being shut down; all the other Yates and Thom engines have their original barometric condensing plants, coupled up as in the case of the new plant to a cooling tower and canal.

In connection with the new plant, two twin-cylinder air pumps, gear driven from 46 H.P. direct-current motors (speed 680 R.P.M.) are installed, also three 50-H.P. motor-driven circulating pumps which will deliver 600,000 gallons of water per hour to a central rising main with connections to the two condenser heads.

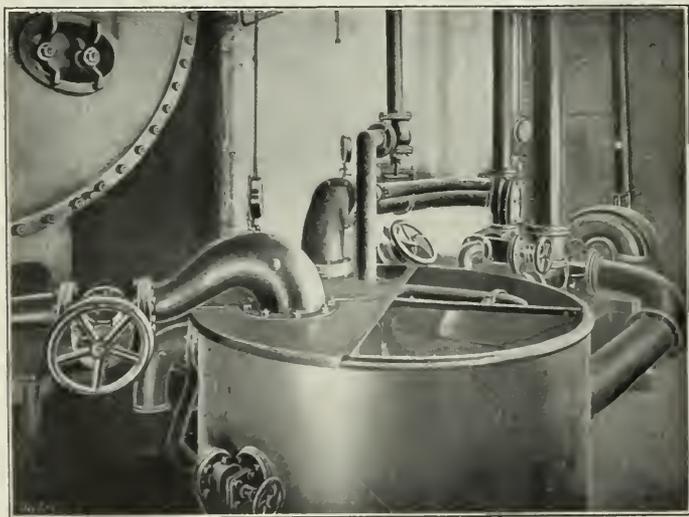
A small ironclad switchboard adjacent to the motors contains the necessary starting and controlling gear.

In addition to the generating plant already mentioned, the Stuart Street station contains the two 3,750-kw. vertical triple-expansion engine sets installed when the second portion of the station was originally opened, and three high-pressure turbo-alternators added by Mr. Pearce. Of

The third unit is also a Howden-Siemens combination, with a capacity of 8,000 kw.; both the Howden



VIEWS SHOWING ARRANGEMENT OF 4,500-KW. EXHAUST TURBINE PLANT, BAROMETRIC CONDENSING PLANT, & C., STUART STREET STATION, MANCHESTER.



TURBINE-DRIVEN KINETIC ROTARY AIR PUMP AND TANK FOR 8,000-KW. TURBINE SET, STUART STREET STATION, MANCHESTER.

these, the first, a Willans-Siemens set of 6,000-kw. capacity installed in 1907, and the second, a Howden-Siemens set of 7,000-kw. capacity, have been referred to in our pages.

turbines are of the Zoelly impulse type, and the Siemens alternators are totally enclosed machines, ventilated with filtered air from external electrically-driven blowers, three of which are installed.

An interesting feature of the last turbine plant installed is the condensing plant, of the Contraflo Kinetic type, made by Messrs. Richardsons, Westgarth and Co., and in connection with which both the air and circulating pumps are steam-turbine driven.

The Contraflo condenser is similar to several already installed in Stuart Street, and has a cooling surface of 10,500 sq. ft. Formerly Edwards air pumps have been used in the station, but in this case Mr. Pearce decided to adopt the Kinetic rotary air pump.

In this system the air is withdrawn by a steam jet and expelled by a special arrangement of water jets known as the "Kinetic ejector." The pump supplying the water to these jets is driven by a small turbine, the exhaust from which is used in the steam jet for withdrawing the air from the condenser, and as the water is the condensate or feed water, the thermal efficiency of the apparatus is exceedingly high.

It is well known that the rarefying effect of a steam jet in a condenser is greater than can be produced by a mechanical air pump, except the pump is artificially cooled

and of abnormal size. Therefore, a very high efficiency of tube surface can be obtained when a steam jet is employed.

Water jets alone are incapable of withdrawing large quantities of highly attenuated air by reason of its large volume and are consequently unsuitable for the production of high vacuum when the air leakage is appreciable. But if a steam jet is placed in advance of the water jets, the air mixes with the steam, and when this aerated mixture comes in contact with the water jets, the steam is condensed and the air is as it were automatically deposited on the water surfaces. It is, therefore, easily expelled. The steam jet also acts as a booster, and when air is present in abnormal quantities, the boosting has the effect of increasing the air density, so that the layer of air deposited on the water surfaces is of increased weight and yet of a volume within the discharging capacity of the jets.

(To be concluded.)

## NOTES.

(Continued from page 1068.)

**Institution and Lecture Notes.**—**PHYSICAL SOCIETY OF LONDON.**—At the meeting held on June 13th a paper on "Some Experiments on Tinfoil Contact with Dielectrics" was read by Mr. G. E. Baird. This paper describes some experiments showing how the accuracy of the different kinds of electrical measurements that are made on condensers is influenced by the use of an imperfect tinfoil contact. In connection with the measurement of the direct-current conductivity of a condenser having tinfoil armatures, the experiments of Mr. Appleyard, in which the current a minute or two after the first switching on of the current was greater than that at the time of switching on, are referred to. These experiments go into the matter in more detail. By choosing a suitable dielectric—celluloid, which has a conduction current of a greater value than the rate of change of displacement current—it was found possible greatly to increase the magnitude of these secondary increases in current. Voltage has quite as much effect as mechanical pressure in bringing about an intimate contact and acts independently of it. While considerable errors are liable to be made in deducing the specific direct-current conductivity of a dielectric between tinfoil armatures, the same is not true for measurements of the alternating-current conductivity. It is shown experimentally, even under the worst possible circumstances, the dielectric being only lightly bound up with the interleaved tinfoil, that for telephonic frequencies the maximum difference between the observed conductivity and true conductivity is 15 per cent. and of capacity is 5 per cent. Finally, the influence of imperfect contact upon the accumulation of residual charge is considered.

A paper "On a Method of Measuring the Pressure of Radiation by Means of Thin Metal Foil" was read by Mr. Gilbert D. West.

The pressure of the radiation emitted by a carbon filament lamp at a distance of a few centimetres is sufficient to cause a microscopically measurable deflection of the end of a suspended strip of gold or aluminium foil, and by this means the radiation pressure can be calculated knowing the weight of the strip. The results agree to within about 10 per cent. with the energy content per cubic centimetre as measured by the initial rate of rise of temperature of a copper plate exposed to the radiation.

A paper "On the Emission of Electricity from Hot Bodies and the Quantum Theory" was read by Dr. W. Wilson.

**Deaths by Lightning.**—Most people, says Mr. Marriott, the secretary of the Royal Meteorological Society, in *Knowledge* for June, imagine that the number of persons killed by lightning each year is very great. This impression is far from being correct. Statistics show that during the 10 years 1901-10 the Registrar-General reported 124 fatal instances of lightning stroke in England and Wales—a yearly average of only 12.4 deaths, or 0.36 per million living. In the 29 years 1852-80 there were 516 such deaths, the yearly average for that period being 18.8, or 0.88 per annum per million living. The numbers of these deaths varied widely in different years; three people were killed by lightning in 1863 and 46 in 1872. The annual death-rate from lightning also varies widely in different parts of England. In the north Midlands from 1852-80 it was 1.8 annually per million living, in the Metropolitan district only 0.13. On the Continent much higher yearly death-rates are found. In Hungary the annual death-rate from lightning is said to be 16 per million living; in Styria and Carinthia about 10 per million; in Prussia, 4.4; in France and in Sweden, 3; in Belgium, 2, so far as the imperfect statistics available go. In the United States of America the annual death-rate per million is high—about 10—in consequence of the frequency of thunderstorms on the one hand and of the large percentage of the inhabitants engaged in outdoor labour on the other; about 700 or 800 deaths from lightning were estimated to occur in the United States every year by Henry in 1900 in a population of 76 millions. Many more people are struck by lightning than are killed.

**Private Fire Brigade Championship.**—This competition was held at the Guildhall on Saturday last, June 21st, and as a result the Robertson Lamp Section Brigade took second place and won the Bronze Medals; the Oram Lamp Section Brigade obtained the fourth place. There were 23 brigades competing.

**Appointments Vacant.**—Senior draughtsman for the Birmingham Corporation electric supply department (£130); assistant engineer for Southwark B.C. electricity works (£160). See our advertisement pages to-day.

**The Electric Lighting of Motor-Buses.**—In the course of a paper on "Steam Motor-Omnibuses," read at a joint meeting in New York of the American Society of Automobile Engineers and the British Institution of Automobile Engineers, by Mr. Thomas Clarkson, of Chelmsford, the author referred to the question of the lighting of such vehicles, which had been a very troublesome problem, neither oil nor acetylene having proved satisfactory. Mr. Clarkson stated that he first experimented with electric lighting for bus illumination about ten years ago, the original lighting being worked off a storage battery. This not proving satisfactory, a scheme was subsequently devised whereby a small storage battery was used in combination with a special dynamo driven by the car, and with cut-outs, similar to the lighting systems now used on pleasure cars. After running this combination for several years, he abandoned it in favour of a dynamo of the ordinary type directly attached to a small steam engine, no batteries or cut-outs being employed. The little engine runs at a constant speed of 900 R.P.M., and the equipment provides current for 150 C.P. per bus. Mr. Clarkson, who, as is well-known, is associated with the National steam buses running in the metropolis, states that the equipment has proved completely satisfactory. The cost and weight of the installation have been reduced, as well as cost of maintenance, at the same time greater brilliance of illumination has been secured.

**Educational Notes.**—The Senate of London University has appointed Mr. E. H. Lamb, M.Sc. (Vict.), A.M. Inst. C.E., to the University Chair of Civil and Mechanical Engineering tenable at the East London College. Mr. Lamb had a distinguished career at Owens College, Manchester, and graduated with first-class honours and the University Scholarship in Engineering in 1899. Since 1903 he has been technical and scientific adviser to Messrs. W. H. Allen, Son & Co., of Bedford, and demonstrator to the pupils and apprentices of the firm. He is the author of a paper on "The Torsional Vibrations of Shafting," for which he was awarded a premium by the Institution of Electrical Engineers.—*Times*.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.*

**Central Station Officials.**—MR. W. WYLD, who has been appointed electrical engineer at Hampstead, was on Saturday the recipient of a presentation from the employees of the Birkenhead Corporation tramways department. The proceedings were presided over by Mr. J. Dudleston, traffic superintendent. Appropriate speeches were made by the chairman, Messrs. R. Chadwick, J. Gunn Wallace, G. H. Godding, S. Edge, E. Evans, T. Crawshaw and F. T. Coram, after which Mr. Clarke presented Mr. Wyld with a silver tea service, as a token of esteem from the employees of the department. Mr. Wyld expressed his thanks, and asked the men to give the same loyal support to Mr. Clarke, his successor, as they had given to him. The staff of the Electricity Department presented Mr. Wyld with a barometer, the presentation being made by Mr. Shallcross, the borough electrical engineer.

At Maltby (Yorks), on June 18th, the marriage took place of MR. HENRY NEVILLE ROGERS, of the Rotherham Corporation electricity staff, and Miss Annie Fearby Brown, elder daughter of Mr. Richard Brown, of Roche Abbey Mill, Maltby.

The General Purposes Committee of the Crewe T.C. has recommended that the salary of MR. H. H. DENTON, chief electrical engineer, be increased by £50 a year; and that of MR. HOOLEY, his assistant, by £25 a year.

On the occasion of his marriage to Miss Elsie R. Jourd, of Belvedere, MR. VICTOR R. LOWRY has been presented with a brass and oak gong by the staff of the Farnham electricity works.

The Rugby U.D.C. has increased the salary of MR. T. S. SHENTON, manager of the electricity works, from £200 to £225 per annum.

MR. L. H. C. WEBSTER has been appointed assistant mains engineer to the Dover Municipal electricity undertaking. There were 37 applications. The appointment was previously offered to Mr. J. L. H. Cooper, who subsequently withdrew.

**Tramway Officials.**—It is proposed to increase the salary of MR. R. S. PILCHER, manager of the Aberdeen Corporation Tramways, from £400 to £500.

A financial daily says that MR. H. E. BLAIN, late general manager of the West Ham Corporation Tramways, has now taken up the appointment of assistant purchasing agent to the Underground Electric Railways and their allied companies.

**General.**—A Canadian exchange states that Mr. H. H. COUZENS, the new manager of the Toronto hydro-electric system, arrived in Canada from England during the first week of this month. He takes actual charge of the system on July 1st.

CAPTAIN TERRICK CHARLES FITZ HUGH, M.V.O., the Chief Commissioner in the Far East, recently appointed by the British Engineers' Association, left London for Peking, *via* Siberia, on Saturday, June 21st, accompanied by his technical secretary, Mr. L. B. Stevens, M.A.

MR. W. MURRAY MORRISON, M.I.E.E., general manager of the British Aluminium Co., Ltd., whose marriage was announced in the last issue of the ELECTRICAL REVIEW, has been presented by the staff and employes with a solid silver cigar box and cigarette box.

MR. JOHN HOWARD HOWARD, of Clapham Park, Bedford, only son of Sir Fred. Howard, of J. & F. Howard, Ltd., electrical and general engineers, of Bedford, and his wife, celebrated their silver wedding on June 19th, and were the recipients of many cordial congratulations.

MR. HERBERT BERRY (Messrs. Berry, Skinner & Co.) will be leaving England on July 25th, by the *Empress of Britain* for Canada, arriving at Montreal on August 1st. He will subsequently visit Toronto, Niagara, Winnipeg, Calgary, Edmonton, Vancouver and Victoria; returning through the United States—Minneapolis, Chicago, Detroit, Pittsburg and New York.

MR. C. V. BIGGS has removed from 28, Victoria Street, S.W., to 48, Westminster Palace Gardens, Artillery Row, Victoria Street, S.W.

MR. MARCONI arrived in New York on June 11th to give evidence in a patent action in connection with his company, and to inspect the installations at Belmar, N.J., and Glace Bay.

MR. TOM WESTGARTH, on resigning the position of managing director of Messrs. Richardsons, Westgarth, & Co., Ltd., of Middlesbrough, has been presented by the officials, foremen, and workmen with an illuminated address in album form, and a gold bracelet for Mrs. Westgarth.

On Saturday last, MR. SEYMOUR C. TOYE, who has been for some time in the employ of Messrs. J. H. Tucker & Co., electrical accessories manufacturers, of Birmingham, was presented with a suit case as a mark of esteem, upon his leaving the firm to take up a position on the commercial staff of the General Electric Co., High Street, Birmingham.

**Obituary.**—The death is reported from Amble, Northumberland, after a prolonged illness, of Mr. Robert Wanless, electrician to the Port and Harbour Commissioners. Over a quarter of a century ago deceased was engaged for the installation of electric light at Warkworth Harbour, and upon the completion of his contract continued in the service of the Commissioners. He manifested an active interest in local affairs, and, as a Freeman, was a Past Provincial Grand Officer of the Province of Northumberland. He was in his 57th year.

**Wills.**—The late MR. JOHN TROTTER, chairman of Crompton & Co., Ltd., left estate valued at £37,865 gross and £27,723 net.

## OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

**Electric Ignition Co. (1913), Ltd.**—Particulars of £2,500 debentures created May 24th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Acts, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

**British Union Lamp Works, Ltd.**—Charge on company's undertaking and property, present and future, dated May 7th, 1913, to secure all moneys not exceeding £3,000, for which the charges may become liable to pay under a guarantee to the company's bankers. Holders: T. Griffiths, Thirfield, Mooland Road, Didsbury, near Manchester; and G. E. Jowett, Yew Tree House, Eccles, Manchester.

**Browett, Lindley & Co., Ltd. (63,128).**—Return dated April 7th, 1913. Capital, £120,000 in £1 shares (60,000 pref.), 50,000 pref. and 50,000 ord. shares taken up. £1 per share called up on 42,000 pref. and 23,478 ord. £65,478 paid. £34,522 considered as paid on the remainder. Debenture stock outstanding: To sundry holders, £40,000; as security for sundry loans and bank overdraft, £27,165; total, £47,165.

**A. Broyolle & Co., Ltd. (70,210).**—Return dated April 10th, 1913. Capital £40,000 in £1 shares (20,000 pref.), 20,000 ord. and 19,346 pref. shares taken up. £1 per share called up on 13,000 ord., and 19,346 pref. £34,346 paid. £7,000 considered as paid on 7,000 ord. Mortgages and charges: £16,300.

**Electrolite, Ltd.**—Particulars of £500 debentures, created April 10th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

**Altrincham Electric Supply, Ltd. (46,795).**—Return dated May 22nd, 1913. Capital, £50,000 in £1 shares: 35,000 shares taken up; £35,000 considered as paid. Mortgages and charges: £35,000.

**Garrett, Hartley & Co., Ltd.**—Debenture dated June 17th, 1913, to secure £350, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: S. Hartley, Cranford, Grand Drive, Raynes Park, S.W.

**Anglo-Portuguese Telephone Co., Ltd. (22,545).**—Return dated May 23rd, 1913. Capital £150,000 in £1 shares. 100,000 shares taken up. £1 per share called up on 1,046 shares. £1,046 paid. £98,954 considered as paid on remainder. Mortgages and charges: £43,625.

**Bournemouth and Poole Electricity Supply Co., Ltd. (55,189).**—Return dated March 27th, 1913. Capital £500,000 in £10 shares (25,000 ordinary, 7,500 4½ per cent. preference and 17,500 6 per cent. second preference). 16,000 ordinary, 7,500 4½ per cent. preference and 15,000 6 per cent. second preference shares taken up. £375,000 paid. Mortgages and charges: £157,500.

**Beck & Moss, Ltd. (69,298).**—Return dated April 19th, 1913. Capital, £2,500 in £1 shares. All shares taken up. £1 per share called up on 525. £525 paid. £1,975 considered as paid on remainder. Mortgages and charges: Nil.

## CITY NOTES.

### Shawinigan Water and Power Co.

THE directors' report for the year ended December 31st, 1912, states (says the *Financial News*) that the gross income for 1912 shows an increase over that of 1911 of \$349,814, and the net revenue an increase of \$249,706. The average percentage of operation and general expense to gross income has been, for the past five years, on a basis of 10½ per cent. The ratio for the year 1912 is 9·4½ per cent. The operations of the company during the year have been carried on without abnormal interruption, with the exception of one occurrence in the month of September, when, through the breaking of a turbine end casting, considerable water escaped into the power house, and through its reaching some of the generators, delay was occasioned owing to the drying-out of field coils, &c. In the last annual report the directors advised of the completion of the new development with machinery installed in station No. 2 up to a capacity of 30,000 H.P. In August last it was decided to install a third unit of 15,000 H.P., and this installation is nearing completion. With this unit the total electrical capacity of the two stations will be 100,000 H.P. The continued demand for power makes it evident that this addition to the plant will be required for use at an early date. The rapid industrial development of the city of Three Rivers makes it expedient to provide for further demands from that point, and the directors have in contemplation, in the spring of 1913, the erection of a third transmission line to Three Rivers. The Cedars Rapids Development Co. has acquired from the Dominion and Provincial Governments the right to take from the St. Lawrence River, at Cedars Rapids, about 30 miles above the City of Montreal, sufficient water to develop 160,000 H.P. The development work for this plant has been in operation since early in 1912, and the first installation of 100,000 H.P. will be completed in the fall of 1914. The control of this company is vested in the Shawinigan Water and Power Co. and the Montreal Light, Heat and Power Co. This power will be, to a large extent, used for electro-mechanical and electro-metallurgical processes at Cedars Rapids and elsewhere, while a considerable portion will be available for distribution through the Montreal Light, Heat and Power Co. in the section of the city furthest removed from the terminals where power is obtained from the Shawinigan Co.

### NEW COMPANIES REGISTERED.

**Crompton & Co., Ltd. (129,649)**—Registered June 19th, by Deacon & Co., 9, Great St. Helena, E.C. Capital, £221,007 in £1 shares (126,000 7 per cent. non-cumulative preference). Objects: To carry on the business of electrical engineers, workers in metals, contractors for the supply of electrical plant, producers and distributors of electrical energy, manufacturers of electrical, steam, petrol and other motors, tramways, trams and locomotives, &c., to acquire the assets and liabilities of Crompton & Co., Ltd. (incorporated in 1883), and to adopt an agreement with the said old company and the liquidator thereof. The signatories (with one share each) are:—G. F. Medcalfe, 9, Great St. Helena, E.C., solicitor; R. C. Allen, 238, Dunstons Road, East Dulwich, S.E., gentleman; R. Gibson, 8, Great St. Helena, E.C., solicitor; T. J. Bowles, 118, South Park Road, Forest Gate, gentleman; W. Escott, 118, Addison Gardens, W., gentleman; W. J. Park, 4, Aberdeen Road, Highbury, N., gentleman; H. C. Blackburn, 24, Elsham Road, Leytonstone, gentleman. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than eight) are to be appointed by the signatories: qualification, 500 shares. Remuneration, £200 each per annum (chairman, £300 and 5 per cent. of the distributed profits, divisible (maximum additional remuneration, £1,000). Registered office, Salisbury House, London Wall, E.C.

**North British Wireless Schools, Ltd. (8,711)**—This company was registered in Edinburgh on June 20th, with a capital of £12,000 in £1 shares (9,000 cumulative preference participating), to establish day or boarding schools or colleges, and to carry on the business indicated by the title. The subscribers (with one preference share each) are:—T. H. McLaren, 105, West George Street, Glasgow, law clerk; W. Y. Chrystal, 226, St. Vincent Street, Glasgow, chartered accountant; H. J. Stevenson, 160, Onslow Drive, Dennistown, Glasgow, clerk; J. B. Dunlop, 101, Douglas Street, Glasgow, clerk; K. Patrick, Trafford Park, Bishopton, clerk; Miss D. Dolz, 9, Palmoral Crescent, Green's Park, Glasgow. The first directors are W. J. Kerr, G. Ritchie and W. N. Mackay, all of Glasgow. Registered office, 226, St. Vincent Street, Glasgow.

**Hales, Hancock & Co., Ltd. (129,694)**—This company was registered on June 21st, with a capital of £100 in £1 shares, to carry on the business of manufacturers, importers and exporters of china, porcelain, earthenware, pottery, terra-cotta, sanitary ware, fireclay, drain and water-pipes, electrical and art pottery, &c. The subscribers (with 25 shares each) are:—E. C. Hales, Gamage Buildings Holborn, E.C., merchant; P. Hancock, Gamage Buildings, Holborn, E.C., traveller. Private company. Table "A" mainly applies. Registered office, Gamage Buildings, Holborn, E.C.

**Electric and General Investment Co., Ltd.**

The annual meeting was held on Tuesday at Winchester House, E.C., Mr. J. B. Braithwaite presiding.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 1035), said the story they had to tell the shareholders for the past year was a very simple one. They had made a profit of £11,797, which was about £3,000 less than last year, but in view of the very disturbed state of financial affairs during the greater part of the year, the Balkan trouble and various things of that kind, he thought they would agree that the company had done fairly well under the circumstances. After charging the various amounts stated on the debit side of the profit and losses account against it, they were left with a balance of £4,922 to deal with. That sum they proposed, subject to the shareholders' approval, should be dealt with by paying the balance of the 10 per cent. dividend on the preference shares of the company, by paying 6d. a share on the deferred shares and by carrying forward to next year £2,922. They were distributing £3,000 in dividends this year, and were proposing to carry forward, approximately, £3,000 to next year, so as to make the position as sound as they could. In addition, during the year they had redeemed and cancelled £963 of debentures, so that that amount was reduced to £19,570. During the year they had realised some old investments, involving a loss of £4,119, which they deducted from the contingency fund, which was provided to meet such losses. Out of the profit and loss account for the current year they had transferred to the credit of the contingency fund £3,071, raising it now to £81,000; and with the reduction of nearly £1,000 in the debenture stock outstanding, they practically reinstated it exactly where it was before they realised those old losses to which he had alluded. One gentleman wanted to know why they did not pay more in dividends under the circumstances, but he thought the shareholders would agree with him that their policy was to put the company into a thoroughly sound financial position, by carrying forward the amount they had done, and endeavouring to strengthen their reserves. In this way they believed they were acting in the best interests of their shareholders. There was a considerable amount of fair business which did not appear in the accounts, a profit on which should be realised during the current year. He hoped the year would not be quite so unsettled financially as this year had been, that it would be a year of greater prosperity, in which case they would spare no effort to see that the shareholders shared in that prosperity. He moved the adoption of the report.

MR. J. CECIL BULL seconded the motion, which was carried without any questions being asked.

The CHAIRMAN next moved the payment of dividends.

This was seconded and carried.

**J. G. White & Co., Ltd.**

THE annual meeting was held yesterday at Cannon Street Hotel. The report of directors for the year ended February 28th, 1913, showed that the results of the business continued to be satisfactory, the net profit on the year's trading being £88,797. A further £10,000 was allocated out of profits to the special dividend equalisation reserve, making this reserve £50,000. £20,000 was also added to general reserve. The directors again recommended a dividend of 12 per cent. per annum on both classes of shares, and, in addition, an extra dividend of 10s. per share on the ordinary shares. The balance to the credit of profit and loss, after bringing in £21,212 from the previous account, deducting the interim dividend paid on the preferred and ordinary shares at January 1st, 1913, and making provision for percentages due to directors and staff, was £89,904. The directors recommended a dividend of 6 per cent., less income-tax, on the cumulative preferred shares for the half-year to February 28th, 1913 (making 12 per cent. for the year), £9,000; a dividend of 6 per cent., less income-tax, on the ordinary shares for the half-year to February 28th, 1913 (making 12 per cent. for the year), £3,000; extra dividend of 10s. per share, less income-tax, on the ordinary share capital for the year, £25,000; to general reserve, £20,000; special reserve for equalisation of dividends, £10,000; to be carried forward, £22,904.

**R. Waygood & Co., Ltd.**—The directors report that the profits for the year ended March 31st, including £6,254 brought forward, amounted to £31,541. The managing director's and directors' fees absorb £2,800, and after paying the preference dividend, and putting to reserve £1,500, a further dividend is to be declared at the rate of 9 per cent. per annum for the six months to March 31st, making, with the interim dividend already paid, 7 per cent. for the year on the ordinary shares, leaving £9,691 to carry forward.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended April 25th, 1913, amounted to 1,204,906, compared with 884,966 units in the corresponding four weeks of 1912.

**Yorkshire (West Riding) Electric Tramways Co., Ltd.**—The directors have declared an interim dividend on the 6 per cent. cum. preference shares at the rate of 3 per cent. per annum.

**India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.**

A HALF-YEARLY meeting was held at the company's offices, 106, Cannon Street, E.C., on Tuesday, Major Leonard Darwin presiding.

The CHAIRMAN said at those half-yearly meetings they gathered together so that the board might have the opportunity of laying before the shareholders some remarks on what had passed in the affairs of the company since the previous annual general meeting. There was usually also a declaration of interim dividends to be made. When he addressed them a year ago he had the unpleasant task imposed upon him of informing them that the board did not see their way, as they thought it imprudent, to pay an interim dividend to the holders of ordinary shares, while they had no hesitation in paying the interim dividend on the preference shares. While making that announcement, he ventured to express the opinion that they were getting into their normal stride, as the abnormal conditions were passing away. On the present occasion he had much pleasure in being able to state that the board felt justified in paying the customary interim dividends on both preference and ordinary shares. They did not wish the shareholders to read into the declaration more than they stated. The raw rubber market was not yet outside the influence of undue speculation, be it for a fall in price, be it for a rise, and the position of the consumers of that product was somewhat dangerous in so far that the ordinary laws of supply and demand were small guides, and might even prove misleading when applied to the short periods of time with which ordinary consumers had to deal. This was all the more true on occasions when all the factors at work for these short periods could not be accurately gauged. The board had recently had before them evidence that several of the combinations which reaped great advantage during the period of artificial values of three years ago, to-day lay waterlogged and broadside on in the trough of the wave they created. He might mention that some of their competitors in the motor-tire trade were making reductions in their selling prices. Those reductions were to take effect from the 16th inst. The board doubted the wisdom of their policy, as their turnover in this line of goods doubtless showed an increase because many manufacturers, and they among the number, had been enlarging their powers of production. At the annual general meeting in December last he mentioned that their cable steamer *Silverton* had completed the laying of a submarine cable between Australia and New Zealand, and he had now to say that the period of guarantee then pending, terminated without mishap and the vessel returned to London. She would shortly sail from Queens-town to the Atlantic to carry out some cable repairs in replacement of their *Dacia* which sustained some damage while occupied on the work during abnormally heavy weather. The *Buccaner* had been employed by H.M. Post Office and by the French Government on the West African Coast and also in the neighbourhood of Madagascar. The vessel was now on her way home, and would carry out some further work on the West African coast before reaching London. Their general business had been quite normal.

In conclusion, MAJOR DARWIN moved that on July 1st a dividend be paid to the holders of preference shares of 5s. per share, less income-tax, being the half-yearly dividend due on that date at the rate of 5 per cent. per annum; and further, that on July 1st a payment of 5s. per share, free of income-tax, be made to the holders of ordinary shares, being an interim dividend of 2½ per cent.

MR. R. K. GRAY seconded the motion, which was adopted.

**Stock Exchange Notices.**—Applications have made to the Committee to allow the following to be quoted in the Official List:—

Automatic Telephone Manufacturing Co., Ltd.—100,000 ordinary shares of £1 each, fully paid (Nos. 1 to 100,000) (renewed special application).

The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Madras Electric Tramways (1904) Ltd.—20,000 6 per cent. cumulative preference shares of £5 each, fully paid (Nos. 1 to 15,000 and 30,001 to 35,000).  
Sao Paulo Electric Co., Ltd.—£120,000 additional 5 per cent. 50-year first mortgage bonds of £100 each (Nos. B 1 to B1,200).

**J. Stone & Co., Ltd.**—A financial contemporary says that the accounts for 1912 show that, after full allowance for depreciation, the profits amounted to £143,661, plus £19,380 brought forward, making £193,041. The directors recommend a dividend of 10 per cent. on the ordinary shares and a bonus of 2s. 6d. per share, placing £70,000 to the reserve and carrying forward £77,996.

**Greenwood & Batley Co., Ltd.**—After providing for interest on the debentures, expenses and management and doubtful debts, the accounts for the year ended March, 1912, show a profit of £15,275, plus £3,648 brought forward, making £18,924, out of which the directors have appropriated to depreciation £7,000, provision for charges under the National Insurance Act £500. After paying 7 per cent. on the cumulative preference shares there is carried forward £4,396.

**Japan.**—The Kyoto Electric Light Co. is declaring a dividend at the rate of 12 per cent. for the last half-year.

**W. & T. Avery, Ltd.**—Dividend for the second half of the year ended March 31st at the rate of 15 per cent. per annum on the ordinary shares, 10 per cent. for the year.

### Manila Electric Railroad and Lighting Corporation.

As European Fiscal Agents, the Municipal and General Securities, Ltd., have issued the eighth annual report of the Manila Electric Railroad and Lighting Corporation. The report states that the gross earnings for the year ending December 31st, 1912, were \$1,597,674, being an increase over the previous year of \$144,986 or 9.98 per cent.; operating expenses and taxes increased \$82,643, or 12.87 per cent., while the net earnings from operation were \$873,187, an increase of \$62,338, or 7.68 per cent. Interest charges during the year were \$277,500, and sinking fund requirements were \$28,250, leaving surplus earnings for the year of \$567,437. The annual appropriation for the replacement and renewal fund of \$80,000 has been maintained, and deducting this from the year's surplus earnings, there remains an available surplus for the year of \$487,437, being an increase of \$61,613 over the previous year. From this amount there have been paid four dividends of 1½ per cent. each, and an additional dividend of 1 per cent., making 7 per cent. for the year, aggregating \$350,000, leaving \$137,437 over all disbursements and reserves, which has been transferred to surplus account, making the total accumulated surplus with reserves at December 31st, 1912, \$1,362,140, an increase over 1911 of \$282,062. The Company has no floating debt, the current liabilities consisting of accrued interest and monthly operating accounts. During the year 1912 the operating expenses included \$160,574 for maintenance, and \$103,800 was expended on new construction. Charges to maintenance were higher than in the previous year on account of a thorough overhauling of the road and heavy replacements of ties and ballast. A total of 2.38 miles has been added to the company's trackage. At the beginning of 1912 the company voluntarily made a reduction in the then existing lighting rates, notwithstanding which there was a gross increase for the year from lighting and power of \$83,487. The directors also concluded it would be good policy, in respect to the Company's relations with the public, to make a still further reduction in the lighting rates, effective January 1st, 1913, which reduction, it is estimated, will stimulate business, and will not adversely affect the net earnings of the Company. The contract for street lighting in the city of Manila will shortly expire, and negotiations are now in progress towards renewal on terms satisfactory to the Company. Business conditions were somewhat unsettled during the last six months of 1912, a strike and boycott in the tobacco industry was in progress and weather conditions were unfavourable. Dividends have been paid as follows: 1903, 3 per cent.; 1907, 3 per cent.; 1908, 4 per cent.; 1909, 4 per cent.; 1910, 4 per cent.; 1911, 5½ per cent.; 1912, 7 per cent. Beginning with the quarter ended March 31st, 1913, the directors increased the dividend rates from 6 per cent. to 7 per cent. per annum. Since the beginning of the current fiscal year, there has been added \$35,000 face value of the 5 per cent. Fifty-year First Lien and Collateral Trust Sinking Fund Gold Bonds to the sinking fund, making the total bonds in that fund \$183,000.

### Paris Metropolitan Railway.

THE report of the Compagnie du Chemin de Fer Métropolitain de Paris states that down to the end of 1912 no line had been handed over by the City of Paris since the Place Péreire de Champeret line in 1910, which was opened for traffic in February, 1911, although one section had been rendered available in April, 1913, and a second was pending. Nevertheless, the company had not remained inactive, as advantage had been taken of the stoppage in the development of the network to complete and improve the lines already in operation, and to prepare for the rapid execution of various works. These included permanent-way works, the construction of further ventilating bays, the erection of additional vertical lifts, works at the generating and sub-stations, and the laying of new three-phase cables, which will permit of all the sub-stations being supplied from the Saint Denis station of the Paris Electrical Distribution Co. The length of the railway in operation remained at 44 miles throughout the year, and the average net receipts amounted to £12,801 per mile, as compared with £12,468 in 1911. It is submitted that the increase would have been considerably greater had it not been for the new and very active competition of motor-omnibuses, particularly in the final months of the year. Whilst the transformation had yielded to the Omnibus Co. an excess of £352,000 in receipts, as contrasted with the preceding year, the Metropolitan Co.'s receipts advanced by £41,000, with a network which practically experienced no change. Since the motor-omnibuses entirely replaced the older 'buses—that is, since the last days in December, 1912—a slight reduction in the receipts had taken place. The decline only averaged £29 per day in the first four months of 1913, notwithstanding that the railway company benefited from the strike of the taxi-cab drivers in the corresponding period in 1912, but in the last six weeks of the four months the deficiency had given place to an increase of £77 per day. There was consequently no retrogression, but merely a temporary stagnation, and there was no doubt that the increasing progression would soon be resumed.

The total receipts, including sundry items, amounted to £2,216,000 in 1912, and the working expenses were £942,000, the ratio of expenses to receipts having been 42.52 per cent., as compared with 42.01 per cent. in 1911. After deducting the contractual payment of £711,000 to the City of Paris, meeting general expenses, loan charges, &c., the net profits are returned at £345,000, as against £342,000 in 1911, and a dividend of 17s. 2d. (8.6 per cent.) per share has been declared, as compared with 16s. 9½d. in the previous year. The ordinary and deferred shares

represent a capital of £3,000,000, and the loan capital totals £1,000,000. Application has now been made to the responsible authorities for permission to make a fresh issue of £1,000,000 in bonds out of the emission of £3,000,000 which was approved in general meeting in 1910, and it is expected that the loan will be offered for subscription in the current half-year. During 1912 the bonuses granted to the *personnel* for the purpose of interesting them in the efficient working of the railway reached the sum of £37,100, this comparing with £35,900 in 1911, and the number of employés and agents rose from 5,262 at the end of 1911 to 5,308 at the close of 1912. A second matter in which the company takes an interest in its workers relates to the provision, in conjunction with the Cheap Dwellings Co., which was formed in 1910 with the financial assistance of the Metropolitan Co., of block dwellings for the railway workers, whilst at the same time the company has now advanced loans totalling £40,000, at from 2½ to 3 per cent., for the erection of small houses in Paris and the suburbs. A five-storey block has just been completed at Saint-Ouen for the accommodation of 47 families—of those workers who have the largest families and the lowest wages—the rents ranging from 4s. to 5s. 7d. per week, for three or four rooms.

**Continental.**—FRANCE.—Another large company has been formed in France in connection with the supply of electrical energy for power purposes. The latest is the Société de l'Électricité de la Région Valenciennes-Anzin, the capital of the concern being £800,000.

The report of the Société Westinghouse, of Paris, for the last financial year shows a profit of £4,230, as against the loss of £7,663 in the preceding 12 months.

La Société Générale d'Entreprises Electriques is the name of a new company which has just been formed in Paris (71, Boulevard Raspail), with a capital of £12,000.

The balance sheet of La Société Continental Edison, of Paris, for the last financial year, shows a profit of £147,348, as compared with £154,420 in the preceding 12 months.

La Société des Ateliers Electriques Roche-Grandjean is the name of a new company which has just been formed in Paris (27, Boulevard de la Chapelle) with a capital of £13,400, to carry on the electrical engineering works known by the same name.

Just recently there has been quite a rush in the formation of new companies in connection with electricity supply undertakings in France. Among the new concerns are the Société des Forces Motrices de la Loue, which has been organised in Paris (69, Rue de Miromesnil) with a capital of £44,000, to put down a plant to utilise the water power of the River La Loue, at Mouthier (Doubs), in the generation of electrical energy for lighting and power purposes; La Société Electro-Industrielle de Chorges, formed at Chorges in the Hautes Alpes, with a capital of £3,000, to establish a small plant to utilise certain available water power near that little town; and the Compagnie de l'Electricité d'Ivry-le-Pré to establish a small central electric lighting station in the little town of Ivry-le-Pré (Cher).

La Société des Forces Motrices du Breda et de la Grande Valloire is the name of a new company which has lately been formed at Lancy (Isère), with a capital of £44,000, to establish a plant to utilise the water power of the rivers Breda and Grande Valloire, in the Isère Department, in the generation of electrical energy for lighting and power purposes. Another new concern is the Société Sarthoise d'Electricité, formed at Le Mans (Sarthe), with a capital of £16,000, to establish a small central electric lighting station in that town.

**BELGIUM.**—The balance-sheet of the Antwerp Telephone and Electrical Works, of Berchem, Antwerp, for the last financial year shows a loss of £5,836.

La Société Belge pour la Fabrication des Cables et Fils Electriques, of Brussels, reports a net profit of £9,294 for the last financial year.

**GERMANY.**—The Deutsch Ueberseeische Electricitäts Gesellschaft, of Berlin, reports a net profit of £563,990 for the last financial year, an increase of £137,180 over the preceding 12 months. The dividend is being increased from 10 to 11 per cent.

The Elektro-Mobil Gesellschaft is the name of a new company which has just been formed in Berlin, with a capital of £5,000, to start a new service of electric motor cabs in the German capital.

**HUNGARY.**—La Société Auxiliaire d'Éclairage et de Transport de Force de Kolozvar is the name of a new company which has just been formed in Brussels with a capital of £43,600 to acquire and carry on the central electric lighting station of the Société d'Éclairage de Clausenburg at Kolozvar, Hungary.

**ITALY.**—The Società Elettrica Coloniale Italiana is the style of a company which has just been formed at Milan with the object of erecting electric installations in Lybia and other Italian colonies. Its capital is 1,000,000 lire, with power to increase to 2,000,000 lire.

**Chilian Electric Tramway and Light Co., Ltd.**—The directors report that for the year 1912 (including £11,357 brought forward and after placing £60,000 to renewals reserve account and £7,000 to insurance account), there is an available balance of £107,851, out of which a dividend of 6 per cent. on the preference shares in respect of the year 1912, amounting to £39,000, has been declared. Further dividends in respect of the arrears of interest on these shares have also been declared—viz., 6 per cent. for 1901 and 5 per cent. on account of 1902, amounting in all to £60,500, leaving £8,351 to be carried forward.

### German Electrical Companies.

**THE Elektrizitäts-Gesellschaft vorm W. Lahmeyer & Co., of Frankfurt-on-Main,** reports net profits, after deducting interest on loans and banking charges and meeting general expenses, amounting to £81,000 in 1912, as compared with £70,000 in the previous year. The directors recommend a dividend of 6 per cent., as against 5 per cent. in 1911.

The accounts of the **Elektro-Trouhand A.G., of Berlin,** show receipts of £41,250 in 1912 as dividend on the company's holding of shares of £750,000 in the Hamburg elevated railway, and interest amounting to £15,600, making a total of £56,850. On the other hand, interest on loans absorbed £33,850, leaving net profits of £23,000, as the general expenses were borne by the founders, the A.E.G. and the Siemens-Schuckert Works.

The report of **Hartmann & Braun, A.G., of Frankfurt-on-Main,** states that the departments were abundantly provided with orders in 1912, and the number of employes had to be increased, namely, from 766 in 1911, to 850 last year. As gross profits the accounts exhibit the sum of £93,000, as compared with £81,000 in 1911, and the amount of £9,700 has been placed to depreciation, as against £7,500 in the previous year. After defraying general expenses, interest on loans, and making other appropriations, the net profits are returned at £29,000 as contrasted with £21,000 in 1911. The dividend in contemplation is 10 per cent. on share capital of £85,000, being the same rate as in each of the two preceding years.

The report for 1912 of the **Deutsche Pope Lampen, of Ais-la-Chapelle,** indicates a further deficiency, which is chiefly attributed to the fall in prices which was mainly due to over-production. The new manufactures which were undertaken during the year, afforded no compensation for the decline, and the battery department was still unable to yield any return. The "ductile lamp" brought out according to the company's own process, had not answered the purpose, and a reversion took place to the former type of lamp which had stood the test. Including the loss of £4,400 incurred in 1910 and 1911, the total deficiency amounts to £13,400, which has been carried forward. It is added that the cost of producing the Pope lamp has been considerably reduced in the current financial year.

### Austrian Electrical Companies.

**THE Hungarian Siemens-Schuckert-Works Co., of Buda-Pesth,** which has works at Pressburg and Gyomro, realised net profits of £13,100 in 1912, as contrasted with £12,500 in the preceding year, and proposes to distribute 6 per cent., as in 1911, on a share capital of £166,000. It is now intended to raise the share capital to £333,000, in order to defray the cost of the newly erected cable factory, and the issue will be carried out by the syndicate headed by the Austrian Landerbank.

The accounts of the **Austrian Siemens-Schuckert Works Co.** show net profits and balance forward of £83,500 for 1912, as compared with £75,000 in the previous year. It is proposed to pay a dividend of 7 per cent. on the share capital of £1,000,000, this contrasting with 6 per cent. in 1911. During the present year, the report states that new contracts have become slower, although the stock of orders still remains satisfactory. It has been decided to increase the share capital to £1,333,000 by the issue of new shares of £333,000.

The directors of the **A.E.G. Union Gesellschaft, of Vienna,** state in their report for 1912 that the works were fully employed during the favourable situation of trade in general last year, and the orders brought forward in the new year would afford an abundance of work for several months. The company was not affected by the results of the political events in the final quarter of the year. The considerable turnover in 1912 and the incidental large increase in stocks, the deliveries not yet brought into account, and the extension of the works, gave occasion to the issue of the previously authorised new capital of £160,000, and this also rendered it possible for the company to undertake the manufacture of other products. The gross profits reached £129,000, as contrasted with £110,000 in 1911, and the net profits were £50,400 as against £44,700. It is proposed to pay 8 per cent. for 1912 as compared with 7 per cent. in the previous year. The completion of the Pressburg-Vienna Railway is expected to take place this year.

### Continental Electrical Companies.

**Swiss-Italian Enterprise.**—The **Gesellschaft Columbus für Elektrische Unternehmungen** has just been formed at Glarus, Switzerland, with a nominal share capital of £1,000,000, of which £640,000 has been issued, and on which 20 per cent. has been paid. The object is to invest in and carry out electrical undertakings of all kinds, particularly in the Argentine Republic, and the company is credited with having already acquired three-fourths of the shares in the Italian-Argentine Electricity Co., of Buenos Ayres. The board of directors includes representatives of Brown, Boveri & Co., the Swiss Railway Bank of Basle, the banking firm of Len & Co., the Swiss Bank Co., of Zurich, the Credito Italiano and the **Compañía Italo-Argentina de Electricidad, of Buenos Ayres.**

The **Paris North-South Railway.**—The working receipts of the **Chemin de Fer Electrique Nord-Sud, of Paris,** amounted to £342,000 in 1912, or £60,000 in excess of the preceding year, and the ratio of working expenses to gross receipts was 51.80 per cent., as compared with 52 per cent. in 1911. The net profits were £80,000, as against £69,000, and the dividend remains at 5s.

per share on an ordinary share capital of £3,000,000, as in the preceding year.

The report of the **Ateliers de Constructions Electriques du Nord et de l'Est, of Jeumont,** states that the turnover in 1912 exceeded that of the previous year by 28 per cent. notwithstanding the prevalence of excessively keen competition. Extensions of the large machine shops were carried out so as to be able to construct the largest machines, and the 12,000 kw. alternator delivered to the Saint Denis station of the Paris Electricity Co. had been put into operation with complete success. The locomotive of 1,500 H.P., which was supplied to the Compagnie du Midi for the haulage of heavy and high-speed trains on mountain lines, had yielded results which had induced the railway company to order eight further locomotives of the same type. As a result of the increasing number of customers in the vicinity of Paris, the company had thought it advantageous to have shops within easy reach of the city, and the works of the **Société des Procédés Claret and Vuilleumier** had been acquired for the purpose. The pig-iron, bronze and steel foundries were in full operation, and the company's steel castings, in particular, were much appreciated. Concerning the cable factory, the report mentions that it was very well occupied despite competition, and the turnover in armoured cables was 35 per cent. in excess of 1911. The production and sale of rubber insulated wires and cables were extended and the factory for insulated tubes is fully employed; whilst the rolling mill and wire-drawing mill were brought into use in April, 1912. The accounts indicate a gross surplus of £144,000 and profits, after defraying general expenses and setting aside £60,000 for depreciation, as against £22,000 in 1911, amounting to £81,000, as contrasted with £59,000 in 1911. A dividend at the rate of 6 1/4 per cent. has been declared on share capital of £1,000,000, this comparing with 6 per cent. in the previous year.

The greatest overseas electricity supply undertaking—that of the **German Transmarine Electricity Co., of Berlin**—experienced a further course of favourable development at Buenos Ayres in 1912. Not only so, but as all the parts of the city upon which buildings have been erected will be equipped with distributing mains in the present year, the directors entertain no apprehensions that the prosperity of the enterprise will be prejudiced by the competition of the **Italo-Argentine Electricity Co.,** which was granted a lighting concession by the municipal council in 1912, or of the **Lacroze Tramway Co.,** which also applied for a similar concession. Apart from the supply of electrical energy for lighting and power purposes in Buenos Ayres, for the operation of tramways and for the working of the underground railway which is to be opened this year, the company also owns supply works at Santiago and is likewise financially interested in other lighting undertakings and tramways in Buenos Ayres, the Chilean Electric Tramway and Light Co., the Valparaiso tramway and the Trans-Atlantica tramway at Monte Video. The total of these investments amounts to £1,398,000, whilst the advances made to these and other companies represent a further sum of £2,655,000. The capacity of the company's works at Buenos Ayres increased from 74,760 kw. in 1911, to 100,300 kw. in 1912, and the length of mains from 1900 to 2,213 miles; the connections rose by 19,000 kw. to 134,980 kw., apart from 22,820 kw. for the tramways; and the production advanced from 193,350,000 kw.-hours in 1911, to 209,970,000 last year. As gross profits from working, dividends, &c., the accounts show the amount of £1,474,000, as compared with £1,203,000 in 1911, and after meeting general expenses and taxes, interest on loans (£210,000), and depreciation (£308,000), the net profits are returned at £663,000, as contrasted with £526,000 in the previous year. It is proposed to pay a dividend of 11 per cent. on the ordinary share capital of £5,000,000, and 5 1/2 per cent. on new capital of £1,000,000, leaving £14,000 to be carried forward. This result compares with 10 per cent. in each of the three preceding years. The loan capital in 1912 amounted to £4,213,000, and had recently been increased to £5,463,000 by the issue of £1,250,000 in new bonds.

### Mexican Light and Power Co., Ltd.

THE accounts for the year ended December 31st, 1912, shows that the net revenue in gold, after paying all expenses and fixed charges, amounted to \$1,372,686, which, with \$984,127 brought forward, makes a total credit balance to profit and loss account of \$2,356,813. Of this the directors have paid a dividend of 7 per cent. on the preferred shares, and 4 per cent. on the ordinary shares, absorbing \$963,400, and have placed to reserve account \$209,008, and there remains a balance to the credit of profit and loss account of \$1,184,405. The reserve account, after crediting the amount carried from profit and loss account, has been reduced to \$300,000 by debiting to such account \$336,892 for extraordinary expenses incurred during the year. In order to ensure proper protection of the company's properties, and the continuous operation of its service during the recent disturbance in Mexico, the management was obliged to incur a considerable amount of extraordinary expenditure, and the company was able to maintain its services in a very satisfactory manner, and did not sustain any serious damage to its property. The statistics show an increase in the sale of power over the previous years, but not so great as it should have been if the condition of the Republic had been normal. The operating expenses, however, show a reduction from 31.06 per cent. in 1911, to 24.68 per cent. in 1912. The extension of the system of canals and tunnels to divert several rivers into the Necaxa watershed has been proceeded with as rapidly as the conditions have permitted, and although the work has not been completed quite as soon as was anticipated, the board expect that the entire system will be finished and in operation during the course of the year.

During the year the Mexican Light and Power Co., Ltd., acquired the El Oro Light and Power Co. (Cia. de Luz y Fuerza de El Oro, S.A.), which the board believe will prove a profitable investment. The storage in all the reservoirs at December, 1912, was 68,400,768 cb. metres, or an increase of 13,958,489 cb. metres, and greater than ever in the history of the company. Since the beginning of 1913 Mr. R. C. Brown has been appointed vice-president of the company, and Mr. Harro Harrsen, after being elected a director, has been appointed managing director, resident in Mexico City, Mr. C. B. Graves, late vice-president and general manager of the Manila Electric Railway and Light Co., being appointed general manager. The directors express their great appreciation of the services during the past year of Mr. R. C. Brown, managing director, and also of the officials resident in Mexico during a very trying period, especially Mr. H. Harrsen, general manager, and Mr. Luis Riba, legal representative.

The capacity of generating plants is as follows:—Necaxa, 94,000 H.P.; San Ildefonso and other small plants, 10,777 H.P.; Pachuca Light and Power Co., 12,140 H.P.—Total, 116,917 H.P.

Reserve steam plants in Mexico City, including Mexico Tramways Co. plant, 14,250 H.P.—Grand total, 131,167 H.P.

Installations connected.—The number of arc lamps has decreased from 3,914 to 3,055; incandescent lamps have advanced from 400,422 (33,246 H.P.) to 466,256 (31,042 H.P.), and motors from 88,532 H.P. to 99,631 H.P. The total connected is 130,673 H.P., as compared with 121,778 H.P.

	1911.	1912.
Gross earnings	\$7,581,027	\$8,034,539
Operating expenses and maintenance	2,193,028	1,853,143
Net earnings	\$5,388,999	\$6,181,396

(Mexican currency.)

### Mexico Tramways Co.

THE sixth annual report, for the year ended December, 1912, states that the operation of the company's undertaking during the year has shown a satisfactory increase. The net revenue in gold for 1912, after paying all expenses and fixed charges, amounted to \$1,830,480, which, with the balance brought forward from 1911, makes a total credit balance to profit and loss account for the year of \$2,617,046, out of which the directors have paid four quarterly dividends at the rate of 7 per cent. per annum, leaving a balance in the profit and loss account of \$1,462,928, which has been carried forward. The ratio of operating expenses to gross income for the year 1912 was 47 per cent., as compared with 48.57 per cent. in 1911. In order to ensure proper protection of the company's properties and the continuous operation of its service during the recent disturbance in Mexico, the management was obliged to incur a considerable amount of extraordinary expenditure, and as a result the company was able to maintain its services in a very satisfactory manner, and did not sustain any serious damage to its property. At December, 1912, the tramway system consisted of 208.30 miles of single track, of which 193.30 miles were operated by electricity, and 15 miles by mules—the electric track mileage having been increased by 17.80 miles and the mule track mileage having been reduced by 4.55 miles. The first sections of the suburban lines to Toluca and Puebla, respectively, have been placed in operation; the Toluca section as far as Cuajimalpa, a distance of 5.405 miles from Santa Fe, and the Puebla section as far as Tulyehualco, a distance of 6.878 miles from Xochimilco. The mule lines were electrified during the year from Ixtacalco to Ixtapalapa, and from Tacubaya to Santa Fe. The physical condition of the company's undertaking in all departments is satisfactory. The property has been maintained in excellent condition and repair, and for this purpose \$735,076, Mexican currency, has been expended during the year. The company has constructed 11 first-class electric passenger cars, as well as eight other cars.

Since the beginning of 1913, Mr. R. C. Brown has been appointed vice-president, and Mr. H. Harrsen, after being elected a director, has been appointed managing director, resident in Mexico city, Mr. C. B. Graves, late vice-president and general manager of the Manila Electric Railway and Light Co., being appointed general manager.

The directors express their appreciation of the services of Mr. R. C. Brown, managing director, and also of the officials resident in Mexico during a very trying period, particularly of Mr. Harro Harrsen, general manager, and Mr. Luis Riba, legal representative.

### Aron Electricity Meter, Ltd.

THE directors' report for the year ended March 31st, 1913, shows, after providing for general charges and depreciation, a net profit of £32,653, making, with £4,456 brought forward, a total available profit of £37,109. Out of this the directors distributed in December last a dividend of 3 per cent. on the preference shares, absorbing £3,747, leaving to be disposed of £33,362. The directors recommend a further 3 per cent. on the preference shares, making a total for the year of 6 per cent., absorbing £3,747, a dividend of 7 per cent. on the ordinary shares, absorbing £8,750, transfer to reserve towards goodwill and patents of £15,000 (making this reserve £55,000), carrying forward £5,865. The past year's trading in electricity meters and taximeters has again been most satisfactory, the sales having exceeded those of any previous year. The company's factories have been fully employed, and the necessary extensions to cope with the increased business are being carried out. The meeting is called for July 1st.

### Edison & Swan United Electric Light Co., Ltd.

MR. ELLICE CLARK presided at the Cannon Street Hotel on June 18th, over a meeting of the first debenture stock of the above company, for the purpose of considering, and if thought fit, passing the resolution which appeared in the ELEC. REV. for June 6th, p. 951.

The CHAIRMAN said he was in the chair as the surviving trustee. Some attention had been called in the Press to the fact that he occupied the dual position of a director of the company and a trustee for the debenture-holders. It was only due to him to state the circumstance under which he became their trustee. The late Mr. Forbes, who was chairman for many years of Edison & Swan, resigned the position of trustee for the debenture-holders, and for the purpose of economy he (the speaker) was appointed a trustee in his place without receiving any remuneration. Whilst the late Lord Avebury, who was a trustee, was alive, that was a satisfactory arrangement, but now that arrangement must be subject to revision, and he proposed, in the course of a few days, to resign his position as trustee. He did not propose to make any remarks as to the scheme himself, but would leave that to Mr. Ford, the chairman of the company.

MR. C. J. FORD said they had all had before them the circular, but he would like to give some further information respecting the position of the company, and the reasons which had induced the board to ask their assent to the proposals. He was approached some three years ago by an influential body of shareholders, with a view to becoming director and chairman of the company; he gathered, amongst other things, that the company was in want of funds, and he informed the parties that no one could be expected to take up the position unless both the share and debenture stockholders were prepared to support him in some scheme with the object of providing further capital. After many discussions, the only apparent means available was the uncalled capital upon the "A" shares which was pledged to the debenture-holders. So far as he could judge, there was no other practical course open to him except that which they proposed to adopt. It had been suggested that they might dispose of their interest in the Altrincham Co., and there were at least two objections to that. It could only be done by forming a company to take over the whole undertaking of the Altrincham Co., and if this were done the Edison & Swan Co., as the promoter and vendor, would have to take a large proportion of the purchase price in securities of the new company. On the other hand, whatever cash they might receive would have to be secured by way of underwriting the new shares, and they would also have to underwrite the working capital. This would be expensive, and the fullest benefit they could possibly derive from the whole transaction would not furnish them with sufficient cash to meet their requirements. Then, again, the Altrincham Co. was progressing very favourably, and last year the net profit, before paying debenture interest, which absorbed £1,250, was £5,750. This year it was calculated the profit would not fall short of £7,250. This being so, it was extremely advantageous to retain the Altrincham securities. As to the necessity of raising further money, as they knew, the company were originally the sole owners of the patents relating to the incandescent carbon lamp, and practically held a monopoly until the year 1893, when the patents expired. During that time large profits were made, but so far as he could judge, far too large dividends were distributed. After the expiry of the patents the manufacture of electric incandescent lamps was thrown open to competition, and the company's profits began to fall away. In 1901 the metallic-filament lamp came in, and this necessitated the expenditure of a large sum of money on new plant, which, he was informed, had amounted to upwards of £30,000. The plant had hardly been installed when the metallic-filament lamp was, in part, superseded by the drawn-wire filament, and about £15,000 was expended in new plant to manufacture this type of lamp. They had also an extensive plant at Ponder's End works for the general fittings business, and this side of the business had been constantly extending. The engineer, however, told him that he found the greatest difficulty in handling profitable orders with which they were entrusted, because he had not sufficient plant to cope with them. He did not want them to think that, should they obtain the money they wanted, they were undoubtedly going to run into heavy expenditure in new plant, for as far as he was able to judge, about £6,000 would do all they wanted. One of the most important matters was that of properly bringing their products before the public. If they obtained this money they would enter on a scheme of consistent advertising. A moderate amount of money prudently employed could do a great deal, and as they found their sales increase they would increase their advertising. It was the only way for a commercial concern to live, and if they could not adopt the course pursued by others the business would not progress, and they would be lucky if they did not recede. They had a good name, and with push and publicity he felt confident that the company could maintain its place in the front rank of the electrical industry. Since he had acted as chairman economies had been effected, and the general expenses had been reduced to the extent of about £6,000 per annum. Arrangements had been made to remove the London premises from Queen Street, and they were looking out for premises possessing a good show-room in one of the leading City thoroughfares. They were advised that there would be no difficulty in letting the Queen Street premises at a substantial rent. With regard to the scheme itself, Clause 1 dealt with the consolidation of the existing first and second debenture stock. It provided for the merging of the £135,602 5 per cent. second debenture stock with the £313,872 4 per cent. first debenture stock. As a matter of fact, £5,977 of the first debenture stock and £67,000 of the second debenture stock, which was included in the figure he had mentioned, had been deposited as security for loans amounting to

£22,000, and if the new money was available, these would be paid off and the stock handed back to the trustees. They would then only have a total issue of about £370,000 consolidated debentures. The stock redeemed could not be issued without the consent of the new trustees. Clause 2 related to the handing over to the trustees of the debenture holders of 25,000 5 per cent. debentures and 33,346 shares of £1 each, fully paid, in the Altrincham Electric Supply, Ltd. The debentures were the total amount issued at the present moment, and the total shares of the company at present issued were 35,000, so that the trustees would hold practically the whole of the capital of this company. It was told that some time back the Altrincham municipality opened up negotiations with the Edison & Swan Co. for the purchase of the Altrincham undertaking, and that the company considered they were entitled to £100,000 or thereabouts in cash for the undertaking. The business had made substantial profits and was an increasing one and should be worth close on £100,000, and the debenture-holders in obtaining this security in place of the £1 per share uncalled were getting a very fair exchange. Further, under the scheme, whenever a sale did take place of the Altrincham undertaking, the whole of the sum realised would be available for the redemption of the debenture stock. Since the original issue of the scheme, in order to meet the views of some of the stock holders who thought they were not getting a sufficient *quid pro quo* for giving up the call, it had been agreed also to specifically charge to the trustees the freehold and leasehold property of the Edison and Swan Co. These stood in the books at £76,000, after writing off depreciation from time to time. Clause 3 dealt with the formation of a sinking fund for the redemption of debentures. As things now stood there was no time fixed for the redemption of the stock; now, if only a few thousands per annum were applied in redemption either by purchase in the market or by drawings, it all helped to raise the price of the stock. Clause 4 gave the company the right to call up an amount not exceeding £1 of the uncalled liability of £2 per "A" share. If the whole of this amount was ultimately collected it would produce £99,261. Some of them no doubt were shareholders as well as holders of the debenture stock, and no one regretted the necessity for the call more than the board. He might remind shareholders that it was far better for them to pay up the £1 of the liability when it was going into the coffers of the company and would considerably strengthen the position of the company, than to let things drag on as they were now with a liability always hanging over their heads of having to pay £2 per share to the debenture holders if things should go wrong with the company. To sum up the points for and against the scheme: he would say that on the one hand they had £67,000 second stock to rank *pari passu* with the first, and they gave up the right of what it was worth to perhaps some day call up £1 per share on 99,000 shares. On the other hand they had specifically charged to them £146,000 of security; the knowledge that when Altrincham was old the proceeds would go to pay off the stock; an additional one-half per cent. interest; a sinking fund to redeem yearly a portion of the debentures; and a strong company. If the scheme was defeated he supposed they would muddle along as heretofore with the stock unsaleable at 60. He asked them to support the board by agreeing to the present proposals. They had a difficult task before them, that they fully realised, but with the assistance of the debenture holders they were not afraid of the future.

MR. LEA SMITH said he opposed the whole scheme on principle. They knew that the rights of preference shareholders had been wiped out, and the preference shareholders were sick of the whole thing, and he did hope they were not going to start the same thing with debenture-holders. The debenture-holders subscribed their money on the faith of the security of the uncalled capital, and now they were going to have this taken away. He said deliberately that if those who were opposing were beaten, they would see what they could do. This was not a question of compromise, but a question of principle. He asked if it was fair and right for the directors, without calling their shareholders together, to spring this on the debenture holders. He would do all he could to stop it, and as an ordinary shareholder he would not pay any call on his shares which the first debentures were entitled to, unless he was forced to do so by law.

MR. LOCK agreed generally with Mr. Lea Smith that the rights of debenture-holders should not be interfered with, but in this case he thought there was good cause stated for moderating their rights. He was satisfied that their security would be much improved by the proposed scheme.

MR. E. ATKIN said that years ago he was a severe critic of the company, and he had intended that day supporting Mr. Lea Smith, but the statement of the chairman had converted him.

MR. TRENCH, whilst sympathising with the board, opposed the scheme on principle, and wished to move an amendment to the effect that the meeting be adjourned until the new trustee had been appointed and had reported on the scheme.

The CHAIRMAN said they could adjourn the meeting, but they would only be able to discuss the matter before the meeting.

MR. CLAY urged an adjournment to enable the board to confer with some of the opponents of the scheme.

After further discussion, MR. FORD said he entirely agreed on principle that the merging of the second debentures with the first was wrong. He also agreed that tampering with the security of the debenture-holders was wrong. If, however, they looked on the other side of the picture, he contended that the propositions of the board altogether outweighed the disadvantages. He considered that the opposition took great responsibility if they defeated the scheme.

The resolutions were then proposed by MR. FORD and seconded

by MR. QUILTER, and on a show of hands, were carried by nine votes to eight.

MR. LEA SMITH demanded a poll, and it was announced that the result would be declared on the following Friday.

In the afternoon MR. W. DOUGLAS HARRIS presided over a meeting of the second debenture holders, and MR. FORD again explained the scheme.

The resolutions were carried with one dissentient.

The result of the poll of the first debenture stockholders, on the scheme for the consolidation of the first and second debenture stocks shows that there were 16,235 votes (representing £162,602 of stock) in favour of the scheme and 7,212 votes (representing £72,478) against. Stockholders attending the meeting holding 60 votes (representing £600) did not vote. Under the terms of the trust deed a three-fourths majority of the votes in the room (which would be 17,652 votes) was necessary for the adoption of the scheme, and the voting showed 1,117 votes short of this.

### Puebla Tramway, Light and Power Co.

THE report of the directors for the year ended December 31st, 1912, states that further improvement is shown in the results of trading. The net profits in Mexico in 1912 amounted to £76,931, as compared with £67,039 for 1911, £61,678 for 1910, £48,678 for 1909, and £27,354 for 1908. After meeting all expenses, bond interest and first mortgage bond sinking fund, there remains a profit for the year of £354, plus the balance of £6,197 brought forward, making a balance at the credit of profit and loss of £6,551, which it is recommended should be carried forward. All sections of the business show satisfactory increases. Having regard to the disturbed condition of Mexico throughout the period, the directors think that the results of the year's working may be considered as very encouraging. The construction work at the Tuxpango Falls is proceeding satisfactorily, and it is hoped that it will be completed by October next. A contract for the sale of energy to the Vera Cruz Electric Light, Power and Traction, Ltd., has been entered into on terms satisfactory to both companies. Owing to pressure of business engagements, Lord Cowdray has resigned his seat on the board.

Concurrently with the ordinary general meeting of this company in Toronto, a meeting of the shareholders was held on June 18th, at Salisbury House, E.C., Sir Clarendon G. Hyde, the president, in the chair.

Proposing the adoption of the above report, the CHAIRMAN, after explaining that the meeting was held later this year, owing to the recent revolution in Mexico, said that the political situation in that country was still far from satisfactory. It was a matter of congratulation to the directors to know that no damage had resulted to their property, and that business had proceeded throughout the whole period of unrest in a satisfactory manner. Indeed, he was pleased to say they had had an increase of business in all departments. Late in February one of the company's transmission lines was cut by a brigand, who had the assurance to demand a weekly payment in order to permit the company to carry on its business. He need hardly tell them that the directors did not comply with such a demand. The development work upon the Tuxpango Falls had been going on rapidly. Commenced in February of last year, they expected to have had it finished by the end of April of this year. The local disturbances had naturally had the effect of diminishing the supply of labour, and of delaying the arrival of machinery and material, but in spite of those drawbacks, the work was well in hand. The power house was in course of erection, the tunnel was 85 per cent. finished, the pipe line and other masonry works were nearly completed; practically the whole of the pipes and machinery were on the ground, and it was expected that the work would be finished by October 1st. The transmission lines from Tuxpango to Puebla city were already finished and in use. They were able to get a temporary supply from the falls of Orizaba, by arrangement with a local jute mill company. That additional supply was brought into use last December, and would abundantly serve their needs until they were able to dispense with it by the opening of their power house at Tuxpango. In anticipation of the opening of their new power house, they had concluded a contract for the sale of electrical energy to the Vera Cruz Electrical Light, Power and Traction Co., Ltd. That would mean a large increase in their income by the supply of a minimum of 2,000 H.P., and although the rates they were getting were comparatively low, the contract at any rate provided an immediate market for a substantial portion of their new available supply, and whilst relieving their standing charges, would do something more than pay interest on the capital invested. As the demands of the Vera Cruz Co. increased, they hoped that the contract would assume a more profitable shape. Another matter of interest had been the negotiations for the electrification of the city tramways in Puebla. The city authorities were extremely anxious that the present mule teams should be replaced by electrical traction. The directors were not especially anxious in the matter, as the capital involved was heavy, necessitating the entire reconstruction of their present lines, whilst the additional profit to be derived was not likely to be fully commensurate with the expenditure. They must, however, face the fact that the Puebla trams must sooner or later be electrified. After considerable negotiations with the Governor, they arranged a contract in which, in return for a subsidy and certain privileges, they undertook to electrify the tramways within a given period. The revolution in February last changed most of the officials throughout the Republic, and the local State Congress, when the contract came

before them, rejected it. The directors were not, however, on that account discouraged; the demand for electrifying the tramways came from the authorities, and not from the company. They were glad to be relieved, in the present state of the Money Market, from the necessity of raising the additional funds, and they hoped that before the matter again became ripe the restoration of order throughout the Republic, the additional sales at their power house and an improved Money Market here would place the company in a strong position to raise any funds required. Turning to the accounts, they would see that, although they had not yet got any benefit from the capital in the Tuxpango Falls, the net profits had increased by a little under £10,000. He thought they would consider that an eminently satisfactory result, having regard to all the circumstances of the case. The profits in Mexico had increased from £26,000 in 1903 to practically £77,000 in 1912. When the new power house was available they saw no reason why that rate of increase should not at least be maintained.

MR. S. MACKEW seconded the motion, and the report was adopted.

### Marconi International Marine Communication Co., Ltd.

THE thirteenth ordinary general meeting was held on Monday at the office, Marconi House, Strand, Mr. Godfrey Charles Isaacs, the managing director, presiding.

The CHAIRMAN, in proposing the adoption of the report, said he was pleased to say that the business of the company continued to develop. During the past year there had been a very substantial increase in the receipts and in the number of ships equipped, with the result that the profit was between £9,000 and £10,000 in excess of the previous year. One of the items which was of particular interest was that of ships' telegrams, news service, traffic and ships' subsidies, which during the past year had exceeded £100,000. The number of ships equipped up to the end of last year was 580, and to date it had reached 686, and he was glad to say that the number was continuing to increase in the same ratio. The company was conducting a business which served a very valuable purpose for the mercantile marine. He did not know that there was another industrial business which played a more important part in the world than did wireless telegraphy on ships at sea. During the past 12 months they had had a very large number of instances where it was more than probable that in times past when there was no wireless telegraphy, many ships would have sailed from their ports and would never again have been heard of. In practically all those cases not only had all the passengers been saved, but the ships themselves had been saved. He did not know yet what part that might play in reducing the cost of insurance to shipowners, but it seemed self-evident that whereas in the past a number of ships would have been total losses, in every instance where a ship had been fitted with wireless telegraphy during the past 12 months both the ship and the cargo had been saved. There had been a considerable amount of legislation during the past year in nearly all countries, providing that ships should be fitted with wireless telegraphy. There had been a certain limit to which the law applied. In most cases it only touched ships carrying 50 persons or more, whether passengers and crew or crew alone. He thought that that was likely to be the beginning of much legislation, and that as time went on they would find that the laws would be made to apply to every ship that sailed from a port. Personally, he could not see why that should not be the case, for whether there be 50 persons on a vessel, or 25 or less, it seemed to him that if there be a means of safeguarding the lives of those on board, it should be applied in every instance where it was possible. In this country they were expecting similar legislation. Exactly what line it would take he was not yet in a position to say, but he contemplated that it would go rather further than the laws of other countries.

MR. H. S. SAUNDERS seconded the motion, and the report was adopted without discussion.

## STOCKS AND SHARES.

Tuesday Evening.

MARKETS round the Stock Exchange, with very few exceptions, have undergone further severe falls since our last week's statistics were made up. A lot of forced stock came in for sale, and prices melted like snow under the pressure to realise, although a strong recovery to-day, Tuesday, wiped out much of the previous fall. The trouble is no longer so much political as it is financial, and that there must be distress in many quarters is obvious enough from the depression which prevails in stocks and shares. Quotations for investment securities have kept tolerably steady, but in anything where a bull account exists the process of disintegration went on from day to day for nearly a week. On the eve of the present settlement, happily, a material rally occurred, though the worst of it is there is not much confidence felt with regard to a continuance of the improvement.

Consols went down to nearly the lowest price which they have touched in their present 2½ per cent. condition, but on the quotation picking up Home Rails accepted the cue and also hardened. Metropolitan on Monday were 2½ down on the week, Districts 2½; while the steam stocks showed long catalogues of substantial falls. To-day, Tuesday, has seen the 2½ restored to

Metropolitans, and Districts are only 1½ lower on balance. District Prior Lien Debenture shed 2 points, but Central London Ordinary regained its fall of the week previous. City of London 1903 Preference also rose 2, bringing it into line with the 1901 stock. Underground Electric Railway shares fell to 3½, a drop of ½, and the 1s. shares at 8s. 9d. were ¾ down, while the 6 per cent. income bonds lost 1. Of the slower-moving shares, Potteries Preference eased off to 12s. 6d. The London and Suburban issues are a trifle easier—it will be noticed that we have included these in our over-leaf lists.

Electricity Supply shares have attracted a little attention, because of the fresh fall in City of London Ordinary, where the price has got down to 15½. Vague hints reach us of "something being up"; but whatever that may be, the price is certainly not, and the people who in the ordinary way support the shares, have been holding their hands. With regard to these, however, as in most of the markets, it is not surprising that the price should have given way, because in such troublesome times to attempt a bullish demonstration is simply to invite proprietors to take advantage of the opportunity to get out of their shares at what looks a good price. County Preference fell ½ to 11½, St. James' are a little easier at 6½, and Westminster Ordinary at 8½ are ½ down. Charing Cross Preference lost an equal fraction; and the only rise in the list is one of ½ in Bonnremouth and Poole Second Preference shares, which did not participate last week in the advance in the other classes of this company's shares.

The suggested reconstruction of Crompton & Co. served to stimulate a little inquiry for the company's Debenture stock, and the price has risen 2 points. Edison & Swan descriptions are notably unchanged on the battle which has been going on in connection with the reorganisation scheme, which was defeated at the meeting.

The other manufacturing shares are fairly steady, though Henleys and Callenders reduced ¼, while Babcock & Wilcox at 2½ are ¼ down. Arons have issued a good report, showing an increase in the dividend from 6 per cent. to 7 per cent; the company has sold more taximeters in the past year than it has done previously in the course of its history. Upon this the shares hardened to 15s. middle. British Westinghouse 4 per cent. Debenture is 1 up.

Stock and shares in the Latin-Canadian group have been amongst those most affected by the depression, and subsequent recovery, in the markets; at times some of the low-priced shares in this division were almost unsaleable. The market has braced up from the worst, but on balance there is a fairly long list of declines left. British Columbia Electric stocks have been extremely heavy, and the Deferred at 117½ is 6½ down. The Preferred at 106½ shows a loss of ½, and the 5 per cent. Preference is a point lower; though, curiously enough, the 4½ per cent. Debenture at 94 is a point to the good. Mexican Light and Power Common remained at 68½; the Preferred shares fell 2, which raises the yield on them to 7 per cent. on the money.

Montereys and Mexican Electric Light Bonds are both a point down. Canadian General Ordinary fell 3½, but Shawinigan Water and Montreal shares retained their prices. Mexico Trams dropped 3, to regain 2 later on, and Rio First Mortgage Bonds fell ½. In most of these cases the declines are due to causes extrinsic to the undertakings, and there can be little doubt that when these are removed the quotations will recover. That this will be a matter of time may be taken for granted, because the results of such a series of shocks to confidence in Stock Exchange investments cannot be repaired at a few days' notice.

Anglo-Argentine Tramways 4½ per cent. Debenture is a point down. The Fives keep steady about 96½, at which there is a quiet flow of investment going on, the security being considered quite good. It is certainly well covered, according to the last reports issued by the Company. Other South American issues have given way in sympathy with the rest. La Plata Trams, Para Electric Railways Ordinary, and City of Buenos Ayres Trams are all somewhat easier. Brazil Traction shares slumped to 86, rebounded to 90, and show no net change on the week; while the new 6 per cent. Preference shares are being quietly absorbed in the neighbourhood of 98, by those who do not mind running a slight risk for the sake of a good return on the money. According to the prospectus recently issued, the dividend on these is well secured.

There is not much change in the Telegraph market. West India and Panama and Globes are each ½ down. Eastern Telegraph 4 per cent. Debenture stock is ½ higher, a similar fraction being lost by Western Telegraph 4 per cent. Debenture stock. A recovery of ¼ in New York Telephone 4½ per cent. Bonds is evidence of the investor being in the markets, for the security in their case is excellent. Reuters shares are weaker at 10, their par value. National Telephone Deferred stood out as a feature of strength amidst weak markets, the price hardening up to 23; and Marconis, after dipping to 3½, improved to 3½ buyers, when a few "bears" came in on the eve of the account to level up their commitments. In addition to this, the market had the benefit of the news that the company had just concluded an important contract with the Norwegian Government for the supply of an installation, this being taken as testimony to the Marconi system being one of the best. After falling to 2½, the Preference shares recovered to 2½.

The Rubber share market, after being exceedingly flat, experienced a sharp recovery. Earnest discussions are taking place with a view to raising the price of the plantation product—or, at all events, for bringing it more into line with that of Fine Hard Para. The price of which stands about 10d. per lb. higher than plantation rubber. Why there should be this difference between the two classes of material is also a matter of keen debate, for all the recent controversy in connection with the subject leaves it still a conundrum.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Shars.	Dividends for	Closing Quotations June 24th.	Rise + or Fall	Present Yield p.c.	NAME.	Stock or Shars.	Dividends for	Closing Quotations June 24th.	Rise + or Fall	Present Yield p.c.
Bournemouth & Poole, Ord.	10	5 8	8 84-104	..	5 17 1	Kensington & Knightsbridge, Ord	5	9 81	7 1-7 2	..	4 s. d.
Do. 4 1/2 % Pref.	10	4 4 1/2	8 1/2-9 1/2	+ 1/2	4 12 4	Do. 4 % Deb.	Stock	4 4	90-98	..	4 6 0
Do. Second 6 % Pref.	10	8	10 4-10 1/2	..	5 12 11	Kent Elec. Power, 4 1/2 % Deb.	Stock	4 4	76-80	..	5 12 6
Do. 4 1/2 % Deb. Stock	Stock	4 4 1/2	90-98	..	4 11 10	London Electric, Ord.	5	2 1/2	1 1/2-1 1/2	..	4 7 9
Brompton & Kensington, Ord.	5	10 10	8 1/2-8 1/2	- 1/2	5 9 7	Do. 8 % Pref.	5	5	4 1/2-5	..	6 0 0
Do. 7 % Cum. Pref.	5	7 7	8 1/2-8 1/2	..	4 0 0	Do. 4 % First Mort. Deb.	Stock	4 4	88-91xd	..	4 8 0
Central Electric Supply, 4 1/2 % Guar. Deb.	100	4 4	94-97	..	4 2 6	Metropolitan	5	4 41	8 1/2-8 1/2	..	5 10 4
Charing Cross, West End & City	5	5 5 1/2	4 4-4 1/2	..	5 11 1	Do. 4 1/2 % Cum. Pref.	5	4 4 1/2	4 1/2-4 1/2	..	4 17 4
Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 4-4 1/2	- 1/2	5 0 0	Do. 4 1/2 % First Mort. Deb.	Stock	4 4	96-101	-1	4 9 1
Do. City Undertaking (1/2 % Cum. Pref.)	5	4 1/2	3 1/2-4	..	5 12 6	Do. 8 1/2 % Mort. Deb.	Stock	8 1/2	50-88	..	4 4 4
Do. Do. 4 % Deb.	100	4 4	90-92xd	..	4 7 0	North Metropolitan Power Sup- ply, 5 % Mortgages (Red.)	100	5 5	98-101	..	4 19 0
Chelsea, Ord.	5	5 4 1/2	4 1/2-5 1/2	..	4 15 8	Notting Hill, 5 % Non-Cum. Pref.	10	6 6	92-102	..	5 11 7
Do. 4 1/2 % Deb.	Stock	4 1/2	96-99	..	4 10 11	Oxford	5	7 1/2	6 1/2-6 1/2	..	5 13 9
City of London, Ord.	10	8 8	14 1/2-16	- 1/2	5 12 0	St. James' and Pall Mall, Ord.	5	10 10 1/2	8 1/2-8 1/2	..	5 14 9
Do. 6 % Cum. Pref.	10	6 6	11 1/2-12 1/2	..	4 16 0	Do. 7 % Pref.	5	7 7	6 1/2-7	- 1/2	5 0 0
Do. 6 % Deb.	Stock	6 6	118-120	..	4 8 4	Do. 5 1/2 % Deb.	100	8 1/2	8 1/2-8 1/2	..	4 0 0
Do. 4 1/2 % Second Deb.	10	4 1/2	100-102	..	4 8 8	South London, Ord.	5	6	2 1/2-2 1/2	..	7 7 8
Comity of London, Ord.	10	6 6	10 1/2-10 1/2	..	5 10 4	Do. 5 % First Mort. Deb.	100	5 5	98 1/2-10 1/2	..	4 13 6
Do. 6 % Pref.	10	6 6	11 1/2-11 1/2	- 1/2	5 2 2	South Metropolitan, 7 % Pref.	1	7 7	1 1/2-1 1/2	..	5 17 11
Do. 4 1/2 % Deb.	Stock	4 1/2	104-106	..	4 5 0	Do. 4 1/2 % First Deb. Stock	100	4 1/2	98-99	..	4 10 6
Do. 4 1/2 % Second Deb.	Stock	4 1/2	98-101	..	4 9 1	Urban, Ord.	28	Nil	..	..	..
Edmundson's, Ord.	23	Nil	..	..	Nil	Do. 6 % Cum. Pref.	5	2 1/2	2 1/2-2 1/2	- 1/2	5 3 6
Do. 8 % Cum. Pref.	5	Nil	..	..	8 6 8	Do. 4 1/2 % First Mort. Deb.	100	4 1/2	8 1/2-8 1/2	..	5 19 6
Do. 6 % Non-Cum. Pref.	5	..	1 1/2-2 1/2	..	5 4 8	Westminster, Ord.	5	10 10	7 1/2-8 1/2	- 1/2	5 19 6
Do. 4 1/2 % First Mort. Deb.	100	4 1/2	8 1/2-8 1/2	..	5 4 8	Do. 4 1/2 % Cum. Pref.	5	4 1/2	4 1/2-5 1/2	..	4 5 9
Folkestone	5	5 5	4 1/2-5	..	6 0 0						
Do. 5 % Cum. Pref.	5	5 5	4 1/2-5	..	5 0 0						
Do. 4 1/2 % First Deb.	100	4 1/2	90-92	..	4 17 10						
Hove	5	9	7 1/2-7 1/2	..	5 16 2						

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Aelaide, 6 % Pref.	5	8	5-5 1/2	..	5 14 6	Monterey Ry. Light & Power, 5 % 1st Mort. Deb.	100	5 5	78-81	-1	6 5 6
Caenita, Ord.	5	8 1/2	6 1/2-7 1/2	..	4 17 8	Montreal, Lt., H. and Power	\$100	8 9 1/2	210-220	..	4 1 10
Do. 6 % Pref.	5	5 5	4 1/2-5 1/2	..	5 16 5	Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	\$500	5 5 1/2	15-25	..	..
Cajary Power, 1st Mort. Bds.	100	5 5	98 1/2-95 1/2	..	6 3 11	River Plate, Ord.	Stock	10 10	207-217	..	4 8 0
Canadian Gen. El. Com.	\$100	7 7	118-123	- 1/2	5 13 10	Do. 4 1/2 % Deb.	Stock	6 6	102-107	..	5 9 1
Do. 7 % Pref.	\$100	7 7	118-123	- 1/2	5 13 10	Do. 5 % Deb. Stock	Do.	5 5	100-102	..	4 18 0
Coroba Lt., Power and T., Ord.	100	8 8	6 1/2-6 1/2	- 1/2	5 4 9	Roy, Elec. Co., Montreal, 4 1/2 % 1st Mort. Deb.	100	4 1/2	100-102	..	4 6 8
Do. 5 % Deb.	100	6 6	6 1/2-6 1/2	- 1/2	5 4 9	Shawigan Water, Capital	\$100	5 5 1/2	126-130	..	4 0 9
Elec. Lt. and P. of Coobabamba, 3 % Bonds	100	6 6	90-92xd	..	6 10 5	Do. 5 % Con. 1st Mort. Bonds	\$500	5 5	107-109	..	4 11 9
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5 5	90-98	..	5 7 6	Do. 4 1/2 % Fer. Deb.	Stock	4 1/2	97-100	..	4 10 0
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	\$500	5 5	92 1/2-94 1/2	..	5 5 9	Do.	4 1/2	97-100xd	..	4 10	
Esigeille Elec. P. and Lt., Ord.	100	Nil	..	..	Nil	Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5 5	93-96	..	5 5 2
Do. 6 % Pref.	1	6 6	..	..	9 12 0	Victoria Falls Power, Pref.	1	1 1/2	178 1/2	..	..
Kaministiquia Power, 5 % G. Bs. Madras, Ord.	\$500	5 5	100 1/2-102 1/2	+ 1/2	4 17 7	West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6 6	106-108	..	6 11 1
Melbourne, 5 % 1st Mort. Deb.	100	6 6	108 1/2-106 1/2	..	4 14 0						
Mexican El. Lt., 5 % 1st M. Bds.	5	5 5	7 1/2-8 1/2	- 1/2	6 1 11						
Mexican Lt. & Power, Common	\$100	4 4	67-70	..	5 14 4						
Do. 7 % Cum. Pref.	\$100	7 7	96-100	-2	7 0 0						
Do. 8 % 1st Mort. Gold Bds.	..	5 5	87-90	..	6 11 1						

TELEGRAPH AND TELEPHONE COMPANIES.

Ampson Telegraph	10	4	4 1/2	6 1/2-7 1/2	..	6 2 0	Monte Video Telephone, Ord.	1	6 6 1/2	1-1 1/2	..	5 6 8
Do. 5 % Deb. Red.	Stock	5 5	96-98	-1	6 2 0	Do. 5 % Pref.	1	5 5	..	..	5 14 8	
American Teleg. & Teleg., Cap.	\$100	8 8	130-133	..	6 0 4	New York Teleg., 4 1/2 % Gen. Bnds.	100	4 1/2	97-98	+ 1/2	4 11 10	
Do. Collat. Trust	\$1000	4 4	91-93	..	4 5 1	Oriental Teleg. and Elec.	1	6 6	1 1/2-1 1/2	..	6 10 2	
Aiglo-American Telegraph	Stock	6 6	61-64	..	4 13 9	Do. 6 % Cum. Pref.	1	5 5	1 1/2-1 1/2	..	4 18 0	
Do. 6 % Pref.	Do.	6 6	107 1/2-109	..	6 10 0	Do. 4 % Red. Deb.	Stock	4 4	88-90	..	4 8 11	
Do. Del.	Do.	80 1/2	23 1/2-23 1/2	+ 1/2	6 6 4	Pacific and European Teleg., 4 1/2 % Guar. Deb.	Do.	4 4	98-100	..	4 0 0	
Aiglo-Portuguese Tel., 5 % 1st Mort. Deb.	100	6 5	104-106	..	4 15 8	Reuter's	10	10 10	9 1/2-10	- 1/2	9 10 6	
Chill Telephone	5	7 7	7 1/2-7 1/2	..	5 1 1	Submarine Cable Trust	Cert.	6 6	124-127	..	4 14 6	
Commercial Cable, 8 1/2 % Deb.	Stock	4 4	83 1/2-85 1/2	..	4 18 7	Telephone Co. of Egypt, 4 1/2 % Deb. Red.	Stock	4 1/2	96 1/2-98 1/2	..	4 11 5	
Cuba Telegraph	10	6 6	8 1/2-8 1/2	..	6 6 4	United River Plate Telephone	5	8 8 1/2	6 1/2-7	..	5 14 4	
Do. 10 % Pref.	10	10 10	12 1/2-13 1/2	..	5 19 4	Do. 5 % Cum. Pref.	5	5 5	5 1/2-5 1/2	..	4 9 0	
Direct Spanish Telegraph, Ord.	5	4 4	8 1/2-8 1/2	..	6 8 6	West Coast of America	2 1/2	2 1/2	1 1/2-1 1/2	..	4 7 0	
Do. 10 % Cum. Pref.	5	10 10	6 1/2-7 1/2	..	6 12 0	Do. 4 % Debs., 1 to \$500 guar. by Bras. Sub. Tel.	100	4 4	96-99	..	4 0 10	
Direct United States Cable	10	5 5	5 1/2-6 1/2	..	6 5 6	West India and Panama Teleg.	10	1 1/2	2 1/2-2 1/2	- 1/2	4 10 11	
Direct W. India Cable, 4 1/2 % Reg. Deb.	100	4 1/2	98-101	..	4 9 0	Do. 8 % Cum. 1st Pref.	..	10 10	9 1/2-10 1/2	+ 1/2	5 18 5	
Eastern Telegraph, Ord. Stock	Stock	7 7	123-131	..	6 10 0	Do. 5 % Cum. 2nd Pref.	10	8 8	9 1/2-10	..	5 0 0	
Do. 8 1/2 % Pref. Stock	Do.	8 1/2	7 1/2-7 1/2	..	4 12 1	Do. 5 % Debs.	100	5 5	101-108	..	4 17 1	
Do. 4 % Mort. Deb.	Do.	4 4	90 1/2-92 1/2	+ 1/2	4 8 5	Western Telegraph, Ltd.	10	7 7	13-13 1/2	..	5 8 8	
Eastern Extension	10	7 7	12 1/2-13	..	5 7 8	Do. 4 % Deb.	Stock	4 4	92 1/2-94 1/2	- 1/2	4 4 8	
Do. 4 % Deb.	Stock	4 4	92-94	..	4 5 1	Western Union 4 1/2 % Fdg. Bonds	\$1000	4 1/2	90-93	..	4 16 9	
East and S. Africa Tel. 4 % (Mt. Db. Mauritius Sub.)	95	4 4	98-100 1/2	..	3 11 7							
Globe Telegraph and Trust	10	6 6	11-11 1/2	- 1/2	5 4 4							
Do. 6 % Pref.	10	6 6	12 1/2-12 1/2	..	4 13 2							
Great Northern Telegraph	10	13 13	80-82	..	6 5 0							
Indo-European Telegraph	35	13 13	65-67	..	5 14 0							
Maekay Companies Common	\$100	5 5	80-83xd	..	6 0 6							
Do. 4 % Cum. Pref.	\$100	4 4	67-70xd	..	6 14 4							
Marconi's Wireless Telegraph	1	20	3 1/2-3 1/2	+ 1/2	6 10 4							
Do. 7 % Cum. Pref.	1	17	2 1/2-2 1/2	..	6 13 4							

\* Unless otherwise stated, all shares are fully paid.

α Paid in deferred interest warrants.

† Interim Dividend.

8s. In Funded Dividend Certs.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

Table listing electrical companies (Home) with columns for Name, Stock Share, Dividends for, Closing Quotations June 24th, Rise or Fall, Present Yield p.c., Name, Stock Share, Dividends for, Closing Quotations June 24th, Rise or Fall, Present Yield p.c.

ELECTRIC RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Table listing electrical companies (Colonial and Foreign) with columns for Name, Stock Share, Dividends for, Closing Quotations June 24th, Rise or Fall, Present Yield p.c., Name, Stock Share, Dividends for, Closing Quotations June 24th, Rise or Fall, Present Yield p.c.

MANUFACTURING COMPANIES.

Table listing manufacturing companies with columns for Name, Stock Share, Dividends for, Closing Quotations June 24th, Rise or Fall, Present Yield p.c., Name, Stock Share, Dividends for, Closing Quotations June 24th, Rise or Fall, Present Yield p.c.

\* Unless otherwise stated, all share are fully paid. † Interim dividend. ‡ Dividend of 4 per cent. guaranteed by Underground Electric Railways.

## INTERNATIONAL TIME SERVICE.

On Tuesday next, July 1st, the new arrangements for the distribution of time signals, organised by the Bureau Central International de l'Heure, will take effect, superseding the signals at present issued from the Eiffel Tower and Norddeich. The facility with which accurate time can be transmitted from observatories on land to ships at sea, as well as to other observatories, surveyors, clock makers and others to whom precision in this regard is of the first importance, is by no means the least of the many benefits conferred upon humanity by radio-telegraphy, and it was the demonstration of its capabilities by the French Government station at the Eiffel Tower which led to the International Conference of 1912, appropriately held at Paris. We explained in our issue of January 10th, 1913, the method which has been adopted for the new service, and reproduced the diagram which forms the key to the signals. From the end of the fifty-seventh minute of the hour, warning signals are sent out consisting of the letter X (— . . —) for 50 seconds, followed by silence for five seconds, after which the first time signal is given, consisting of three dashes each lasting for one second, separated by intervals of one second. Thus the end of the third dash coincides precisely with the end of the 58th minute. Afterwards the letter X (— .) is sent every ten seconds, followed by the second time signal, and finally a series of G's (— —) followed by the third time signal, the last dash ending precisely at the hour. These signals will be sent out from the Eiffel Tower daily at 10 a.m. and midnight, with a wave-length of about 2,500 metres, and from Norddeich at midday and 10 p.m.; both series should be easily received at any part of the United Kingdom. The times of the signals given at other centres are as follows, Greenwich time being stated in each case:—

San Fernando (Brazil) ...	...	...	2 a.m. and 4 p.m.
Arlington (U.S.A.) ...	...	...	3 a.m. and 5 p.m.
Manila and Mogadiscio ...	...	...	4 a.m.
Timbaktu... ..	...	...	6 a.m.
Massouah ... ..	...	...	6 p.m.
San Francisco ... ..	...	...	8 p.m.

One of the great advantages of wireless time service is the exceedingly short interval between the dispatch and the reception of the signals, which, in most cases, renders any correction on this account unnecessary. There is, however, an appreciable time lag between the initiation of the signal by the standard clock in the originating observatory and the emission of the train of waves which constitutes the dash or dot, owing to the necessary interposition of a relay and other transmitting apparatus in the sending station; this is very carefully determined, and is allowed for at the sending end, so that the actual radio-telegraphic signal is accurately timed.

Reception can be effected with an antenna of modest dimensions, over a range of a few hundred miles from such a station as the Eiffel Tower or Norddeich; indeed, as we recently noted, even an iron bedstead may suffice. The observer listens to the signals, with the clock or watch to be compared before him, and with practice it is not difficult to estimate the difference between the true time as given by the signal and that of the clock to a half or even a quarter second. Beyond this degree of accuracy it is necessary to have recourse to more refined methods of observation, either with the aid of automatic recording apparatus or with the system described later. M. Albert Turpain has succeeded in devising methods whereby a photographic record of the signals can be made simultaneously with a record of the beats of a local chronometer 300 km. from the Eiffel Tower, giving an accuracy of  $\frac{1}{2}$  second; or by speeding up the apparatus so that the photographic film travels at the rate of 100 mm. per second, enabling the arrival of the time signal to be recorded within a millimetre, it is possible to determine the correct time to about  $\frac{1}{100}$  second.

But recording apparatus is not essential to obtain this

degree of accuracy, as we shall show—premising that an accuracy of this order is necessary when, for instance, an observatory which has been prevented by cloudy weather from determining the time by astronomical observations is taking the time from an observatory more favourably situated. Before the ordinary night signals, the Eiffel Tower sends a series of 180 short dots regularly spaced by one second less about  $\frac{1}{10}$  second. In each series the 60th and 120th dots are suppressed, in order to facilitate counting by the observer, who listens to the dots and to the beats of his seconds clock or chronometer. The two series will generally be out of phase, but during the period whilst the 180 dots are being dispatched there must be three coincidences between the dots and the beats, spaced 50 seconds apart. Noting the time indicated by the chronometer at the moment of coincidence, as well as the number of the dot at which the coincidence occurs, it is easy to calculate the time indicated by the chronometer at the instant of the arrival of the first dot. If the time of a coincidence was, for example, 23 hr. 30 m. 25 s., the number of the dot at that moment being 42, the time of the first dot by the chronometer must have been 23 hr. 30 m. 25 s. — 41 ( $1 - \frac{1}{10}$ ) seconds = 23 hr. 29 m. 44.82 s. It will be seen that this "method of coincidences," which has been used for the purpose of comparing clocks and chronometers for generations, is really nothing more or less than the familiar vernier, applied to the measurement of time instead of space, and it enables the true time to be communicated with an accuracy of about  $\frac{1}{100}$  second.

As the determination of the time by astronomical methods involves a knowledge of the longitude of the place at which the observations are made, it follows that if the time can thus be accurately transmitted, the difference of longitude between two places can be accurately measured, and thus the time service becomes of great value to astronomers and surveyors. The system has already been employed for this purpose in France, Belgium, and the French African colonies. As the wireless signals can be received in places difficult of access, such as Central Africa, the surveying of such regions is thereby greatly facilitated. Observations have even been made between Arlington, U.S.A., and the Eiffel Tower, though the low power at present available at these stations (50 or 60 kw.) and the great distance between them (6,000 km.) have made the process difficult. The difference of longitude between Arlington and Paris, to an accuracy of a few hundredths of a second, has thus been determined, and the results will shortly be published; further observations will be made during the coming winter. In the case of so great a distance the time occupied in the transmission, at the speed of light (300,000 km. per second), is not negligible, amounting to 0.02 second.

Unfortunately, Greenwich Observatory, though equipped with receiving apparatus, is unable to transmit the signals, and is, therefore, omitted from the list of international time centres. While every credit is due to the French Government for taking the initiative in this respect (although, as a matter of fact, it was not absolutely the first to employ radio-telegraphy for this purpose, time signals having been distributed from Halifax, Nova Scotia, in 1906), we cannot but agree with Mr. F. Hope-Jones, who recently drew attention to the fact that as Greenwich has hitherto taken the lead in giving the time to the world, the British Government ought to have been the first in the field. As we noted last week, a constant difference has been observed between Greenwich mean time and the time signals from the Eiffel Tower and Norddeich, the latter being on the average 0.3 second late on Greenwich.

One of the applications of the time service which has gained an extended vogue abroad is to the determination of the correct time by watch and clock makers for the purposes of their business. Scores of amateurs in this country take their time from the Eiffel Tower, and there is no reason whatever why our manufacturers should not do the same, as the receiving apparatus is simple and easily managed. The only formality required is to obtain a licence from the Post Office, which presents no difficulty. This licence is necessary even if only receiving apparatus is installed.

We are indebted for much of the foregoing information to the interesting paper read by Commandant Ferrié at the recent Electrical Congress in Paris.

## REVIEWS.

*Toll Telephone Practice.* By J. BERNHARD THIES, B.S., LL.B., and GUY A. JOY, B.E. With an introductory chapter by FRANK F. FOWLE, S.B. London: Constable & Co., Ltd. Price 14s. net.

The rapid developments which are taking place in the art of telephony are forcibly brought home to one by a perusal of this book, which, as indicated by the title, deals exclusively with toll, or, as we may say on this side of the Atlantic, trunk line working.

Not so many years ago, in treatises on telegraphy, the telephone used to be relegated to a single chapter at the end of the book. We then had special text-books on telephony; but the subject has now grown so vast that it would be almost impossible, at the present day, to give in a single volume a detailed account of every phase of the methods and processes employed in the electrical transmission of speech.

Telephony originated in America, and it is to American writers that we are indebted for the best treatises on the subject. This is, to a certain extent, a disadvantage for the British reader, for not only have the various telephone systems been developed here on somewhat different lines from those followed in America, but the technical vocabulary employed in New York differs in many respects from that used in London. It does not take long, however, for the reader to become acquainted with the unfamiliar phraseology, and although the systems described in American books may not be exactly similar to those in use in Great Britain, yet the study of American methods cannot fail to be of help to the telephone engineer in this country, by giving him new ideas and suggestions for the development of the special systems with which he is more immediately concerned.

The introductory chapter of the volume under review gives a brief historical sketch of the development of the subject. The modern systems, from rural lines to large lamp-signalling trunk switchboards, are then described in detail. After a chapter dealing with junction line arrangements between trunk exchanges and local automatic exchanges follow descriptions of the supervisor's desk connections and the equipment of the test-clerk's table. The superposition of telegraph circuits on trunk lines, and the methods used to increase the number of separate trunk connections which can be obtained with a given number of lines, are then discussed.

The remaining chapters of the book deal with test boards, line construction, a brief discussion of the theory of telephone transmission and the advantages to be derived from the use of loading coils, induction troubles and their remedies, the various methods of testing necessary in a trunk exchange, the routine maintenance of trunk circuits, and a description of the telephone relay.

The book is well printed, the diagrams are excellent, and we can confidently recommend it to those telephone engineers who wish to broaden their views on their profession and to keep themselves up-to-date with the developments of the subject.

*Bells, Indicators, Telephones, Fire and Burglar Alarms, &c.*  
By J. B. REDFERN and J. SATIN. London: Constable and Co., Ltd. Price 1s. 6d. net.

This volume is one of the well-known electrical installation manuals, and, like the others of the series, it is well worth the price asked. The total number of pages is divided among the several subjects treated in the following manner:—Bells, 32; indicators, 10; telephones, 74; fire and burglar alarms, 3. We rather think it would have been better to have devoted one volume to bells, alarms, indicators and primary batteries, and a second to telephones. The text is not divided into chapters, but into 72 paragraphs, by which the various items are indexed. As the paragraphs are mostly one page, or less, in length, the indexing by paragraphs does not introduce any particular inconvenience, though we much prefer references to pages.

As the authors point out, bell-fitting can be reduced to a fine art if only a little common sense be brought to bear upon it, but, owing to the simplicity of electric bells and their circuits, they are apt to be regarded with contempt by the

average wireman. The authors explain, by clear text and illustrations, the construction and relative advantages and spheres of applicability of various types of bells (including the polarised magneto-ringing pattern). Admirable though this section is in other respects, a serious omission seems to be the absence of explanatory and advisory text dealing with the relation between bell resistance and battery power required, &c.

The line illustrations (of which there are 85 in all), are very neat and clear, but in some cases the arrangement of the circuit might have been chosen so as to indicate the fundamental lay-out more clearly. Fig. 15, for instance, is a case in point.

In connection with burglar alarms, it would have been well to illustrate a few inconspicuous and reliable arrangements for mounting contacts on windows, show-cases, &c., and we find no reference to the best types of batteries to be used in closed-circuit alarm installations.

The telephone section deals, under various paragraph headings, with direct working telephones, the construction and function of induction coils, magneto- and intercommunication telephones, location of instruments, cables and wiring, ringing batteries and their location and connections, telephone switchboards, the central-battery system and outside line construction, and includes useful instructions for working the switchboard system. In this section (seeing that the index, though good, is by no means complete), we believe that titles should have been attached to the illustrations, or, at least, parts of the text should have been italicised so as to facilitate reference to any particular topic. There is a general similarity between telephone wiring diagrams which renders such a course particularly desirable. Paragraph 33 extends over 13 pages, and includes 12 figures, and yet has no sub-section headings or illustration titles.

No space is devoted to automatic exchange working—the development of which is surely sufficient to justify its treatment. Probably space limitations precluded the introduction of this subject, thus supporting our view that it would have been advisable to keep the telephone matter in a separate volume. However, the book is to be thoroughly recommended to wiremen and those engaged in the installation or working of telephone equipments. In a later edition we hope to see the index somewhat amplified.

*Iron and Steel.* By O. F. HUDSON, M.Sc., and GUY D. BENGOUGH, M.A., D.Sc. London: Constable & Co., Ltd. Price 6s. net.

To the making of books on the subject of iron and steel there seems to be no end, and the critic might question the need for still another, did not the authors, by their reference to their work as "an introductory text-book for engineers and metallurgists," imply that it was by no means intended to compete with the "classics" on these subjects by Harbord, Turner and others. Both authors are specially fitted to deal with these metals, and especially the effect of mechanical and heat treatment on their properties and on those of their alloys, by virtue of the large amount of original research work that they have done in this direction. They wisely ignore almost entirely in the volume under review the practical details of methods of production, in order that more attention may be directed to matters of greater importance to engineers and other users of these metals, such, for example, as mechanical testing, the properties of cast-iron, foundry practice and the mixing of cast-iron for foundry work. In the section devoted to the latter there is included a useful table showing the composition of cast-iron suitable for different purposes, such as thin ornamental work, medium-sized castings for general work, heavy machinery castings and engine cylinders and hydraulic work. The table shows how careful the engineer must be about the composition of his castings, for while the silicon in light, thin work can be as high as 2.50 per cent., it should not exceed 1.00 per cent. in the case of cylinder castings. Malleable castings are now so largely used in spite, be it noted, of the advent of cast steel, to which an instructive chapter is devoted, that the authors' account of this useful and cheap material, which can be successfully employed for innumerable small castings of thin section, will be read with special interest.

The use of the electric furnace in the manufacture of iron and steel is discussed. It is shown that this type of furnace is not used much in this country at present—owing to high cost of energy—though one might expect its use in the Sheffield district in connection with the production of alloy steels. Both of the authors are expert metallographists, hence we are not surprised to find a number of excellent reproductions of microphotographs, which will enable the reader the more readily to comprehend the somewhat highly technical matter of the composition of iron-carbon alloys.

The volume concludes with a section devoted to the corrosion of iron and steel by Dr. Bengough, who is peculiarly fitted to deal with this very important subject by virtue of his position as Honorary Investigator to the Corrosion Committee of the Institute of Metals, in which capacity he must have had exceptional opportunities of looking into this still mysterious subject.—G. S. S.

*Simple Electric Cookery.* By MAY LITTLE. London: Jarrold & Sons. Price 1s. 6d. net.

This, we believe, is the first electric cookery book; it is a sign of the times, and will be warmly welcomed by two great classes—the suppliers and the consumers of electricity—to say nothing of the manufacturers of electrical cooking apparatus. The author is a highly qualified teacher of cookery, and gives demonstrations at the Norwich electricity department's showrooms. The first 27 pages are devoted to hints and notes on electric cooking, and a variety of apparatus by leading makers is illustrated, but the pages are not loaded with descriptions of these. The convenience and simplicity of electric cooking, which needs no special training; the perfect regularity of the heating and the certainty of always achieving the desired result; and the economy which can be effected by the proper use of the apparatus, are pointed out. The safety from shock and from fire, and the absence of fumes and dirt (due to the absence of fumes) are other advantages which are cited, together with the saving of labour. The author emphatically declares that cooking by electricity is economical in every way, and that if electricity can be had at 1d. a unit or less, the cost compares very favourably with that of gas at 2s. 6d. per 1,000 ft.

The reduction in the loss by shrinkage of meat, with the accompanying gain in digestibility and flavour, is not overlooked. Instructions are given for cleaning an electric cooker, and for carrying on the usual operations, and a few particulars are added as to the cost of cooking by electricity. The remainder of the book—100 pages—is devoted to recipes numbering 185, and covering all the requirements of a large household; these are too highly technical for us to venture on discussing them, but we may note that directions regarding the "heat" to be employed, the use of "residual heat," &c., are of frequent occurrence. In other words, this is not an ordinary cookery book with an introductory chapter on electric cooking; it is a new work, written expressly to guide the user of electric cooking apparatus, by one who is an expert in the art. We have no hesitation in commending it to the notice of all who are concerned with this increasingly important branch of the electrical industry.

**Charging Electroscopes.**—Writing to *Nature*, Mr. R. Whiddington says he finds that a very convenient way of charging an ordinary gold-leaf electroscope is to rub the charging rod with the glass bulb of a glowing carbon-filament lamp. The leaf system becomes negatively charged. It is quite easy to charge a Braun electrostatic voltmeter to several thousand volts in this way.

There appears to be nothing mysterious in the phenomenon. The glass of the lamp is kept hot and free from moisture by the heat supplied from within, and is, therefore, always in a suitable state for producing electricity by friction against metals or other substances. A glass tube filled with hot mercury can be used as successfully as the lamp.

This method of producing electricity by friction is easy to employ and certain in action; the degree of electrification can be regulated to a nicety.

**Electrical Congress in Argentina.**—A scheme is on foot to organise an Electrical Congress in Buenos Ayres, to which all the electrical engineers in Argentina and Brazil would be invited.

## AIR-GAPS IN MOVING-COIL INSTRUMENTS.

By CHARLES C. GARRARD, M.I.E.E.

A MOVING-COIL ammeter or voltmeter consists of a permanent magnet arranged with a narrow air-gap, or gaps, within which a pivoted coil, carrying a current proportional to the quantity to be measured, moves. The torque set up by the electrodynamic action of the current on the magnetism in the air-gap deflects the instrument and causes the same to indicate. The object of this article is to consider the effect of various arrangements of the air-gap on the efficiency of the instrument, and also to deal with several points in the manufacture of such instruments, which may be of interest. In addition, some considerations on the subject of the permanent magnet itself will be dealt with.

1. *Torque Experienced by a Wire carrying a Current in the Field Produced by a Permanent Magnet.*—Let  $l$  be the active length in inches of wire (*i.e.*, within the action of the magnetic field),  $i$  the current in amperes flowing through the wire, and  $B$  the magnetic density (*i.e.*, number of magnetic lines per sq. centimetre in the air-gap), then—

$$\text{Force acting on wire} = l \times 2.54 \times i / 10 \times B / 981 \text{ grammes.}$$

$$\text{Torque} = \text{force} \times \text{radius in centimetres at which the force acts} = \text{gramme-centimetres torque.}$$

In a good 90° scale moving-coil instrument the torque at full scale deflection is generally about 1 gramme-centimetre.

2. *Magnetising of Permanent Magnets.*—Before magnetising, the magnets should be finished machined, and provided with their cast-iron or mild steel pole pieces, which should not be removed after magnetisation; in fact, as far as possible, the magnetic circuit should not be disturbed after the magnetising and ageing process. Generally, it will be necessary to remove the core round which the moving coil swings. But nothing further should be moved without remagnetising the magnet.

The first process is to magnetise the magnet to saturation. This is most conveniently done as follows:—

A magnetising coil is provided, of, say, 28 turns, so made that each turn is in two halves, an upper and a lower one. The upper halves are arranged on a plate hinged relatively to the plate carrying the bottom halves. Thus the coil can be opened out, a magnet inserted and the coil closed again, and the magnetising circuit is complete round the same.

The joint between the upper and lower halves of each turn can be a mercury one, the coils being thick copper wire of, say, No. 10 S.W.G. The coil so formed is then connected a number of times, as a short-circuit, across a 200 to 250-volt direct-current supply in series with a circuit-breaker, which naturally operates each time a short-circuit is made. As small a resistance is placed in series with the magnetising coil as possible. Naturally, such work may cause some disturbance to the electric supply in the neighbourhood, and in some factories it is found most convenient to carry out magnetising work when the rest of the shops are shut down. The most suitable resistance and setting of the circuit-breaker for the local conditions will, however, be found by trial, the principle being by means of sudden magnetic blows, so to speak, to magnetise the magnet to saturation.

3. *Maximum Value of Magnetisation of the Magnet and Effect of Arrangement of the Air-Gap.*—The saturation value of a good magnet will be about 3,500 lines per square centimetre cross-section of the magnet. It should be noted that this saturation value is the remanent magnetism after the magnetising force has been removed and while the magnet is subjected to the small self-demagnetising action of its own free poles. It is not necessary to go into this minutely, the chief point to bear in mind being that the maximum number of magnetic lines which can be got through the magnetic circuit depends almost wholly upon the character of the steel and the cross-section of the magnet, and not upon the shape or size of the narrow air-gap of the instrument. As, moreover, the magnetic leakage of lines—*i.e.*, lines not passing through the air-gap—is, with a good design of instru-

ment, not more than about 10 per cent., it will be seen that the amount of magnetism available for giving the deflecting torque to the instrument simply depends upon the quality and size of the permanent magnet and not upon the arrangement of the air-gap.

4. *Parallel Arrangement of Air-Gaps.*—This disposes of the claim recently made (see *Electrician*, Vol. LXX, p. 671) that the arrangement of the two air-gaps of a moving coil instrument in parallel (see fig. 1) instead of in

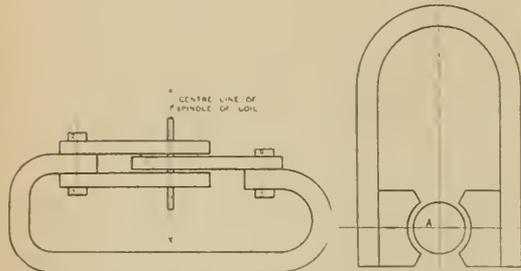


FIG. 1.—AIR-GAPS IN PARALLEL. FIG. 2.—AIR-GAPS IN SERIES. PERMANENT MAGNET SYSTEMS.

series is an advantage. The claims put forward for this arrangement were:—(a) Greater permanence; (b) remarkable freedom from external interferences; (c) exceedingly strong working field.

As regards (a) this cannot be affected by the air-gap, as it simply depends on the magnetic rigidity of the magnet, which will be dealt with later; and (b) and (c) simply depend upon the density of magnetism in the air-gap. As the total magnetic lines available simply depend on the magnet, it will be seen that, with equal magnets, the density in the air-gap of the parallel arrangement is half that in the series arrangement (assuming the air-gaps equal in area). Therefore the effect of exterior fields is double in the parallel-gap instrument and the working field is one-half.

5. *Ageing of Permanent Magnets.*—The process described in paragraph No. 2 has brought the magnet to a state somewhat under complete saturation. Such a magnet cannot, however, be used in an instrument with any hope of constancy of calibration. It is necessary to subject it to the so-called ageing process. Many methods have been proposed for this

nating current around the magnetising coil. When doing this the demagnetising alternating current must be gradually increased to its maximum and then gradually decreased to a small value before breaking the circuit. Thus any ambiguity as to the exact point in the current curve at which the circuit is ruptured is obviated. In order to secure the best results it is necessary to carry the demagnetisation down to a comparatively low figure. Thus the saturated magnetic density in the air-gap of an instrument having a magnet illustrated in fig. 2 would be 1,100 lines per sq. centimetre before removing the central core. After demagnetisation the value should be equal to about 60 per cent. of the saturation value.

The process of demagnetisation affords an excellent test as to the quality of the magnet. The amount of demagnetising current required to reduce the magnetism by the above amount is approximately proportional to the coercive force. Any magnet, therefore, which requires less than a certain demagnetising current should be rejected. For the magnet shown in fig. 2 the demagnetising alternating current should not be less than 390 ampere-turns, equal to an  $H$  of 17 (corresponding to the root mean square value of the current; naturally at the maximum of the alternating current wave the demagnetising  $H$  is proportionally larger).

In addition to the demagnetisation brought about by the alternating current, it is found that mechanical vibration has a certain effect. After, therefore, the treatment with alternating current, the central core  $A$  (fig. 2) is removed, and the magnet system is struck a number of smart blows, afterwards measuring the magnetic flux. This is kept up until no further diminution of flux occurs. A good magnet will only fall a further  $1\frac{1}{2}$  per cent. of the saturation value under this treatment, and this likewise affords a further criterion of the goodness of the magnet, any magnet falling more than this value due to mechanical shock being rejected.

It will be seen that the final magnet, as used in the instrument, will have a working magnetic flux density of about 600 lines per square centimetre. This corresponds to good modern practice. Such an aged magnet, if tested as to the effect of further magnetising and demagnetising forces, will give a result represented in fig. 3. It will be seen that any less magnetic force than that to which it has been subjected during the ageing process is without permanent effect on the calibration of the instrument.

THE I.M.E.A. CONVENTION, 1913.

(Continued from page 1020.)

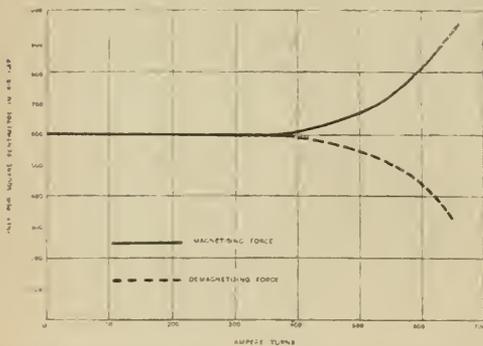


FIG. 3.—EFFECT OF MAGNETISING AND DEMAGNETISING FORCES ON AGED MAGNETS.

in the past, but it may be said that the underlying principle of them all is to subject the magnet to a greater demagnetising effect, previous to putting it into the instrument, than it is likely to meet with in use. Lesser demagnetising influences have afterwards no permanent effect on the magnet. This property of the permanent magnet is somewhat extraordinary, and so far as the writer is aware, no satisfactory explanation has been given of it.

The chief part of the ageing process is to demagnetise the magnet from its saturation value by passing an alter-

WHATEVER else may be said of this year's Convention, it cannot be denied that it provided enough, and to spare, of occupation for those who chose to avail themselves of it. The discussions—those to which the Press were admitted—were interesting, and dealt with matters of moment to municipal electricity suppliers; and we have no reason for supposing that the discussions *in camera* were any less interesting, although whether they realised the expectations of their originators seems to be another matter.

The first day's proceedings were referred to at some length in our last issue, and concluded with a meeting of the "Point Fives" and their friends at the Delico Restaurant. The lengthy discussion on electrical heating and cooking dealt principally with questions of tariff, standardisation of apparatus, and publicity—the first two being subjects on which agreement can scarcely be expected, as between the station engineer and the manufacturer of apparatus, at the present time.

Wednesday morning was given up to a discussion of the I.M.E.A. Bill, and heating and cooking, *in camera*, and in the afternoon a large party visited the Electric Railway Power House, at Lot's Road, Chelsea. In the evening the annual dinner, held at the Hotel Cecil, was very largely attended by the members and their ladies and guests, the latter including Mr. W. Duddell, president of the Institution of Electrical Engineers; Mr. A. L. C. Fell, chief officer, L.C.C. Tramways; Mr. Wm. Bryan, chief engineer, Metro-

politan Water Board; Dr. Ferranti; Mr. C. H. Wordingham; and Mr. J. H. Rider. Mr. J. E. Edgcome, president, I.M.E.A., occupied the chair.

Following the loyal toasts, Mr. W. DUDELL proposed "The Association," emphasizing the advantages which such meetings as that gave in providing opportunities for discussion, and the pleasure with which he had welcomed them at the Institution on the previous day. The PRESIDENT, in replying, urged that despite its youth, the Association could claim to have done some good work. The combination of technical and civic membership was of great value; the 400 members were approximately equally divided between the engineers and councillors, and it was something that such a huge sum as 120 million pounds had been entrusted to their care. He regretted that Parliamentary duties had called away Sir W. H. Davies and Mr. G. Cave, to whom they were indebted in connection with their Bill. This Bill was, he thought, in their own interests, and would benefit the electrical industry generally; it would mend the present illogical situation, in which certain powers were possessed by some towns and not by others. He appealed to the members to help the Bill forward by bringing local pressure to bear; the Association ought to be able to exercise greater Parliamentary pressure than it had done. He concluded by a reference to Mr. Shawfield, whose position he was occupying that night.

MR. R. A. CHATTOCK, who was originally down for a Parliamentary toast, proposed "Our Past Presidents," coupling with it the names of Mr. C. H. Wordingham, Mr. J. H. Rider, and Mr. J. F. C. Snell, all of whom briefly replied. MR. WORDINGHAM, mentioned his regard for the Association, of which he claimed to be one of the founders, and his conviction that its success was due to its exclusively municipal membership, while MR. RIDER (also a founder) expressed his great pleasure at meeting them, and MR. SNELL credited the Association with having shaped his career in the early days.

MR. HARRY RICHARDSON proposed "Our Guests," the MAYOR OF KINGSTON (Councillor C. H. Burge), and DR. FERRANTI replying.

The various speeches were interspersed with musical items, this portion of the programme, arranged by Miss Haidee Hamilton, being greatly appreciated by those present.

On Thursday the meeting was resumed at Kingston-on-Thames, where, in the Empire Theatre, the visitors were cordially welcomed by the Mayor, Councillor Burge. The stage effect was all that could be desired, and we congratulate the corner-men on their dignified performance.

Even the Mayor, whose opening evidently had *not* been rehearsed, and who, having too hastily assumed that Mr. Christie's paper covered familiar ground, discoursed on the hygienic advantages of purifying the atmosphere in which we live! provided excellent entertainment, especially when later the real subject of Mr. Christie's paper was emphasised by that gentleman himself. This paper, on "Air Filtration for Electrical Machinery," and the discussion which followed its reading, are dealt with elsewhere; we believe that the consensus of opinion, aided by Dr. Ferranti's masterly exposition of the subject, was all in favour of the wet system of air filtration, so far as the short experience of its use can permit of an opinion being formed. The whole subject has come forward so rapidly that the manufacturer of electrical machines has been taken by surprise, although to do him credit he seems to be quickly grasping the situation.

There appears to be no reason for doubting the efficacy of the system under ordinary running conditions, and provided that circumstances do not arise in which the temperature of the air falls during its passage through the machine.

Following this paper came one on "Electric Vehicles," by Messrs. W. H. L. Watson and Raymond J. Mitchell. Fortunately, the volume which these gentlemen had prepared, and which contains a great deal of interesting matter, was only "introduced," and this allowed of a discussion in which about a dozen speakers took part. This covered questions of tariff and charging arrangements, but perhaps the suggestion of Mr. Ayton, that a Special Committee should be formed to discuss the provision of charging facilities, garaging, &c., was the most helpful contribution.

No doubt the electric vehicle, particularly the heavy commercial vehicle, is attracting the attention of station engineers all over the country, and it is significant that at the annual general meeting, which took place on the following day, a resolution by Mr. Ayton substantially embodying his suggestion for a Committee was adopted by the Association.

In conjunction with this paper a demonstration of various types of electric vehicle was given, for the benefit of the visitors. Included among the cars was the Arrol-Johnson vehicle, which had a few days previously journeyed from Dumfries to London. This trial run was initiated by our friends of *The Electrician*; we gather that 362 miles were

covered and that charging current, reckoned at a fair average rate of 1d. per unit, would have cost 17s. 6d. for the run. The total running time was about 30 hours, the speed averaging between 11 and 12 miles an hour; the vehicle, which was built for town work, proved quite reliable despite its rough journey, and at Kingston attracted considerable attention.

At the conclusion of the meeting, the visitors adjourned to Nuthall's restaurant, where luncheon was served on the lawn; subsequently, the party—numbering, we believe, about 400—enjoyed a short trip on the Thames, a call being made at Hampton Court on the return journey where, however, the brief time at our disposal and the exorbitant demands made upon it by the inevitable photographer, did not allow of more than a passing glance at the beautiful gardens. Our municipal readers will be interested in the view of the party in one of the quadrangles, which we reproduce on page 1070.

The day finished with a dinner in the evening at Nuthall's, at the conclusion of which the President's health was drunk with enthusiasm, somewhat out of phase musically, but none the less sincere.

On Friday morning the annual general meeting of the Association was held.

The first business, the election of a new president, resulted in Mr. R. A. Chattock being elected for the ensuing year, so that to Birmingham will fall the honour of entertaining the Association during its next convention. In passing, we may congratulate the Association on its choice; its new President is an engineer of wide experience and unquestioned ability, full worthy of the honour bestowed.

The feature of the business meeting was undoubtedly the masterly control exercised by the President, Mr. Edgcome. We never remember having seen the annual report and accounts adopted with such celerity before!

We do not know whether Mr. Edgcome has been studying present-day Parliamentary tactics, but certainly his method of taking the report, page by page, mentioning page numbers only and those generally two or three ahead of his audience, had a great, though possibly unintentional, resemblance to the guillotine methods favoured by the "lightning" legislators.

Mr. Ayton's electric vehicle committee proposal, some questions as to publicity expenditure, a request for more "secret" meetings next year, and some sort of an explanation to the Press as to the objects of the latter, were the only items of interest, but a special (private) meeting followed, at which the amendment of the articles of association and other matters were discussed. The rest of Friday was an "off day," so far as the visitors were concerned, and many of them returned to the North during the day. Nevertheless, a goodly muster of visitors, some 70 or 80 strong, started off on Saturday morning to visit the installation of "Humphrey" pumps at the Chingford Reservoir of the Metropolitan Water Board.

This was probably the most interesting visit of the week, from an engineering standpoint, as the Chingford pumps are the only commercial examples of their kind, and, moreover, have some interest to electrical men in view of the suggestions which have been put forward for utilising them in conjunction with hydraulic turbines coupled to generators for producing electricity.

There are five pumps, four of which are each rated at 350 H.P., the other being half that size. The pumps are arranged in wells, with the 7-ft. diameter gas heads, each containing a number of inlet and scavenging valves, a few feet below floor level: the cycles of operations recur with great regularity, and the operation of the pump produces only muffled sounds.

The pumps are fed with gas from Dowson producers, running on anthracite costing about 30s. per ton, and consume 81 lb. fuel per W.H.P. The large pumps make 10 strokes or explosions per minute, each resulting in the lifting of 15 tons of water into their water towers, from which a continuous flow takes place into the reservoir. The visitors were allowed to climb to the top of the water towers, where the rise and fall of the water illustrated the cycle of operations in the pump.

The pumps run for a period of 14 or 15 hours without attention, the pump room being, as a rule, locked at night.

It is interesting to note that coil ignition is fitted and

used in preference to the magneto, the explanation being that with the former system, though water may, and probably does, quench the first spark, yet the succession of sparks with the coil ensures ignition.

Combustion appears to be of a most complete character—we put our head into the exhaust chimney without recognising it as such; moreover, no discoverable contamination of the water takes place.

Blowers for forced scavenging were installed, but the pumps appear to work equally well without them. We gathered that the pumps cost £10 to £12 per W.H.P., and it therefore remains for electrical men to add the cost of hydro-electric equipment for comparison with steam turbine plant. Although the pump fuel costs are low, it is evident that in its present stage of development, the gas pump *cum* hydro-electric plant is only an intelligent anticipation of a possibility. Nevertheless, the Humphrey pump is one of the most remarkable engineering achievements of recent times; the fact that it has so admirably fulfilled the intentions of its designer is a tribute to the scientific accuracy of present-day engineering knowledge.

After inspecting this plant many of the visitors proceeded to Chingford, where luncheon was served at a local hostelry, and returned to town later in the day.

In conclusion, we think the Convention of 1913 will bear full comparison with any of its numerous predecessors; for the smooth conduct of the varied business of the week, all credit is due to Mr. J. E. Edgcome, who so ably discharged the difficult, though to him not unfamiliar, office of president.

#### Air Filtration, Cooling and Ventilation of Electrical Machinery.

By J. CHRISTIE, Engineer and Manager, Corporation Electricity Department, Brighton.

THE following notes are intended to apply to the air filtration, cooling and ventilation of large steam turbo-driven alternators.

By fitting end bells, air ducts and forced ventilation, the makers, without any very material alteration in the design, have, with the same carcass, been able to double the output with a decreased temperature rise, whilst the selling price per kilowatt of rating has been proportionately reduced.

To effectively cool large units of plant with the surrounding air at normal temperature, some 5 to 7½ cb. ft. of air per minute per kilowatt of rated output must be forced through the windings of the machine, the general practice being to draw this from outside

air ducts choked up, and with the consequent rise in temperature the efficiency of the machine rapidly falls off. A sensitive air gauge is a most useful accessory to fix on the main air duct to the machine, as it shows the attendant at a glance the actual condition of the ventilating system.

Where no filters are provided, there is little doubt but that the condition of the varnish and insulating fabric on the end windings becomes in time seriously affected by the heat and the constant sandblast action which takes place due to the large volume of grit charged air moving at high velocity over their surface, thus making it porous. If a machine in this condition is allowed to cool down in a humid atmosphere, the insulation, due to the absorption of moisture, rapidly falls below a surface figure, and this I believe is the real cause of many mysterious "burn-outs" for which it has been difficult to account. Most of you who have had this unpleasant experience will, I think, agree with me that such failures have generally occurred when a machine has just been run up and put on load after a lengthy rest.

The type of air filter most commonly in use consists of closely woven cloth, tightly stretched on suitable wooden or wickerwork frames, and so arranged as to present a large area to the incoming air, thus keeping the velocity and pressure on the fabric at this point as low as possible. The general practice is to allow one-fifth of a square foot of filter medium per cubic foot of air per minute. This is approximately equivalent to one square foot of area per kilowatt of rated output, and in the case of large machines it becomes a most unwieldy surface to handle efficiently. At best, this type of filter can only be regarded as an unsatisfactory makeshift, and it possesses the following disadvantages:—

1. The large space occupied in proportion to its capacity.
2. It requires cleaning at frequent intervals.
3. The filter cloths wear out quickly and are expensive to renew. (£75 to £100 per annum for cloth and labour is by no means an outside figure for the efficient maintenance of such a filter on say, a 3,000 kW. set of plant.)
4. The cleaning of the filter is a long and dirty job, and can hardly be accomplished without taking the machine out of service for some considerable time.
5. Owing to its combustible nature it is a hazardous fire risk.
6. Unless of liberal area it quickly chokes up, and the air pressure rises till the fabric bursts. It is well to note that the air pressure on the intake duct of a machine should not be allowed to exceed 1 to 1½ in. of water, otherwise there is a grave risk of oil vapour being drawn in from the bearings if the oil is run at the excessively high temperature one usually sees on turbine installations, and this has a most harmful effect on the insulation.

As an efficient substitute for a cloth filter, a suggestion was put to me last year to use a water spray screen such as is fitted in the "air conditioning chamber" in the Plenum system of ventilating large buildings, and facilities were afforded me for inspecting such an equipment in connection with a large institution in London.

On the face of it, at first sight, it strikes one as a rather daring proposition to pass air through water then directly into the internal anatomy of a high-tension alternator, but I was so satisfied with the experiments which I was kindly enabled to carry out, that I

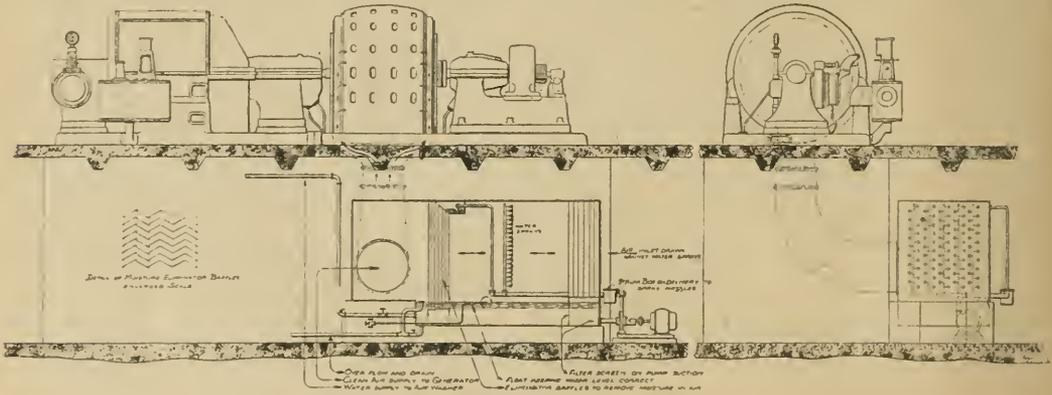


FIG. 1.

the building, or, where the conditions are favourable, from the engine room basement, the circulation being effected either by separate motor-driven fans or by fans fitted to the rotating part of the machine itself.

For moderate sized units of, say, 3,000 to 5,000-kw. capacity, at speeds of 1,500 R.P.M., I favour this latter arrangement, as being cheaper, more efficient and reliable, but for large slower speed plants, and where there are several of these sets working together, then undoubtedly the best lay-out is to provide main inlet and outlet ducts common to all machines with branches and dampers to each unit, and to have a combination of fans on the rotors themselves supplemented by separate motor-driven fans for heavy overloads, the air filters being fitted at the ends of the intake duct, and preferably in a suitable chamber outside the building.

All air about a power house, no matter how cleanly the surroundings may be, is heavily charged with dust and fine gritty particles in suspension, and unless every care is taken to filter it before passing it through the machine, the windings become coated and the

had no hesitation in recommending my Council to purchase a suitable apparatus of this type for the last new alternator installed at our Southwick power house. It consists (see fig. 1) of a strong rectangular galvanised sheet-iron chamber, one end (the air intake) being open and fitted with louvres. This opening is of such sectional area that the velocity of air at this point, when the machine is going full blast, is comparatively low.

In our case this filter is fixed in the basement adjacent to the machine foundations. Some 2 ft. inside the air inlet a water screen is fitted. This consists of a series of small nozzles pitched 6 in. apart uniformly over the entire area. Some 6 ft. beyond the screen a moisture eliminator is fixed (this is a sort of baffle). Thence the air passes directly into the alternator.

The base of the chamber forms a fresh-water tank holding some 300 gallons, and is fitted with a ball-cock off the town mains to keep the level constant, and to make up for any evaporation.

A small motor-driven centrifugal pump, of about 2 H.P., circulates this water at a pressure of 20 to 25 lb. per sq. in. through the

system. The nozzles project this water in the form of a finely atomised spray directly against the incoming air (this space, when the apparatus is working, having the appearance of a dense steamy bank of cloud), and all solid matter in suspension in the air is caught and precipitated in the tank. Any beads of moisture or grit carried through with the air are effectively trapped by the eliminator, and nothing but pure cool humid air is carried into the machine. In some localities during the winter months with this class of filter it will be desirable to fit a small steam coil in the water tank just sufficient to keep the water from freezing.

The advantages claimed for the water screen filter are:—

1. For equal capacity the space occupied is less, and in the case of large machines only about half that of a cloth filter.

2. No fire risk.

3. The apparatus is quickly and easily cleaned, it being only necessary to drain off the water at intervals depending on the amount of dirt in the air (once every two weeks in our case is often enough), wash out the tank with a hose pipe, fill up and start the pump again. All this can be done in a few minutes and without even taking the machine off load.

4. No costly filter cloths to frequently wash and renew.

5. The resistance to the air is always constant, and is less than one-third that of a cloth filter, so that the power for driving the main fan is proportionately less, whilst the total energy consumed by the outfit as a whole shows a substantial saving over that required by a cloth filter, after making full allowance for driving the water circulating pump.

6. The air after passing through the filter is not only pure, but is generally several degrees colder than the surrounding air, due to its being reduced to wet bulb temperature, consequently its cooling effect on the machine, volume for volume of air, is proportionately greater, this difference in temperature being generally most marked in the summer time just when the extra cooling effect is of the greatest value.

In tropical climates or in situations where the surrounding air is at an abnormally high temperature, it is possible, by introducing a small refrigerating plant into the water circulating system, to "super-cool" and control the temperature of the air down to a degree far below the corresponding wet bulb temperature. Experiments which I have carried out show that it is possible by this means to reduce the temperature of the air to within a few degrees of the temperature of the water through which it is passed.

The first cost of a water screen filter, of course, varies with the size of the alternator to which it is fixed. In machines of say, up to 3,000 kW., it is some 60 per cent. greater than a cloth filter, but in the case of larger machines of 5,000 kW. and upwards the advantage as regards price lies with the water screen type.

In my opinion, due to the increased cooling effect obtained, especially during hot weather, an extra 10 to 15 per cent. overload can be carried on any machine so equipped without increasing the temperature rise, and if a super-cooling refrigerator is fitted in the water system, this overload capacity can be still further increased to 25 or 30 per cent.; in fact, I firmly believe that in the near future turbines of ample power to carry extra heavy overloads will always be provided. The attendant will then simply load up the alternators to which they are coupled till their temperature attains a predetermined maximum safe limit, and electrically-controlled thermometers on the switchboard for this purpose will supersede the ampere and wattmeters now used. This extra cooling effect is perhaps the chief advantage of this system, especially where large units of plant are concerned, as the additional output obtainable for practically the same capital outlay amply justifies its general adoption.

The Southwick machine is generating three-phase alternating current, 50 periods, at 8,000 volts with 250 volts excitation on the field windings. Our equipment has been running since August last with entire satisfaction, and the insulation resistance has been consistently maintained, showing that any moisture carried through with the air is harmlessly evaporated on the warm windings of the machine, and that this type of filter may with safety be used for ventilating extra high-tension machines or air-cooled transformers without detriment in any way to their insulation. The additional humidity in the air really has a beneficial effect on the insulation, preventing it from being baked to destruction as is not uncommon where machines are run at high temperature and heavy overloads with dry, hot, gritty air constantly circulating through their ventilating ducts.

Several engineers who have extensive installations of cooling towers in close proximity to their ordinary cloth air filter intakes have kindly furnished me with the percentage of humidity in the air as now used. This is often found to be as high as 90 to 100 per cent., so that they are really working almost under the same conditions with their present filters as regards risk, if any, to the insulation due to humidity, but without the cooling and cleansing advantages of the water screen.

With the gigantic units of plant, 10,000 kW. and upwards, now being installed by many of the principal undertakings throughout the country, this system of water screen filter seems to offer, so far as present knowledge goes, the most satisfactory solution of this somewhat difficult problem of suitably conditioning the air to be used for their effective ventilation.

At the conclusion of the reading of his paper, MR. CHRISTIE asked manufacturers of machines to say what was the minimum insulation resistance considered safe with 10,000 volts.

MR. HALE (Sturtevant Co.), in opening the discussion, said he had for some time been an advocate of water spray cooling, and could not see that the new system would be worse than the old one,

where in many cases very damp air was drawn in. In one dry filtration plant, spray from cooling towers was drawn in and actually froze the filter cloths, and prevented air from passing through them at all.

MR. D. BENNETT, criticising the wet filtration system, said the metal baffles would rust away; in Manchester and Leeds the cleaning of the dry filter pockets occurred only six or eight times a year, and the cost was about £8 per annum. The most convenient method was to use a vacuum cleaner, and the condenser vacuum could be used; the fire risk had been exaggerated. Tests of the dry filter system showed a water gauge resistance of 1 mm. when newly put to work, increasing to 5 mm. in six weeks' time, when cleaning took place. For a 3,000-kw. plant the wet system would cost 27 per cent. more than the dry, while the position was reversed for a 5,000-kw. plant, in which case the dry filter would be 10 per cent. more costly.

MR. R. J. KAULA (Willans & Robinson) said it was possible that with a machine on very light load, some moisture would be deposited with the wet filter system, and it might be better to shut down the water spray a short while before stopping to ensure that dry air was passed through. Forced ventilation would spread a fire in a machine very rapidly, and dampers should be fitted to shut off the ventilation if necessary.

MR. S. E. FEDDEN (Sheffield) said very little appeared to be known about the ventilation of machines either by internal or external fans. He had a machine which would give 8,000 kW. without, and 12,000 kW. with fan ventilation. The external fan appeared to have to overcome the suction of the rotor fan before it did good work, and it had therefore to be large. He supposed that greater air pressure gave a greater cooling effect. Some manufacturers absolutely refused to guarantee their machines for use with the wet air filter, and it would be interesting to have their reasons.

MR. A. H. SEABROOK (Marylebone) said the Oerlikon Co. had greatly disliked the idea of the wet filter system being used in connection with plant they were supplying to him, but as a result of investigating the matter they were converted and had adopted it for several plants.

MR. F. H. CLOUGH (B.T.H. Co.) considered the Brighton installation very convincing, but the mica and asbestos installation used in modern machines was not quite so impervious to moisture as varnished material, and it would be necessary to look into the question. The safe insulation resistance of a machine could be found from the formula: voltage at terminals/(kW. capacity of plant + 1,000).

MR. FELDMAN (A.E.G.) did not think manufacturers could be asked to accept the wet filter straight away. The experience of his firm was that it was not profitable to connect two fans in series as mentioned in the paper, and he thought the time lag would interfere with the use of thermometers on the switchboard as suggested, as they would not follow load fluctuations closely.

MR. J. SHEPHERD (L.C.C. Tramways) said that he considered the difference in cost as between the wet and dry air filters was such a small percentage on the cost of a generating plant, that it paid to adopt the better system. The County Council was installing a 100,000 cb. ft. wet filtration plant at Greenwich, which would be the largest in the country. From experiments made he had found at Greenwich that a 10,000-kw. machine would have in one year to deal with 10 cb. ft. of dust, which illustrated the necessity of adopting adequate air filtration.

DR. FERRANTI pointed out that it was a mistake to think of wet air being introduced into a generator; this was not proposed. Experience in America with air compressed by means of water proved that the air was very dry; it appeared, moreover, that if one wanted to get rid of the small particles of water in air, the latter should be brought into intimate contact with a body of water which would absorb the small water particles and leave the air dry. In the wet filtration system the baffle must have a surface of water flowing over it to obtain this result. Reduction in size of generators led to small air passages, which were easily choked, and this in turn involved filtration of the air. The fire risk with a cloth filter was a real one from his experience; despite the care exercised in its production such a filter was a make-shift. Experience with air-washing plant showed that there was no cleaning or stopping, and it was easy to get over freezing by turning the air from the engine room through the filter in cold weather.

MR. C. H. WORDINGHAM said there appeared to be very little danger of water being deposited by fairly moist air in a warm machine. In regard to the use of a thermometer on the switchboard, the time lag was not of so much importance, provided a safe temperature limit was not exceeded; but the question was how to measure the temperature of the critical part of the machine?

MR. THOS. ROLES (Bradford) said his experience with the cloth filter for three 3,300-kw. turbine sets had convinced him that it was unsatisfactory. He found at Bradford that it was dirty after one month's use; in dry weather the dirt could be removed by a vacuum cleaner, but in wet weather the dirt was really slime, and it was often necessary to scrap the filter screens. The humidity at Bradford was often 80 to 90 per cent. He was strongly of opinion that it would pay to replace the dry filters at this station by the wet type, as it was found that the air after passing the present filters was not free from very fine dust, and this was deposited in the machines, so that in time the latter would be dangerously choked.

MR. JOHN CHRISTIE, in replying, said he was quite satisfied that the resistance of the water spray to the air was negligible in the wet filter. The insulation of his machine was 18 megohms, with small variations up and down, and this appeared quite satisfactory.

## NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

### Electricity in the Operating Theatre.

A new electrical device for administering anaesthetics during an operation has been developed by DR. EDWARD R. KELLOGG, of Los Angeles, who uses a small motor and pumps, together with an electric heater. The invention not only enables the surgeon to operate with greater dispatch and facility, but eliminates some of the greatest dangers attendant upon operations on the throat. One of the great causes of fatalities following an operation is pneumonia, caused by the lungs becoming chilled through the introduction of the cold ether. The electric heater does away with this by bringing the anaesthetic to blood temperature. The warm vapour is pumped through a rubber tube into the throat of the subject, and a switch regulates with precision the amount of anaesthetic administered, so that there is no risk of giving an excessive amount with the new device. While the patient is under its influence, the operator can work upon the throat with the tube

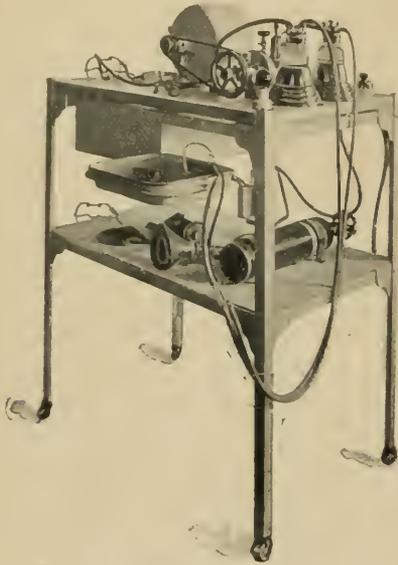


FIG. 1.—MOTOR AND PUMPS FOR ADMINISTERING ANAESTHETICS.

in place, knowing that there will be no occasion for him to stop in the middle of a delicate operation to replace the mask and give more anaesthetic. This eliminates the danger of the patient strangling from clots in the larynx and bronchial tubes. The blood is drawn off as fast as it flows through a rubber tube used by an assistant, connected with a vacuum bottle; by the action of a pump the vacuum is maintained to the proper degree for drawing away the blood during the operation. This is a great advantage, as it does away with the need of sponging, and allows the operator to see clearly what he is doing. The suction tube is valuable in other ways, such as removing obstructions from the bronchi. Pus can be drawn from the ear, the nose or the bronchi when necessary by this device.

The device in a Los Angeles Hospital has been used with complete success by the inventor and other leading specialists in more than 100 operations. The illustration shows the final perfected model of the apparatus.

### Generator Protection for Chicago.

By an unfortunate slip, the titles of figs. 2 and 3 under this heading in our last issue were interchanged. The error will, of course, be obvious to most readers, but the uninitiated might be misled.

### Magnetising Permanent Magnets.

A new magnetising device for permanent magnets has just been designed by the Witton Kramer Electric Tool and Hoist Co. (for whom the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, London, E.C., are the sole selling agents) at the request of large manufacturers of permanent magnets with a view to enabling a large magnetising force to be effectively applied to the magnet during the magnetising process. As will be seen from the accompanying illustration, fig. 2, it consists of a strong electromagnet with steel pole-pieces working along slides, machined and fitted with high accuracy. The moving poles may be drawn together by a right and left-handed copper screw. The permanent magnet is gripped between the two pole-pieces by operating the handwheel attached to the screw. The particular magnet shown requires 1 KW. to energise it. The jaws may be opened out from 1 in. to 8 in.

The best procedure to follow is, after putting the magnet in the jaws, switch on the current to its full value. Then the current is reversed and the magnetising force applied in the opposite direction. This is repeated several times, and on the

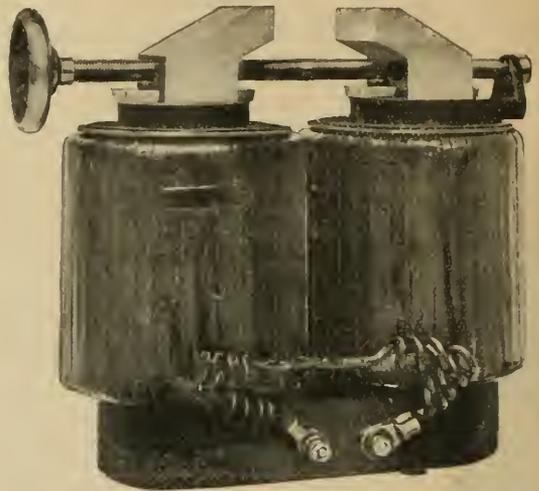


FIG. 2.—WITTON-KRAMER MAGNETISING DEVICE FOR PERMANENT MAGNETS.

final application of the current in the correct direction for magnetising, the current should not be suddenly switched off, but should be diminished gradually to zero. A number of these magnetising devices have been supplied to various firms for making permanent magnets for electric meters.

### Measuring the Height of Poles.

The height of pole required to keep overhead wires clear of any obstruction, such as trees, buildings or other wires that cross a proposed line, can be ascertained readily by a simple device called the "Teleheight." It is a vest pocket instrument of the simplest construction, with which the object to be cleared is sighted; the spirit level that forms part of the instrument is tilted by means of a thumbscrew until the bubble of the level is shown in a mirror crossing the line of the obstruction. The turning of this screw to the required position brings a pointer to a certain number on the scale attached to the "Teleheight," and this number indicates the height of a pole that will clear the top of the tree or house by 5 ft., allowing for the sinking of the pole to the required depth in the ground. Thus, if the foreman who reads the scale finds the pointer at 50, he knows that a 50-ft. pole, sunk 6 1/2 ft. in the earth, will clear the obstruction by 5 ft. The proper angle of sighting is found readily by measuring off 75 ft. in a straight line from the base of the obstruction, care being taken to remain on a level with the point from which this measurement is made. From this distance the user sights the top of the tree or other obstruction.

It is understood that poles of different height require different depth in the ground, and therefore the calibrated scale allows for the various heights. For instance, a 75-ft. pole will require to be set 8 ft. in the ground, a 60-ft. pole 7 ft., and a 30-ft. pole should be set 5 ft. deep. The foreman does not have to stop to calculate this, as his scale gives him the correct height, allowing for these variations.

The "Teleheight" was invented by two Milwaukee Street Railway and Lighting Co. officials, who had found that much of their time was taken up in adjusting claims made by property owners, whose trees had been ruined by careless trimming. The loss of time and money was so great, that it was recognised that a remedy must be found, and as a result, Mr. S. B. Way, vice-president and general manager, and Mr. John L. Fay, superintendent of lines, put their heads together, and devised this practical instrument, which was tried out to their satisfaction by the foremen of that company. The friction between the corporation and the public was lessened by showing due regard for the property owners' trees, and the success of the device was so pronounced that it is now being manufactured by a firm in St. Louis, W. N. MATTHEWS & BRO., which specialises in telephone supplies. The simplicity of operation makes the "Teleheight" efficient in the hands of the average foreman. The principle employed is familiar to all surveyors.

### Wireless Receivers for Time Signals.

In view of the fact that on and after July 1st wireless time signals will be transmitted daily at 10 a.m. and at 12 midnight from the Eiffel Tower, and at 12 noon and 10 p.m. from Norddeich, the SYNCHRONOME CO., of 32 and 34, Clerkenwell Road, are offering complete wireless receiving sets designed for watch and clock-makers. The necessary instruments are combined on a neat board occupying little space, and the whole outfit is appropriately called a "Hörphone." No technical knowledge in the use of the apparatus is required, and it is very simple in construction.

### E.A.C. Mining Switchboards.

The illustration, fig. 3, shows a typical mining board recently supplied by THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, London, S.W. It will be noticed that this comprises a number of panels, and that the main portion of each is a substantial cast-iron pedestal; the top of this forms a bus-bar chamber, in which the bus-bars are mounted on large moulded mica insulators  $\frac{1}{4}$ -in. thick, and carries the oil switch of

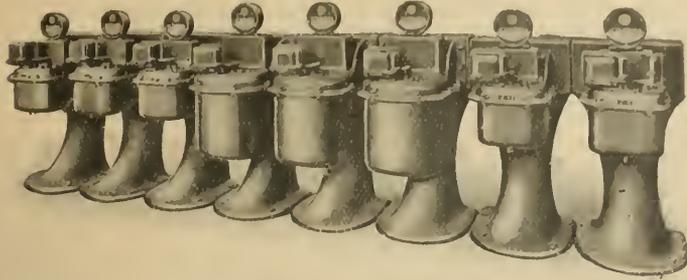


FIG. 3.—E.A.C. MINING SWITCHBOARD.

standard E.A.C. drum pattern. All the usual accessories, such as instruments, interlocks, &c., can be provided, and also isolating links by means of which the oil switches can be rendered "dead" for purposes of inspection and cleaning. Simplicity is a leading feature of the design, and all parts are readily accessible. Extensions are effected by installing extra panels, and are facilitated by the fact that the pedestals for all sizes of switches and bus-bars are of the same general dimensions.

### Aston's "F. T." Fireproof Lampholders.

MESSRS. VERITYS, LTD., of 31, King Street, W.C., have introduced a switch lampholder completely encased in an "Astonite" insulating cover, which renders it impossible to touch any part of the metal sleeve, while the rest of the metal casing of the holder is dispensed with entirely. The design is such that the parts are firmly held in position, and the switch is a neat little quick-make and quick-break type, with double break knife contacts completely sunk in the porcelain body, and operative in either direction. The holder fully complies with the Home Office regulations.

### Electric Hot Plates.

THE SCHNIEWINDT ELECTRIC CO., of 40, Stamford Street, Birmingham, have brought out a series of electric hot-plates in a variety of patterns, constructed of cast-iron and "asbestos-cement," with nickel-chrome resistance wire. The plates are very strong and light, and the heating elements are easily replaced if necessary, but are very durable. They are put forward not only for cooling, but also for use in chemical laboratories, and can be made in any shape or size to meet requirements.

## OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"RHEOSTAT" writes:—"In my premises I have a direct current three-wire supply with 460 volts across the outers, motors and lighting on 230 volts. A short while ago, when my motors were running and lamps lit, the Supply Co. had a breakdown on one side, which put 460 volts across my installation, with the result that the lamps and motors blew up. Can I make the Supply Co. pay for this damage? Can I claim for broken lamps if their voltage varies more than (is it) 2 per cent. up or down?"

\* \* The answer to this question depends very much upon the exact facts which "Rheostat" is able to prove. It is provided, by Sec. 86 of the Schedule to the Electric Lighting Clauses Act, 1899, that nothing in their provisional order is to exonerate the undertakers from any indictment, action, or other proceedings for nuisance in the event of any nuisance being caused or permitted by them. Again, they are answerable for all accidents, damages and injuries happening through the act or default of the undertakers or any person in their employment by reason or in consequence of any of the undertaker's works. There is some conflict of judicial and other opinion as to whether actual negligence must be proved to account for an accident happening in circumstances like those described by "Rheostat." Upon the whole, the opinion is expressed that he will have to prove negligence. (See, generally, Electric Lighting Clauses Act, 1899, Sec. 77; Brocklehurst v. Manchester Tram Co., 17 Q.B.D. 118; Midwood v. Manchester Corporation, (1905) 2 K.B. 597.)

"CINEMA" writes:—(1) "I shall be glad to know if a case has ever been settled in the Courts, bearing on the question of the different charges of the Electric Light Co. for lighting, power and heating. I have carefully looked up all the Acts, including the

one of 1882, but do not see any reference to the various methods of charging; for instance, in one town we are charged for the motor-generator which is connected to the projection arc lamp used in connection with the cinematograph apparatus, at lighting rate, whereas in another town we are charged at power rate. It always seems to me that this particular machine gives one of the most remunerative types of load, as the load factor usually approximates 50 or 60 per cent. Further, the Act of 1882 states that the undertaker shall not be entitled to prescribe any form of lamp or burner, or in any way control or interfere with the manner in which electricity is used.

"Another instance: with an average load factor of about 35 per cent., we are charged an average of 1.95d. per unit, whereas a man who cooks his chop in his office or boils a kettle at exactly the same time is charged 1d. per unit, and this, of course, seems to me to be a most unreasonable advantage to him, although, of course, his load factor is absolutely infinitesimal, and consequently his units cost very much more to generate. Again in the Act of 1882 in Sec. 18, it is laid down that 'every person is entitled to a supply of electricity on the same terms as any other persons under similar circumstances are to a corresponding supply.'

"In a certain town we start our motor-generator which, as I stated previously, supplies the current of the projection arc lamp used in connection with the cinematograph apparatus, at 11 o'clock in the morning and it is run without interruption until 10.30 at night, and yet we have to pay as much for our current as a man who runs a similar size motor on a circular saw and stops at 5 o'clock in the evening. For the rate of charging to be absolutely fair, it appears that we should both be charged the same price up to 5 or 6 o'clock in the evening, and then if the current cost more to generate, we might reasonably be asked to pay more for same.

"As a rule the companies admit that they cannot give undue preference, and claim that they do not, because they say that they charge all cinematograph theatres the same price, and, in some cases, I admit they do, but does not this argument amount to a claim that they are entitled to give preference to one trade and boycott another? Yet the Act distinctly states that every person must be treated on the same terms, and so far as I know the law treats a public company as a "Person or persons." If the Electric Light Co. can discriminate between the various trades, why cannot the Water Co.; yet so long as we use the same gallons of water per day as any other consumer, we have the advantage of paying for it at the same price. Further, in a certain case an electric supply authority have refused to supply us with electric current for the purpose of driving fans, at the power rate, because they say that the cables are run in capping and casing—the voltage being 230—and if we are to have the benefit of the power rate, we must run the cables in a screwed steel barrel. These requirements seem to me to be absolutely illegal."

\* \* There is no case which bears specially upon the different charges for lighting, power and heating; in other words, there is no decision which says "in these circumstances the undertakers must charge as for power, or in these conditions the undertakers may charge as for light." Further, the practice appears to vary (quite legitimately) in different districts, and so long as the rules about undue preference are observed, there is no reason why the company may not make what charge it likes for cinematograph or other purposes within the statutory limits. It is difficult to see how supply to a cinematograph can be described otherwise than as supply for lighting purposes. With regard to undue preference, it may be mentioned that in the case of Metropolitan Electric Supply Co. v. Ginder (1901), 2 Ch. 799, it was laid down that "uniformity of demand" and "day-time service" were factors to be considered in deciding whether one consumer is preferred to another. As to the refusal to supply current for fans, that seems to be unjustifiable.

## PATENTS EXPIRING IN 1913.

(Concluded from page 1007.)

21,778. "Lifts." H. ROWNTREE. October 31st.—Relates to electrically operated and controlled lifts in which, (1) the cage being at rest at any landing it can be sent to any other landing by pressing a button at any one landing; (2) once started the motion of the cage cannot be arrested or reversed until it has arrived at the landing to which sent; (3) the cage slows down and stops automatically; and (4) the cage cannot be operated so long as a door at any one of the landings is open.

21,881. "Electric lamps; alloys." H. H. LAKE. (See de Commentry-Fourchambault et Decazeville.) November 1st.—Leading-in wires are made of alloys of iron and nickel, and may also contain other metals. A nickel-steel alloy with about 86 per cent. of nickel has a temperature-expansion coefficient nearly zero, and by adding a proper quantity of one metal, preferably nickel, the alloy can be made to have the same coefficient as any glass used for bulbs. The wire is enclosed in thin glass, melted at the lowest possible temperature, so that the wire does not come in contact with the flame.

22,020. "Wireless telegraphy." W. P. THOMPSON and F. BRATN. November 3rd.—Relates to wireless telegraphy in which the spark gap is arranged in the primary of a transformer, the secondary being connected to earth and aerial conductor. A Leyden jar is used as a generator, but an induction coil may be employed.

23,476. "Lamps." A. DUTTON and W. M. GARNER. November 24th.—Lamp of the type in which the daylight is obtained from an electric lamp or other lamp by passing the light from this through copper-sulphate solution, or through glass coloured with copper oxide or otherwise, or by reflecting the light from a coloured surface, the materials used being such as to absorb rays occurring in excess in the lamplight. The light so obtained is suitable for colour-matching or general lighting.

23,501. "Electric lighting." W. L. WISE. (Moore Electrical Co.) November 24th.—Relates to vacuum-tube lighting. The generator is constructed to produce an alternating electromotive force varying with great abruptness. The generator supplies the lamps, and a condenser and inductive resistance are connected with the circuit. In other arrangements, step-up transformers may be employed.

24,048. "Autographic telegraphs." F. RITCHEY. December 2nd.—Relates to that class of autographic telegraphs in which the levers attached to the transmitting stylus cause the movement of levers over sectional resistances arranged in arcs. At the receiving station the levers connected to the receiving stylus are actuated by line coils pivoted in strong magnetic fields. An application for the extension of the term of this patent has been made.

24,450. "Electric telegraphs." J. A. L. DEARLOVE and S. G. BROWN. December 8th.—Automatic transmitting apparatus for submarine and other working is arranged with needles pivoted to the ends of levers connected to earth and line. The levers have controlling springs and extensions, with which a spring, forming an extension of a lever carrying stops, engages. The levers can make contact with fixed stops, or with the stops on the lever, these stops being connected directly to the battery or indirectly through the curbing device. The lever carrying the stops is continuously reciprocated by the cam disk, which is also connected by the link and spring with the lever. The contact-lever, together with a fixed stop and connected levers, are mounted on a slide provided with an adjusting screw, the position of the slide determining the curbing action.

24,718. "Telephone systems." J. E. KINGSBURY. (Western Electric Co.) December 12th.—Relates to telephone systems in which a central source of power is employed for both signalling and conveying. In the subscriber's apparatus, either transmitter or receiver may be shunted by an impedance coil, which may form an additional circuit on the induction coil. Arrangements are described by which "private" or "exchange" extensions connected to a local exchange may communicate with that exchange, with one another, or the "exchange" extensions with the main exchange through the local exchange by means of a source of power located at the central exchange.

25,188. "Wireless telegraph." G. MARCONI and MARCONI'S WIRELESS TELEGRAPH CO. December 18th.—Relates to wireless telegraphic apparatus in which the transmitter or receiver is arranged as described in specifications No. 12,326, A.D. 1898 and No. 6,929, A.D. 1899. The secondary coil of the induction coil is connected at each end to the coherer, and is divided in the centre by a condenser. The condenser is also arranged in the local circuit, including the impedance coils, battery, and receiver. The induction coil may be arranged with the halves of the secondary coil wound in a single layer, or in a series of layers decreasing outwardly in the number of convolutions. The length of the wire in the single layer form corresponds with the height of the aerial conductor.

25,846. "Perforators for automatic telegraphs." A. S. FRAMPTON and F. L. MITCHELL. December 21st.—Relates to improvements in the class of instruments described in specification No. 2,904, A.D. 1897. The key levers are arranged below the surface of the case. The acting portions of the levers are brought up through an opening in the case, and are so bent as to form a vertical series, of which the upper and lower representing the signal keys are in contact with the contact or spacing punch, which can act by itself. The punch holders are held back by springs acting on a block through which the signal punch holders slide, but which is attached to the spacing punch holder. The key levers may be operated by electromagnets, contact keys being employed to close the local circuits.

25,757. "Electric motors, lifts." H. ROWNTREE. December 30th.—Relates to continuous-current motors for operating lifts, &c., and to the means for varying the speed and direction of operation thereof. A motor is employed in which the armature and field are independently revolvable, and one of these parts is rotated by a motor, which may be an electric, steam, gas, or other motor. The speed and direction of rotation of the main motor are controlled by varying the strength of the current supplied either to its field or armature.

25,768. "Lifts, esp." H. ROWNTREE. December 30th.—In electrically actuated and controlled lifts, the following objects are effected, viz.—(1) All the movements of the cage are controlled by push-buttons in the cage and at the landings. (2) By the operation of a push-button at a landing, or a corresponding one in the cage, the movement of the cage to, and automatic stopping at, that landing is effected. (3) The hoisting mechanism cannot be put into action until all the well doors are closed. (4) A push-button having been operated, any subsequent operation of another button is ineffective until the cycle of operations proper to the first button has been completed. (5) The motion of the cage is automatically accelerated and retarded as it is started and stopped respectively. The necessary electric circuits are shown diagrammatically in the specification.

13,428. "Trolley heads for electrically-propelled vehicles." J. T. MATON. June 10th.

13,435. "Dynamo-electric machines." FIRMEN BOSS DYNAMO WERKE, LTD. (Siemens-Schuckertwerke G.m.b.H., Germany.) June 10th. (Complete.)

13,447. "Electric elevator systems." E. M. FRASER. (Convention date, July 29th, 1912, United States.) June 10th. (Complete.)

13,450. "Three-phase differential gear." L. FAX and R. TAINE. (Convention date, June 21st, 1912, France.) June 10th. (Complete.)

13,458. "Electrical device for the selective detection of periodic electrical impulses." R. P. HOWGRAVE-GRAHAM. June 10th.

13,465. "Separation of liquid suspensions." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 10th.

13,480. "Apparatus for testing the specific gravity of acid in cells with sealed covers." D.P. BATTERY CO., LTD., and T. C. ELLIOT. June 11th.

13,490. "Vapour electric apparatus." M. VON RUCKLINGHAUSEN, A. HELBERGER and V. HENN. (Divided application on 24.6.3.1912, October 28th.) June 11th. (Complete.)

13,541. "A magnetic brush or brcom for separating ferrous metals from non-ferrous metals." J. W. BRYANT. June 11th.

13,546. "Pneumatic-electric trackers for electric-mechanically operated musical instruments." C. W. DORRICO. June 11th. (Complete.)

13,557. "Automatic adjustable electrical overload circuit breakers." H. T. HOLMES and J. KEMP-WELCH. June 12th.

13,588. "Circuit switches, wall-sockets and brackets." J. B. MEILLER-JOHN. June 12th.

13,589. "Means for automatically shutting off steam or electrical current and applying the brakes when the signal is against a railway train." W. S. McLEAN. June 12th.

13,602. "Manufacture of electric cables." C. J. BRAVER and E. A. CLAREMONT. June 12th.

13,610. "Cooling electrical and other apparatus." ART.-GER. BRUNN, BOYER ET CIE. (Convention date, February 20th, 1913, Germany.) June 12th. (Complete.)

13,616. "Intercommunication telephone systems and apparatus therefor." J. A. ROMER. June 12th.

13,632. "Tortuous filament electric incandescent lamps." A. GRAMMONT. (Convention date, June 13th, 1912, France.) June 12th. (Complete.)

13,636. "Receivers for use in wireless telegraphy and telephony." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and C. S. FRANKLIN. June 12th.

13,637. "Means for increasing the frequency of alternating currents." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and C. S. FRANKLIN. June 12th.

13,654. "Electric switches." E. A. FAGERLUND. (Addition to 13,353 of 1913. Convention date, June 14th, 1912, Sweden.) June 12th. (Complete.)

13,656. "Systems of electric distribution." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) June 12th.

13,660. "Electric lighting indicator." J. C. HUTTON. June 12th. (Complete.)

13,654. "Magnetic compasses for ships' boats or the like." C. A. BARTLETT and T. W. BAUCE. June 13th.

13,694. "Method of lighting and unlocking miners' safety lamps with alternating current." W. W. GOSDON. June 13th.

13,695. "Incandescent electric lamp filaments." C. W. READ. June 13th.

13,698. "Electric fountains and water display effects and fittings and appliances used in connection with them." H. P. ALLISON. June 13th.

13,715. "Electric clock." J. G. ECOTT. June 13th.

13,721. "Electric switches." O. LUCAS and F. HANDLEY. June 13th.

13,727. "Electric ignition devices for acetylene or other gas lamps." E. LE FAYE BENOIT. June 13th.

13,748. "Selectors for automatic or semi-automatic telephone systems." SIEMENS & HALSKER ART.-GES. (Convention date, June 22nd, 1912, Germany.) June 13th. (Complete.)

13,755. "Production of high-tension discharges." W. H. WILESON. June 13th.

13,764. "Electrical resistances." W. M. MORDEY. June 13th.

13,769. "Operation of by-pass gas burners by electrical current." E. J. PARBLEW. June 14th. (Complete.)

13,782. "Sparking plugs." A. DALE. June 14th.

13,791. "Commutator for electrical dynamos and motors." L. HARTMANN. June 14th.

13,793. "Apparatus for causing electrical impulses to transmission to a distance." J. A. GARDNER and A. FERGUSON. (Addition to 27,229/10.) June 14th. (Complete.)

13,820. "Electrical connection devices for railway and like vehicles." L. BOIBALLET. (Convention date, July 29th, 1912, France.) June 14th. (Complete.)

13,822. "Electrical illuminating apparatus or instruments." H. CBERON, H. DOMINICI and R. BUCARD. (Convention date, June 15th, 1912, France.) June 14th. (Complete.)

13,823. "Starting and lighting systems for motor road vehicles." W. H. GLASER. June 14th.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

13,275. "Adjustable telephone arms." McFEN J. D. CARRIER. June 9th.

13,305. "Electricity meters." G. WALL and FERRANTI, Ltd. June 9th.

13,308. "Electromagnetic friction couplings." P. FOISLER. (Convention date, June 8th, 1912, Germany.) June 9th. (Complete.)

13,310. "Systems and apparatus of radio control." J. B. HAMMOND, JUN. (Convention date, June 7th, 1912, United States.) June 9th. (Complete.)

13,315. "Alternating-current electromagnets." CRIS ELEVATOR CO., LTD. CRIS ELEVATOR CO. G.M.B.H. (Germany.) June 9th. (Complete.)

13,343. "Electric light fittings." J. A. BAUER and A. FORTSCHE. June 9th.

13,347. "Governing mechanism for prime movers." BRITISH THOMSON-HOUSTON CO., LTD., and F. SAMUELSON. (Addition to 9,241. June 9th.)

13,358. "Means for automatically operating electrical resistances, more particularly for use in conjunction with connectors, such as lamp-holders, wall sockets, and the like." J. P. NAYLOR and NAYLOGRAPH, LTD. June 9th.

13,359. "Electric safety devices against house-breaking, burglary, and the like." C. PASTORE. June 9th. (Complete.)

13,373. "Inspection attachments for the cylinders of internal-combustion engine, and sparking plugs for use in connection with such attachments." ELECTRIC IGNITION CO. (1913), LTD., and A. E. FLETCHER. June 10th.

13,387. "System of multiple telephone-call indicators." S. D. WILLIAMS. June 10th.

13,389. "Electrical connectors." C. R. BELLING. June 10th.

13,406. "Attachment of the filaments of electric glow lamps to the leading-in wires." J. FLECHMAN. June 10th. (Complete.)

13,418. "Reverse power relay." E. G. WATERS. June 10th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1912.

TUNGSTEN FILAMENT AND A PROCESS OF MANUFACTURING SAME. J. HUBERS. (Julius Pintsch Akt.-Ges.) 5,626. February 2th. (Cognate application, No. 8,755 of 1912.)

TUNGSTEN FILAMENT AND A PROCESS OF MANUFACTURING SAME. J. HUBERS. (Julius Pintsch Akt.-Ges.) 5,627. February 2th.

DRAWN METAL FILAMENT AND A PROCESS OF MANUFACTURING SAME. J. HUBERS. (Julius Pintsch Akt.-Ges.) 5,628. February 2th. (Cognate application, No. 3,749 of 1912.)

METHODS AND APPARATUS FOR CHARGING STORAGE BATTERIES. D. H. WILSON. 9,735. April 24th. (Addition to No. 9,593 of 1912.)

ELECTRICAL HEATING APPARATUS. R. B. MATTHEWS. 12,3 C. May 24th.

SAFETY APPARATUS FOR SIGNALLING ON AND STOPPING TRAINS INDEPENDENTLY OF THE DRIVER. E. WILSHIRE. 12,571. May 24th.

ELECTRIC SEARCHLIGHTS. SOC. ANON. OPTIC ELECTRIQUE. 12,850. May 24th. (May 31st, 1911.)

HOLDERS FOR INCANDESCENT ELECTRIC LAMPS. J. P. NAYLOR and NAYLOGRAPH, LTD. 12,881. May 24th.

COUPLINGS AND MEANS FOR FASTENING WIRES TOGETHER AND TO TERMINALS OF ELECTRIC BATTERIES, LAMPS, WALL PLUGS AND OTHER APPARATUS OR APPLIANCES. V. C. H. GIBSON. 17,446. May 24th.

DRAWINGS OF WIRES, AND MORE PARTICULARLY OF TUNGSTEN AND OTHER METAL FILAMENTS OF GLANDIZ. 12,469. May 24th.

TELEPHONE EXCHANGE SYSTEMS. E. R. COLWIND. 12,547. May 28th.

PROGRESS FOR THE MANUFACTURE OF FILAMENTS OF ALLOYS OF TUNGSTEN. M. M. HUBERS, EXECUTOR OF THE LATE J. HUBERS, deceased. (Julius Pintsch Akt.-Ges.) 12,752. May 30th.





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